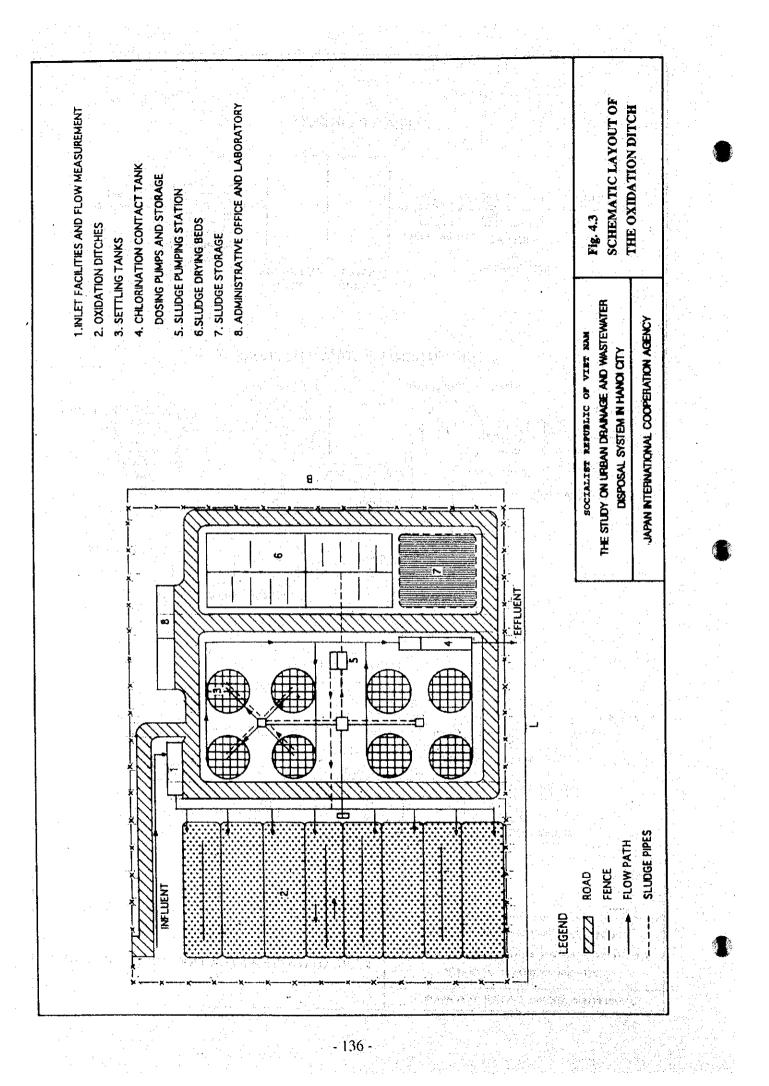
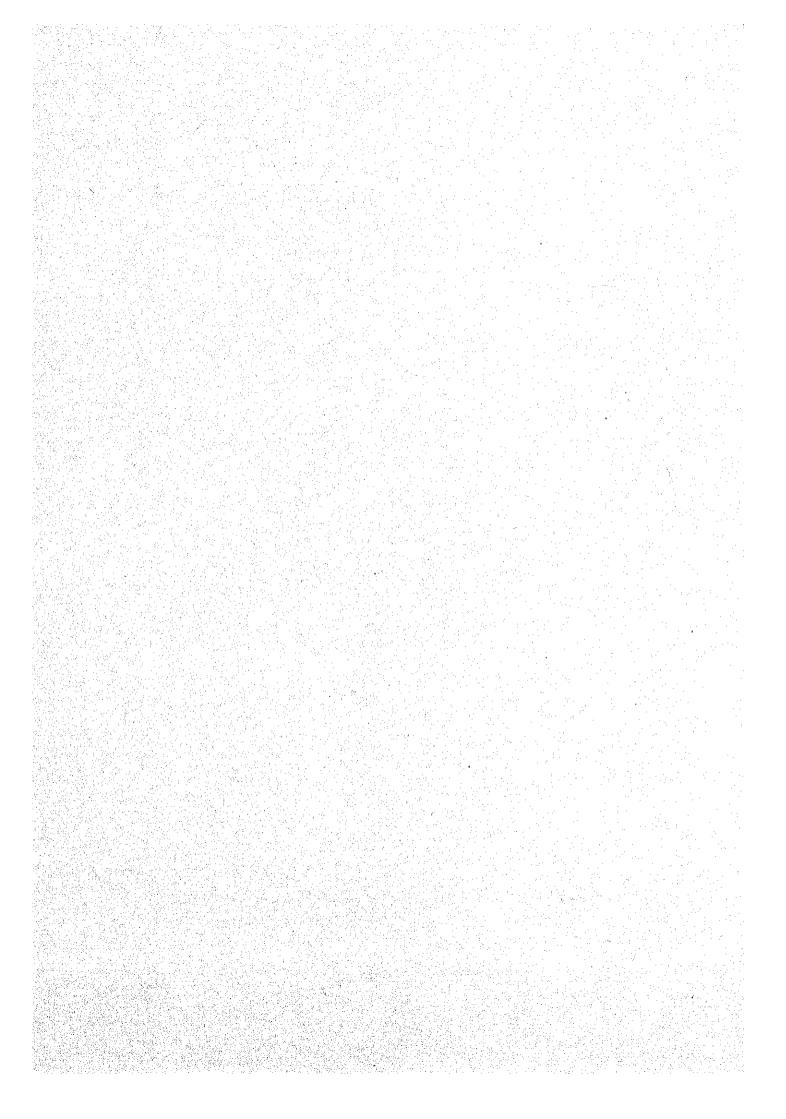
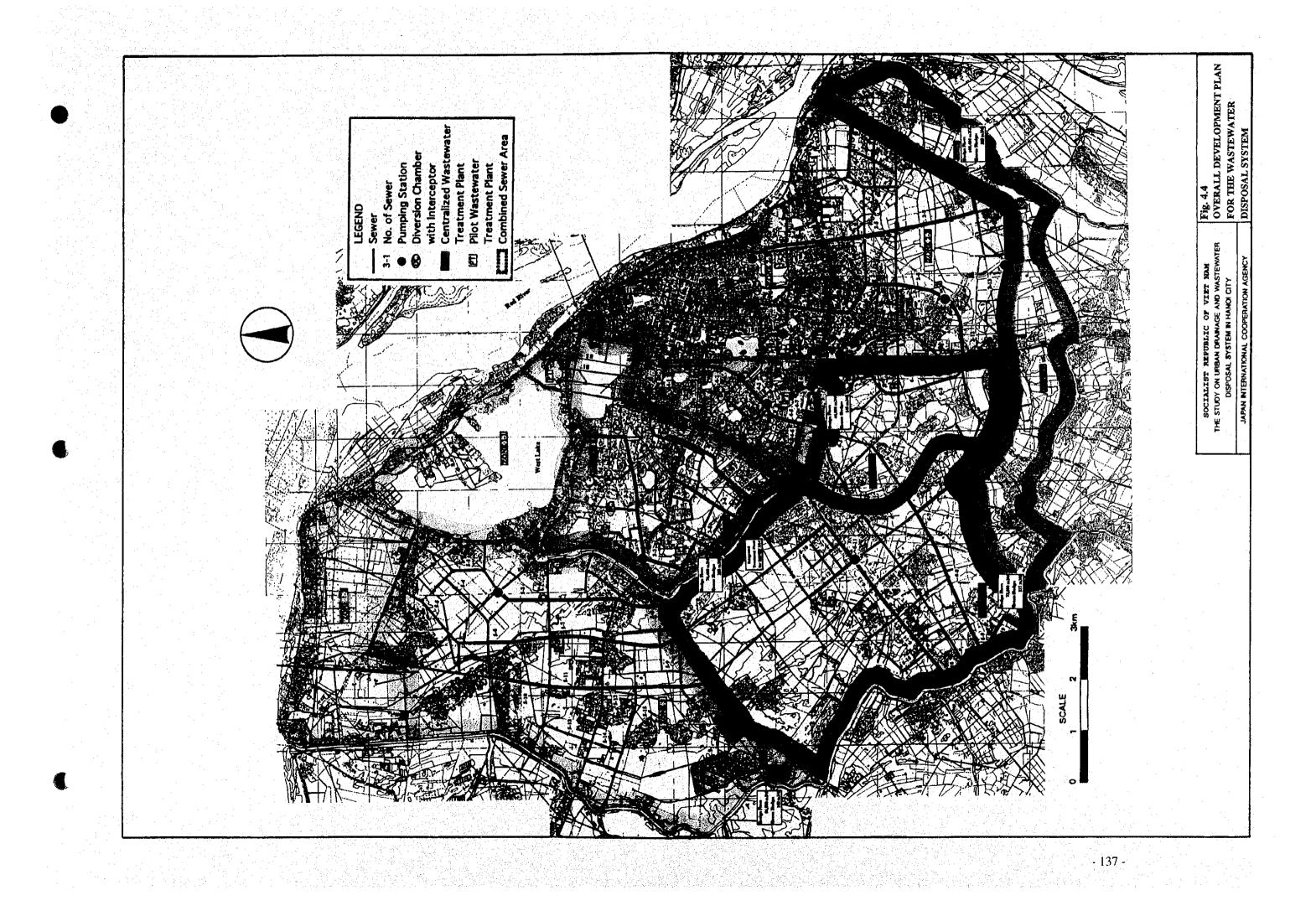
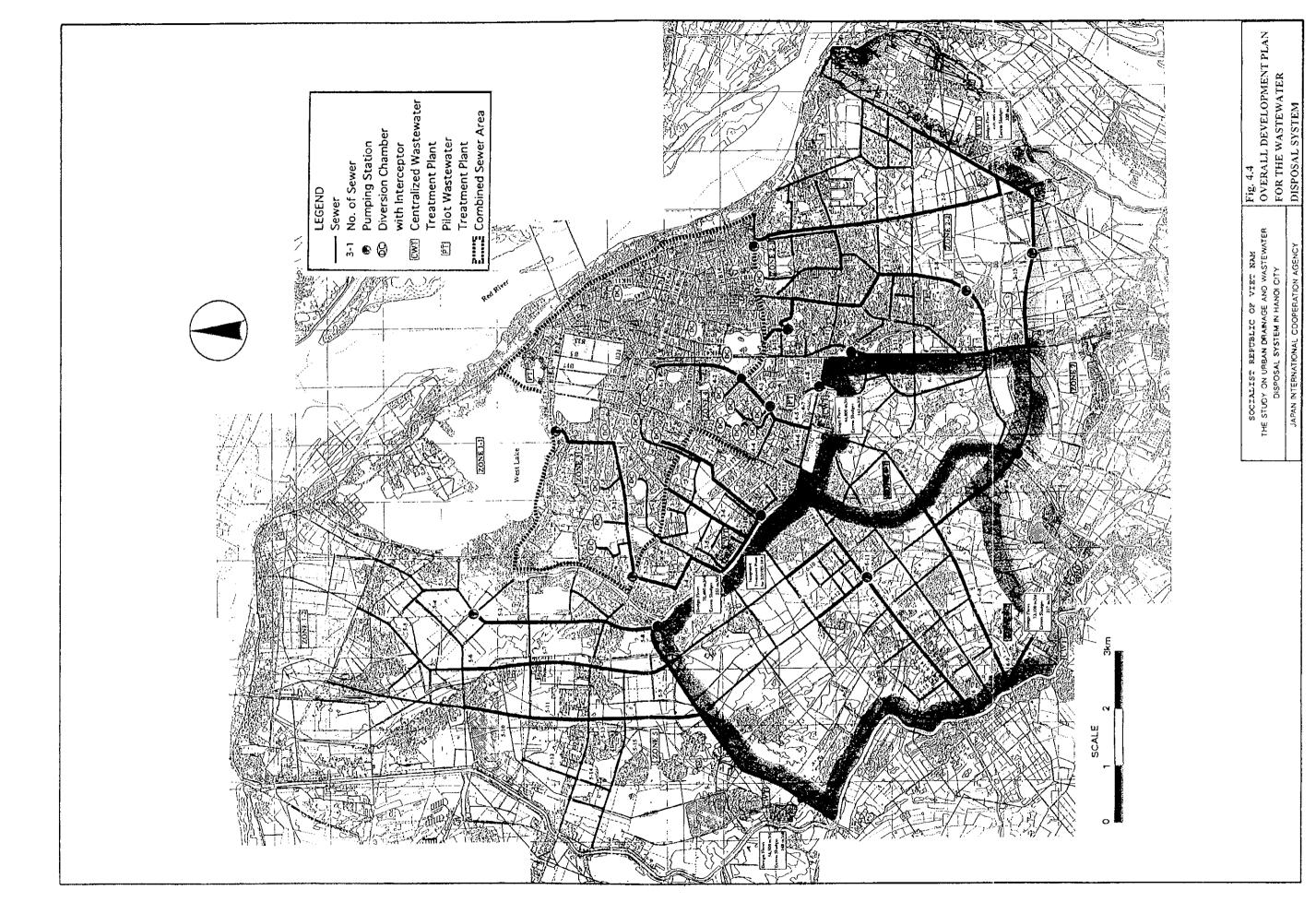


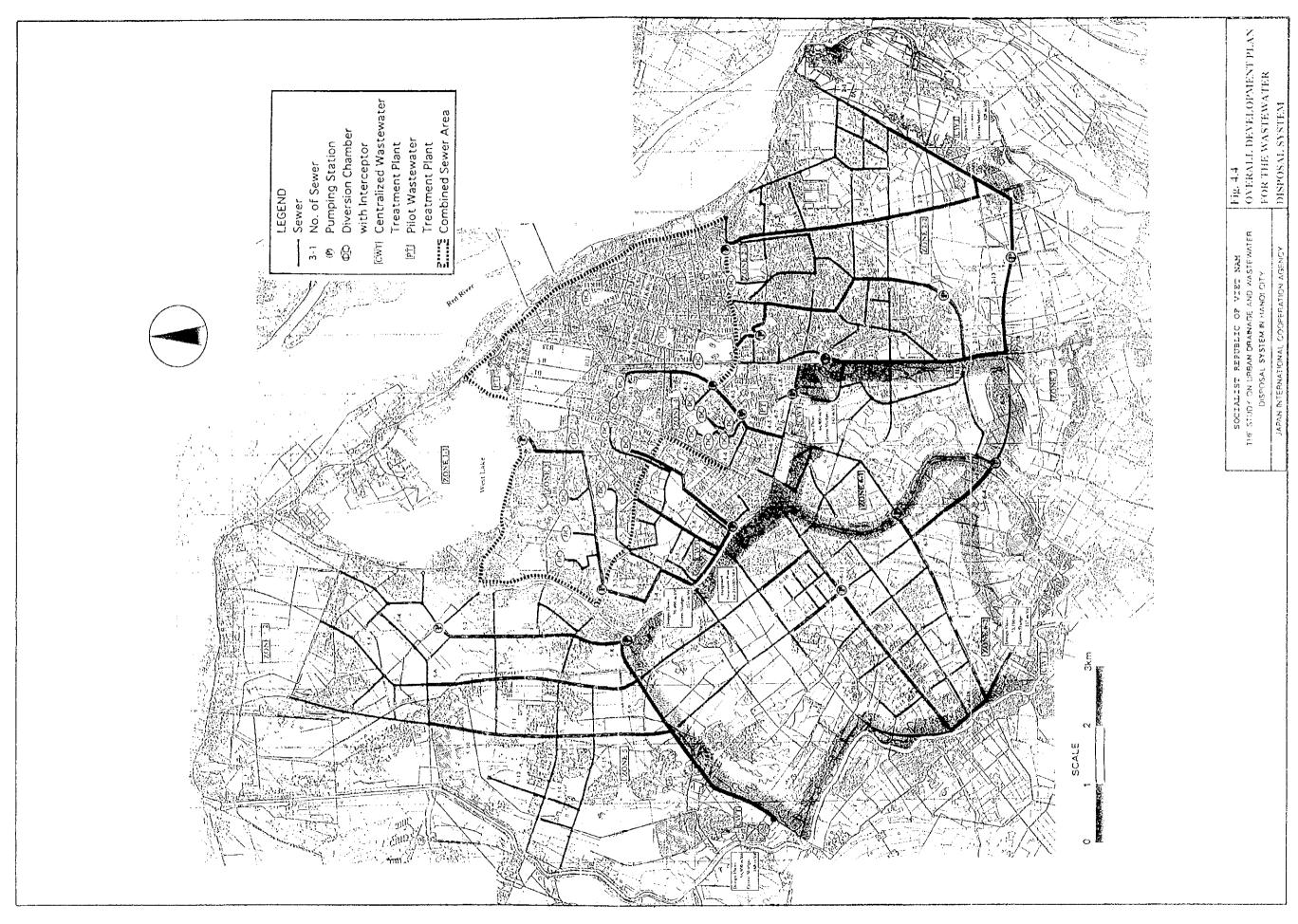
- 135 -

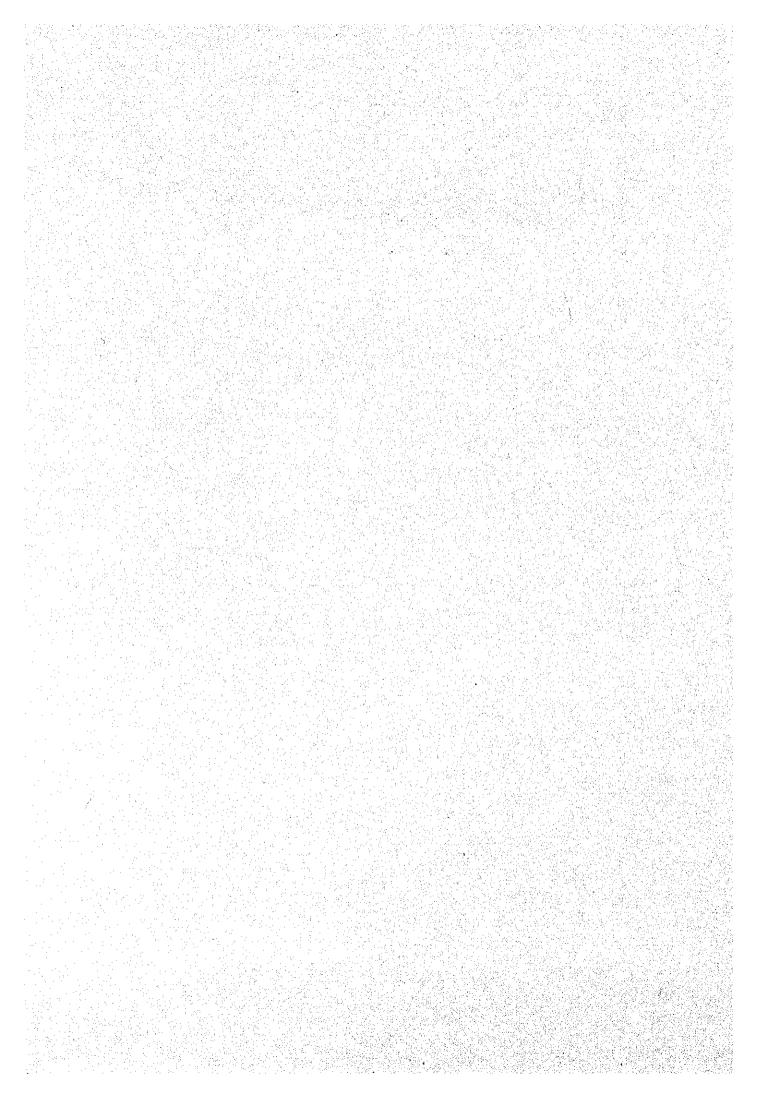


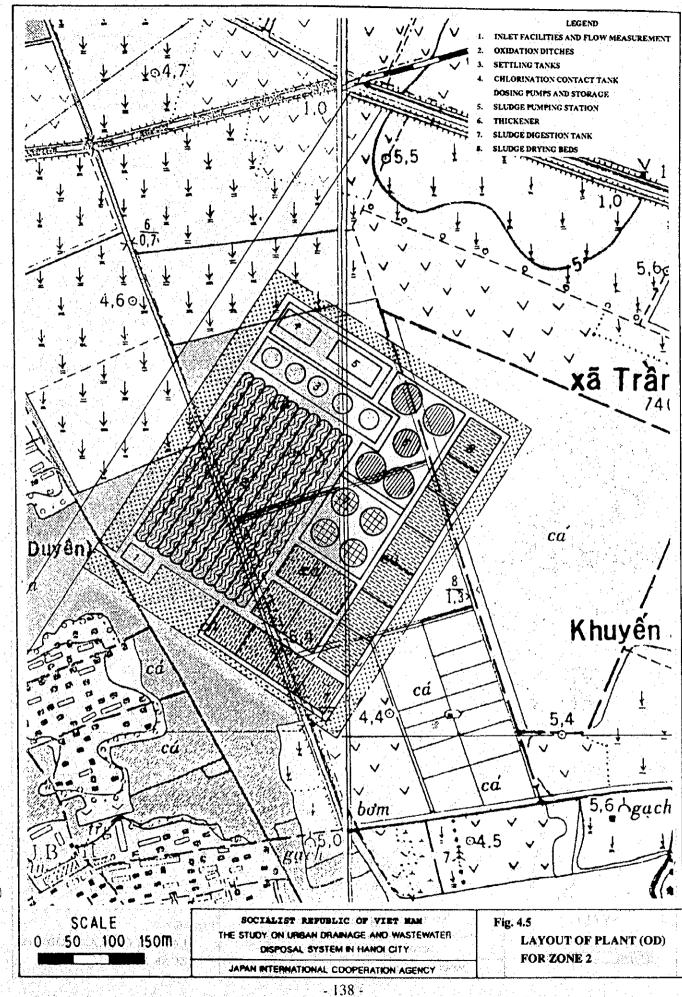


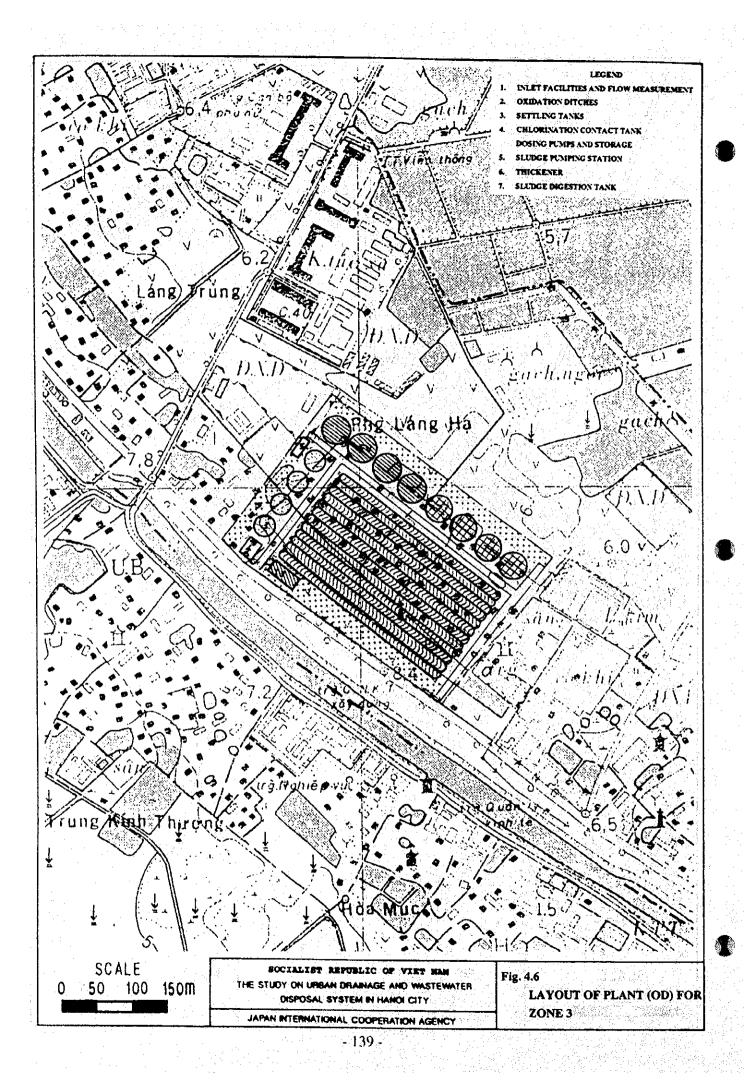


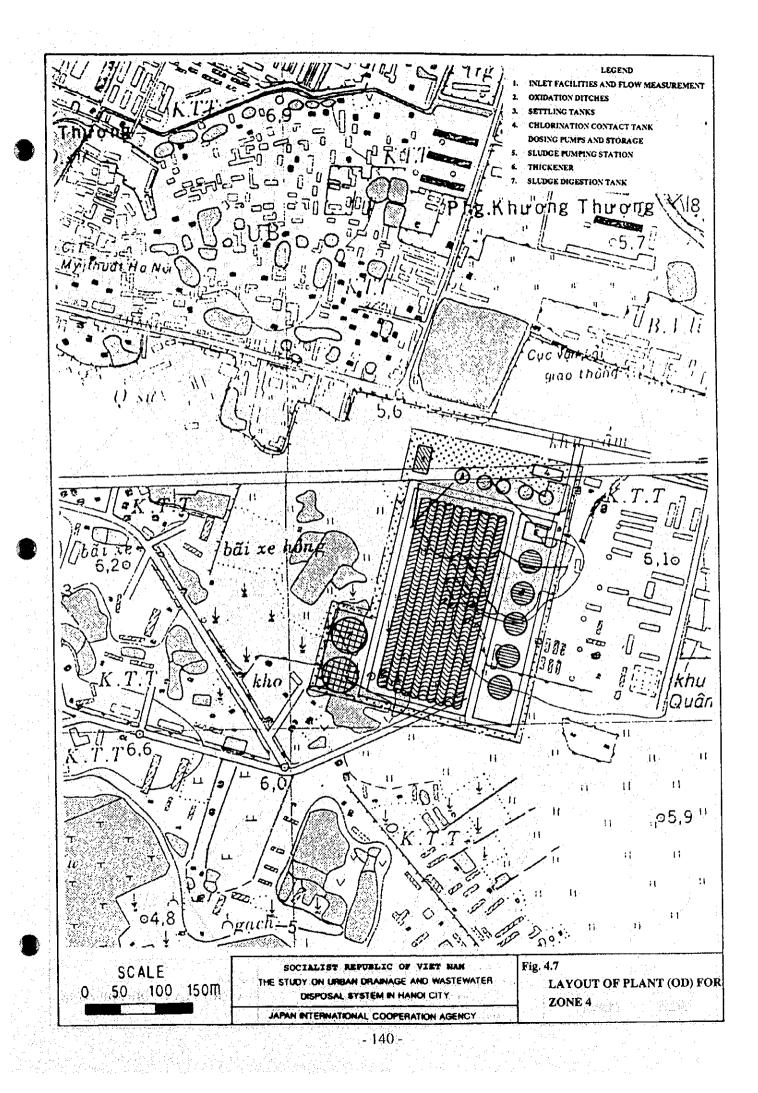


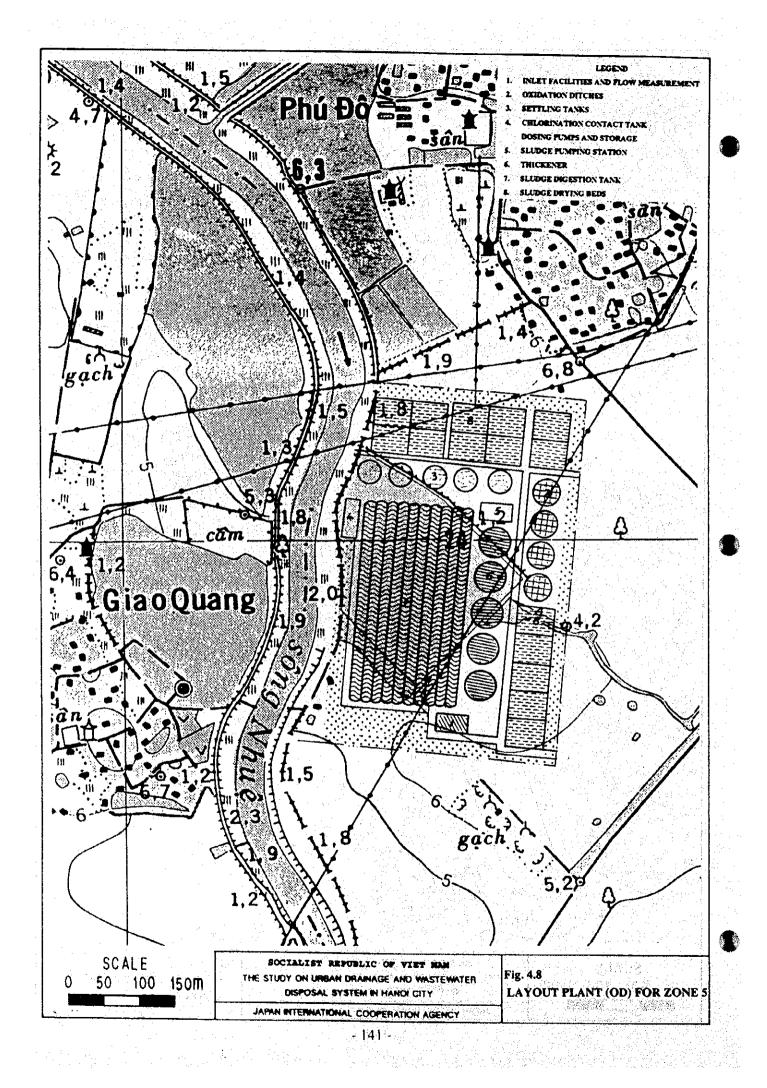


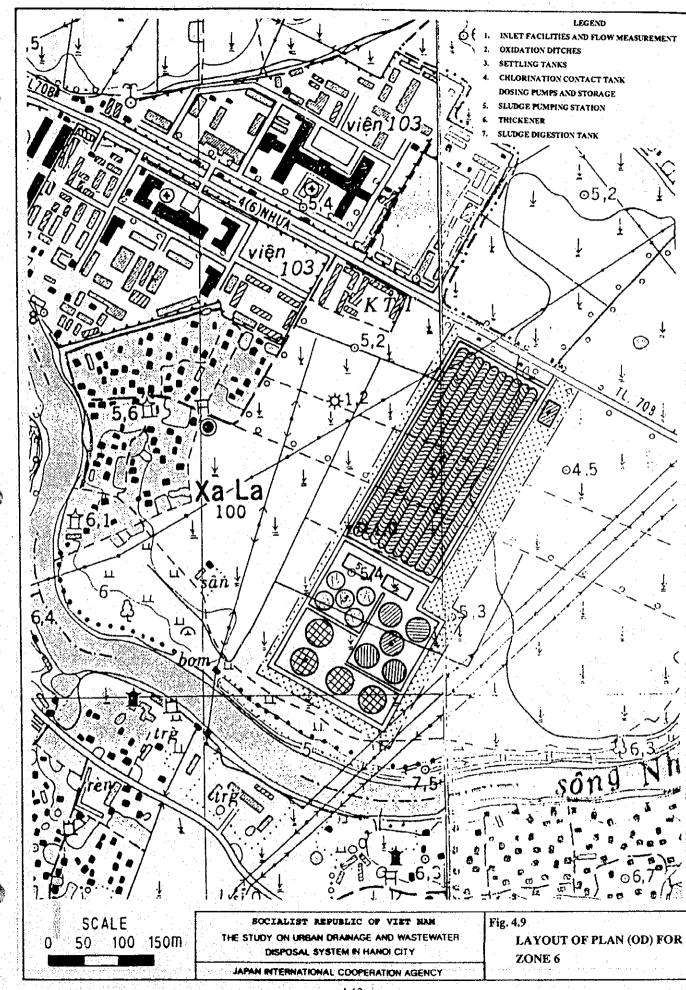












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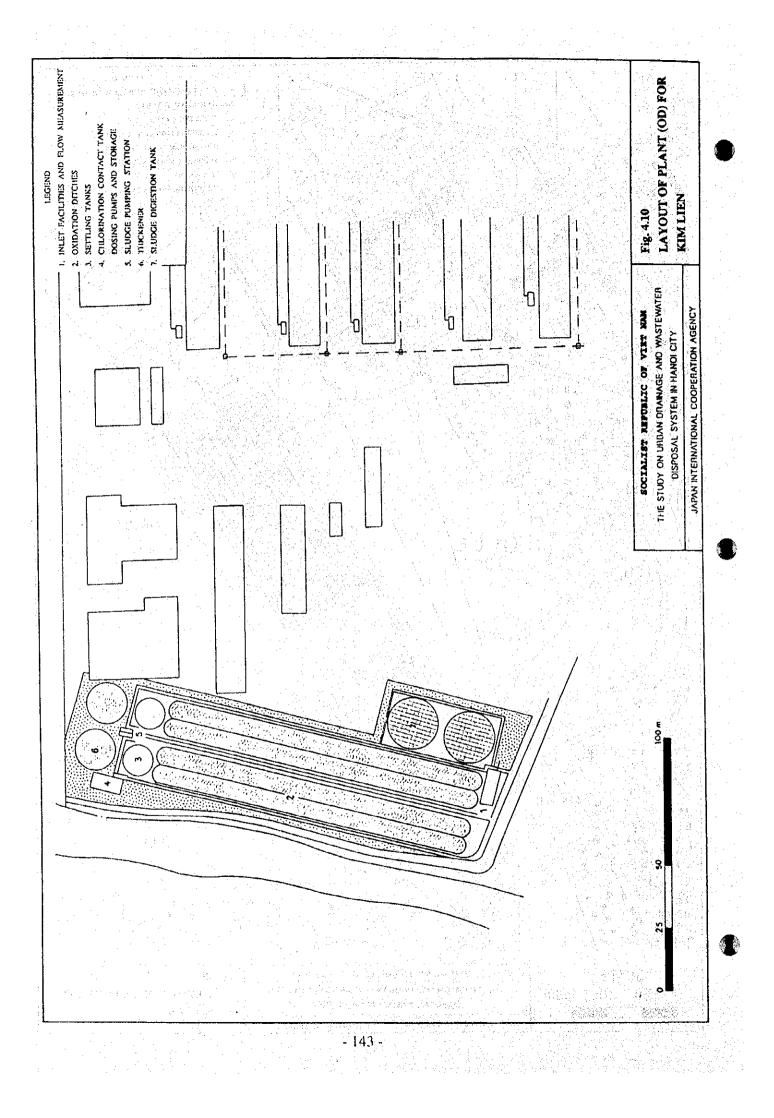


Fig. 4.11 IMPLEMENTATION SCHEDULE OF THE WASTEWATER DISPOSAL PLAN

Yes	1974	1997	1998	1779	2000	2901	2000	2003	2004	2005	2006	2007	2008	2008	2010	3911	2012	2013	2014	2015	2016	2017	2018	2019	2020
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DISBURSEMENT SCHEDULE OF THE WASTEWATER DISPOSAL SYSTEM (1/4)

2020 2019 2018 2017 2016 2013 2014 2013 2012 2011 2009 2010 ť , (Unit:Million USS) 100 0.410 0.207 1.702 2.912 0.464 2007 1,702 0741 02491 02491 8.3581 8.3581 3.231 17.471 17.474 11.832 11.832 0.5201 0.5201 0.5201 0.5201 0.6201 0.207 13.534 2005 2006 2.912 0.207 HC2 C1 20C.1 0.546 0.207 **100** 1.702 4.455 0.613 0.332 1.468 8.00 6.195 66.1 11.833 11.833 11.833 4.455 4.455 4.455 1.940 1.178 0.207 8 16.288 18.228 1.226 2010 2010 2010 2010 126.6 012.1 002.6 014.0 2.638 21.415 21.415 23.743 1.178 4.760 4.760 1.178 0.207 1.793 1.178 1,226 2002 0.207 0.041 16.2815 1.226 0.613 1.226 2007 0.207 0.041 2000 233 123 0.562 0.207 0.12 2550 255.0 255.0 255.0 255.0 0.410 6661 3 373 0.273 0.312 2.724 2.724 0.207 0.641 8.580 0.613 0.613 1.226 **3.443** (3.443) 1661 1.870 2.724 2.724 0.189 0,277 0.641 1.134 2.485 0.207 0.207 1997 Ycar 19X6 1.134 11.584 0.476 72.1157 102.65 14.254 0.189 11.419 1.900 5.741 0.273 35,499 17.820 3.879 2,448 2,166 2,166 2,356 522 57.198 2,505 31.175 Tota Fig. 4.12 ž Sewcrage Zone Nem Engineering Service Crist Engineering Service Cost Sub-Tota Sub-Tota , Pilot Treatment Plant L'Treatment Plant and Acquisition Cost Land Acquisition Coll iewenge Laite Water Quality In hysical Costingency Physical Contingency desinistration Cost **Identistration** Cost Sewerage Lake Water Quality I **Construction Cort** Construction Cost Treatment Plant **ONE 2-1 ONE4**

Fig. 4.12 DISBURSEMENT SCHEDULE OF THE WASTEWATER DISPOSAL SYSTEM (2/4)

)												z	(Unit:Million USS)	уя USS)								ł	ł	ł]
Sewerage Zone	Total	Yeir 19%	2061	8661	6661	2000	300	2002	2003 2	2004	2005 2	2006 2	2007 21	2008	2009 20	2010 24	2011 2	2012 2	2013 21	2014 2	2015	2016 2	2017 2	2018	2019	2020
CONE J		 		1 8													ŀ	 	 							
A.Construction Cost	62.904		.					\$16.0					18.383 18.363 18.383	11 (195)		2.922		- 14 		 			<u> </u>			
I. Treatment Plant	37.383	 	:					-		. <u>.</u>		-	_					•			·					
2.Sewenge 3.Lake Water Quality Improvement Work	183				<u></u>		816.0	816.0	<u>.</u>		<u>.</u>		c 776.c		776'C	776-0	 			• •	<u></u>		<u></u>			
B.Land Acquisitions Cost	15.200									<u> </u>	7.600	7,600				<u></u>	<u> </u>							· · · ·	-	
C.Engineering Service Cost	9.436				1.Oat		810.1	1.045		1.04	1.048		1.048	1.048	1.048	8401				Es		<u></u>	<u> </u>	 		
D.Administration Cost	3.905			0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	000.0	<u></u>		<u>sj. j</u> Na				- <u>.</u>			•
E.Physical Contingency	18,289			0.060	0.270	0.060	0.453	0,453	0.060	0.270	.790	1.580	3.946	3.946	3.946	1,454	<u> </u>			<u></u> 			· · ·	·	e Li di	
Mit-Total	HT.901		\dagger	0.360	6197	0.360	2.7.0	2.720	0.360	1.619.1	10.739	9.480 23.678		23.678 2	23.678 8	1.724		┼╢			╎╽	╞╴┫			Π	
XONE 2-2							 							100					199							
A. Construction Cost	35.375			· · ·										·	91	1295 1	10.295 10.295 10.295		4.489				<u>`</u>			
L.Treatment, Plant	17.413		•					· · · · · · · · · ·		•			<u> </u>	-						· · ·						
2.Scwenner 3.Lake Water Quality Improvement Work	0.000								· · · ·	<u></u> .				····		4 489	4 4 80	6 8 4					······································	• •		
B.Land Acquisition Cost	1253						. :							0.627	0.627		<u></u>		<u></u>							
C.Engineering Service Cost	5.306						••• •• •••••							1901		1901	1961	1.061	1,061							
D.Administration Cost	1.834				•								0.262	0.262	0.262 0	0.262	0.262	0.262	0.262	••						
E.Physical Costingency	8.753												0.052	0.390	0.178 2	2.324	2.324	2.324	1.162							
Sub-Total	52.518	\uparrow	Π	Π								$\left \right $	0.314	2.339	1.066 13.942 13.942	1.942 1	3.942 1	13.942	6.974	Η				Π		

DISBURSEMENT SCHEDULE OF THE WASTEWATER DISPOSAL SYSTEM (3/4) , Fig. 4.12

Sewarge Zone	Total	Ycar	1997	1994	665	2000		2002	2003	2004	2005	2004	2007 26	2008 21	2000	2010	2011 2	2012 2	2013 20	2014 2	2015 2	2016 2	2017 2	2018 2	2019	2020
ZONY, 6-1			- · · · ·			+	╉╍╍	+	+	+			<u>∔ -</u> ₹		- R					3						
A.Construction Cast	30.705						••••				33							3.986	8 9 86 8	8.986	3.746	: .		• •.		÷.,
1. Treatment Plant	15.721							<u> </u>				· · ·	;; ;		in a t			5.240	5.240 5 3.746 3	5.240 3.746	3.746					
2.Sewerage 3.Lake Water Quality Insprovement Works	- A9												· · ·		<u> </u>				e 1			· <u> </u>				•
B.Land Acquinition Cost	0.718			-												6500	6500			•	<u></u>			-		
C.Engineering Service Cont	60			: .	,, <u>,, ,, ,,,</u>		; ;								0.768	0.768		0.768	0.768 0	0.768	0.768					
D.Admisistration Cost	1521		 									0.157 0	0.157 0	0.157 0	0.157	0.137	0.157	0.157	0.157 0	0.157	0.157		• •			
E.Physical Contingency	7_520		:					· · ·			-	0.031	0 110.0	0.001	0.185	122	0.103	26	1.982	1.982	0.934					1.7
statistics of the second s	45.120		Ť	1		╈	-		\uparrow	+	╉	01110	0 189 0	0.130	981	1341	0.619 1	1 108.11	11 666 11	1.68.1	3.605					
ZONE 5		ţ-	Γ			†	<u>†</u>			<u> </u>		\vdash	-	1.1 1.1						50 v. v.						
A.Construction Cost	17.397	_				~	· .			•			<u></u>			<u> </u>				7	21.971	2 1.16.112	1 1/26 12			
L'Trentwork Plant	31.460					÷					w, 			·			 			· • •	10.489	10.489	10.489			· .
2.Sowcage			•								. <u>.</u>					/								-		
															<u></u>						· · · ·		- cij			
B.Land Acquisition Cost	2.755								· · · ·	<u> </u>									Sec. 1					1. 2. 1.		
C.Engineering Service Cost	11.660														1. A., 1. A., 1. A.,	<u></u>		51.9.1	1.935		566.1	SC6.1	535	1.935		Σin in Na 4
D.Administration Cost	4,006		••••••	4						<u>.</u>		<u>- 141 - 1</u> 	<u></u> 	 * . *			0.50	10.0	0.00	0.501	0.501	105.0	10.0	10		
E.Physical Contingency	19.154	·			•					i j							0.100	0.4477	0.763	976.0		4,831	in t	2.7%		
Sele-Trank	114 924	-	T				-	+	-		+	-		-		-	0.601	2.923	4.576	2.254 2	29.289 2	29.289 2	29.289	16.703		
ZONE 41			Γ				1.1			 		 														
A.Comparison Cont.	61.433						<u>.</u>					<u></u>											957.1	17.256	17.256	199.6
Treatmost Plant	22.778	- · ·					<u>.</u>			• •	·		in Turk Birth	<u></u>	<u></u>							, i ez	1.593	1.193	19976	110.6
Concernes 3.Latic Water Quality Improvement Works																						<u>.</u>		- 		
B.Land Acquisition Cost	1.040																			- C - C - C - C - C - C - C - C - C - C	0.52	225				
C.Engineering Service Cont	9,215					1	×											 		1.11	ŝ	<u></u> 			2	
D.Administration Cost	3.124												22,		<u></u> 1911 -						0.391	6.0		2	161.0	6.0
E. Physical Contingency	14.962											· · · ·			 		0.000		0.078	SECO	0.489	0.182	1437	3.837	121	2.318
Sade Taicat	19.774	T					╡┨		\dagger	+	╈	┼┨	$\left \right $		╞┨	\mathbf{H}	0.000		0.469	2112	57.6	160	21.019	610.13	61013	100

DISBURSEMENT SCHEDULE OF THE WASTEWATER DISPOSAL SYSTEM (4/4) Fig. 4.12

											-	(Unit:Million USS)	lion USS											ŀ
Lotte	Total Y	Yer					- Cupp	ų,	2	\$00¢	, vo	2007	2005	2009	2010 2	2011 20	2012 20	2013 20	2014 20	2015 2016	5 2017	7 2018	8 2019	9 2020
keen			1		-	╋	┿	+			Ţ	╈	+	+	╈	÷	┞	┞				-	_	_
1-1 3NOZ					Contractory.	and and and	Non-Television	Contraction of the	No.	200 A 1	2000	10000	24.20	14 1 1 2 E										
A.Construction Cont	15.600			0.880	154-1 081	098.0 12	53 0.963	0.063	0.863	0.865	0.863 0.863	0.863	0.161	0.463	0.463	0.863 0	0 (298.0	0.363	0 (910	0.163				
1. Treatment Plant	13.800	.			0	0.863 0.863	3 0,863	3 0.863	0.363	0.860	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.863	0.963	0.863				
2.Sewenge 3.Lake Water Quality Inquivement Work	0.048			8.0	0.550 0.550	0.580	1 	· · ·					·	••••••								. <u></u>		
B.Land Acquisitions Cost	2.982			6	0.186 0.1	0.186 0.186	0.136	6 0.186	5 0.186	0,136	0.186	0.186	0.186	0.136	0.136	0.186 0	0.136 0	0.186 0	0.136					
C.Engineering Service Cont	2.341			0.1.30	0.130 0.1	0.130 0.130	00 0.130	0 0.130	0.130	0.130	0.130	0.130	0.1.0	0.130	0.130	0,130	0,130 0	0.130	0.130 0.	0.130				
D.Administration Cost	0.930		6.00	0.049 0.0	0.049 0.0	0.049 0.049	69 0.049	640.0 69	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049	0.049 0.	0.049				
L Physical Contingency	4.372			0.036 0.2	0.249 0.4	0.431 0.246	46 0.246	46 0.246	6 0.246		0.246	0.246	0.246	0.246						0.208				
Selv-Total	- 617-22	Ŧ	0.059 4	21 212.0	1.4% 2.3	2587 1.474	71 1 77	74 1474	4 1 474	1.474	F	Ē	R -	E	14	N.F.		1	1.474	057	┦	-	+	╀
T-1 HNOZ		 																5 617.6	5 (5)	1491				
A.Construction Cost	17,038			<u>-</u> -									704.7	701-7										
1. Treatment Plant 2. Severate	Ŧŝ					. <u>.</u> .	<u>-</u>						1.074	1.01	1.074	1.074	6	64 CO	1.074	1.074				
3.Late Water Quality Improvement Work	0.000	<u>.</u>										0000	0000											
B.Land Acquisition Cost	190.0		<u>.</u>			<u> </u>	<u></u>					0.181				0.181								
C.Exgineering Service Cost	2,556	<u>.</u>			_							0.284	0.284	0.284	0.234	0.284	0.234	0.284	0.284 0	0.234			<u></u>	
D.Adminêktrations Cost	0.870				<u>.</u>						0.087	0.087	0.087	0.067	0.087	0.087	0.007	0.087	0.067	0.067		<u> </u>		
E. Physical Contingency	4.165										0.017	0.110	172-0	0.571	172.0	570	0.571	172.0		0.289				
Sab-Total	24.990	╉	-+	+	+	+	+				0.104	0.662	3.423	1.423	3,423	1561	5	112	142 1	5		$\left \right $	╉	
L'ANOZ		 	 	┢															- 100					
A.Consumetion Cost	13.253					L	_				1,325		1325	1.325	1325					<u> </u>				
1.Treatment Plant	13.253										1.325	1.325	5251	1.325	1325	5201	1325	221	271	526	<u>.</u>			
2.Sewerage 3.Late Water Quality Improvement Works																								
B.Land Acquisition Cost	0.415									0.042	2 0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042					
C.Engineering Service Cost	3386								0.181		0.181	0.181	0.131	0.181	0.131	0.181	0.181	0.131	0.181.0	0.181				
D.Administration Cost	0.683					70	0.046 0.0	0.046 0.046	16 0.046	6 0.046	0.016	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046	0.046				
E. Physical Contingency	3.268					6	0.0 0.0	600.0 600.0	0.045	10.017	0.319	0.319	0.319	610.0	6100	0.319	615.0	615.0	610.0	0100				
Such-1 retail	109761	\dagger		+	+	0	0.055 0.0	0.055 0.055	5 0.272	2 0.104	4 1.912	1.912	1.91	6	216:1	1912	Ē	<u> 1</u> 8 1	1912	19.61 2981	1		$\left \cdot \right $	Η

5. PROJECT EVALUATION AND DEVELOPMENT PROGRAM

5.1 Development Cost

5.1.1 General

The construction cost and operation and maintenance cost for the urban drainage plan and wastewater disposal plan are estimated on the following assumptions:

- (1) Total construction cost consists of, direct construction cost, government administration cost, land acquisition cost, engineering service cost, and physical contingency (price contingency is excluded from this cost estimate).
 - (2) All the costs are estimated in US\$. The basic exchange rates applied are:

US\$ = Yen 100 = VN Dong 10,800

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- (3) The cost of imported machineries, equipments and materials excludes imported tax and duties since such taxes are not imposed for this government project.
- (4) The labor cost applied is the prevailing wage rate in Hanoi city (no adjustments are made for estimating the shadow wage rate since the current rate barely covers subsistence income levels).
- (5) All project costs are estimated at mid. 1994 price levels.

5.1.2 Drainage Plan

The construction and OM costs of the urban drainage plan for the To Lich River basin and Nhue River basin are estimated as follows:

				(US\$ 1,000)
Basin/S	itage		Const. Cost	OM Cost (per year)
To Lich	n River B	Basin		
(1) 19	st Stage	in i sugni i sen Grafita anti-an	160,470	1,143
(2) 21	nd Stage	i de la composición d Composición de la composición de la comp	156,939	579
	Sub-total	N	(317,409)	(1,722)

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Nhue	River Basin	an sea an	
(1)	Co Nhue	86,218	273
(2)	My Dinh	40,950	159
(3)	Me Tri	53,588	179
(4)	Ba Xa	25,942	118
	(Sub-total)	(206,698)	(729)
Total		524,107	2,451
	the second s		

The operation and maintenance cost includes costs for the dredging of channels, removal of garbage and other debris, repair of embankments and other structures, and the OM of pumping stations and related facilities.

5.1.3 Wastewater Disposal Plan

The construction and OM costs of all the wastewater disposal plans (Zone 1-1 to Zone 7) are estimated as follows:

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(1) Centralized Treatment		
Zone 2-1	85,522	1,130
Zone 2-2	52,518	577
Zone 3	109,734	1,198
Zone 4	69,504	900
Zone 5	114,924	1,082
Zone 6-1	45,120	517
Zone 6-2	89,774	799
(Sub - Total)	(567,096)	(6,203)
(2) On-Site Treatment	an a	
Zone 1-1	26,233	419
Zone 1-2	24,990	279
Zone 7	19,607	1,136
(Sub - Total)	(70,830)	(1,834)
Total	637,926	8,037

The centralized treatment plans (Zones 2-1, 2-2, 3,4,5 and 6) will be implemented as a public investment project, while the on-site plans (Zone 1-1, 1-2 and 7) will be implemented by the community or as a private investment. The total required investment is US \$ 638 million.

Total annual OM costs for all the wastewater disposal plants are estimated at US\$ 8.04 million, US\$ 6.21 million for the centralized treatment plants and US\$ 1.83 million for the on-site treatment plants.

5.2 Project Evaluation

5.2.1 General

Economic and financial evaluation is conducted for the urban drainage plan and the wastewater disposal plan. To estimate economic benefits, the reduction in flood damage relate to the urban drainage plan, while quantifiable benefits including the reduction in disease contraction, tourism promotion, improved groundwater quality, and increases in land value relate to the wastewater disposal plan.

Construction costs, operation and maintenance costs, and replacement costs are estimated at mid-1994 price levels. Costs exclude price escalations and transfer payments including import tax and other related taxes.

The Economic Internal Rate of Return (EIRR) is calculated for the selected urban drainage plan and the wastewater disposal plan on the basis of their estimated economic benefit and cost, and having a projected economic life of 50 years. The comparison of EIRR between the urban drainage plan and the wastewater disposal plan cannot be made directly, since the benefit estimate methods are different.

For the financial analysis evaluated in line with the government budget and national economy, fund requirements are estimated for the implementation of the selected projects up to the year 2020. Appropriate sewer charges are also judged considering the required operation and maintenance costs and the affordability of the residents.

5.2.2 Economic Evaluation

- (1) Drainage Plan
 - (a) Economic Benefits

The economic benefits expected from the urban drainage plan are derived from reduced flood damage and increased contribution to environmental improvement. However, only the reduction of flood damage is estimated for this economic study. For the estimate, direct damage on property, including houses, household goods, shops, merchandise, public/government buildings and factories, and on agricultural production are initially estimated by applying the damage ratio to the damage potential and flood frequency. Indirect damage is also taken into account; includes damage to transportation and communications, and a loss of income for this factory owners and employees.

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The expected reduction is calculated by estimating the difference between the average annual flood damage prior to construction and after completion of the project. After implementation of the drainage plan, the Study Area will be free from floods with a return period of 10-years or less. The estimated annual economic benefits both for To Lich River basin and Nhue River basin are presented below.

Economic Benefit of Urban I	(US\$ 1,000)
Ecc	onomic Benefit (1994)
To Lich River	
1st Stage	7,537
2nd Stage	5,026
(Sub-total)	(12,563)
Nhue River	
	n 157 , an an har second a p
My Dinh	2.4.1.985 and a second the
Me Tri	1,018
e an	528
(Sub-total)	(2,688)
Total	15,251

The benefits estimated above are expected to increase at 8 % ^{*1} per annum which corresponds to the economic growth of the region.

*1: Due to the rapid urbanization of the Nhue River basin, an increased rate of 11 % is applied.

(b) Economic Costs

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Economic construction costs are estimated using the economic price for land acquisition and compensation, summarized below:

Economic Cost of Orban Di	(US\$ 1,000)
	Economic Cost
To Lich River 1st Stage	146,809
server and Stage a structure of a strategy	138,894
en in the (Sub-total) and the second s	(285,703)
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Co Nhue	73,188
My Dinh	35,430
Me Tri	42,076
Ba Xa a set and a set	24,147
(Sub-total)	(174,841)
Total	460,544

Economic Cost of Urban Drainage

(c) Economic Evaluation

On the basis of the estimated economic construction cost, OM cost, and economic benefit, EIRRs are calculated for the six plans. For the calculation, all the plans are assumed to be completed within 6 years. The calculated EIRRs are presented below:

	EIRR (%)
To Lich River	(11.6)
1st Stage	11.7
and Stage	. The constant of the transformation 11.4 , the transformation 1
Nhue River	(9.3)
Co Nhue	*
My Dinh	11.1 (1997) (199
Me Tri	10.0
Ba Xa	9.3
an a	

EIRR is not calculated since the total estimated benefit could not cover the project cost.

As indicated above, the To Lich River drainage plan for the 1st and 2nd stages has the highest economic rate of return, and can be economically justified. In the Nhue River basin, the My Dinh, Me Tri and Ba Xa show reasonable returns though Co Nhue does not produce any justifiable benefits. The Nhue River drainage plan is also economically viable as a basin drainage plan. (The cost benefit stream of the six plans are presented in Table H2.1 to H2.6 in Appendix H).

(2) Wastewater Disposal Plan

(a) Economic Benefit

Through the improvement of the wastewater disposal system, the following economic benefits are expected.

- (1) Reduction in disease contraction
- (2) Tourism promotion (contribution to increased tourism)
- (3) Improvement of groundwater quality
- (4) Increased land value
- (5) Increase in agricultural and fishery production
- (6) Improvement of living environment
- (7) Facilitation of urban development in Hanoi city

Only four of the above benefits are estimated quantitatively, and are compared to the economic cost for economic evaluation. The estimated economic benefits per year in the Study Area are summarized below:

			(US\$ 1,000)
		Economic	Benefit (1993)
Reduction in	disease contractio	n	953*
Tourism pror	motion	2,4	160*
Improvemen (for 5 y	t of groundwater (ears)	n al diserti di si in anti di si in anti Santa di secondo di si internetta di si internetta di si internetta di Santa di secondo di si internetta di si int	559
Increased lan (for 10		46,	500
	····		

The benefits are expected to increase at 8 % per annum which corresponds to the economic growth in the region.

(b) Economic Cost

The economic construction costs of the wastewater disposal plans are estimated by using the economic price for land acquisition and compensation. The estimated economic costs are summarized below.

		(US\$ 1,000)
	Econom	nic Cost(1994)
Zone 1 - 1		22,488
Zone 1 - 2		24,546
Zone 2 - 1		82,447
Zone 2 - 2	a sa siya sa sa sa Tari ya sa sa sa sa sa	50,981
Zone 3		90,648
Zone 4		55,165
Zone 5	1	11,542
Zone 6 - 1		44,239
Zone 6 - 2		88,498
Zone 7		19,098
Total		89,652

Economic Cost of the Wastewater Disposal Plan

(c) Economic Evaluation

On the basis of the estimated economic benefit and cost, EIRRs can be calculated for each zonal development plan. For the calculation, all the development plans are assumed to be completed within 5 years. The resulting EIRRs are presented below:

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	Zones	EIRR (%)	
	Zone 1 - 1	4.4	•
	Zone 1 - 2	a. a data ana ara ara ara ara ara ara ara ara ar	
	Zone 2 - 1	5,7	$(1,1)^{(1)}$
an an là thair Tha tha chuir an là thair	Zone 2 - 2	na ang ang akarang ang ang ang ang ang ang ang ang ang	2011 - E
	Zone 3	8.2	
	Zone 4	6.7	
	Zone 5	1.9	
unta sa tr <u>i</u> ri Li si	Zone 6 - 1	2.1	n an
	Zone 6 - 2	1.7	an sea an fairte
a ta <u>Gr</u> é	Zone 7	en el la cual d' * plyrage d'estre pl	

EIRR is not calculated since the total estimated benefit did not cover the project cost.

The above results indicate that Zone 3 produces the highest return among the ten zones and can be economically justified, Zones 4, 2 - 1 and 1 - 1 are marginally viable, while Zones 6 - 1, 5 and 6 - 2 do not presently produce any justifiable benefits. Zones 1 - 2 and 7 do not produce sufficient benefit to cover the project costs. (The cost benefit stream of the ten zonal plans are presented in Table H2.10 to H 2.19 in Appendix H.)

5.2.3 Financial Evaluation

(1) Required Government Investment

For the assessment of the financial viability of the project; annual disbursement for the project implementation is prepared on the assumption that all the project components are to be completed by end of 2020. Required annual government investment for urban drainage and wastewater disposal during the period of 1995 - 2020 is presented in Table 5.1.

As presented in the table, the total investment will be US\$ 1,162 million during this period (26 years), equivalent to an average of US\$ 44.7 million per year.

(2) Government Budget Analysis

To check the financial viability of the project, capital expenditure of the government and of Hanoi city are reviewed. The government capital expenditures during the period of 1989 - 1993 were assessed, indicating capital expenditure at 3.1 - 7.5% of the GDP averaging at 5.7% for the past five years.

During the past five years, most capital expenditure was directed to the development of roads and irrigation facilities. The expenditure for other sectors including water supply, drainage and sewerage remains at less than 10 % of the total expenditure. Out of the national capital expenditure, about 5 - 7 % has been allocated to infrastructure in Hanoi city.

At present, capital expenditure is barely adequate to maintain the national infrastructure. For sustaining the economic growth projected in the national development plan, capital expenditure should be drastically increased.

In due consideration of the above, projection of capital expenditure on infrastructure, was made by the State Planning Committee (SPC) assuming that GDP will increase at the relatively high rate of 10 - 12 % during the period up to 2010. The projected capital expenditure is presented in Table 5.2. (The projected expenditure includes loans from international organizations).

Possible national capital expenditure on Hanoi's infrastructure is estimated based on the following assumptions.

- (1) Capital expenditure to be allocated to Hanoi city is 7 10% of national capital expenditure.
- (2) The allocated amount for drainage and sewerage is 7 12 % of Hanoi's capital expenditure.

The estimated possible capital expenditure is presented in Table 5.2. and summarized below:

29年後後の後に対し、大学の時期に行			(US\$ million)
	2000	2005	2010
Capital Expenditure in Hanoi	343	635	1,081
For Drainage and Sewerage	34	64	130

Comparing the proposed cost disbursements with the projected capital expenditure results in the following:

- During 1996 1998, the required fund will be considerably larger than projected capital expenditure. To achieve this, 1.8 to 2.2 % of the national capital expenditure on infrastructure is to be allocated to the Hanoi drainage and sewerage sector.
- (2) After 1998, and except 2002 and 2003, the projected government expenditure will provably cover the required investment.

The estimated figures of possible capital expenditure indicate that the proposed investment for drainage and wastewater disposal in Hanoi city can be generally financially justified. Assuming the support of high economic growth during 1994 - 2010, will result in the increase of capital expenditure at the relatively high ratio of 13 % per annum. (SPC projection)

In the case of a more moderate increase of the capital expenditure, say 8 % per year, is assumed, Hanoi city's share of the capital expenditure or investment share for drainage and sewerage is to be raised substantially in order to sustain the required investment.

(3) Finance for On-site Plants

In zones 1 -1, 1 - 2 and 7, on-site plants are proposed. Among these zones, community plants and septic tanks are planned for the general residents in zone 1 - 1 and zone 7, respectively. (In zone 1 - 2, community plants are planned for industrial estates and high class residential estates, which will be financed by private investors.) The on-site plants are planned in principle to be financed by the residents. However, in due consideration of the socio-economic situation of the region, some other financial arrangement seems necessary. One financial arrangement is the setting up of a revolving fund in HPC. Using this fund, a soft loan will be arranged for the installation of the community plants and septic tanks. The soft loan shall cover 90 % of the installation cost with an interest rate of 7 - 10 % per annum and repayment period, after installation, of 5 years. The soft loan would be generated from international financial sources or by local budget allocation.

The required revolving fund is estimated to be about US\$ 6.8 million compared to a total investment of US\$ 15.5 million. Assuming that repayment of the loan is to be used for new installations and interest will cover cost increases for the future installation.

For loan issuing and repayment and installation, sewer cooperatives will be set up in zone 1 - 1 and zone 7. The loan will be provided to the sewer cooperatives through the Department of Land and Housing (DLH). The overall organizational setup for the installation and operation of the on-site plants is described in Appendix H of the Master Plan and summarized in Figure H3.1 of the appendix report.

(4) OM Cost and Sewer Charges

In the proposed implementation plan, OM cost for urban drainage is estimated as follows :

2000 - 2006	US\$ 0.57 - 1.72 million/per year (To Lich)
2007 - 2016	US\$ 1.80 - 2.45 million/per year (To Lich plus Nhue)

According to the HSDC budget in 1994, the allocated amount for the operation and maintenance is 12.8 billion Dong (US\$ 1.19 million), while the total budget for the HSDC is 16 billion Dong (US\$ 1.48 million). In order to cover the additional OM costs required for the urban drainage plans, the HSDC budget (33 % per year during 92 - 94), is to increase by 7.7 % per year in net value during 1994 – 2006. Taking into consideration of projected future economic growth and the past trends of the HSDC budget (33 % increase per year during 1992 – 1994), this expected increase seems attainable.

OM costs for wastewater disposal or its part is basically recovered by beneficiaries in most developed countries. At present in Hanoi city, 10% of the water charge is imposed on beneficiaries as a sewer charge, which is used for the operation and maintenance of the sewer system.

In this study, the sewer charge to be collected for recovering the OM cost is estimated on the assumptions that (1) the present ratio of water charges between households and commercial/factories ($0.06/m^3$ for households and $0.3/m^3$ for commercial/factories) continues in the future and the sewer charge is assessed corresponding to water consumption, and (2) the total population of the Study Area

excluding zones 1 - 1, 1 -2 and 7 will be 1,460,000 in 2010 and the number of households will be 339,700

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The estimated sewer charge enabling recovery of the OM cost is \$5.7 /household per year. The estimated figure is equivalent to 0.6 % of the estimated average household income for urban residents (US\$ 960 / year in 1994). This indicates that the OM cost can reasonably be recovered by the sewer charge if the above share can be maintained, and an another state of the state of th

However, water charges per household are estimated at \$ 8.5 per year in 1994 $(901 / \text{day per person}, \text{ no. of people in household is 4.3, water charge 0.06 $ /m³).$ Compared to this, the sewer charge is about 67 % of the water charge, which is considered high. All the field of the first of the first of the first of the second seco

5.3 Eles Overall Implementation Plan de la compare de la secondada de la compare de la comp

The implementation schedule for the urban drainage and wastewater disposal plans is prepared on the basis of the following conditions and assumptions.

Drainage Plan

(1) The To Lich River basin having a higher economic return will have first priority, (1st stage to 2nd stage)

(2)The Nhue River basin drainage plan is to be implemented at a later stage due to its lower economic return and budgetary constraints. In due consideration of their socio-economic and engineering aspects, Co Nhue, My Dinh, Me Tri and Ba Xa sub-basin plans will be implemented in this order.

Wastewater Disposal Plan

- Implementation priority for the wastewater disposal plan is determined by (1)various factors, including population density, land use, pollutant load, cost efficiency of disposal, and economic return.
- In regard to the above, the highest priority is given to Zone 2 1 to be (2) followed by Zones 4, 3, 2 - 2, 6 - 1, 5 and 6 - 2.
- (3)Zone 1-1, 1-2 and 7 are on-site plants and are planned to be implemented on a separate basis (private investment project).

Figure 5.1 shows a proposed implementation schedule of the drainage and wastewater development. Based on the proposed implementation schedule, EIRRs are calculated for the overall urban drainage plan and the wastewater disposal plan as presented in Table 5.3 and 5.4.

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EIRR for the overall drainage plan 10.9 %

EIRR for the overall wasterwater disposal plan 5.2 % (excl. Zones 1-1, 1-2 and 7) (1994) [1996] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [1906] [

As indicated above, the overall drainage plan shows a high return and early implementation is justified, while the overall wastewater disposal plan shows a relatively low return.

5.4 Initial Environmental Examination of the Proposed Projects

In general, the proposed projects will not cause adverse effects to the quality of the environment. Environmentally the project creates a positive effect by improving the drainage system of the city. There will be no major environmental problems in implementing the project.

Nevertheless, in further planning and design of the project, consideration should be taken to minimize the possibility of environmental issues arising. The following main topics will be further analyzed in the subsequent environmental assessment (Appendix F).

5.4.1 To Lich River Basin Drainage Project

(1) Yen So Pumping Station

(a) Environmental Impact

The pumping station, will create very little environmental impact, as the area required is relatively small, 1.7 ha. According to the present designs, the buildings barely disturb or change the landscape. However, the channel which connects the regulating reservoir to the pumping station (Inlet channel) and the pumping station to the Red River (Outlet channel) are new structures which cut the natural connection.

The impact on the Red River water quality depends on the use and capacity of the pumping station. Storm water is usually contaminated, with turbidity and the amount of suspended solids high. However, during heavy rain water volume and flow will increase, as will the dilution capacity, ensuring water from the reservoir has only a temporary impact.

(b) Mitigation of Adverse Impacts

The biggest impact will be during the construction work, which will also increase traffic in the area. Erosion has to be eliminated during construction work and use. The maintenance of the channels has to be arranged to ensure there is always enough area for water to flow freely.

(2) Regulation Reservoirs

(a) Environmental Impact

In the Yen So reservoir, the difference between maximum and minimum water levels will be 3.0 meters, having a big impact on vegetation and fauna, and causing erosion on the banks, if changes occur very quickly and often. Storm water can also have an impact on the water quality of reservoirs. It is very probable the amount of suspended solids, nutrients and bacteria will increase after the discharge of storm water. Water pumped from reservoirs to the Red River may also reduce the water quality in the Red River.

In the Yen So area, the present lakes are used for fish farming. The ponds are emptied and dredged every year, creating conflict between the needs of fish farming and flood controlling. The water level will increase from present levels, and different areas of the reservoir will be enlarged. These will cause changes in fish farming methods, and in maintaining the reservoir.

Besides Yen So two other regulating reservoirs are proposed, Linh Dam and Dinh Cong, with implementation planned during the second stage. These lakes are to be excavated to complete the regulation capacity of the Yen So reservoir. There will also be two new channels, and the flow direction of the Lower Lu River basin will be changed.

The reservoirs, besides being used for drainage purposes, will also be used for fish farming and recreation. The surrounding areas will be parks and/or green areas. According to the City Master Plan, Linh Dam lake will be an important recreational area in the future, and the demand for water quality will be high. There are also many pagodas around the lake.

(b) Mitigation of Adverse Impacts

To keep water quality in reservoirs as clean as possible, there will be provision made for an ordinary drainage channel connecting the river system directly to the pumping station.

Construction work of the reservoir will last about three years, and during that time about $3,500,000 \text{ m}^3$ soil will be excavated. To minimize transportation costs, the soil should be used near the construction area, e.g. as a material for dikes. To prevent erosion, banks have to be covered with grass or other revetment material.

The location, area and depth of the reservoir has to be designed with care, to eliminate groundwater contamination, the lowering of groundwater levels and soil subsidence in Phap Van well field, located next to the reservoir.

(3) River Improvement

(a) Environmental Impact

The planned improvements are limited dredging in upstream and downstream areas of the main rivers, and some bridge re-construction.

(b) Mitigation of Adverse Impacts

The biggest impact will be during the construction work, when there will be disturbance of traffic. Temporary increase in turbidity and suspended solids may be possible during construction. Impacts on water quality can be controlled and measured downstream. (4) Drainage Channel Improvements

(a) Environmental Impact

The planned improvements are mainly concerned with the re-construction of bridges to increase flow in the channels. Inadequately sized culverts collect floating garbage causing clogging, which prevents the flow. The improvement of the flow is obvious after cleaning the channels.

(b) Mitigation of Adverse Impacts

It is very possible that the soil in the channel banks and the bottom sediment are polluted, because they have long been used as illegal dumping sites. Polluted soil will have to be removed.

The increase of erosion and amounts of suspended solids has to be prevented and measured during construction. Work has to be completed without affecting water quality downstream. Special attention has to be paid to the prevention of erosion during and after construction.

(5) Lake Dredging

(a) Environmental Impact

It is proposed to dredge 18 lakes of which four will be dredged during the first stage of implementation.

Many lake bottoms seems to be devoid of life, so dredging doesn't cause serious harm to the lake ecosystem. One of the biggest environmental problems is the relocation of sludge.

At the same time, attention should be paid to the banks and surrounding areas to improve the whole area and increase the use of the lakes. Lakes which are used for recreation should be conserved for that purpose. Well-maintained lakes and parks increase the value of the living environment.

(b) Mitigation of Adverse Impacts

Water quality, amount and type of sediment, possible bottom fauna and vegetation have to be studied before and after dredging to establish the real impact of dredging. Mitigation of the wastewater load to lakes has to occur at the same time as dredging, otherwise the restoration will only have a minor influence.

The impact of dredging can be mitigated with good work planning. The treatment and storage of the sediment and sludge has to be organized to prevent future problems.

The amount of sediment will be so great, that the timing of the work has to be done carefully. Work has to commence during the dry season to mitigate the impact. There has to be control during the construction work to accommodate any unforeseen changes.

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(6) Lakeside Protection Works

(a) Environmental Impact

There is a conservation proposal for 11 environmentally valuable lakes. Proposed conservation methods call for the excavation of sludge from the lake bottom, construction of a different kind of revetment on the slopes, and the aeration of selected lakes.

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To prevent erosion, and the illegal construction of houses, and the dumping of garbage, some kind of protection of the lake banks is needed.

(b) Mitigation of Adverse Impacts

The material for the pavement and slope revetment of the bank has to be selected in regard to each lake. Also during the rainy season and flooding the inundation area can be quite large, causing water build up on the sidewalks.

(7) Storm water sewers

- Rehabilitation of existing sewers

- Installation of new sewers

(a) Environmental Impact

The work consists mainly of construction of new sewers. The replacement of pipes will be determined only after inspecting their condition, during the cleaning work.

The present sewers are old and dilapidated and do not provide adequate drainage for even normal rainfall. Therefore it is necessary to clean the old sewers and construct new, sewers commencing with the most serious inundation areas. Increasing the storm water sewer capacity and decreasing the inundation areas improves both the quality of the environment and sanitation.

(b) Mitigation of Adverse Impacts

The present implementation schedule compared to demand, is slow and inadequate. Sludge from the cleaned sewers has to be disposed of without creating harm to people or the environment.

5.4.2 Existing Sewerage / Channel Dredging Projects

Supply of Dredging/Cleaning Equipment

Dredging/Cleaning Work

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(a) Environmental Impact

Environmentally, the cleaning and dredging of sewers and channels is very important. It has a very positive environmental impact and is highly recommended especially during the rainy season, because clogged and stinking sewers cause serious environmental and sanitation problems.

(b) Mitigation of Adverse Impacts

Sludge and garbage removed from the channels and sewers must be handled with care as it can contain bacteria and other harmful matter. Special attention must be paid to the safe use of equipment and to protection, during the work. It must be noted, that if the pipes are flushed using high pressure, there may be overflow from the manholes, discharging dirty sludge into the streets.

Treatment and storage of the sludge must be arranged to prevent health or environmental problems. Transportation of sludge has to ensure there will not be spillage. If vacuum tanks are not used, the load must be covered.

It would be beneficial when discussing the cleaning, transportation and composting of the sludge, to utilize pilot testing areas. The most critical technical and environmental areas should be studied.

Due to the continual dumping of refuse, open channel dredging is a continuous process. To create long-term benefits, people must be educated in the correct disposal of solid waste.

5.5 First Priority Project for Implementation

(1) Proposed Project

The To Lich River basin drainage project is selected as the first priority project. Early implementation of the project is supported by it's high economic return and also from a technical/environmental aspect. The project is tentatively named, "Hanoi City Drainage and Environmental Improvement Project."

(2) Objective of the Project

The main objective aims of the proposed project are:

- (i) The reduction of physical damage presently caused by flood inundation and improper drainage
- (ii) The improvement of the urban sanitary environment (through decrease of inundation) and the improvement of the water-front environment (through river/lake conservation work)

(3) Implementation Cost and EIRR

The total cost for the project is estimated at about US\$ 317 million. EIRR is assessed as 11.6 %.

(4) Phasing of the Project

The implementation of the project is proposed to be in two stages. The first stage being concerned with selecting the highest priority work of the project relating to the reduction of flood damage.

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Table 5.1 PROPOSED COST DISBURSEMENT SCHEDULE

(US\$1,000)

2012 2013 2014 2015 2016 2017	3 5,629 6,166 5,447				3 5,629 6,166 5,447			2	2,629 6,166 5,447	2 35.567 30.720 23.268 42.666 30.342 52.908			3	2 13,942 6,973	9 11,893 11,893 11,893 5,604	11 2.923 4,576 2.254 29,289 29,289 29,289	469 2.312 2.936 1,093 23,019	4 1,474 1,474 1,474 1,242	1 3.423 3.423 3.423 1.735	2 1,912 1,912 1,912 1,860	5 41,196 36,886 28,715 42,666 30,382 52,308	
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2007 2008 2009	28,285 27,845 22,023			-	28,285 27,845 22,023	20,892 7,342	2,556 8,916 9,645	4,837 11,587 12,378		16,809 33,015 32,663		2,778	9,480 23,678 23,678	314 2,339 1,066	189 189 1,110			727'I 727'I 727'I	662 3,423 3,423	1,912 1,912 1,912	45,094 60,860 54,686	
2006	308,16		-		308,15	23.458	3,000 54	5,348 4,3		168'16		17,473	1,619 10.739 9,4		681	· .		1,474	104	1,912	63,697	
2004 2005	25,217 21,962	19,346		19,346	5,871 21,962	5,87) 21,962				14,181 20,668	8,800	3,275 17,473	360					I,474 I,474		272 102	39,398 42,630	
2 2003	53,534	2 46,841		2 46,841	6,69,8	¥69'9				26,350	15 23,743	S 8.358	2,720		-	•		14 1,474		55 55	H 89,884	
2001 2002	22,439 57,422	27,439 57,422		22,439 57,422				 		23,553 34,022	21,415 21,415	249 8,358	360 2,720					1,474 1,474		55	45,992 91,444	
2000	15,780 22	15,780. 22	4,889	10,891 22						7,093 23	2638 21	246	1,619,1					2,587	•		22,873	
6661	27,568	27,568	27,568	:				÷		5,968	3,373	743	¥.			 		1,494	•		33,536	
1998	47,235	232 U	47,235							5.933	I, \$70	318 E						215			53,168	
1997	+2762	42,762	42,762							5,038	7.17	3,845		 				8	1		47,800	
1996	29,866	29,866	59 86 2					<u> </u>		166'E	1,134	2,857					 	 			33,857	
1995	8 8	6,150	8,150			 	 	 	ļ		 			 	 						8,150	.
	524,107	- 117,409	160,470	156,939	206.698	86,213	40,950	595,62	25,942	637,926	85.52	105-69	109,734	52,518	45,120	114,924	89,774	26,233	24,990	109'61	1, 162,033	
	L. Uthen Drainage Plan	I To Lich River	In Stage	Sa Sa	2 Nhee River	CoNtra	My Die	Me Tri	Ba Xa	II. Wastewater Disposal Plan	(D) 2-1 (2017)	(2) Zone 4	(3) Zone 3	(4) Zone 2-2	(5) Zone 6-1	(6) Zone 5	(7) Zose 6 - 2	(8) Zone 1 - 1	(9) Zone I – 2	(10) Zone 7	III. Grand Total	

(US\$ million) 12857 14920 17100 19250 21870 24570 27950 2 8 . 10 12 85 Table 5.2 PROJECTION OF CAPITAL EXPENDITURE FOR THE INFRASTRUCTURE <u>3</u> 3 *1 Projection by SPC, 1994, Total Capital Expenditure includes expenditure for infrastructure, industry (power), and other sectors 3790 4510 5160 2 10 10 15 9650 11020 ġ ġ 1-~ ~ Е ð Allocated to Hanoi City 1- Total National Capital 2- Projected Capital (b) 3 (b) x 4 (a) Infrastructure *1 Expenditure on Expenditure *1 for Drainage & (b) 2 x 3 (a) Expenditure Expenditure Sewerage (a) % (a) % 3- Capital 4- Capital

- 166 -



Table 5.3 (1) COST BENEFIT STREAM OF THE PROPOSED URBAN DRAINAGE PLAN (1/2)

	C of	100.2	108.12 Art Bt	191 W	016.12	12,743	16,364	TM 15	216:05	042.12	21.078	25,813	010.15	CNC.9C	20,613	22.168	19,650	7,603	8,140	8,705	7,839	1012	2451	2,451	2.451	2,451	2,451	2.451	2,451	126.45	2.451	2.451	18.736	2.451	158.5	1116	1245	2,451	12,479	2,451	2.451	2,451	6.209	2.451	1087
(nnn:teen)	Tiotal	0		c	12	5	1 143	1.143	1.11	221-1	1.722	1.722	1.804	1.908	1.995	2.096	2,165	2,333	2,113	2.368	2.992	144	. 151 c	2.451	2.451	2.451	2.451	2,451	2,451	142	2,451	2.451	2.451	2.451	1477	2.451	2.451	2,451	2,451	2,451	2.451	2.451	2.451	2.451	1047
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	To Lich (1)				1	÷.	2/2			211	6711	66171	6414	1,143	1.143	1.143	1,143	- 143-	1.143	1.143	1.143	1.143	143	- EF1 -	LFI I	64.1	1.143	1.143	1,143	1,143	143	£F1'1	1.143	1.143	- -	2	211	911	61.1	541.1	1.143	1.143	1.143	1.143	4
	Total	1,994	23.867	38.330	40,101	BOC'17	1.2.1.1	177.01	HOP'R	1 202	935601	160 12	21.175	664.42	18.618	20.072	17,485	5270	5,807	6.337	5.447	•				0	0	0	0	32,478	9	0	16.285	•	0	072 7) -	10,028	0	0	0	3,758	0	
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<pre>- Y > > </pre>	TalitAni	_					7,282	13.21	8	168 11	014-61) ;:										-			16.285							 					
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Table 5.3 (2) COST BENEFIT STREAM OF THE PROPOSED URBAN DRAINAGE PLAN (2/2)

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Total	0	9	•	0 112 1	10.05	12917	056.01	15.066	19,286	36672	30.695	33,334	36.144	30.418	45.786	LER CY	10. 89	75.302	13,051	15.414	12.414	85.414 #5.414	15,414	\$5,414	85.414	85.414	85,414	85.414	85.414	85,414	85,414	85,414	85.414		\$5,414	85,414	FIF58	85.414	85,414		15414	15,414	15,414	25414
Ba Xa						:								-			0	1 274	2,362	4.725	4.725	81	111	4.725	4,725	4,725	1725	177	4.725	4.725	4.725	173			52.7	4.725	1.725	FL F	54.1		171	4.725	4 725	1725
Mc To														•	89	1999	7394	\$207	9.310	011.0	9,110	0110	0.1.6	9.1.0	9,110	0116	9.110	0116	9,1,0	9,110	9.110	9,110	0116	0116	0110	011'6	0116	01.0	0116	0110	0116	9.110	9.110	0110
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To Lich ()					1.1.1	12.917	13 950	15.066	16,272	17.573	11.979	161-07	22.137	10,00	25.122	1 I I	11 11	35.129	37,940	37.940	37:940	37,940	010	37,940	37,940	37,940	37,940	37,940	37,940	37,940	37,940	17.940	046'16	044.15	ONG LE	37.940	37,940	37,940	99.55		Dir.	37,940	37,940	11 AM

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 Table 5.4
 COST BENEFIT STREAM OF THE PROPOSED WASTEWATER DISPOSAL PLAN (2/2)

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5.2%

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No Proposed Project Cost YEAR Remark 949596679669000102030405060708091011121314151617181920 U6\$ mil STORIMATER DRANAGE PROJECTS 1st Stage Project proposed for OECF loan program (Additional installation in parallel T T þ 2nd Stage with the construction of new city ist Stage TO LICH RIVER BASIN DRAINAGE PROJECT 317 111 A. (45m3/s) (45m3/s) A1. Yen So Pump Station (90m3/s) (Yen So Reserv.) (Linh Dem/Dinh Cong Lekes A2. Regulating Reservoir (130ha) TT A3, River improvement W/Gates (33km) A4. Drainage Channel Improvement (31km) A5.Lake Dredging (18 main lakes) AS, Lakeshore Protection Works (11 lakes) A7.Stormweter Sewers 1.51 (1) Rehabilitation of existing sewers Additional installation in parallel with the construction of new city road) (2) Installation of new sewers R, HILLE HIVER BASH DRAMAGE PROJECT 207 1st priority area in Nhue basin 81. Co Nhue Sub-basin Drainage Project 86 (1) Pump Station/Reservoir/Chennels (Additional installation in parallel with the construction of new road) (2) Stormwater sewers The second 2 sub-basin projects in parallel 82, My Dinh and Me Tri Sub-basins Drainage Project 95 (Additional installation in parallel (1) Pump Station/Reservoir/Channels with the construction of new road) (2) Stormwater sewers 111 83. Sa Xa Sub-beein Drainage Project 28 Additional installation in parallel (1) Pump Station/Reservoir/Channels with the construction of new road) (2) Stormwater sewera EXISTING SEWERICHANNEL DREDONG PROJECT 20 C. C1. Supply of dredging/cleaning equipment 10 Initial Dre Continous Dre doina C2. Dredging/cleaning work 10 By SDC D. ASSOCIATED PROJECTS (By Other Agencies) D1. Nhue River Improvement Project MONR (Construction) (1) Right Bank Dyke with Inland Drainage (Construction) (u/s from To Lich confluence, L-20km) (Study) (Desig Improvement from downstream (2) Nhue River Overall Improvement to upstream (d/s from To Lich confluence, L-50km) (Construction) D2. Red River Dyle Reinstatement Project MONR HON-STRUCTURAL MEASURES 10 E TILLOTIC DELLARIE DELLARIE DELLARIE TESTING TELLED TELLED TELLENCIAS control E1. Flood Plain Management. 5 E2. Provision of On-site Storage for New Estate Priven Development For Red River **NOM** E3. Flood Forecasting and Warning System E4. Public Information and Education Programme 5 LAKE CONSERVATION PROJECTS WEST LAKE CONSERVATION PROJECTS 110 F1. Comprehensive Environmental Study Э 71 F2. Lake Shore Road/Park Project (50) Dredging area by area for ... protection of bottom fauna F3. Lake Sediments Dredging Project 50 CITY LAKE CONSERVATION PROJECT 10 G. 77 G1. Lake side Road / Park Projects (say 50 lakes) (10)

Fig. 5.1 (1) MASTER PLAN - IMPLEMENTATION SCHEDULE

0.5

G2. Lake water Aeration Projects (say 20 lakes)

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Proposed Project	Cost	L	- j.		<u>, i</u>	_			<u>. (* 1</u>			<u>E :</u> /			<u></u>	1.0			<u>.</u>			<u></u>		Remark :	pose i i
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H3. Zone-4 Wastewater Disposal Project	69			1					4	Ľ		. j		:		Ľ	1					· · .	• :		s dig
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H4. Zone-5 Wastewater Disposel Project	115			1	Ľ			<u>:</u> :	4		ŀ		·		20	H	Z						s 2		
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(2) Wastemater Servers	_	Ц			L		1	4	4		┦╴┤		1		Ŀ			-	-	1	Ļ	4	Ļ		
H5. Zone-6 Wastewater Disposal Project	135										."		Zon	6	1)			Ē	17		(Zor		11		
(1) Wastewater Treatment Plant		Π	Τ		े	1.1			T	Ι			Ι	Ι		Γ			J	ľ					
(2) Wastewater Sewers	Ι	Π		Τ		197	Ι	T	Τ	Ι	Π	Π	Ι	Τ						1.4					
ON-SITE WASTEWATER TREATMENT PROJECT	71						<u>.</u>	4							Ŀ	Ĺ			\bot			\downarrow	1		
J1. Zone-1 Community-based Treatment Project	51			ľ	Z			<u>in</u>		du	UZ.			100	ti I	1			1-2)	Ł				For selected areas	
J2. Zone-? Community-based Treatment Project	20	Π								Z					11	F	11	11	tİI	{				For selected areas	
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PLOT WARTEWATER TREATMENT PROJECT	22	Π			T	Π					1		1	T	T					T			T		
K1. Km Uen Rehabilitation Project	6	Ħ	_		÷	h		+	5		\mathbf{H}				╋					t	H	+	1	n de grade al de co	<u>.</u>
K2. True Bach Wasteventer Treatment	6	Ħ		F	7	h					╉╴			╈		t			-	1			+	Low level restment at	eristici
	-	\downarrow	-		Τ.					<u>_</u>	Ļ	Ľ	-	╞	4.		ļ.,		4	╇			÷	sever putlets	
K3. Lake Inlet Pollutant Load Reduction	10			1	F			•	2.44			<u></u>	- 1							1				Either sedimentation be	nein or
		╉╋		+	1	┢	H	+	+	╈				╉	+				┿	╈	+		+	enterceptor besin	
FLUSHING WATER DIVERSION PROJECT	60	╉┦			+	╋	Η	$\left \right $	+	†;	1			. †.		-	2003							To be implemented o	
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L1. Nhue Pumping Station/Diversion Channel								÷.												H	+			Increase in capecides setting basin and ch	
L2. To Lich Diversion Weir		\mathbf{T}		1		1	Π			T	t	11		1	T	t	1		Ť	Ľ			T	Rubber dam	
L3, Canals and Pipes in City Areas		Π			1	ŀ		·				Π					1	Π		Ţ.				Extension of canals/p	, ices
	-	\square		4	÷	+	\square			4	+	Н		+		1	-	$\left \cdot \right $	4	-	F		1	area by area	
	-	+			-	+	Н	\square	-	<u> </u>	+	H		-	+	+-			1	1	-		+		<u> </u>
ASSOCIATED PROJECT (by Other Agencies)	-	┫┥	┥┥	-	╉	+	\vdash				+-		-	÷	╉	╇╌	ŀ	┝╌┥		+	╀	$\left \right $	4		
M1. Upgrading/Increase of Public Latrines	UPENC		┞┨	-	4	F	2			4	Ŧ	-	Ŀ	+	-	+-		$\left \cdot \right $	-	┢	+	\mathbb{H}	+		
M2. Reinforcement of Domestic Wastes Collection System	UPENC	1		Щ.	P	1	R	þoð									1			ł	ľ				
(1) Solid waste collection/disposal	1	Π	Π							-						Τ		Π				Π			
(2) Nightsoil and septic tank sludge collection		$\mathbf{\Gamma}$			Τ	Τ	L		2							Ι								e al conservation de la figura	
	<u> </u>																								
NON-STRUCTURAL MEASURES	20									_								Ŀ				Ц			<u>. 1997</u>
N1. Household's Obligation of Installing Septic Tanks		1	Ι.	Цļ	I)	E¢L	(u	h ij	I	īψ	ψi	i į	ļ	Ηļ	uþ		þ		Ц	ių	Ņ	Π	ι¢	Suict enforcement o	A
N2. Effluent Pre-treatment by Industries		+	H				j.,	H		+	+		╉─		╉	+	╉╴		r-	+	+			regulations	يند من من ا
International Contraction of Antical Stress			μ			1													Ľ		L			Spict enforcement a regulations	
NJ: Provision of Soft Loan for Inselling Septic Tanks	10	1	\square		+	4	ш	μ	ш		1			\square	4	1		Ľ	Ц					Secup of hand symme	<u></u>
N4. Public Awareness Campaign	5	L		H	ц	цı	ш	hi	u	щ	ψu	цı	ļu	ш	ц	ф	ψ	ψu	Ú.	ц	ų	μ	щ	u	
N5. Westerweter Quality Monitoring Program	5	1	ш	щ	u þ	ų,	ф	ŲĒ	IJ	Щ	ιų	фĻ	μ	Щ	uþ	ф	ψ	ψų	ú	ψ	Ú.	щ	ц		<u></u>
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Fig. 5.1 (2) MASTER PLAN - IMPLEMENTATION SCHEDULE

WILL Design Financing/Te Convact Cost : 1994 Base Price (excl. price consingency)) Approx. Estimate

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(BBB) Intern 8888 . Imp nn by Other A