9 URBAN WATER AND SANITATION

9.1 Introduction

Water in its various forms have helped shape Hanoi—whether in a positive or a negative light—into what it is now. On the negative side, chronic flooding and inundations have continued to pose a great threat to the people's safety and infrastructural soundness. Hence flood control remains an important policy agenda of the government. It has also been attending to the improvement and the expansion of water supply, drainage, sewerage, and solid waste systems to ensure safety and sanitary conditions, as well as to avoid the further degradation of the city's environment. While water issues have often been a source of headache for the city, Hanoi's abundance of water bodies lends a certain uniqueness to its landscape, enhances its amenity, and provides recreational opportunities for the people. Plentiful water bodies also promote the extensive coverage of greeneries and growth of trees and plants.

Rapid urbanization involving the increase in urban population and the expansion of urban areas has brought to fore the enormous impacts it can have on the sustainability of water resources. The ever-increasing pace of urbanization requires an equally accelerated implementation of adequate measures to improve water supply, drainage, sewerage and solid waste management to ensure a safe and healthy life for the people and to facilitate socio-economic activities. Urbanization has also led to the reclamation of a number of lakes and ponds for urban development, pollution of underground water, and land subsidence, among others.

The challenge for the water sector is to comprehensively address water-related issues so as to formulate coordinated strategies and actions toward providing a safe and healthy environment for the people, enhancing the urban landscape and the city's identity, while minimizing the negative impacts and maximizing the benefits of urbanization, a trend that is expected to continue in the coming decades.

Thus in this study, six components related to the development of a sustainable water environment for Hanoi were studied in an integrated manner. These components are: (i) water supply improvement, (ii) drainage system development, (iii) sewerage system development, (iv) lake and pond management, (v) flood protection, and (vi) solid waste management.

9.2 Water Supply

1) Current Policy and Undertakings

Development and management of water supply in the city are basically implemented based on *Hanoi Urban Development Master Plan up to 2020* (hereinafter referred to as the "1998 Master Plan") and Decision No. 50/2000/QD-TTg of 24 April 2000. Other main references related to current water supply management include updated sections of the 1998 Master Plan, the general plan on water supply prepared by HWBC and VIWASE in 1999, and the JICA study conducted in 1997.

2) Existing Conditions and People's Satisfaction

At present, water is supplied by HWBC and HWBC No. 2[1] at 572,000 m^3/day, which is the total supply capacity of existing water treatment plants (WTPs) (see Table 9.2.1). This amount is not sufficient to meet the estimated net demand of 555,000 m^3/day as of 2005. Considering a physical loss of 10% and a daily peak factor of 1.35, the gross demand was estimated at 873,000m^3/day.

The service coverage of HWBC and HWBC No. 2 are 81% and 15%, respectively, with respective shares of unaccounted-for water (UFW) at 39% and 23%. Groundwater is the raw water source being extracted from 170 deep wells and 30 shallow wells and treated at 22 WTPs. Water is supplied through 181km of transmission lines and 1,203km of distribution lines. Water users comprise domestic, industrial, commercial, and institutional users consuming 70%, 20%, 6%, and 4% of water supply, respectively.

According to the results of the HIS conducted in HAIDEP in 2005, 41% of the total surveyed households in Hanoi are satisfied with water supply services. While more than 50% of households in the urban core districts of Hoan Kiem, Hai Ba Trung, Ba Dinh, Cau Giay, Long Bien, and Dong Da are satisfied, those in the urban fringe and suburban districts such as Thanh Xuan, Tay Ho, Hoang Mai, Thanh Tri, and Tu Liem are less satisfied (25-40%), and those in the rural areas are least satisfied (10-14%).

3) Main Issues

Although water supply has been improving and expanding its services, there are a number of issues that must be attended such as:

(1) Groundwater Pollution

Pollution of groundwater, which is being used as raw water for domestic use, has been detected in some water treatment plants (WTPs) situated in southern Hanoi, south of RR3, in particular. Based on collected data on raw water qualities in 10 WTPs and treated water qualities in 13 WTPs on Water quality was evaluated for such parameters as pH, ammonia (NH_4^+), nitrate (No_3^-), acid, alkali, hardness, manganese (Mn), and iron (Fe). Salient parameters of their maximum figures were compared with the Vietnam Standards (TCVN 5502:2003) (see Table 9.2.2).

[1] HWBC covers the right bank of the Red River (southwest), while HWBC No.2 serves the left bank of the Red River (east and north).

Table 9.2.1 Summary of Current Conditions of Hanoi's Water Supply

<table>
<tr><th>Item</th><th>Current Situation</th></tr>
<tr><td>1. Water Demand/ Supply Capacity</td><td>
• Water demand (net) was estimated at 555,000 m³/day for the year of 2005. The required capacity to meet the demand was estimated at 873,000 m³/day, assuming a physical loss of 16% and a daily peak factor of 1.35.
• Supply capacity of the existing WTPs is 572,000 m³/day in total, consisting of the following:
<table>
<tr><th>Service Area (plant number)</th><th>Supply Capacity (m³/day)</th></tr>
<tr><td>1) Southwest (10 large WTPs, etc.)</td><td>474,000</td></tr>
<tr><td>2) Southeast (1 large WTP, etc.)</td><td>36,000</td></tr>
<tr><td>3) North (2 large WTPs, etc.)</td><td>62,000</td></tr>
<tr><td>4) Total</td><td>572,000</td></tr>
</table>
• HWBC supplies clean water to southwestern Hanoi (or right bank of the Red River), while HWBC No.2 supplies to southeastern and northern Hanoi (or left bank of the Red River).
• 70% of households replied to be satisfied with the water supply according to the results of HIS (January-February 2005). However, Hanoi might either face water shortage or the unit water consumption (160 l/c/d in urban area and 135 l/c/d in development area) was set a little high.
</td></tr>
<tr><td>2. Water Source and Quality</td><td>
• Groundwater is raw water source for all WTPs; extracted through 170 deep wells and 30 shallow wells.
• Even treated water in some WTPs, situated southwest of Hanoi, is polluted in terms of ammonium (NH_4^+) and E. coli, in particular.
</td></tr>
<tr><td>3. WTP</td><td>
• All the WTPs (19 plants of HWBC and 3 plants of HWBC No.2) are equipped with iron (Fe) and manganese (Mn)-stripping systems consisting of: (i) aeration, (ii) sedimentation, (iii) pre-chlorination and (iv) filtration units.
• The Nam Du WTP, commissioned in 2001, also uses an ammonia (NH_4^+)-stripping process.
</td></tr>
<tr><td>4. Water Supply Network</td><td>
• HWBC has a transmission pipeline (T/L) of 146km installed relatively in recent years and a distribution line (D/L) of 824km installed recently, although a lot of old ones are still in use.
• HWBC No.2 has a T/L of 35km and a D/L of 379km, both of which were installed in recent years.
• A part of Tu Lien and Tai Ho districts is not supplied by HWBC because there is no D/L.
• T/L and D/L are being installed in Cau Giay, and there is a plan for Thanh Xuan to receive water from the Da River.
</td></tr>
<tr><td>5. Operations and Maintenance</td><td>
• Operational performance of both companies is represented by the following parameters (2004):
<table>
<tr><th>Parameter</th><th>HWBC</th><th>HWBC No.2</th></tr>
<tr><td>1) Service coverage (%)</td><td>81</td><td>15</td></tr>
<tr><td>2) Unaccounted for water (UFW: %)</td><td>39</td><td>23</td></tr>
<tr><td>3) Production per person (m³/d/c)</td><td>0.24</td><td>0.51</td></tr>
<tr><td>4) Number of staff (persons)</td><td>1,870</td><td>299</td></tr>
<tr><td>5) Staff per 1,000 connection ratio</td><td>6.0</td><td>9.3</td></tr>
</table>
</td></tr>
<tr><td>6. Customer Classification and Water Tariff</td><td>
• Customers are classified into 4 categories with their respective shares and tariffs (2005) as follows:
<table>
<tr><td>1) Domestic users</td><td>70%</td><td>VND 2,435/m³</td></tr>
<tr><td>2) Industrial users</td><td>20%</td><td>VND 3,913/m³</td></tr>
<tr><td>3) Commercial users</td><td>6%</td><td>VND 6,522/m³</td></tr>
<tr><td>4) Institutional users</td><td>4%</td><td>VND 3,478/m³</td></tr>
</table>
(Tariff excludes sewerage surcharge and VAT.)
• The average water rate is estimated at VND 3,018/m³.
</td></tr>
<tr><td>7. Financial Situation and Sustainability</td><td>
• Key financial ratios of HWBC in 2004 were estimated as follows:
<table>
<tr><th>Indicator</th><th>HWBC</th><th>Check Item</th></tr>
<tr><td>1) Return on assets</td><td>2.2%</td><td>Overall profitability</td></tr>
<tr><td>2) Current ratio</td><td>1.0</td><td>Liquidity</td></tr>
<tr><td>3) Debt-to-equity ratio</td><td>1.8</td><td>Debt management</td></tr>
<tr><td>4) Working ratio</td><td>1.6</td><td>Expenditure level</td></tr>
<tr><td>5) Debt service coverage ratio</td><td>n.a.</td><td>Cash flow</td></tr>
</table>
(n.a.: not computed), Indicators of HWBC No.2 were not yet evaluated.
• HWBC's financial situation has improved.
• A simple observation of HWBC No.2's income statements indicates that its profitability is low. The working ratios slightly exceed 1.0 and the net incomes are narrowly positive.
</td></tr>
</table>

Note: Worked out by the HAIDEP Study Team based on information from HWBC and HWBC No. 2.

Table 9.2.2 Quality of Raw and Treated Water at Four Water Treatment Plants

Parameter	Standard	Ha Dinh	Thuong Mai	Phap Van	Nam Du
1. NH_{4+} (mg/L)	-/3	16/9	18/6	33/22	9/2.5
2. Mn^{++} (mg./L)	-/0.5	0.15/0.11	0.33/0.24	0.22/0.15	0.79/0.16
3. Fe^{++} (mg/L)	-/0.5	23.2/1	21.2/1	9.8/0.53	10/1.95
4. E. coli	-/-	-/-	-/0.58	-/13.75	-/-

Sources: E. coli data from the JICA Preliminary Study Mission Report, November 2004. The rest from HWBC and HWBC No. 2, October 2005.

Results of the comparison show that water is heavily polluted and treatment likewise produces different problems, to wit:

(i) Water requires large amounts of chlorine (Cl_2) for disinfection due to high levels of ammonium (NH_4^+).

(ii) Chlorine (Cl_2), when combined with polluted water, produces trihalomethane which is a carcinogen.

(iii) High ammonium (NH_4^+) content requires a quite delicate adjustment of Cl_2 dosage.

(iv) A Cl_2 underdose voids its effectiveness to disinfect water from contaminants that may distribute infectious diseases through the water supply system.

(v) A Cl2 overdose results in a strong unpleasant smell to water.

Water from the Yen Phu and Phap Van WTPs showed arsenic concentration (0.016 mg/L to 0.02 mg/L, respectively), although it slightly exceeded the maximum limit in the standard (0.01 mg/L). In the future unless handled properly, concentrated arsenic may cause poisoning. Therefore, it can be concluded that groundwater in southern Hanoi, particularly in the south of RR3, is an inappropriate source of water supply

(2) Unaccounted- for Water

Although current unaccounted-for water (UFW) levels can clear the target stipulated in Decision No. 50 in 2000 lowering the UFW to below 45% by 2005, it is still high compared to that in other cities abroad. The UFW target set in Decision No. 50 at 20 to 25% by 2020 may not be easily achievable unless adequate financial and manpower resources are provided.

(3) Limited Groundwater Potential

Decision No. 50 in 2000 has set the maximum limit of groundwater exploitation in the north of the Red River at 142,000 $m^{3/}$day. While this figure is not backed by any scientific research/survey and due to possible contamination, it is recommended that groundwater extraction should not exceed the limit stated in the decision. Current groundwater extraction is estimated at 90,000 to 100,000 m^3/day in total.

In the southwest, or the right bank of the Red River, extraction quantity including that from private wells totals 700,000 m^3/day, which is the limit stipulated in the decision. As the area also experiences groundwater pollution and land subsidence, no further extraction of groundwater is recommended.

(4) Alternative Sources of Raw Water

River flow (or surface water) in the Red River and its tributaries, with plenty of water even during the low water season, is one of the most realistic alternatives to groundwater as raw water for domestic use. Water in the other three rivers, tributaries of the Thai Bin River namely Cau, Cong and Ca Lo Rivers, is too small to use as raw water (see Table 9.2.3).

Table 9.2.3 Flow Conditions of Rivers in/around Hanoi

Name	Gauging Station	Catchment Area (km^2)	Discharge (m^3/sec)		
			Maximum	Minimum	Average
1. Da River[1)]	Hoa Binh	51,800	17,200	174	1,690
2. Thao River	Yen Bai	48,000	10,100	90	768
3. Lo River[1)]	Phu Ninh	67,100	14,000	128	1,030
4. Red River (Thai Bin River Basin)	Son Tay	143,600	34,200	368	3,560
5. Cau River	Dap Cau	5,780	3,500	10	51
6. Cong River	Trung Gia	961	1,880	-	15
7. Ca Lo	Phuc Loc Phung	881	268	-	29

Source: 1998 Master Plan Vol.VI, HMA Report Subsection 7.3.2, Statistical Yearbook 2004
1) Tributaries of the Red River.

(5) Further Operational Improvement

The meter reading, billing, and collection system at HWBC has improved and is currently run in a rather flexible and effective manner. However, further improvement must be considered with regard to: (i) automation/mechanization; (ii) use of appropriate workload; (iii) zoning; (iv) termination of illegal connections; and (v) treatment of public taps.

(6) Private Wells

Residents in areas not covered with water services commonly use private wells. The current volume of water extracted from private wells in southwestern Hanoi is estimated at around 120,000 m^3/day. The quality of such well water is considered to be quite poor due to the area's hydro-geological and topographic characteristics. Improvement of living standards and hygienic condition requires the supply of treated water as soon as possible.

(7) Land Subsidence

Currently about 600,000 m^3/day of water is being extracted in southwest Hanoi. As a result, land subsidence has occurred, most especially in Thang Cong. The annual land subsidence was recorded at 44.77mm in 2000 and 40.88mm in 2003. In Mai Dich it reached a rate of between 1.21 mm/year and 4.3 mm/year from 1998 to 2003. In Phap Van, land subsidence rates are mostly the average of those in Thang Cong and Mai Dich. Periodic monitoring is required, though no serious damages to building and other infrastructure like roads have been reported to date.

(8) Rural Water Supply

While Decision No. 50 instructs that 60 communes should be served with rural water supply by 2010, the number of communes served as of 2004 was only 22. In these 22 communes a total of 65 rural water supply systems are operated by the commune people's committees. The majority of the rural water supply systems have capacities ranging from 300 to 1,200 m^3/day.

Table 9.2.4 Rural Water Supply in Hanoi City

District	No. of Communes Served	No. of Water Supply Systems			
		Constructed by 1999	Constructed 2000-2004	Unknown	Total
1. Thanh Tri	7	4	17	8	29
2. Tu Liem	8	18	5	5	28
3. Donh Anh	2	1	0	1	2
4. Gia Lam	5	1	5	0	6
Total	22	24	27	14	65

Source: Department of Agriculture and Rural Development (DARD) of HPC.

4) Planning Orientation

(1) Planning Targets

Target indicators were set with reference to Decision No. 50, the *Hanoi Metropolitan Area Development Plan* by MOC (July 2005), the *National Strategy for Environmental Protection until 2010, and Vision Toward 2020* by MONRE (NSEP, July 2004), as well as the results of the HIS and the survey on unit water consumption conducted in HAIDEP in 2005 (see Table 9.2.5).

(a) **Service Area:** "Urban area" refers to the existing areas where piped water supply coverage is 90% or more as of 2004. "Development area" refers to designated future urban areas in the proposed HAIDEP General Plan and excludes the above-mentioned "urban areas."

(b) **Service Coverage:** This refers to the coverage indicated in the NSEP (Part Two: Viewpoints, Objectives and Contents), as shown in the table below.

(c) **Unit Water Consumption:** The consumption refers to Decision No.50, as well as the results of the survey on current unit water consumption conducted in HAIDEP in August 2005.

(d) **UFW:** Considering the recent progress in reducing UFW, the UFW target of 30% by 2010 seems realistic. However, the 2020 target of 20 to 25% UFW would be difficult to attain, since physical losses would be more difficult to reduce and in light of the experiences in major Japanese cities. On the other hand, administrative losses can be further reduced by 2020.

Table 9.2.5 Targets for Water Demand Projections

Target	Service Area	2005	2010	2015	2020
1. Service Coverage (%)	- Urban Area	100	100	100	100
	- Development Area	80	87	93	100
2. Unit Water Consumption (l/c/d)[1)]	- Urban Area	160	170	180	190
	- Development Area	135	165	170	180
3. UFW (%)	- Physical loss[2)]	16	15	15	15
	- Administrative loss[2)]	21	15	13	10
	Total	37	30	28	25

Source: HAIDEP Study Team.
1) For domestic use.
2) Applies to both urban and development areas.

(2) Water Demand Projection

Water demand was estimated based on future population and water consumption level (see tables 9.2.6 and 9.2.7).

In Table 9.2.6, each area includes adjoining areas; the southwest includes the population of Ha Dong, Tram Troi, and An Khanh in Ha Tay Province; the southeast includes Nhu Quynh in Hung Yen Province; and the north, Me Linh and Phuc Yen in Vinh Phuc Province and Tu Son in Bac Ninh Province.

The total demand for urban water was estimated at 555,000 m^3/day in 2005 which would increase to 788,000 and 1,338,000 m^3/day by 2010 and 2020, respectively (see Table 9.2.7). Southwestern Hanoi would account for 60% of the total, followed by northern Hanoi at 24% and southern Hanoi at 16%. Domestic users would require 62%, while nondomestic users and industrial users would both require 19% (see Figure 9.2.1).

Table 9.2.6 Population Forecasts for Hanoi

Unit: 000

Service Area	Year			
	2005	2010	2015	2020
Southwest	2,073	2,301	2565	2,832
Southeast	327	454	580	708
North	338	535	773	1,010
Total	2,738	3,290	3,918	4,550

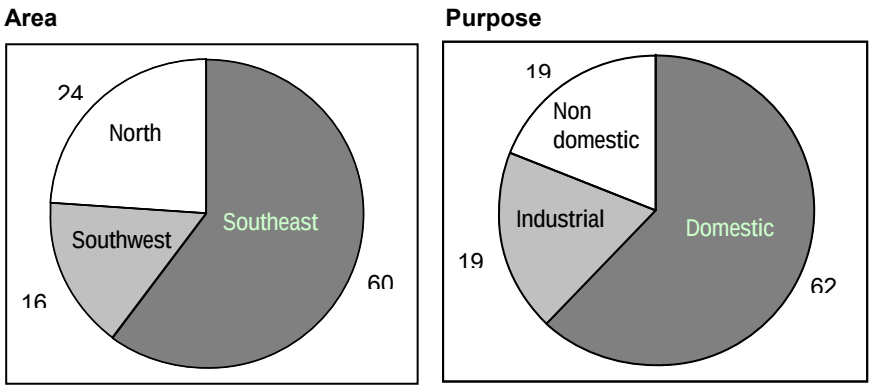
Table 9.2.7 Estimated Water Demand

Unit: 000 m^3/day

Service Area	User	2005	2010	2015	2020
Southwest	Domestic	300	368	436	524
	Nondomestic	90	111	130	157
	Industrial	37	63	91	126
	Subtotal	427	542	657	807
Southeast	Domestic	41	69	95	130
	Nondomestic	12	21	29	39
	Industrial	11	21	30	43
	Subtotal	64	111	154	212
North	Domestic	37	77	122	182
	Nondomestic	11	23	37	55
	Industrial	16	35	55	82
	Subtotal	64	135	214	319
Total	Domestic	378	514	653	836
	Nondomestic	113	155	196	251
	Industrial	64	119	176	251
	Total	555	788	1,025	1,338

Note: Water demand is 1,000 m^3/day. Physical loss in the north is 5%.

Figure 9.2.1 Water Demand Ratio by Area and Purpose



(3) Basic Development Direction

The development directions for urban water supply are as follows:

(a) **Classification of Water Service Area into Three:** To develop new WTPs, the UDAs, including major cities adjoining Hanoi, were divided into three water supply target areas (see Table 9.2.8). A network linking the north and the south of the Red River will be set up to maximize the capacities of the existing WTPs and to support each other in cases of emergencies, as stipulated in Decision No.50.

Table 9.2.8 Planned Water Supply Area and Population, 2003

Service Area	District/Town	Area		Population	
		ha	%	000	%
1. Southwest (south of Red River)	Ba Dinh, Hoan Kiem, Hai Ba Trung, Dong Da, Tay Ho, Thanh Xuan, Cau Giay, Hoang Mai, and Tu Liem (Hanoi City); Da Dong, Hoai Duc and Tram Troi (Ha Tay Province)	23,148	39	1,981	79
2. Southeast (north of Red River)	Long Bien and Gia Lam (Hanoi City), Tu Son (Bac Ninh Province), and Nhu Quynh (Hung Yen Province)	12,340	21	277	11
3. North (north of Red River)	Donh Anh and Soc Son (Hanoi City), Me Linh and Phuc Yen (Vinh Phuc Province)	23,637	40	257	10
Total		59,125	100	2,515	100

(b) **Gradual Shift of Raw Water Source from Groundwater to Surface Water:** Considering the critical conditions in using groundwater in the south of the Red River as raw water for domestic use, the surface water of the Red River main stream is one of the most realistic alternatives to groundwater. Surface water has the advantages of good water quality, comparatively short transmission pipeline length, a rather low O&M cost due to lower electricity consumption for pumping. The disadvantages include turbidity (50 NTU) which can become as high as five times higher than the case of water in the Da River (10 NTU) and the possibility of pollution from upstream areas in the future. Since both the HMA study report (July 2005) and the water quality analysis conducted in HAIDEP in March 2005 present the possibility of turbidity and suspended solids in the Red River and the latter study showing there is no pollution, the problem of turbidity can easily be reduced through coagulation and sedimentation. Surface water in the Thai Binh river basin, which covers the Cau, Cong and Ca Lo rivers, is not recommended due to their quality and quantity as described above.

It is recommended that raw water sources should gradually shift from groundwater to surface water particularly in the south of the Red River. However, since in the north of the Red River the 142,000 m^3/sec limit stipulated in Decision No. 50 is not fully extracted, the balance of 40,000 to 50,000 m^3/day can be exploited in the future depending on the situation.

(c) **From Quantity to Quality:** The living conditions in Hanoi have remarkably improved in recent years. Incomes of the city's people will continue increasing. In such conditions, the people's demand for water supply is expected to change from quantity to quality. Hanoi is receiving an increasing number of foreign tourists and business people.

Availability of safe and high-quality water is important to this sector, too.

(d) **Rearrangement of WTPs in Southwestern Hanoi:** Even treated water has been polluted by ammonia (NH_4^+), in particular water in WTPs in Ha Dinh, Thuong Mai, Phap Van, and Nam Du. Considering the adverse impact caused by ammonia, the shutdown of these WTPs is proposed once clean water from the Da River is secured to supply the area by around 2010, although the WTPs' supply function will remain. The operation of some small WTPs extracting groundwater as raw water for domestic use will also be stopped.

(e) **Simplification of Water Supply System:** HWBC and HWBC No.2 operate around 200 wells. Scattered wells and a large number of pumps require intensive maintenance. Simple and large-scale plans are beneficial from O&M and energy saving points of view. Water treatment plants using surface water would attain this objective.

(f) **Water Demand Projection of Non-Domestic Use:** The unit water consumption for domestic use is based on Decision No. 50. However, for nondomestic water demand, neither a practical planning method nor documents are available, as indicated in existing planning documents. Therefore in this study, nondomestic water demand was estimated as a percentage of domestic demand (see Table 9.2.9).

Table 9.2.9 Adopted Percentages for Estimating Nondomestic Water Demand

Future Urban Area	Ratio to Domestic Water Demand	
	Industrial[1)]	Other Demand
1. Existing Urban Area	3%	30%
2. Development Area	45%	30%

Source: HAIDEP Study Team.
1) Industrial development is expected to occur mostly in future development areas.

(g) **Daily Peak Factor:** In consideration of the large demand of Hanoi City, it is expected that the peak factor for the daily maximum water demand will decrease with the improvement of the entire water supply system, e.g. improvement of the existing distribution network and construction of large WTPs for new development areas. The present peak factor of 1.40 as suggested by HWBC is considered as excessive. When the planned improvements to the distribution network are accomplished, the future peak factor is expected to be lower. It was estimated that the peak load factor of 1.35 in 2005 will gradually decline to 1.20 by 2020. For future industrial areas, where demand control is expected, the peak factor of 1.10 is considered as appropriate.

Table 9.2.10 Setting of Daily Peak Factor

Demand	Daily Peak Factor			
	2005	2010	2015	2020
Domestic (D)	1.35	1.30	1.25	1.20
Nondomestic (Non-D)				
Industrial (I)	1.10	1.10	1.10	1.10

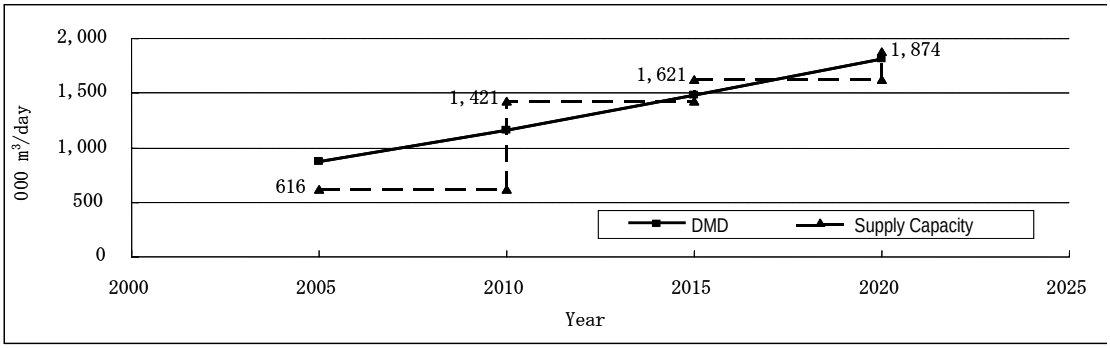
(4) Plan Formulation

(a) **Estimate of Distribution Capacity of Facilities:** In order to meet the demand for 1.3 million m^3/day, the distribution capacities of facilities needs to be 1.8 million m^3/day (see Table 9.2.11).

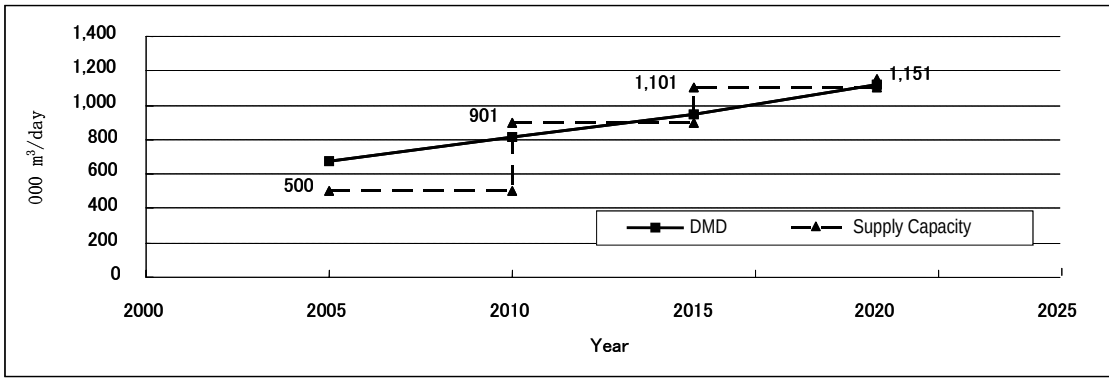
(b) **Development Plan:** The development plan for the water supply system in Hanoi was worked out based on the existing demand and projects and done in a way that supply capacity would meet the demand in the whole of Hanoi and in each service area (see Table 9.2.12). The demand-supply balance was further analyzed over the years leading to 2020 (see Figure 9.2.2). Results show that there will be a shortage up until the existing and proposed projects are completed around 2010. Once they are in operation, this problem will be solved. However, facilities should be developed continuously so that supply will be able to keep up with the ever-increasing demand.

Figure 9.2.2 Daily Maximum Distribution and Supply Capacity

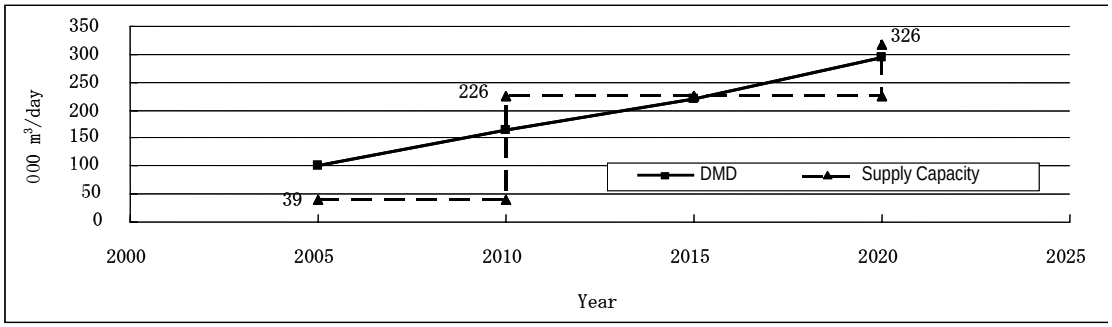
Entire Hanoi



Southwestern Hanoi



Southeastern Hanoi



Northern Hanoi

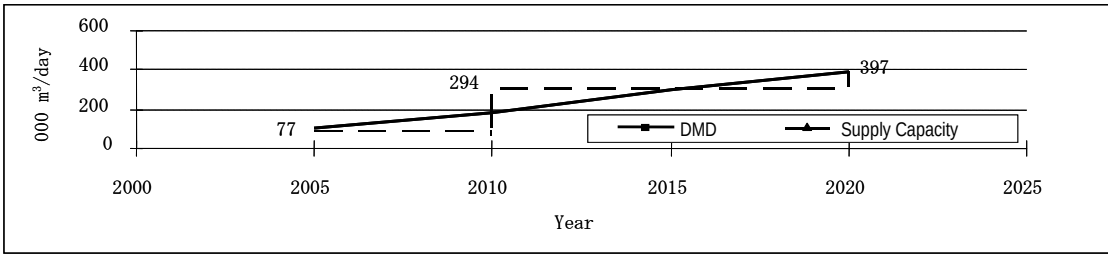


Table 9.2.11 Daily Maximum Distribution of Water for Facility Development Plan

Year	Service Area	Net Demand (000 m^3/day)	Physical Loss (%)	Daily Ave. Distribution	Peak Factor		Daily Maximum Distribution (000 m^3/day)
					(D) & (Non-D)	Industrial Use	
2005	Southwest	427	16	508	1.35	1.10	674
	Southeast	64	16	76	1.35	1.10	100
	North	64	16	76	1.35	1.10	98
	Subtotal	555		660			872
2010	Southwest	542	15	637	1.30	1.10	814
	Southeast	111	15	131	1.30	1.10	164
	North	135	15	158	1.30	1.10	197
	Subtotal	788		926			1,175
2015	Southwest	657	15	773	1.25	1.10	951
	Southeast	154	15	181	1.25	1.10	221
	North	214	15	251	1.25	1.10	305
	Subtotal	1,025		1,205			1,477
2020	Southwest	807	15	950	1.20	1.10	1,124
	Southeast	212	15	248	1.20	1.10	292
	North	319	15	374	1.20	1.10	394
	Subtotal	1,338		1,572			1,810

Source: HAIDEP Study Team.

Table 9.2.12 Facility Development Plan

Unit: 000 m^3/day

Area	Capacity and Development	Daily Max. Distribution	Source			Balance
			Ground-water	Surface Water	Total	
Entire Hanoi	1. Existing Capacity (as of 2005)	(873)	616	0	616	
	2. Reduction[1)]		-99	0	-99	
	3. Development-1 (ongoing)		204	0	204	
	4. Development-2 (VINACONEX-1)		0	200	200	
	5. Development-3 (HAIDEP:WS-1, -3 and -5)		0	500	500	
	Subtotal (1 to 5: up to 2010/11)	1,155	721	700	1,421	266
	6. Development-4 (VINACONEX-2)			200	200	
	Water Demand in 2015	1,477			1,621	145
	7. Development-6 (HAIDEP:WS-2, -4 and -6)			250	250	
	Total (1 to 7: up to 2020)	1,810	0		1,871	61
Southwest	1. Existing Capacity (as of 2005)	(674)	500	0	500	
	2. Reduction[1)]		-99	0	-99	
	3. Development-1 (ongoing)		150	0	150	
	4. Development-2 (VINACONEX-1)		0	200	200	
	5. Development-3 (HAIDEP:WS-1)		0	150	150	
	Subtotal (1 to 5: up to 2010)	814	525	350	901	87
	6.Development -4 (VINACONEX-2)			200	200	
	Water Demand in 2015 (1 to 6)	951			1,101	150
	7. Development-6 (HAIDEP:WS-2)			50	50	
	Total (1 to 7: up to 2020)	1,124	0	50	1,151	27
Southeast	1. Existing Capacity (as of 2005)	(100)	39	0	39	
	2. Development-1 (ongoing)		37	0	37	
	3. Development-2 (HAIDEP:WS-3)		0	150	150	
	Subtotal (1 to 3: up to 2010/11)	164	76	150	226	62
	Water Demand in 2015	221			226	5
	4. Development-3 (HAIDEP:WS-4)		0	100	100	
	Total (1 to 4: up to 2020)	293	0	100	326	33
North	1. Existing Capacity (as of 2005)	(98)	77	0	77	
	2. Development-1 (ongoing)		17	0	17	
	3. Development-3 (HAIDEP:WS-5)		0	200	200	
	Subtotal (1 to3: up to 2010/11)	177	94	250	294	117
	Water Demand in 2015	304			294	-10
	4. Development-6 (HAIDEP:WS-6)		0	100	100	
	Total (1 to 4: up to 2020)	393	0	100	397	1

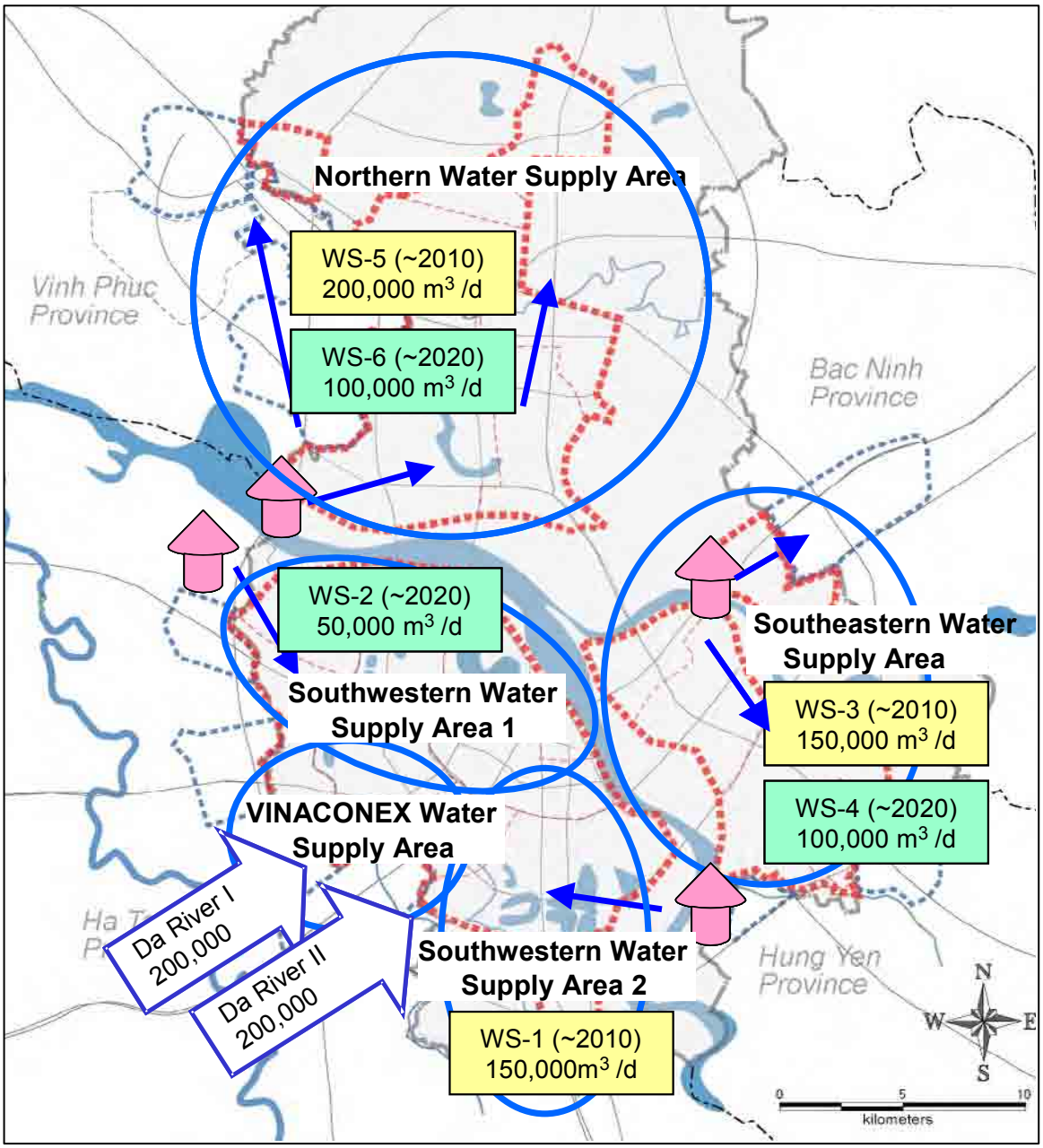
1) Prevention of groundwater use due to heavy contamination and shift to surface water.

(c) **Proposed Plan on Water Treatment Plant Development:** The development of six water treatment plants by 2020, three of which should be completed by 2010 (ie WS-1, WS-3, and WS-5), is proposed. Raw water must not be groundwater but surface water from the Red and Duong rivers (see Table 9.2.13).

Table 9.2.13 Water Treatment Plant Development Plan

Stage	Plant Name/Location	Capacity (m^3/day)	Development No.
First Stage (2006 - 2011)	1) Thanh Tri 2) Thuong Thanh 3) Dai Mach Subtotal	150,000 150,000 200,000 500,000	WS-1 WS-3 WS-5
Second Phase (2012 - 2020)	1) Lien Mac 2) Thuong Thanh 3) Dai Mach Subtotal	50,000 100,000 100,000 250,000	WS-2 WS-4 WS-6
Total (up to 2020)		750,000	

Figure 9.2.3 Proposed Water Treatment Plants and their Service Coverage Areas



(5) Water Treatment Facilities

Treatment plants using the Red River water should have the following facilities (see Figure 9.2.4):

(a) **Pre-settling:** Turbidity and SS of the Red River in dry season are 48 NTU and 210 mg/lL. During the rainy season turbidity increases to 210 NTU, but the SS remains at 205 mg/L. Coagulant requirement is in proportion to turbidity and SS concentration. A pre-settling process might be effective to reduce coagulant consumption. If inclined plates, or tube settling devices, are used in the process, turbidity reduction would be more accelerated.

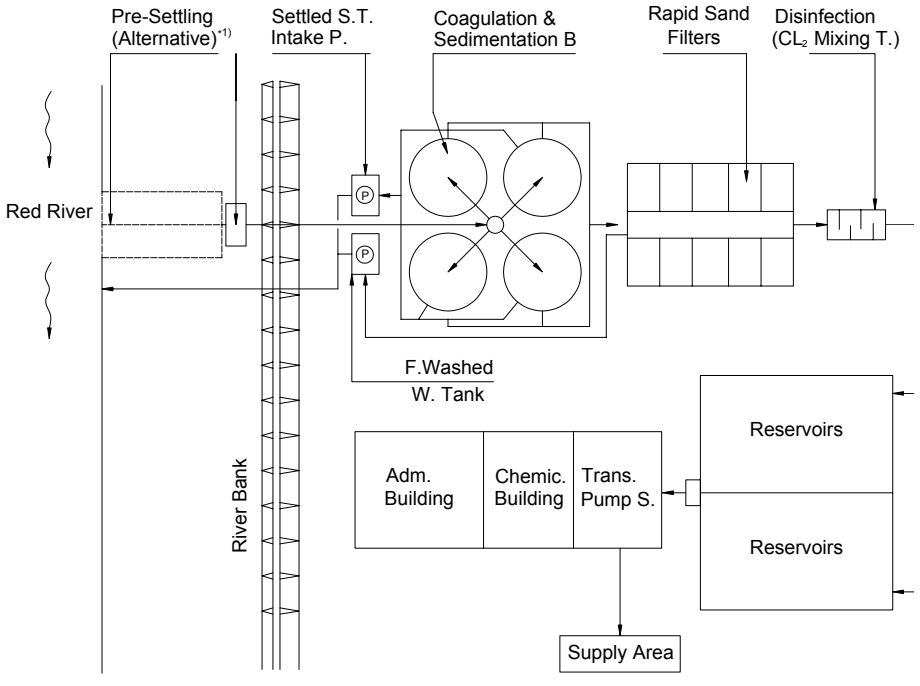
(b) **Coagulation and Sedimentation:** Coagulation process is essential to treat this water, and polyaluminium chloride (PAC) would be the most probable coagulant because it is insensitive to pH and alkalinity changes. Aluminium sulphate - $Al_2(SO_4)3$ - could be the alternative. There are many types of sedimentation tanks. However, a vertical flow type high rate clarifier would be appropriate because sludge from the tank could be better disposed of into the river without any treatment. Since the clarifier has a simple mechanism sludge collector the maintenance would be easier than the other types.

(c) **Rapid Sand Filtration:** Self-wash and gravity type rapid sand filters with air-washing may be appropriate. This filter is a simple structure and has no complex mechanical and electrical equipment.

(d) **Disinfection:** Disinfection should be carried out through the use of sodium hypochlorite instead of chlorine gas. Sodium hypochlorite is a safe chemical and nowadays many plants are changing from gas to hypochlorite.

(e) **Sludge Management:** Sludge management facilities, such as thicker, dewatering facilities, would not be necessary. The amount of solids in sludge discharged from water treatment plants is negligible compared with that of solids in the Red River flow.

Figure 9.2.4 General Plan for Water Treatment Plants

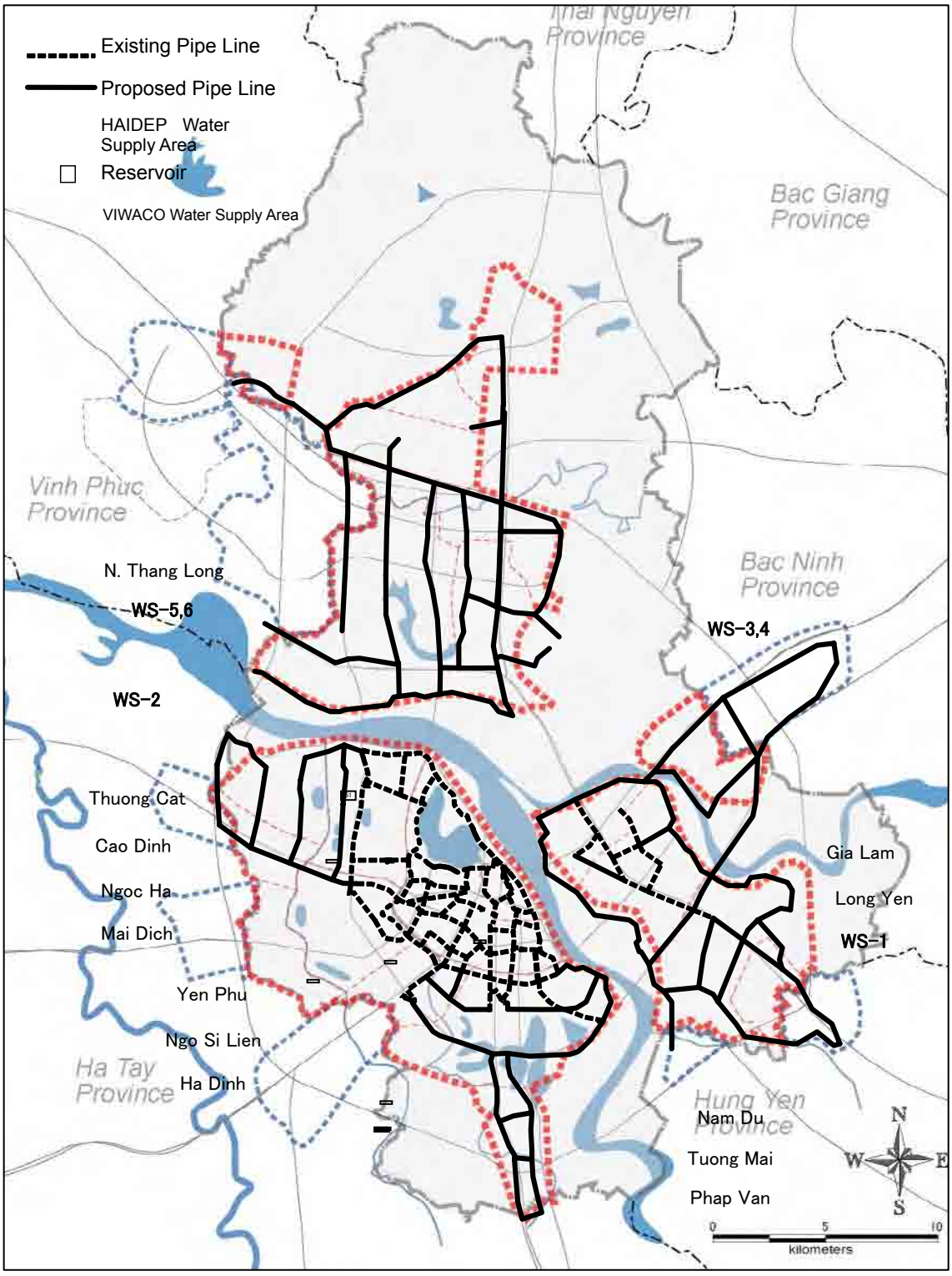


*1) Sludge management Facilty

(6) Improvement of Transmission

Transmission pipelines which will be required in 2020 are outlined in Figure 9.2.5.[2]

Figure 9.2.5 Outline of Proposed Transmission Pipeline Network



[2] The outline of the proposed transmission pipeline network was prepared in late 2005 when the master plan was formulated; therefore the VIWACO water service area shown is separated from the HAIDEP system. The area will be incorporated in the service area of the new water company being formed through a reorganization.

(7) Organizational Improvement

The Prime Minister's Decision No. 94/2005/QD-TTg, of 5 May 2005, is a road map for some SOEs in the urban water and sanitation sector of Hanoi City. The Decision ratifies the restructuring and reorganization of various SOEs under the HPC, including HWBC and HWBC No. 2. Reorganization plans for the HWBC and HWBC No. 2 have been prepared, following a parent-subsidiary company model. The rationale for this conversion is for SOEs to operate in areas with extraordinary economic and social disadvantages and where the private sector is not interested in investing in. The reorganization is expected to result in less intervention from TUPWS in the water sector. However, the HPC's control over the new company will be retained.

Under the reorganization plan, HWBC's current administrative section and production units (i.e. WTPs) will be under the parent company which will have three subsidiary groups: (i) single-stockholder companies, (ii) joint-stock companies, whose majority voting powers lie with the parent company; and (iii) associated companies, in which the parent company has a minor stake. Water distribution companies will comprise the single-stockholder subsidiaries. Construction and materials procurement companies will form the joint-stock companies. Associated companies will include VIWACO, a water distribution company that covers part of the southwestern area, which will use water supplied by VINACONEX.

The organizational structure for the new water company will depend on the progress of facility development and the expansion of service areas. In setting the size of its staff, the number of staff per 1,000 connections can be used as a basic unit. As of 2005, HWBC employed about six staffers per 1,000 connections. HWBC No. 2 has about nine staffers per 1,000 connections. The new water company is expected to have fewer personnel. Supposing that the number of connections will double by 2020 and the number of personnel per 1,000 connections will decrease to five, the number of personnel in 2020 should be around 3,500.

9.3 Drainage System

1) Orientation

According to the HIS, most residents in Hanoi's urban areas suffer annual inundations reaching 10cm or more. Although serious physical damage from the annual floods has not been reported, frequent inundations worsen road conditions and deteriorate sanitary levels in the city. In the southern part of the Red River, the traditional drainage systems, which consist of drainage channels, ditches, and combined sewers, cover about 35 km^2 of the urban core and its surrounding areas. However, due to the systems' limited capacity, residents in these areas suffer from frequent inundations every year. Except for the urban core and its surrounding areas, artificial drainage systems have not been developed. Mostly natural systems, such as small rivers, lakes, and irrigation channels, function as drainage systems.

Urbanization often causes an increases in the frequency of inundations because lakes, ponds, and paddy fields, which retain storm water are reclaimed and converted for urban purposes. Urbanization also initiates the building of concrete structures and asphalt roads, which accelerate storm water overflows on ground surfaces. Thus, inundations are more serious in growth areas with high population densities and economic activities.

To realize better urban living and effective economic activities free from the adverse effects of inundations, it is necessary to establish a suitable drainage system that will cover all urban areas in Hanoi.

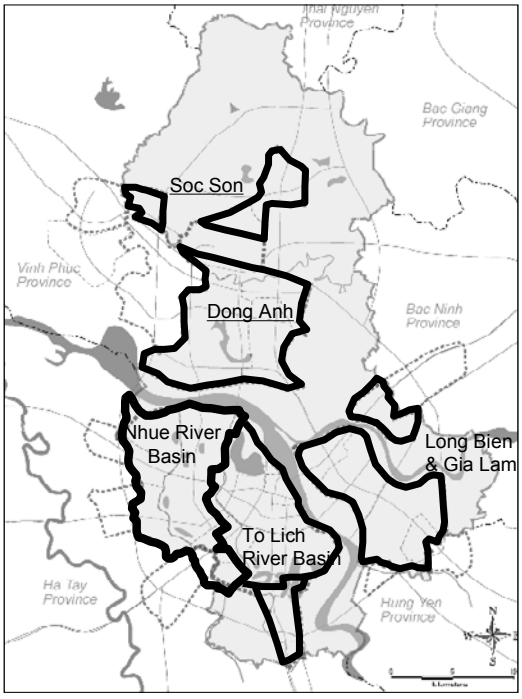
2) Planning Orientation

(1) Planning Targets

Protection Level: The drainage system should protect the urban development areas from inundations of up to 310mm per 2 days of rainfall, which corresponds to a 10-year return period.

Target Area: The target area, for which the ideal protection level has been planned up to 2020, comprises all urban development areas in Hanoi which amounts to an area of 400 km^2 (see Figure 9.3.1). An area of about 107 km^2 (To Lich River basin: 7,750ha and North Thang Long - Van Tri: 2,950ha) is targeted to have the ideal planning protection level by 2010. The remaining 293 km^2 is planned for development during the HAIDEP Master Plan period.

Figure 9.3.1 Target Area for Drainage System Development



(2) Planning Considerations

Realistic Implementation Schedule: A huge amount is required for drainage system development. In the case of the ongoing drainage project (Stage 1) for 77.5 km^2 in Hanoi City, about US$ 130 million in construction cost has been invested for five years. The remaining works, which will cost about US$ 170 million, will

be carried out in Stage 2 between 2006 and 2010. In addition, land acquisition and compensation costs are required, amounting to US$ 100 million in a ten-year period. The proposed implementation schedule should be reasonable from a financial point of view. Development will be carried out starting from higher priority areas, such as those with high population densities and high economic activities.

Effective Land Use and Flexible Development: Because of its flat geography and high river water levels, Hanoi's drainage system will require a large regulating reservoir and drainage pump stations. In the case of the To Lich River basin (77.5 km^2), 244ha of regulating reservoirs have been prepared to keep excessive storm water inside the basin. In the case of the Nhue River basin, its drainage amount is limited to 0.6 $m^3/s/km^2$. As for the To Lich River basin, the required volume to regulate the reservoirs is greater. Regulating reservoirs are usually used only for several rainy days each year. Multipurpose regulating reservoirs, dry reservoirs that can be used as parks or recreation areas during the dry season, are proposed to be developed inside planned park areas to optimize the land usage.

(3) Hydrography

For the planned drainage system that will meet the 310mm per two days of rainfall, the maximum drainage flows and required reservoir capacities (as against certain pump capacities) were calculated using a hydrograph for a 310mm rainfall (see Figure 9.3.2). The hydrograph was prepared in the JICA 1995 drainage master plan study and was used for all the target areas in the HAIDEP Master Plan. The resulting maximum drainage flow is 2.97 $m^3/s/km^2$.

The required reservoir volume and area were also calculated (see Table 9.3.1). Two different conditions were considered. One is the basic condition which covers all the target areas except for the Nhue River basin, and the other covers the Nhue River basin alone.

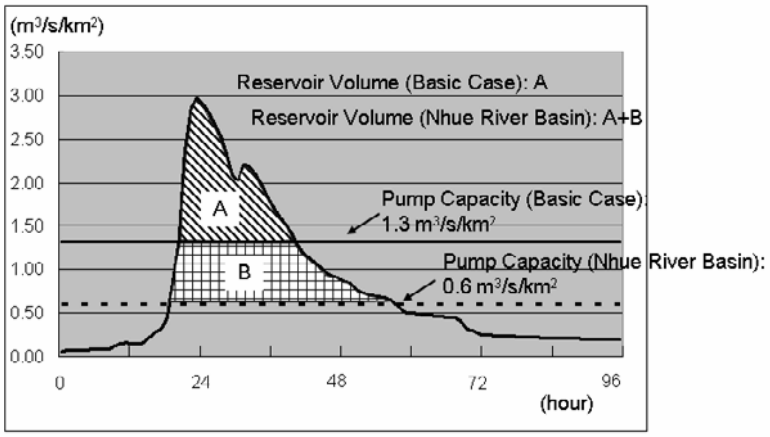
In further stages of the drainage projects, a detailed hydro-calculation need to be carried out giving due consideration to latest land-use conditions and actual drainage flow records

Table 9.3.1 Required Pump Capacities and Reservoir Areas

Requirement	Basic Condition	Nhue River Basin Condition
Pump Capacity ($m^3/s/km^2$)	1.3	0.6
Required Reservoir Volume (m^3/km^2)	61,350	132,347
Required Reservoir Area[1)] (ha/km^2)	2.5	5.3

1) Effective depth of reservoir was assumed at 2.5m..

Figure 9.3.2 Hydrographical Conditions



3) Revision of Drainage Master Plan

In prioritizing areas for drainage system development, population density, frequency of inundations, and economic activities in the target areas were considered. Most target areas are underdeveloped, but the conditions in these areas will change with the progress of urbanization. Prioritization was based on urbanization and population density forecasts.

Based on the above information, the implementation of the drainage system development is proposed (see Figure 9.3.3).

The proposed drainage system for 2020 is summarized in Table 9.3.2. Some of the system's components in the To Lich River basin (7,750ha) and Dong Anh District (2,950ha out of 10,003ha) are already under construction.

Figure 9.3.3 Implementation of the Drainage System Development Plan

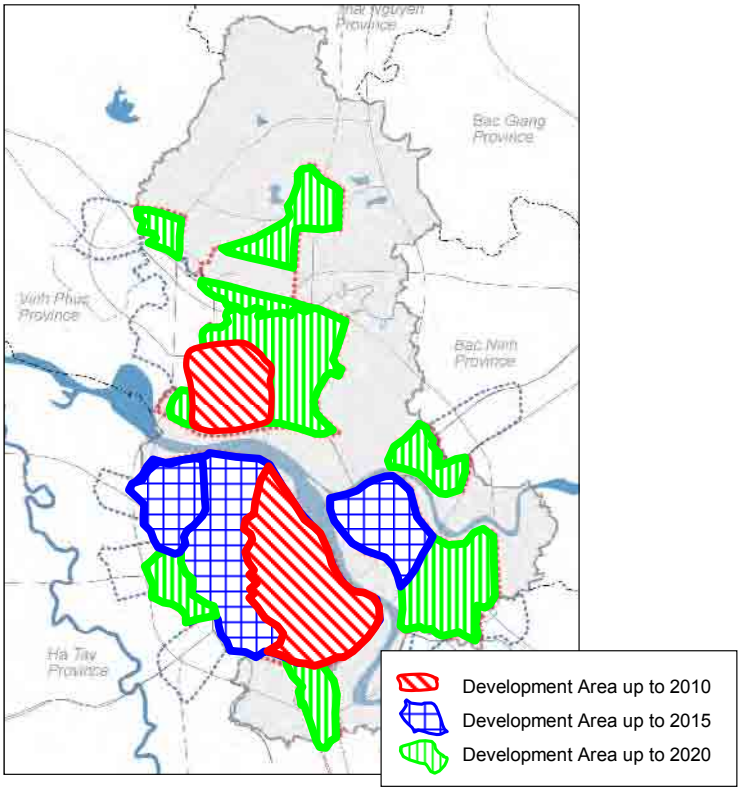


Table 9.3.2 Proposed Drainage System up to 2020

Basin (Service Area)		Area (km^2)	Regulating Reservoir (ha)	Pump Capacity (m^3/s)	Discharge Point
South of Red River	1. To Lich basin[1)]	77.5	244	90	Red River
	2. Nhue River Left Basin (5 basins)	53.0	266	36	Nhue and Red rivers
	3. Nhue River Right Basin (4 basins)	40.0	212	24	Nhue River and Nhue River Branch
	4. Thanh Tri	13.6	--	--	Old To Lich River
	Subtotal	184.1	722	150	--
North of Red River	1. Dong Anh (4 basins)[1)]	86.8	118	44	Ca Lo, Red, and Ngu Huyen rivers
	2. Long Bien & Gia Lam (3 basins)	90.3	186	98	Red, Bac Hung Hai and Ngu Huyen rivers
	3. Soc Son	38.9	--	--	Ca Lo River
	Subtotal	216.0	304	142	--
Total		400.1	1,026	292	--

Source: HAIDEP Study Team.
1) The projects for the To Lich River basin (7,750ha) and Dong Anh District (2,950ha) are in the construction stage.

4) Development Plan by Area

(1) To Lich River Basin

The To Lich River basin, which includes the urban core of Hanoi City and the West Lake (about 930ha), covers 7,750ha (see Figure 9.3.4). Storm water in the whole basin naturally drains into the Nhue River through four rivers (To Lich, Kim Nguu, Lu, and Set). When its water level is lower than four (4) meters, water passes through the Thang Liet gate of the Nhue River. However, when its water levels are more than four (4) meters, storm water cannot be drained at all. Following the implementation of the new drainage system, all storm water will be drained into the Red River by drainage pumps with a 90 m^3/s capacity through two regulating reservoirs (totaling 224ha: Yen So Lake and Linh Dam). Stage 1 of the drainage project in the basin has been completed. Stage 2 will be completed in 2010 (see Figure 9.3.4).

(2) Nhue River Basin

The Nhue River basin in Hanoi City covers about 9,400ha of urban development planning area. Traditionally, the Nhue River is used for irrigation and drainage purposes. According to MARD, because of the river's limited water-holding capacity, the allowable discharge amount is limited to 0.6 $m^3/s/km^2$ only. The drainage pump capacity should therefore be suitable to such discharge amounts. Multipurpose regulating reservoirs with large capacities are required to hold excessive storm water.

In conditions where the Nhue River's water levels are five meters or lesser (upstream of Ha Dong gate to downstream of Lien Mac gate), storm water inside the whole basin drains into the Nhue River by gravity. While, the basin is mostly paddy fields that absorb storm water, it has several small drainage pumping stations.

The Nhue River's left basin drainage system will be composed of five subbasins (see Figure 9.3.5). For its right basin, the drainage system will have four subbasins. Pumping stations and multipurpose regulating reservoirs (about 480ha) are also proposed for construction in the park areas planned in the respective subbasins.

Alternatively, a diversionary drainage system into the Day River, and a pump drainage system into the Red River from the Nhue River, can be developed through the Lien Mac gate. If any of the above measures is adopted, the required area for a reservoir can be reduced.

(3) Long Bien and Gia Lam

When the water level of the Bac Hung Hai River is lower than three meters, most of the storm water from Long Bien and Gia Lam districts naturally flows into it. However, when the water level is higher than three meters, storm water in the basin will be pumped into it, the Red River, or the Duong River (see Figure 9.3.6).

For LG-1 (733ha), one alternative is to directly discharge storm water into the Duong River. Considering the existing drainage system, it is recommendable to discharge storm water from LG-1 and LG-2 (3,000ha) into the Red River through the pumping station and the regulating reservoir in the park area. Storm water in LG-3 (3,152ha) will be drained into the Bac Hung Hai River through a pumping station and a reservoir and into the Thien Duc River.

Figure 9.3.4 Drainage System in the To Lich River Basin

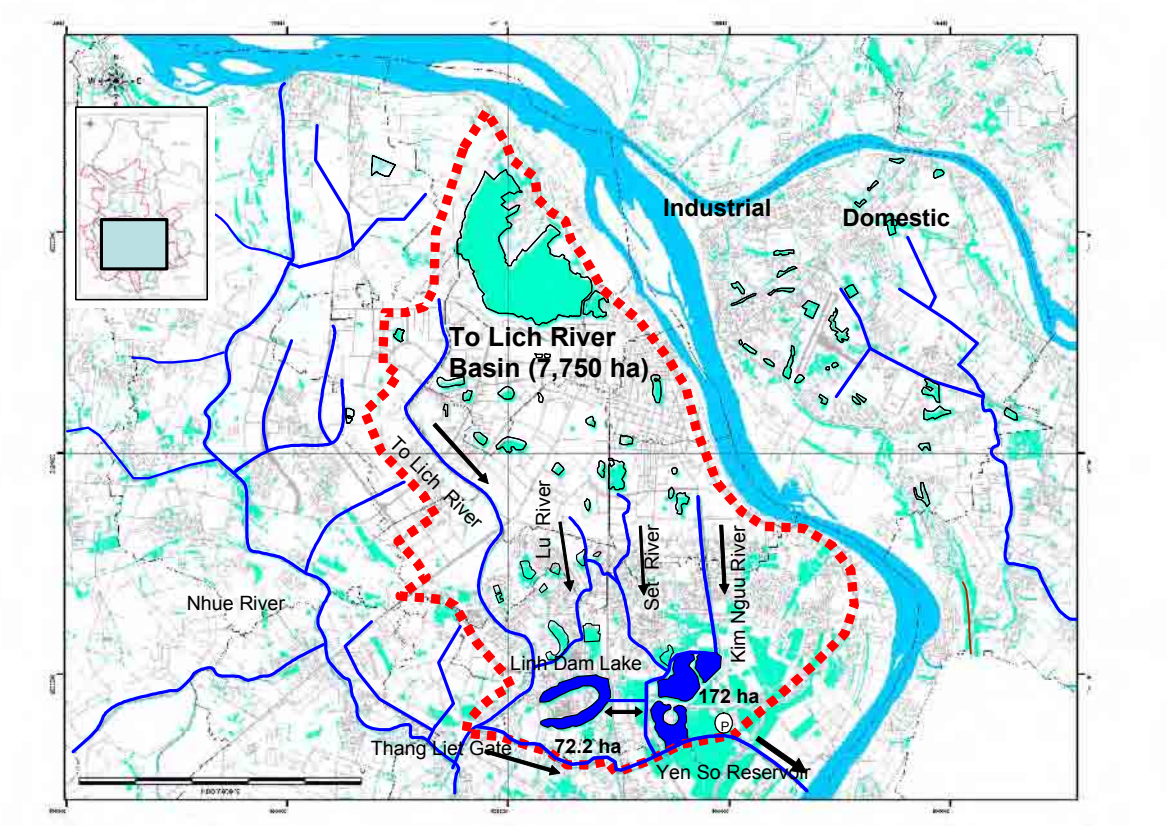
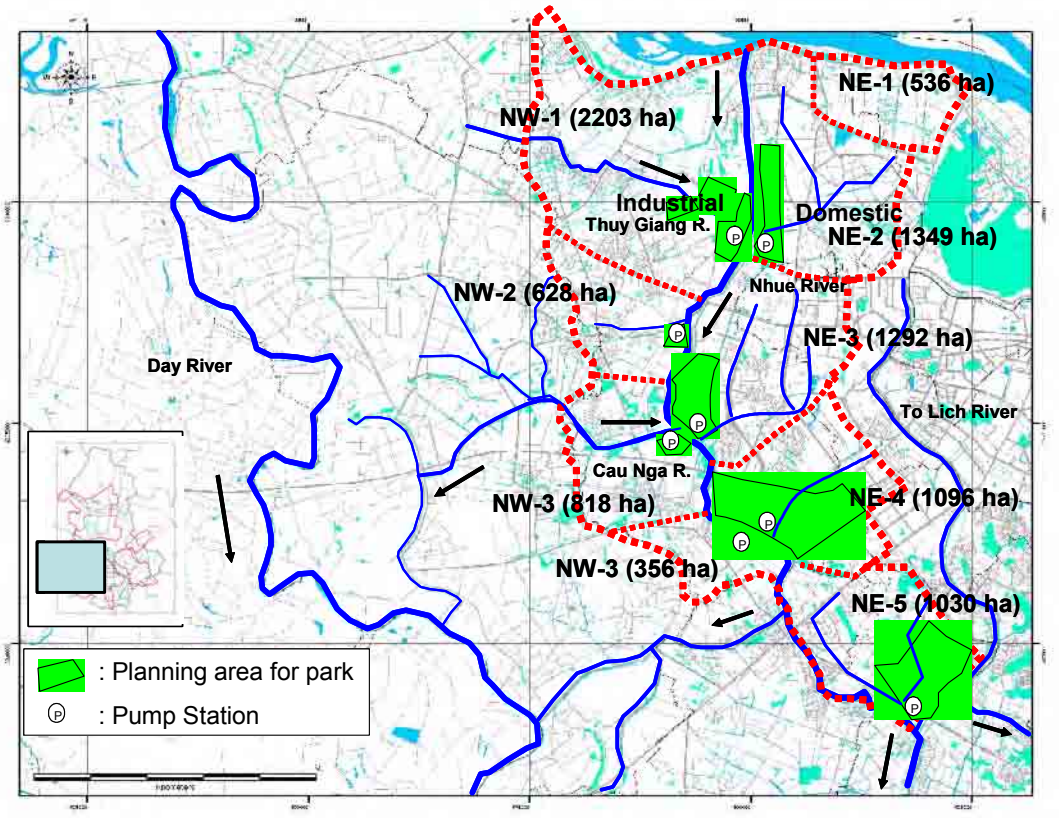


Figure 9.3.5 Drainage System in the Nhue River Basin



(4) Dong Anh

The urban development area in Dong Anh District is 86.8 km^2 and is divided into four basins (see Figure 9.3.7). Basins DA-1 and DA-2 are relatively located at high elevations. Storm water from DA-1 is to be discharged through the Tay canal into the Cau River by pumps. Except for some sunken areas in DA-2, storm water from this basin can be drained into the Ca Lo River by gravity.

When the water levels in Thiep and Ngu Huyen rivers are 6.5m or lesser, storm water in DA-3 can be naturally drained into the said rivers. Because DA-3 has higher elevations than their surrounding areas, inundations, even during high water levels, will not be serious. However, downstream of the Ngu Huyen River outside Hanoi City, serious inundations will occur. Proposed drainage measures for the downstream areas in cases where the water level will rise more than 6.5m include the construction of a regulating reservoir and a drainage pump station to drain water from the Ha Bac River into the Red River.

Under the “North Thang Long-Van Tri Urban Infrastructure Development Project,” the drainage pump system in DA-3 which will discharge storm water into the Red River is under construction. For effective land use in the area, the modification of the shape of Van Tri Lake (270ha) is proposed (see Figure 9.3.7). After the completion of the North Thang Long project, the drainage condition will improve in DA-3.

(5) Soc Son

The urban development area for Soc Son District is planned to be 6,090ha by 2020. Most of the area is located at relatively high elevations of about 10 to 15m. Storm water in the area is expected to be drained into the Ca Lo River by gravity. A large-scale regulating reservoir is not required in this area. Drainage sewers and channels will be installed along roads.

5) Proposed Projects up to 2010

The projects on drainage system development in the To Lich River basin (7,750ha) and the North Thang Long area (2,905ha) should be completed by 2010. Investment costs for the drainage systems from 2006 to 2010 are estimated to be more than US$ 200 million. Feasibility studies of the other areas have not commenced yet. It is, therefore, difficult to commence with other construction projects until 2010, except for Stage 2 of the To Lich River basin project.

Figure 9.3.6 Drainage System in Long Bien and Gia Lam Districts

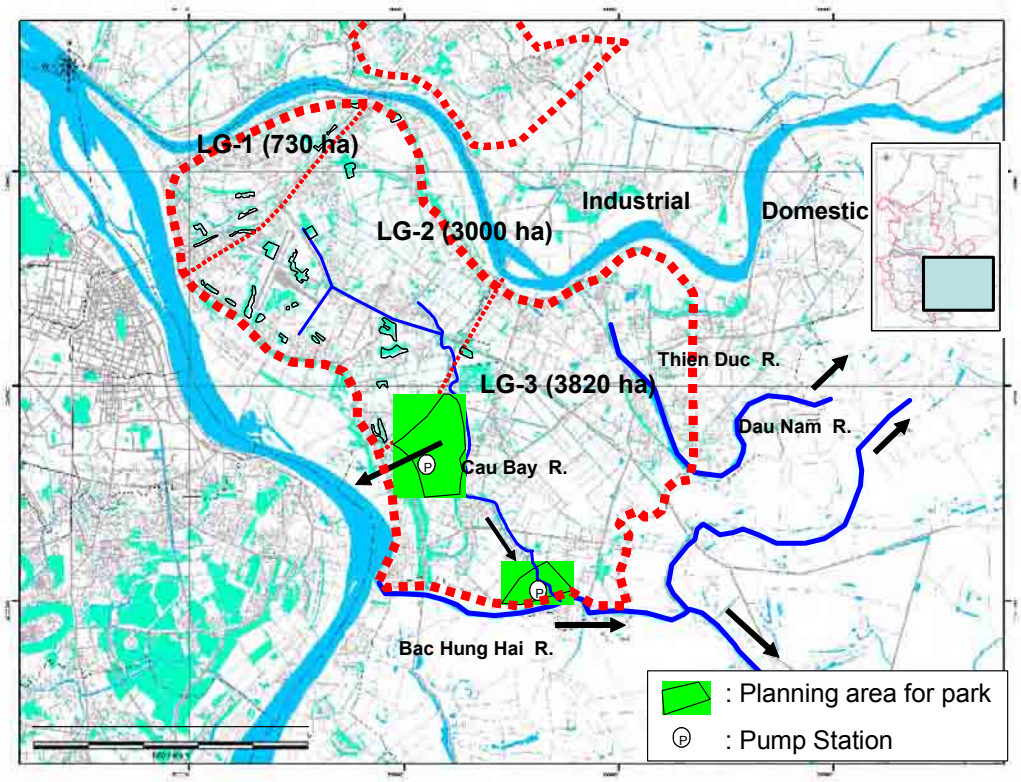
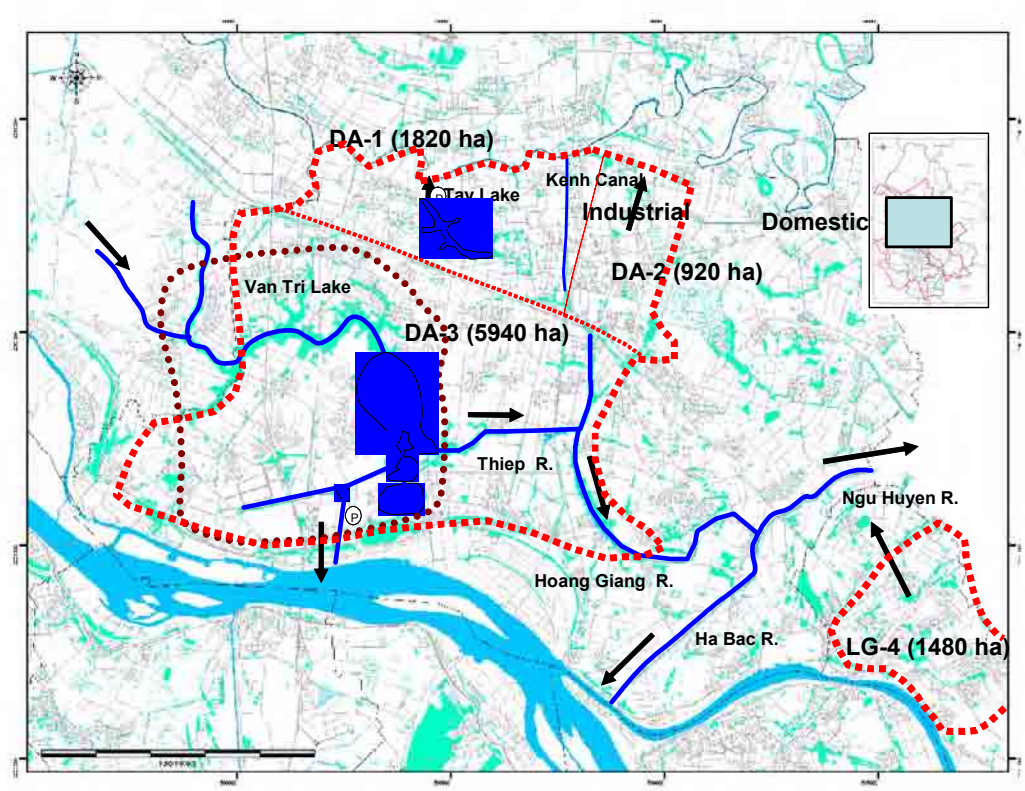


Figure 9.3.7 Drainage System in Dong Anh District



9.4 Sewerage System

6) Overview

Most residents in Hanoi City do not have access to suitable wastewater treatment facilities that meet proper effluent standards. Large amounts of wastewater in Hanoi are simply discharged into public water bodies through drainage systems without suitable treatment. The city is a serious pollution source for the Red River, the Nhue River, and other urban water environments in Hanoi. Downstream water environments and water uses are particularly affected by more than 1 million m^3/day of wastewater from Hanoi.

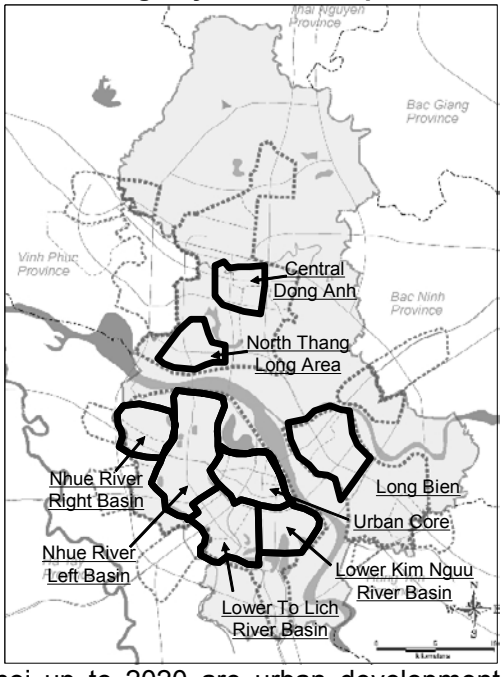
One of the targets of the national orientation toward 2020 is to cover all urban areas with centralized wastewater treatment systems that meet environmental standards. At present, only small-scale systems have been put in place, such as a wastewater treatment plant at the Thang Long industrial estate and two pilot projects in Truc Bach and Kim Lien, which have total treatment capacities of about 11,000 m^3/day.

According to Vietnam's 1996 Building Code, a septic tank with approved design should be installed in newly constructed buildings. While septic tanks effectively treat wastewater at the primary level, they cannot provide treatment levels to meet the effluent standards. The septic tank is an effective measure, but a tentative solution instead of a secondary treatment system, to keep the effluent standard. A sewerage system with several wastewater treatment plants is proposed as a suitable method for treating wastewater in urban areas. There are two issues relative to the objectives of a sewerage system development: (i) realizing a more comfortable urban living in Hanoi free from polluted water environments and poor sanitary conditions, and (ii) minimizing pollution and reducing its environmental impact on Hanoi's downstream areas.

7) Planning Orientation

(1) Planning Targets

Figure 9.4.1 Target Area for Sewerage System Development



Treatment Levels: In order to meet effluent standards, a primary treatment level is not enough, and a secondary treatment process or more advanced treatment processes are required. The target treatment level is basically the secondary treatment. For purposes of effluent re-use, advanced treatment may be considered. Outside the target areas, or before the completion of the sewerage system in the target areas, primary treatment should be introduced.

Target Areas: It will take a long time to establish a secondary treatment system all over Hanoi. In the case of Tokyo, it took almost 100 years to establish a complete sewerage system with secondary treatment levels. The target areas for sewerage system development in Hanoi up to 2020 are urban development areas with population densities of 100 persons/ha, their surrounding areas, the CBD, and centers for public and government activities (see Figure 9.4.1).

(2) Planning Considerations

(a) Development of Two Levels of Wastewater Treatment

Even as the sewerage system is not yet developed, a large number of buildings will be constructed. Hence, as a realistic measure, the development of two types of treatment process for newly constructed buildings is proposed. One is a sewerage system (a centralized wastewater treatment system) with secondary or more advanced treatment processes, and another is a septic tank for primary treatment as a tentative measure. After the completion of the sewerage system in Hanoi, users can switch from the septic tank connection to the sewerage system. The sewerage service ratio is not expected to achieve even half of the urban population in 2020. Wastewater from the remaining population will still be treated by septic tanks.

(b) Development of Sewerage Systems

In buildings in the old city area (the urban core), storm water pipes and wastewater pipes are combined. It would be nearly impossible to separate them and introduce a separated sewerage system in the area. Hence, different approaches to sewerage system development are required for the old city area and for new development areas.

In the urban core, sewerage systems will be developed by connecting the existing combined drainage system with wastewater interceptors. In the dry season, wastewater will be transported to wastewater treatment plants (WWTPs), and during storms, it will be mixed with rainfall and drained into rivers. In the new urban areas, a separated sewerage system is proposed to manage wastewater and storm water separately. The system will require a separated sewer network to directly connect to households.

(c) Social and Environmental Considerations of Sewerage System Designs

It is generally considered that WWTPs have negative effects on their surrounding communities either through the emission of odors or by their mere unsanitary conditions. However, odor and the unsanitary conditions of these plants can be improved or remedied through suitable design and operation. In August 2005, two pilot WWTPs located in residential areas were constructed with deodorization facilities. Experiences from these pilot plants can be used in the design and operation of new WWTPs that will be located near residential areas or those near parks.

In Japan, many WWTPs have been incorporated into the organic design of certain parks or environmental education facilities wherein their effluents are sometimes even used for recreational functions. The construction of WWTPs in the planned park areas and the promotion of their effective uses to their surrounding areas are proposed, e.g. roofs of semi-underground facilities can be used as part of the parks.

8) Revision of the Sewerage Master Plan

In prioritizing areas for sewerage system development, aspects such as population density, water supply, financial affordability of users, environmental standard, and usage of groundwater were examined. Results show that the target areas have almost similar conditions, except on population density and the financial affordability of users. Since the effectiveness of a sewerage system and the levels of pollution generated are highly dependent on population density, the target areas and the development priorities were set based on the area's population density as well as economic and public activities. The proposed implementation schedule and systems are in Figure 9.4.2 and Table 9.4.1.

Figure 9.4.2 Implementation of the Sewerage Development Plan

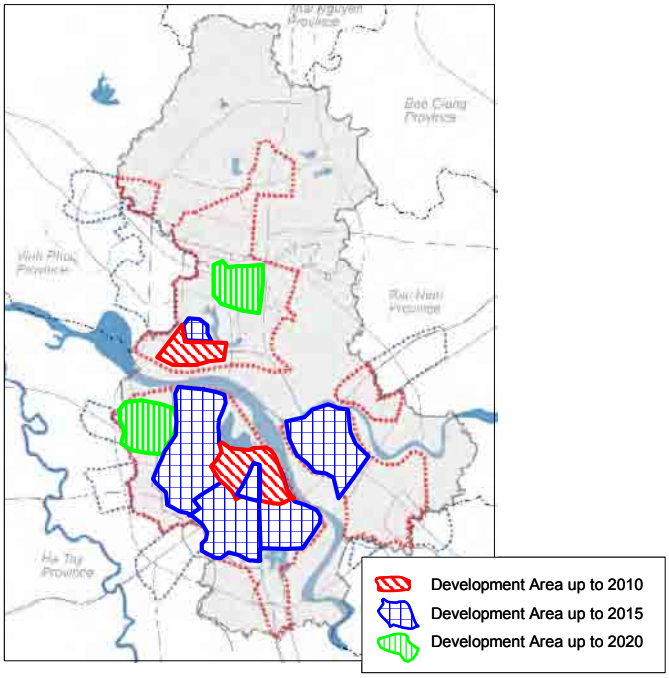


Table 9.4.1 Proposed Sewerage System up to 2020

Basin		Project Code	Area (ha)	Proposed Collection System	Population in Service Area in 2020	Wastewater Treatment Capacity (m^3/day)
South of Red River	1. West Lake	WW-1	310	Separated	42,000	12,300
	2. Urban Core					
	• Bay Mau Lake	WW-2	220	Combined	41,000	13,300
	• Upper Kim Nguu River	WW-3	750	Combined	250000	75,000
	• Lu River	WW-4	470	Combined	142,000	45,000
	• Upper To Lich River	WW-5	1,300	Combined	299,000	90,000
	3. Lower Kim Nguu River	WW-6	1,700	Combined	287,000	90,000
	4. Lower To Lich River	WW-7	2,500	Separated	441,000	140,000
	5. Nhue River Left Basin	WW-8	3,980	Separated	455,000	140,000
	6. Nhue River Right Basin	WW-9	1,700	Separated	190,000	60,000
	Subtotal		12,930		2,147,000	665,600
North of Red River	1. Long Bien & Gia Lam	WW-10	3,730	Separated	343,000	110,000
	2. North Thang Long	---	1,300	Separated	100,000	38,000
	3. North Thang Long Extension	WW-11	500	Separated	60,000	20,000
	4. Central Dong Anh	WW-12	2,200	Separated	198,000	60,000
	Subtotal		7,730		701,000	228,000
Total			20,660		2,848,000	893,600

Note: WWTPs in North Thang Long was completed with 38,000 m^3/day of treatment capacity and 1,300 ha of service area.

The HAIDEP Master Plan differs from the 1998 Master Plan in the following aspects:

(i) Service population is based on the population forecast in the HAIDEP Master Plan which is higher than the forecast in the 1998 Master Plan.

(ii) For the purpose of preserving Bay Mau Lake, a small-scale sewerage system is proposed to cover the lake basin. The feasibility study of the project shows that the project is feasible.

(iii) The location of WWTPs for WW-4 and 5 is proposed at the park planned near Bac Mai airport to minimize the length of the trunk sewer (interceptor pipe) and for effluent water

to be discharged into the Lu River and other lakes, as a form of environmental maintenance flow.

(iv) Because it is difficult to prepare land for the WWTPs in the northern part of the service area, two sewerage service areas in the Nhue River left basin were included in WW-8.

(v) Two sewerage service areas in Long Bien District will be served by one sewerage system. It is believed that one large-scale sewerage system has more advantages, especially if a new urban center will be constructed at Gia Lam airport site.

(vi) The sewerage service area in the Nhue River's right basin was expanded to include the eastern side along NH32 following HAIDEP's population distribution forecasts.

9) Development Plan by Area

(1) To Lich River Basin, Nhue River Basin, and Long Bien District

While the 1998 Master Plan proposed the development of a sewerage system in the To Lich River basin, the Nhue River basin, and in Long Bien District, the HAIDEP Master Plan proposes eight sites based on the many proposals and discussions on WWTP sites in the last ten years. The proposed sewerage systems (see Figure 9.4.3) will, by 2020, cover areas with a population density of more than 100 persons/ha, along with their surrounding areas and urban centers.

(2) Dong Anh

Population density in Dong Anh District will remain relatively low. Most of the area in the district is expected to have a population density of less than 100 persons/ha. Two urban core areas are planned for development along both sides of Van Tri Lake. In the southern side of the lake, a sewerage system with a 38,000 m^3/day of wastewater treatment capacity is being developed to cover 1,300ha. It will be expanded to cover the urban core area and further developed to meet future population increases (see Figure 9.4.4). In addition, a new sewerage system is also proposed to cover a 2,200-hectare area north of Van Tri Lake where population density is more than 50 persons/ha. In the HAIDEP Master Plan, a 4,000-hectare sewerage service area was proposed up to 2020, instead of the 7,596ha incorporated in the 1998 Master Plan due to low population densities.

(3) Soc Son

There is no plan to develop high-density areas of more than 50 persons/ha in Soc Son District. The construction of a sewerage system is not recommended, only small-scale centralized wastewater treatment systems for industrial and/or large housing estates.

10) Proposed Projects up to 2010

Sewerage system development in the urban core has the highest priority, because of the area's high population density and high levels of economic and public activities, compared with other areas in Hanoi. Some of the projects in the urban core were selected for implementation by 2010 based on their financial feasibility.

Considering the priorities on water environment conservation, the HPC has recommended the development of a sewerage system in Bay Mau Lake basin as high priority. It is also estimated that the To Lich and Kim Nguu rivers are very important in improving the environment in the urban core. At present, the development of a sewerage system in the basins of the To Lich River, Kim Nguu River, and Bay Mau Lake (WW-2, 3, and 5) up to 2010 is proposed (see Figure 9.4.5). The feasibility reports for the projects, except for the

Bay Mau Lake project, have not been prepared. The overall feasibility of the sewerage projects for the urban core should first commence as early as possible. Based on the results, priority projects will be selected and implementation schedules will be modified.

Figure 9.4.3 Sewerage System in To Lich and Nhue River Basins and Long Bien District

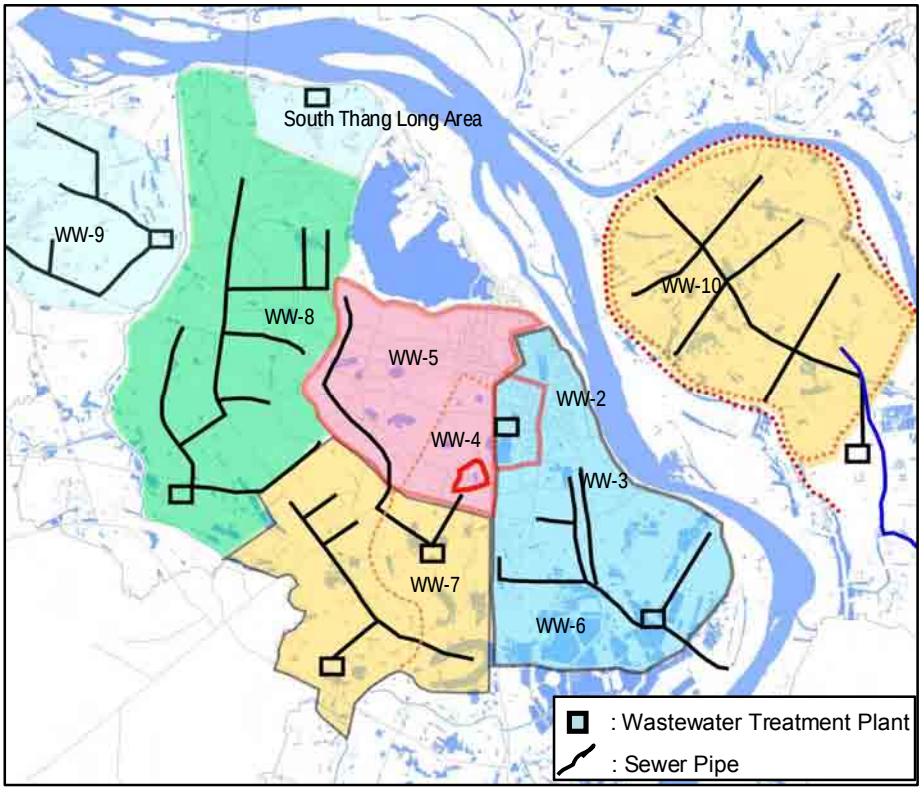


Figure 9.4.4 Sewerage System in Dong Anh District

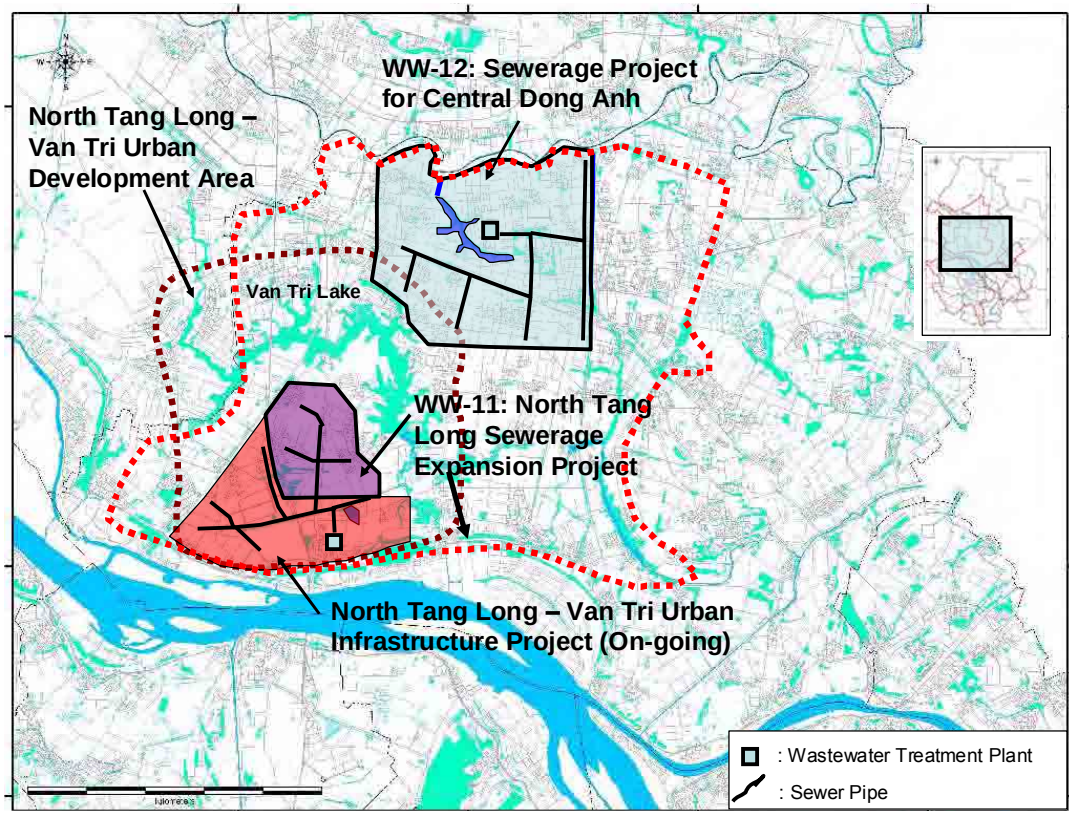
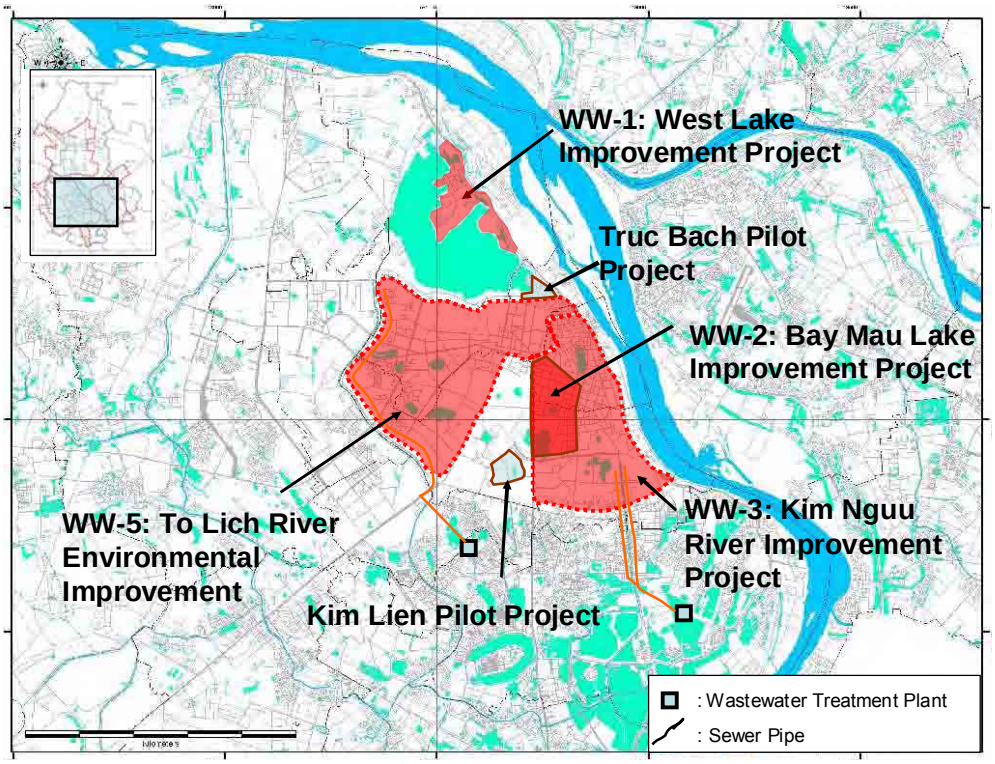


Figure 9.4.5 Proposed Projects up to 2010



11) Recommendations

(1) Consideration of Sewerage Tariff Setting and Subsidy Policy

To allow suitable operation of the developed sewerage systems, the budget for Operation and Maintenance (O&M) costs should be prepared annually. O&M costs include personnel expenses, electricity costs, sludge disposal costs, chemical costs, maintenance and repair costs, etc. O&M costs for all the proposed sewerage systems are roughly estimated at about US$ 45 million a year at 2005 prices. The basic policy on sewerage tariff setting is that O&M costs should be covered by tariff revenues from sewerage users. Following this policy, the average sewerage tariff should be set at VND 3,600/m^3 (US$ 0.22/m^3) in 2009. At present, the nominal sewerage tariff is about VND 360 - 340/m^3, which is 10% of the proposed water tariff. Also, initial connection fees can be imposed to cover part of the capital costs. Sewerage tariff setting and subsidy policies should be considered in further stages.

(2) Capacity Building for HSDC

Since August 2005, around 80 HSDC personnel started to work for the two pilot WWTPs. This is HSDC's first experience in operating a WWTP. To further develop a new sewerage system, operations personnel should be increased. Around 2,000 personnel will additionally be required for O&M activities upon completion of all the sewerage systems.

(3) Regulation of Wastewater Treatment Systems in New Development Areas

There are large-scale urban development plans that are outside the sewerage service planning areas, such as development of industrial estates, housing estates, research institutes/university complexes, etc. According to the Building Code, only septic tank installation is required on new building constructions. The installation of a wastewater treatment system, with secondary treatment process for certain scales of development

such as those covering more than 5ha, is proposed. It is necessary to develop and modify the Building Code and/or the effluent standards.

(4) Organizational Restructuring

State decisions have required HSDC to change its company form from the present municipal enterprise to a public, single-shareholder, limited liability company. The municipal enterprise status under TUPWS' authority is virtually a one-unit operation within the municipal government. The new status, public limited liability company, will be a more straightforward form of state company under HPC's control. This conversion from a division of the municipal government into a state company is, in effect, a form of corporatization.

By this conversion, the sewerage/drainage assets will be transferred to HSDC, which will be able to utilize the assets more flexibly based on its discretion. For example, lands and equipment that are basically used only for drainage services can be used for other profit-generating purposes. The ceiling amount, wherein the HSDC can make capital investments without HPC's approval, will also be raised substantially. In effect, HSDC will be more financially autonomous. However, this means lesser state protection and more exposure to market forces.

The new HSDC will have subsidiary companies inherited from intra-company enterprises previously existing in the HSDC. Some of these subsidiary companies, with attractive product lines or businesses, will be able to offer their shares to other parties. Such practices of allowing shareholders, other than the HPC, will be regarded as partial privatization.

The possibility of merging the HSDC with the water sector (company group of HWBC and HWBC No. 2) is currently remote. An in-depth examination of this option has yet to be conducted officially in light of the absence of sufficient financial data on both the water and sewerage/drainage sectors. The HSDC's current process of forming a public limited liability company could be an initial stage in reducing state control and in supporting the sewerage/drainage sector of Hanoi. If this process turns out to be successful and the sewerage/drainage sector becomes more self-sustaining than current conditions, the merger could be viewed more as a realizable option. In fact, the merger of both sectors cut both ways. Their operations can be rationalized because both sectors nearly have a similar customer base. Technologies used in their O&M also have common aspects. Procurement costs for parts and materials could be reduced by an increase in economic size.

The disadvantage would be a dilution of profitability for the entire company. The sewerage/drainage sector has been dependent largely on state budgets or subsidies because of their traditionally nominal sewerage tariffs (10% of water tariff) and nonexistent drainage tariffs. If the sewerage/drainage sector is merged with the water sector, where cost-recoverable tariffs exist and a collection system has been developed, tariff revenues against costs and the profitability of assets will obviously decrease.

9.5 Lake and Pond Management

12) Overview

There are nearly 900 lakes and ponds, with a hectare or more in size, within the boundaries of Hanoi City which were identified from GIS maps. The urban core and urban fringe areas alone have more than 200 lakes. Other than giving Hanoi its unique beauty and scenic waterscapes, these lakes and ponds in the urban areas and their surrounding areas, are commonly used as relaxation or recreation spots by residents. Traditionally, these lakes also act as drainage systems and work as storm water retention ponds, protecting the city from inundations. In addition, some lakes are used as fishponds or fishing areas. The three common uses of the lakes and ponds are: (i) for recreation; (ii) as flood regulators; and (iii) fishponds. Thus their uses are as varied as they are valuable in Hanoi.

Based on the results of the survey of 156 major lakes in Hanoi, 32 function as parks, 19 have storm water retention functions, and 80 are used as fishponds. The main lakes in the urban core area have been developed into parks, and most of the lakes in suburban and rural areas are used as fishponds. These lakes are not manmade. However, for the purpose of maintaining or promoting their functions, development works were carried out to make them part of the urban infrastructures or to improve their uses such as drainage systems, recreation and relaxation spots, citizens' parks, etc. There have been cases where lakes were filled up to provide new real estate for urban development.

The city's lake areas have decreased due to various urban development projects and illegal encroachments. The latter has a more serious implication on conservation because of the uncontrollable natural events that often ensue if it goes unabated. Some lakes have already been encroached on, while others have almost been reclaimed through the disposal of solid and construction wastes. These forms of encroachments have caused the deterioration of hygienic conditions in or around the affected lakes.

Pollution of lake water is also an important issue in Hanoi. Untreated wastewater from urban areas is being discharged into the lakes, lowering their water qualities. Wastewater interceptor systems have been introduced in some of the lakes to improve water quality.

Results of the water quality survey on 50 lakes show that 23 lakes have failed the standard (levels 3 and 4), and nine lakes (level 4) are assessed as highly polluted. No lake is classified as Level 1. West, Truc Bach, and Linh Dam lakes are classified as Level 2 lakes. Bay Mau, Yen So, and Dong Da lakes are classified as Level 3. Hoan Kiem, Ba Mau, and Kim Lien lakes are classified as Level 4 (see Table 9.5.1).

Table 9.5.1 Criteria Used in HAIDEP for Lake Water Quality Assessment

Level		COD Level	Condition
Level 1	Comfortable Quality	Less than 20 mg/L	No serious pollution source and receiving continuous fresh water inflow.
Level 2	Keeping the Environmental Standard	Less than 35 mg/L	No serious pollution source and no high polluted sediments, but no fresh water inflows.
Level 3	Polluted	35 – 50 mg/L	Between Levels 2 and 4.
Level 4	Highly Polluted	More than 50 mg/L	High eutrophic condition or receiving raw wastewater, or highly polluted sediment.

Source: HAIDEP Study Team.

13) Planning Orientation

(1) Objectives of Lake and Pond Management

The main objectives of lake and pond management are as follows:

(i) To protect Hanoi's lakes from illegal destruction, encroachments, solid waste dumping, etc.

(ii) To develop lakefronts with promenades/walkways and green spaces around lakes.

(iii) To construct large-scale flood regulating reservoirs in coordination with the drainage system development plan, and to increase storm water retention capacities of the lakes by increasing their effective depths.

(iv) To meet environmental standards for lake water and to formulate measures that will ensure higher water quality levels.

(2) Planning Direction

(a) Conservation of Lake Areas and Improvement of Amenities Around Lakes

Revetment is proposed for all lakes that are for conservation in urban development areas. It is an effective measure to prevent illegal encroachment and the dumping of solid wastes. During revetment, the construction of promenades/walkways as well as green spaces is proposed to improve the amenities in the surrounding areas.

(b) Strengthening of Storm Water Retention Functions

The drainage development plan in HAIDEP proposes the construction of large-scale flood regulating reservoirs with about 750ha in the 14 subbasins. Most of the reservoirs are proposed to be developed as dry reservoirs or multipurpose regulating reservoirs that can be used as parks/sports complexes during the dry season. In addition to the regulating reservoirs, lakes with more than 5ha of surface areas will have water gates and pumps to expand their effective depths for storm water retention. In coordination with the park development plan, the land-use development plan has allotted almost 5% of the basin area for lakes and reservoirs (including a dry reservoir).

(c) Water Quality Improvement

In order to meet environmental standards (Class B of the environmental water quality standard, TCVN 5942-1995, is lower than drinking water standard), the following measures are proposed:

- Install wastewater interceptor systems, or suitable wastewater treatment systems, in all the basins to protect lakes from raw wastewater inflows.
- Dredge sediments containing high organic matter from the lakes.

Should these measures be implemented, lake water quality is expected to meet environmental standards. However, following the introduction of wastewater interceptors, water flows will completely stop during the dry season. Under this condition, it will be impossible to achieve Level 1. To exceed the standard, additional measures should be proposed, such as the introduction of environmental maintenance flows.

14) Proposed Projects on Lake Improvement

(1) To Lich River Basin

The proposed project will divert 7 m^3/s of water from the Red River to West Lake and distribute it to other major lakes until it reaches the To Lich and Kim Nguu rivers (Figure 9.5.1). Red River water contains lower chemical oxygen demand (COD) at less than 10 mg/L and is highly turbid, which means that it is useful when diluted with water where organic pollution has occurred. However, high turbidity may affect West Lake's environment. This is something that should be given attention. However, if the water supply for the lakes is considered unsuitable, it is recommended that the Red River water should flow directly to the urban rivers.

Other improvement measures include the following:

(a) Conservation of Lake Areas/Improvement of Amenities Around Lakes

The lake survey identified 91 lakes and ponds with about 1,280ha of water surface in the To Lich River basin, which has an area of 7,750ha. Accounting for more than 10% of the basin is the 930ha West Lake basin which has several smaller lakes and ponds. The rest of To Lich River basin (6,820ha) has 78 lakes and ponds with a water surface of 737ha. Major lakes in the urban core have been developed and incorporated into parks. The construction of revetments and installation of wastewater interceptor systems to help improve the amenities of the remaining lakes in coordination with park development plans are proposed.

(b) Strengthening of Storm Water Retention Function

Drainage system development in the To Lich River basin will be completed in 2010. Two regulating reservoirs, Yen So reservoir and Linh Dam Lake, will have enough capacity to function as drainage systems. In addition, six lakes (31.4ha) have been developed to have storm water retention functions. At the final stage, the development of storm water retention functions for the 16 lakes (88.1ha), up to 2010, is proposed.

(c) Water Quality Improvement

There are still many lakes that do not meet the standard. As a minimum requirement, interceptors and dredging are still useful measures to achieve standard levels. In Hoan Kiem Lake, where the water is highly eutrophied, dredging is not allowed due to a local myth called the "legend of the tortoise", which highlights the necessity to discuss measures to improve the lake's water quality among the stakeholders.

For the next step in water quality improvement for the To Lich River, a project on environmental maintenance flow is proposed with the following objectives:

(i) To supply environmental water to West Lake to improve its water quality.
(ii) To supply clean water to major lakes in Hanoi to meet Level 1 standard.
(iii) To supply maintenance flow to the To Lich and Kim Nguu rivers, because both rivers will dry up after sewerage systems are installed in their respective basins.

(2) Nhue River Basin

In the drainage system development plan, about 500ha of the regulation reservoirs are required to protect the urban development areas in the Nhue River basin from inundations.

Figure 9.5.1 Typical Structural Improvement of a Lake

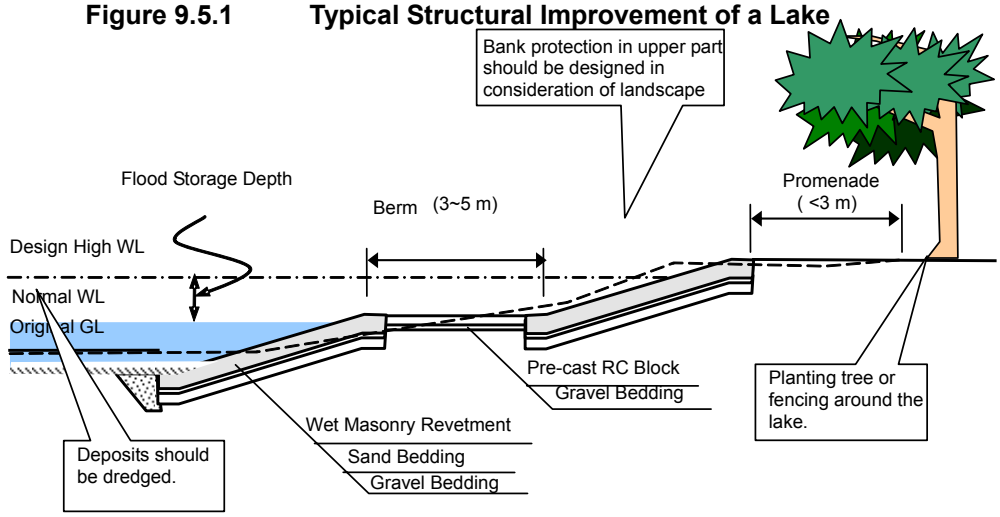


Figure 9.5.2 Structural Countermeasures for Improvement of Water Quality

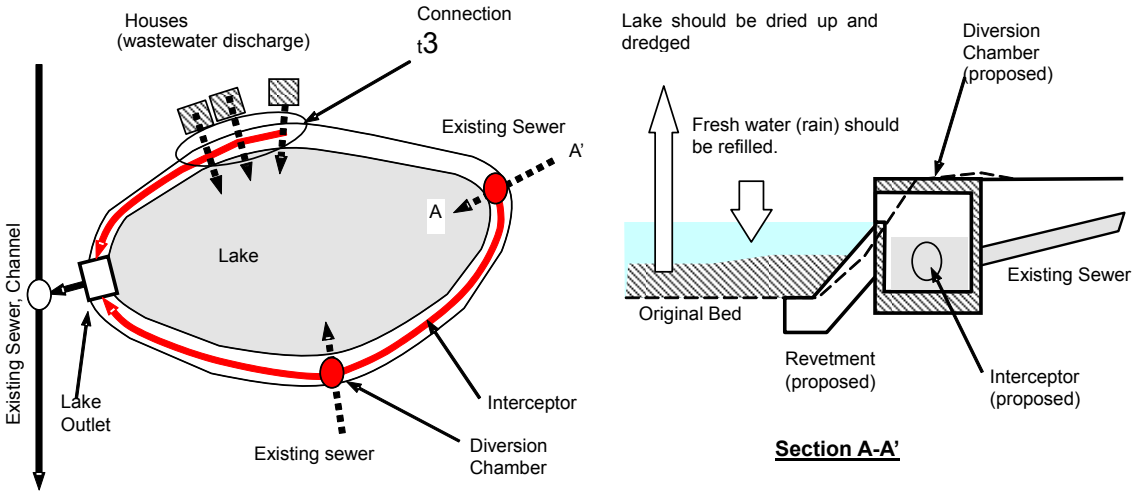
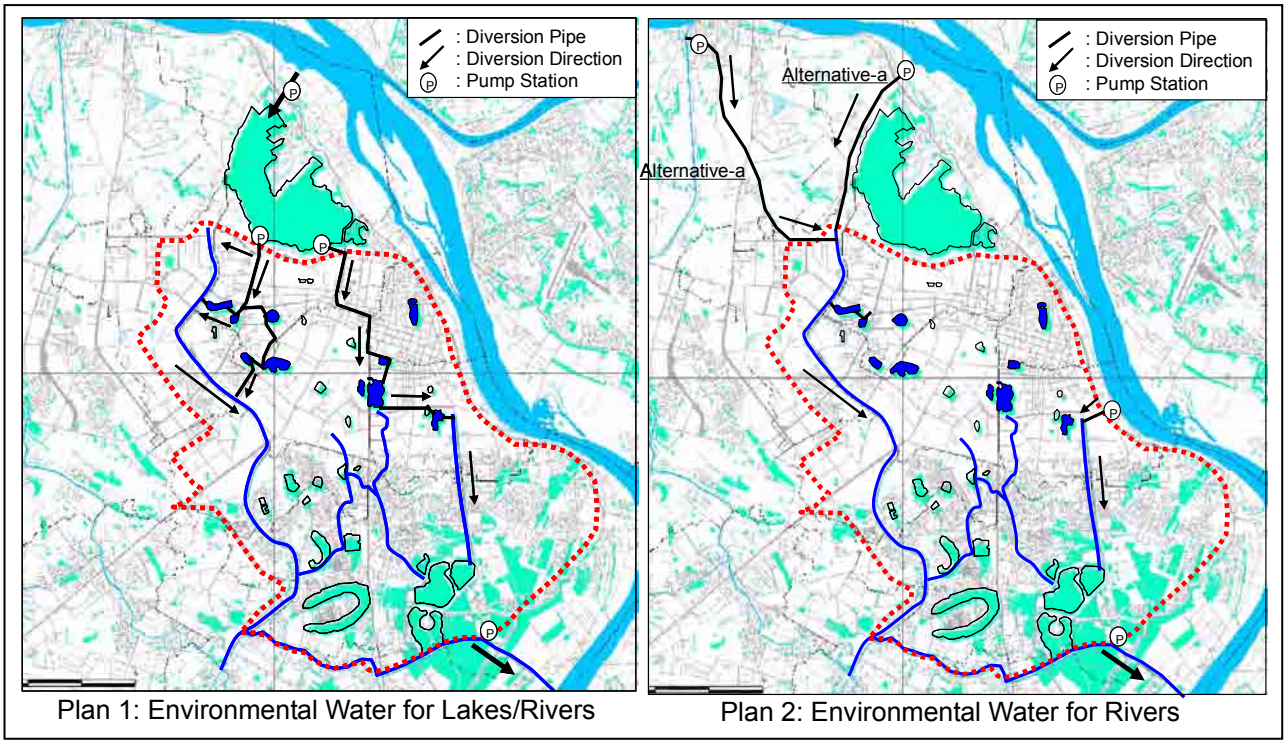


Figure 9.5.3 Layout of the Diversion of Environmental Maintenance Flow



Plan 1: Environmental Water for Lakes/Rivers

Plan 2: Environmental Water for Rivers

The reservoirs will cover about 5.3% of the area, and most of the reservoirs are designed to be dry so that they can be used as parks. They are planned to be constructed in proposed park sites. In addition to the reservoir, 12 lakes (50ha) in the Nhue River's left basin are proposed for improvement.

(3) Long Bien and Gia Lam Districts

In the lake survey, 25 lakes were identified to have 157ha of water surface. All lakes are proposed for conservation together with the development of their recreation functions. For seven lakes with about 54ha total surface, their storm water retention function will be developed. In addition, one regulating reservoir (86ha) will be constructed in the planned park site, and another (72ha) will be constructed outside of it. Some parts of Thien Duc River have wide widths and can function as regulating reservoirs.

(4) Dong Anh

Three regulating reservoirs (total 142ha) and Van Tri Lake (270ha) are proposed to work as drainage systems in Dong Anh District. Currently, Van Tri Lake has a complicated shape and sometimes dries up during the dry season. To effectively use the area and create an attractive landscape, it is proposed that the shape of the lake be modified and its bottom dredged to a depth that will retain water all year round. Some parts of the Thiep and Hoang Giang rivers have wide widths and can function as regulating reservoirs.

15) Recommendations on Lake Management

Required works for lake management are enumerated below.

(i) Control of water level to regulate floods through pumps and gates in the lakes.
(ii) Maintenance of lake structures such as revetments, pumps, and gates.
(iii) Monitoring and improvement of water quality.
(iv) Cleaning of lake water surface and surrounding areas.
(v) Management of commercial, cultural, and tourism activities in/around the lakes.

As the agency responsible for managing the sewerage and drainage systems in Hanoi, HSDC should also be tasked with managing the water level, water quality, and structures installed in the lakes. There are so many lakes/ponds in Hanoi that need conservation. The management of lakes of over 5ha in size and those under 5ha should be separate. While HSDC is already managing 25 major lakes in and around the urban areas, it will in the future, be responsible only for lakes with areas of 5ha or more. However, even if a lake is less than 5ha, if it functions as a storm water reservoir, or require water quality improvement, it will be managed by HSDC.

On the other hand, TUPWS should have administrative control over the exploitation of lakes and should formulate implementation plans on lake improvement. It should handle applications for developing lakes with areas of 5ha or more. Meanwhile, management of lakes smaller than 5ha should lie with the respective district people's committees. The demarcation of administrative control between TUPWS and local authorities are proposed as shown in Table 9.5.2.

As owners of the lakes, HPC and the local communes should appoint an organization that will be responsible for lake cleanliness and the management of commercial, cultural, and tourism activities in and around the lakes. Lake cleaning could be contracted out to the new HSDC as the task is a natural extension of their drainage or sewerage business line.

Table 9.5.2 Proposed Delineation of Lake Management Tasks

Task	Management Responsibility	
	5ha and Over[1)]	Under 5ha
Lake Management (Water Level, Structure, Water Quality)	HSDC	Commune
Management of Parks and Activities (Commercial, Cultural, Tourism, etc.) in/around Lakes	Assigned Authorities by HPC	Assigned Authorities by Commune
Approval of Activities in/around Lakes	TUPWS	District PC
Formulation of Improvement Projects	TUPWS	TUPWS

1) Including some small lakes with areas under 5 hectares.

9.6 Flood Protection

16) Overview

With the severe floods in August 1971 serving as a constant reminder, dyke strengthening projects were carried out on the right bank of the Red River from 1998 to 2002 with ADB financing. The dyke strengthening projects consisted of the following: (i) strengthening by constructing walls and soil reinforcement at the foot of dykes; (ii) pavement improvement; and (iii) grouting to fill voids in embankments, etc. The first item was carried out in sections of less than 2km each. The strengthened sections totaled nearly 20km out of a total dyke length of 30km.[3] Freeboard (difference between crest elevation and design water levels) was also increased in these sections (see Table 9.6.1).

Figure 9.6.1 Dyke Alignment around Hanoi City

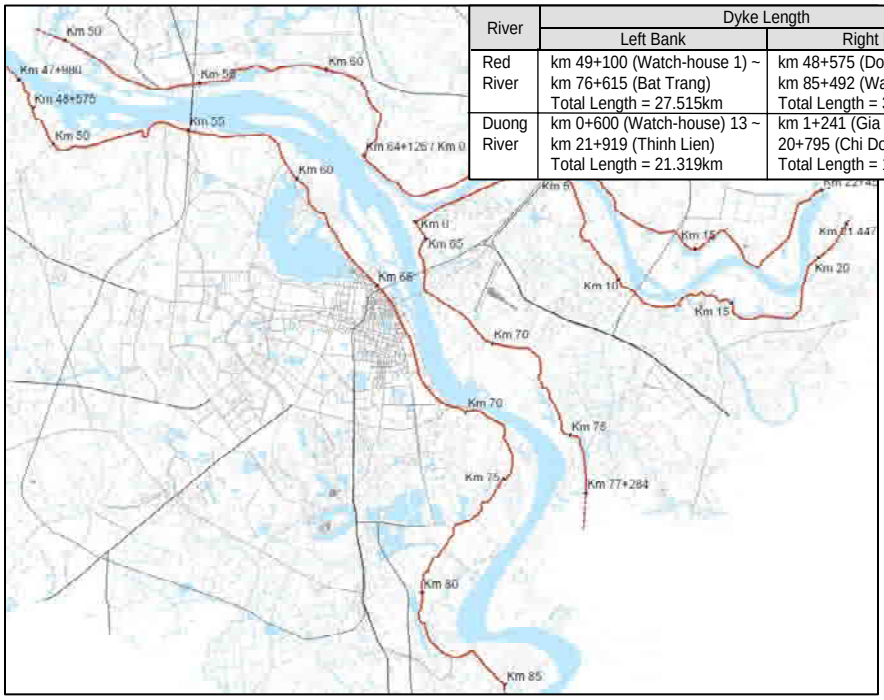


Table 9.6.1 Dimension of Dykes along the Red and Duong Rivers

Description	Red River		Duong River	
	Left Bank	Right Bank	Left Bank	Right Bank
1. Beginning Point (Location)	km49+100 (WH-1)2)	km48+575 (Dong Da)	Km0+600 (WH-13)2)	km1+241 (Gia Thuong)
2. Ending Point (Location)	Km76+615 (Bat Trang)	Km85+492 (WH-34)2)	Km21+919 (Thinh Liet)	Km20+795 (Chi Dong)
3. Total Length[1)]	27.515km	36.917km	21.319 (22.547km)	19.554km (21.447km)
4. Crest Elevation	14 to 14.5m	14 to 14.5/15.2m	11.6 to 15.2m	12.2 to 14.5m
5. Crest Width	6m	6m	5m	5-7m
6. Slope Riverside 7. Landside	1/2 - 1/3 1/2 - 1.3	1/2 - 1/3 1/2 - 1/3	1/2 1/3	1/2 - 1/3 1/2 - 1/3

1) Total length was calculated by the Study Team by referring to the 1994 dyke system map with a scale of 1:100,000. Those in parentheses were abstracted from the 1998 Master Plan.
2) WH = watch-house.

[3] This section provides an evaluation of the current dyke structure based on a hydraulic study and the impact of development carried out in areas outside the dyke on the river water flow.

17) Existing Regulatory Framework

Documents on water laws, orders, decrees, standards, regulations, and technical notes on dyke design and strengthening, as well as publications on flood protection were collected and reviewed. Of these documents, the decisions of MARD No. 59/2002QD-BNN dated 3 July 2002 and No. 609/QD-PCLB dated 6 August 2002 stipulate the design water level (DWL) in the Red River around Hanoi (see Table 9.6.2) and alarming water levels in Long Bien (see Table 9.6.3).

Table 9.6.2 MARD Decision on Design Water Levels

Location Name	Location	DWL of Dyke	DWL (Level I to III)
Long Bien Gauging Stn.	Km66+400 left bank	13.4m	13.1m

Table 9.6.3 Alarming Water Levels of the Red River in Long Bien

Alarming Level	Water Level
Level I	9.5m
Level II	10.5m
Level III	11.5m

Through the ADB-financed dyke strengthening project implemented from 1998 to 2002, some portions of the dyke were strengthened with concrete walling and now have elevations of 15.2m. With this project, a 1.8m (=15.2 – 13.4m) freeboard was secured, compared with the standards adopted in other countries (see Table 9.6.4). Although additional work on the sections excluded from the project is required, further heightening is not recommended as this will also mar the physical landscape of Hanoi.

Table 9.6.4 Freeboards in Selected Countries

Country	Freeboard (m)	Remark
1. Japan	2	Discharge > 10,000m3/sec
2. Russia	0.7 - 0.9	Discharge > 100m3/sec
3. US of America	0.9	-
4. Holland	0.5	-
5. Germany	1	-
6. Hungary	1.2 - 1.5	-

18) Hydraulic Impact on Areas outside the Dyke

(1) Context

Areas outside the dyke of the Red River have been developed without clear policy and institutional arrangements. This section intends to analyze the possible impacts of the hydraulic conditions of the Red River on the activities in the areas outside of the dyke and vice versa.

(2) Water Levels in the Red River

Water levels in the Red River have been recorded since 1902 to 2004. The annual highest levels in the Long Bien area were analyzed. While the levels ranged mostly from 11m to 12 m, the highest water level of 14.02m was recorded on 22 August 1971. The 5-year moving average line shows that water levels remained around EL.11m after the completion of the Hoa Binh dam (see Figure 9.6.2). The records were generalized and translated into probable water levels (see Table 9.6.5).

The impact of the Hoa Binh dam, which was constructed in 1985 with a gross storage

volume of 9.45 billion m3, on Hanoi has been insignificant, although it has contributed to flood control in downstream areas.

Figure 9.6.2 Annual Highest Water Levels in Red River in Long Bien, 1902 – 2004

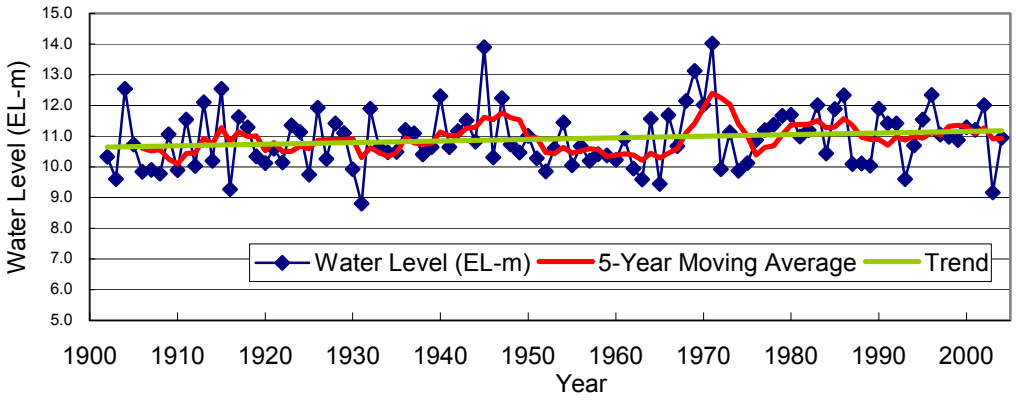


Table 9.6.5 Past Water Levels Estimated Based on Records

Return Period (Frequency)	Data Period	
	1902-2004	1985-2004 (After Completion of Hoa Binh Dam)
50 Years (2%)	13.382 m	13.340 m
100 Years (1%)	13.901 m	13.822 m
125 Years (0.8%)	14.068 m	13.976 m
200 Years (0.5%)	14.418 m	14.302 m

(3) Topographic Conditions of Areas Outside the Dyke

The areas that were studied have a length of about 20km and are situated on the high water channel of the right bank of the Red River between km53+000 (just upstream of Lien Mac) and km73+400 (downstream of Thanh Tri). The channel width ranges from less than 100m to 900m with a ground elevation of between 13m and 8m.

(4) Probability of Inundation

Probable water levels around the site in the near future were estimated using historical data (see Table 9.6.6). This implies that flood from a 2-year return period raises the water level to 10.8m, causing inundation in many parts of the areas outside the dyke. Floods with a 5-year return period will further elevate the water level to 11.6m. Current alarming levels correspond to the estimated probable water levels (see Table 9.6.7). Considering the current development pattern, topography, and flood frequency in areas outside the dyke, inundations due to floods with alarming levels 1, 2, and 3 can occur almost every year here.

Table 9.6.6 Probable Future Water Levels Estimated Based on Records

Return Period (Probability)	Probable Water Level
2 years (50%)	10.755m (10.8m)
5 years (20%)	11.597m (11.6m)
10 years (10%)	12.155m (12.2m)
25 years (4%)	12.859m (12.9m)

Table 9.6.7 Alarming and Probable Water Levels in Areas Outside the Dyke in

Long Bien

Alarming Water Level	Probable Water Level (m)	Probability
Level 1	9.5 - 10.5m	Lowest water level in 44 years (9.17m)
Level 2	10.5 - 11.5	2-year return period (10.8m)/ mean for 44 years (11.1m)
Level 3	11.5m or higher	5-year return period (11.6 m)

(5) Impact of Development on Flood Flow and River Management

Flood flow or flood discharge capacity of the areas was assessed through a conventional method. The width of the Red River, between the Long Bien and Chuong Duong bridges, were estimated based on a topographic map with a scale of 1 to 10,000. The depth was based on the lowest water level. Ground elevation was also estimated as explained above on the elevation of high water channels.

The impact of development in areas outside the dyke on flood flow in the Red River will be most critical at the narrowest section of the Red River between the Long Bien and Chuong Duong bridges. The river cross-section in this area was estimated based on a topographic map and the record of water levels (see Figure 9.6.3). The discharge of the flood flow with the highest water levels recorded in 1969 and 1971 was estimated for this section and for the areas outside the dyke (see Table 9.6.8). Results indicate that only 2 to 3% of flood waters in the Red River flow to areas outside the dyke.

Although the developments in areas outside the dyke will likewise not hinder flood flow in the Red River significantly, there are some critical issues that must be addressed comprehensively from the urban development and management viewpoints, such as the:

(i) Unhygienic conditions due to frequent inundations.

(ii) Difficulty in answering to emergency situations.

(iii) Erosion of slopes between high and low water channels due to high water velocity.

Figure 9.6.3 Assumed Cross-section of Red River between Long Bien and Chuong Duong Bridges

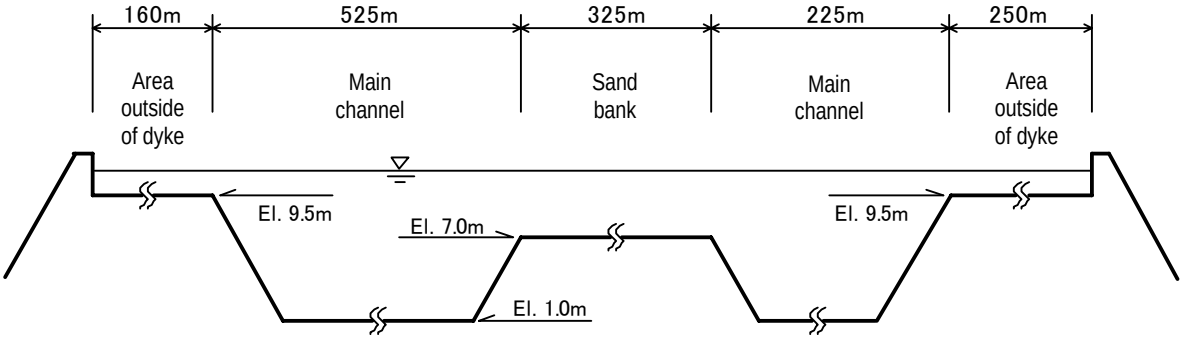


Table 9.6.8 Estimated Discharge during Floods in High Water Channels and between Whole Sections

Date	Water Level (m)	Estimated Discharge (m^3/sec)		(B)/(A) (%)	WSG[1)]
		Section between Long Bien & Chuong Duong Bridges (A)	Areas Outside the Dyke (B)		
Aug.19,1969	13.12	17,300	345	2	1:23,000
Aug.22,1971	14.02	19,600	500	3	1:23,500

1) Water surface gradient (WSG) was obtained through trial estimates of given water levels and discharges in the section between Long Bien and Chuong Duong bridges.

19) Conclusion and Recommendations

Based on the results of the study, the conclusion and recommended measures are as follows (see Table 9.6.9):

(i) Strengthening of dykes around Hanoi, securing of the remaining heights, and strengthening of deteriorated embankments.

(ii) Development of an early warning and flood fighting/evacuation system to ensure a timely and periodic warning system.

(iii) Conduct of a study on the redevelopment of the Day River flood diversion channel to divert flood upstream and help protect Hanoi.

Table 9.6.9 List of Potential Projects

Project No.	Project Title	Project Purpose/Profile
WF-1	Red River Dyke Strengthening Project (stage 2)	● This project aims at strengthening works with the same specifications as those in the ADB project to ensure safety against flood on the right bank of the Red River.
WF-2	Duong River Dyke Strengthening Project (stage 1)	● Following the project (WF-1), strengthening works with the same specifications as those in the ADB project to ensure safety against flood on the right bank of the Duong River.
WF-3	Duong River Dyke Strengthening Project (stage 2)	● Following the project (WF-2), strengthening works with same specifications as those in the ADB project to ensure safety against flood on the left bank of the Duong River.
WF-4	Redevelopment of Day River Flood Diversion Channel	● This project aims at the regeneration of the function of the Day River including a diversion scheme from the Nhue River to the Day River.
WF-5	Development of Flood Early Warning System	● This project aims at introducing methods and techniques for the timely dissemination of flood alarms from the middle to the lower reaches as well as increasing the capabilities in early flood warning.

9.7 Solid Waste Management

1) Overview

There are two master plans on solid waste management (SWM), the 1998 Master Plan and the Environment Master Plan up to 2020 prepared by JICA (JICA EMP). Except for some points, the contents of both master plans are almost identical due to the similarities in the prepared terms. In the 1998 Master Plan estimates on the total amount of generated waste were almost 0.7 million tons for 2005 and more than 1.4 million tons by 2020. Under the JICA EMP[4], the estimate is 1.2 million tons by 2020 based on that year's population forecast of about 3.5 million. This estimate will increase if it is based on the HAIDEP Master Plan's population forecast of 4.5 million (see Table 9.7.1).

Table 9.7.1 Forecast of Solid Waste Generation and Disposal

	Year	JICA 2000 EMP	HAIDEP MP
Population	2010	2,810,150	3,650,000
	2020	3,507,923	4,500,000
Generated Waste Amount (ton/day)[1)]	2010	2,917	4,307
	2020	4,122	5,805
Disposed Waste Amount (ton/day)[2)]	2010	1,558	3,749
	2020	3,037	5,376

1) The unit generation rate was estimated to be 1.18 kg/day/capita by 2010 and 1.29 kg/day/capita by 2020 based on the original projection. Generated waste amount for both plans is the amount from seven urban districts and all suburban districts.
2) Disposed waste amount in the JICA 2000 EMP is the amount from seven urban districts and Soc Son District. Waste from other suburban districts is transported to other interregional landfill sites. Disposed waste amount in the HAIDEP MP is the amount from all urban districts and suburban districts without using any waste reduction measures other than those proposed in the JICA 2000 EMP.

Household wastes generated from seven urban districts are mainly collected by the Urban Environmental Company (URENCO). In the 1998 Master Plan, the introduction of separate collection, i.e. small compactors for narrow roads and medium to large trucks for newly developed areas, is proposed. The JICA EMP proposes a direct collection system, or a secondary transport system. In 2003, 70 compactor vehicles were supplied through the Japan Grant Aid. Although transfer stations for secondary transport have been proposed in both master plans, they have not been constructed yet.

In Nam Son, a large-sized landfill has been constructed with a receiving capacity of 12.4 million m^3 (Phase 2). Although it has been estimated that the site's capacity could last until January 2018, it can be full even before that year because wastes are expected to increase more than what was forecasted in both master plans due to future population growths. The Nam Son landfill will be closed by 2012 if no mitigating measure is put in place. This will be more than 5 to 6 years earlier than its original schedule of 2018. If some waste reduction alternatives, such as composting, materials recovery or incineration, will be introduced, the lifespan of the landfill may be prolonged by a few years.

Regarding medical wastes, infectious wastes are disposed of in the existing incinerator in Cau Dien, whose capacity should be expanded.

[4] Total amount of generated waste to be handled by URENCO except for construction and demolition waste.

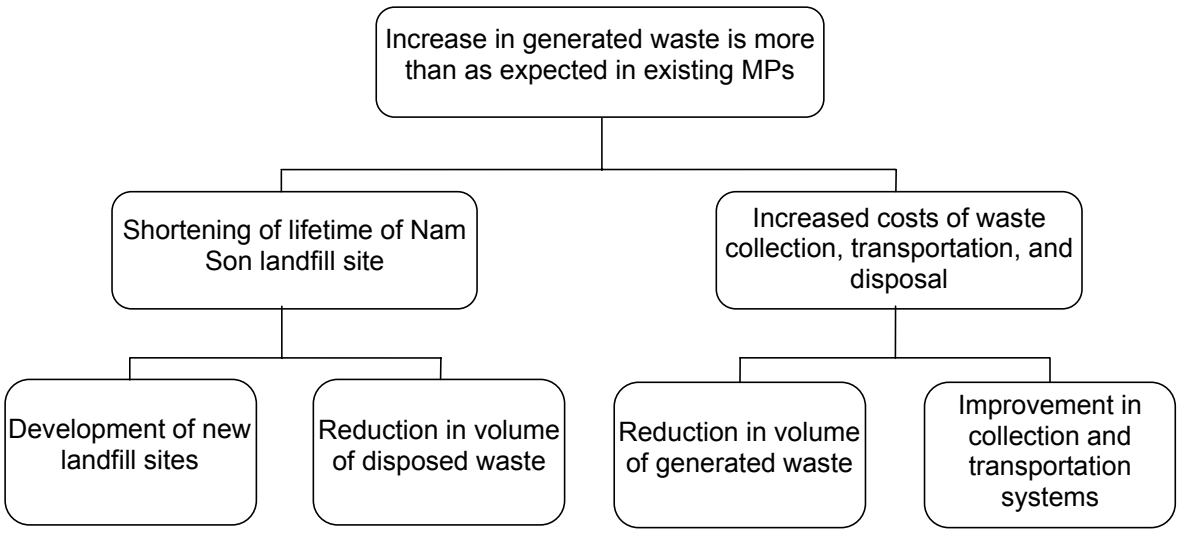
A composting plant with an annual treatment capacity of 250,000 tons has been proposed to reduce waste. However, only one with a capacity of 50,000 tons has been constructed.

Currently, one of the most significant problems is that the volume, or quantity, of waste generation will be more than the estimates in the existing master plans, causing the following problems:

- The lifespan of the Nam Son landfill will be shorter than its original timeframe.
- The cost of waste collection/transportation and landfill operation will increase due to the increase in generated wastes.

To solve these problems, several measures are recommended, as shown in Figure 9.7.1.

Figure 9.7.1 Recognized Solid Waste Management Issues



2) Planning Orientation

(1) Planning Targets

(i) Following the National Environmental Strategy, waste reduction rates (the rate of the amount of reused and recycled waste by the amount of total collected waste) should reach more than 30% by 2020 through the promotion of the 3 Rs (reduce, reuse, recycle).

(ii) Collection service areas should cover 100% of urban areas. The practical collection rate (the rate of the amount of collected waste by that of total generated waste) should be 95%. In suburban districts this should increase gradually up to 65%.

(2) Planning Considerations

(i) The required areas for landfill sites up to 2020 should be secured based on the facility plan with conditions that generated and collected wastes should be reduced by approximately 30%.

(ii) For waste reduction alternatives, the most appropriate combination of the following measures will be studied from the technical, environmental, and financial viewpoints: waste reduction at the generation sources, increase in composting capacities, preparation of waste separation facilities, and introduction of incinerators.

(iii) As mentioned above, landfill in each suburban district (self-disposal) will be reconsidered and the collected waste from suburban districts will be disposed of at the Nam Son landfill, or other designated long-term landfill site(s).

(iv) Waste transfer systems with transfer station(s) will be promoted to reduce transportation costs and improve traffic congestion.

3) Revision of Solid Waste Management Plan

(1) Future Waste Flows

Based on the above strategies, waste flow in 2020 is tentatively proposed (see Figure 9.7.2). There are five main waste categories, namely: (i) municipal solid wastes in urban areas[5], (ii) municipal solid wastes in suburban areas, (iii) nonhazardous industrial and hospital wastes, (iv) hazardous hospital wastes, and (v) construction wastes.

(a) Municipal Solid Wastes in Urban Areas

Primary waste collection will be carried out using handcarts similar to the existing method. Wastes collected by handcarts (95% of generated waste) will be transferred through waste collection vehicles (such as compactors with loading arms). Recyclable materials (inorganic resources) which will be sold to recycling dealers are estimated at 5% of all collected wastes. To achieve this waste segregation at sources will be introduced in some areas. Ninety percent (90%) of municipal solid waste will be transported to transfer stations including waste separating facilities or composting plants. The total capacity of the transfer stations is 5,000 tons/day. These will be located in alternative sites in Dong Ngac and other transfer stations. Some transfer stations will include a separation system.

There are three main flows based on the type of waste characteristics regarding transfer stations which include separating facilities and composting facilities. Firstly, organic-rich wastes (approximately 20 - 30% of collected wastes from urban areas) generated in areas with many restaurants or vegetable markets, can be transported to composting plants. Secondly, inorganic-rich wastes, including recyclable materials, generated from areas with many offices or schools, will be hauled to separation facilities. Recyclable materials, which are easily separated by hand, are estimated to be 20% of all collected wastes in urban areas. Thirdly, wastes generated by other sources will be directly transported to transfer stations and then transported to the Nam Son landfill. All residues from separation facilities and composting plants, as well as the wastes directly hauled to transfer stations, will then be transported to and disposed at the Nam Son landfill.

(b) Municipal Solid Waste in Suburban Areas

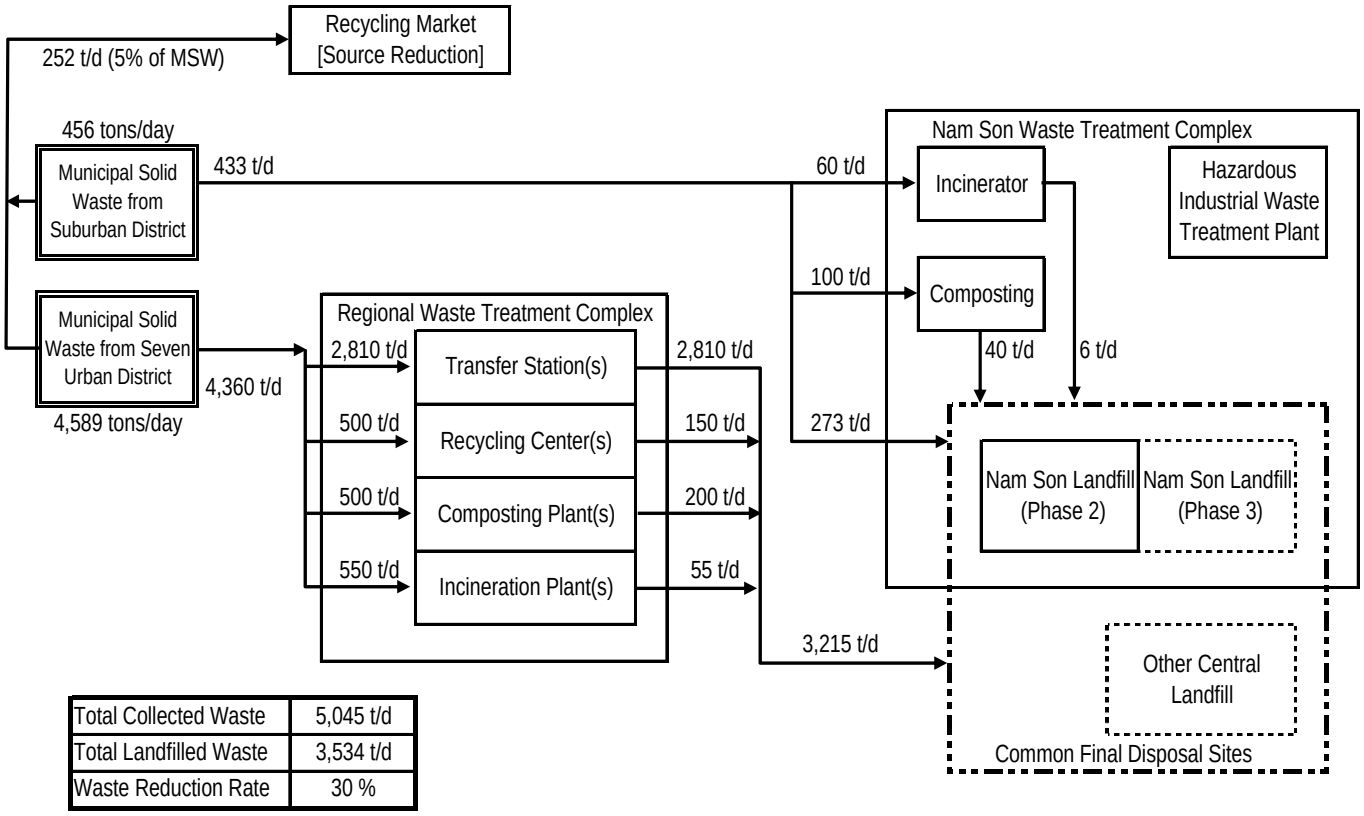
Approximately 20% to 30% of municipal solid waste from suburban areas will be transported to the composting plant at the Nam Son landfill. The rest (70 - 80%) and the residues of the composting process (45% of hauled amount) will be disposed of at the Nam Son landfill. Recyclable materials, which are estimated to be 20% of collected wastes, will be collected at the Nam Son landfill. As a result, 50% to 60% of all collected wastes from suburban areas will be disposed of in the Nam Son landfill.

[5] Urban areas include existing suburban areas which will become urban areas based on the proposed HAIDEP Master Plan.

(c) Other Wastes

Nonhazardous industrial and hospital wastes will be handled in intermediate treatment facilities and their residues will be disposed of at the Nam Son landfill. For hazardous hospital wastes, capacity expansion of incinerators will be considered. Measures on construction wastes are the same as those proposed in the JICA EMP.

Figure 9.7.2 Proposed Solid Waste Management Flow in Hanoi City, 2020



(2) Components of Treatment and Disposal Systems

Based on the proposed waste flow, needed facilities to implement the measures on solid waste management include composting plants, transfer stations, including waste separation facilities, and intermediate treatment plants (needs a detailed feasibility study) (see Table 9.7.2).

Table 9.7.2 Solid Waste Management Measures and Projects

Measure	Proposed Project
Reduction in generated wastes.	Promote source separation systems.
Introduction of effective collection and transportation systems.	Construct transfer stations.
Development of new landfill sites.	Expand capacity of Nam Son landfill.
	Find other landfill sites.
Reduction of disposed wastes.	Promote composting.
	Prepare separation system for recyclable materials.
	Consider intermediate treatment facilities.

(a) **Transfer Stations:** The total capacity of the transfer stations will be 5,000 tons/day. A transfer station in Dong Ngac with a capacity of 1,600 tons/day and others in Duc Giang or elsewhere (with a capacity of 3,400 tons/day) will be constructed. They will include separation facilities which will include compacting and packing systems for separated recyclable materials for selling to recycling dealers. The target volume of recyclable materials (inorganic wastes) is approximately 918 tons/day (20%[6] of segregated wastes) in urban areas by 2020. In addition, source separation systems will be introduced in urban districts by 2010. The target amount is approximately 5% of the volume of generated wastes. The separated recyclable materials will be packed in the transfer stations for selling to recycling dealers.

(b) **Composting:** Composting facilities will be designed to accommodate approximately 25% to 30% of all collected wastes. In addition to a composting facility with a capacity of 50,000 tons/year (137 tons/day) which is planned in Cau Dien, new composting facilities (approximately totally 1,370 tons/day although it depends on the needs of the compost market) for the waste generated in urban areas will be constructed in Cau Dien or other areas. The other new composting facilities (approximately 137 tons/day) will be constructed in Nam Son complex for the waste generated in rural or suburban districts. Residues from composting, which are estimated to be 45% of the hauled wastes, will be disposed of at the Nam Son landfill. Home composting, if promoted for agricultural purposes, especially in suburban districts, will further contribute to the reduction of generated wastes.

(c) **Landfill Sites:** Even if the solid waste reduction program is carried out successfully, the existing Nam Son landfill will be filled up by 2014. New landfill sites should be provided before then. Currently, there is no alternative site in Hanoi, and the disposal of wastes outside of the city is not allowed. The expansion of the Nam Son landfill (Nam Son Phase 3 Project) is therefore proposed. At least 8.6 million m^3 of capacity (43ha) is required to meet the demand up to 2020. Considering the procedures in planning, land acquisition, design and construction, the feasibility study for the project should commence before 2010.

(d) **Intermediate Treatment Systems:** Incinerators are one of the effective intermediate treatment systems that reduce solid waste disposal volumes. However, there are difficulties in introducing large-scale incinerators for municipal solid wastes. These include high operation costs and adverse environmental impacts. Incinerators for municipal solid waste may also not operate fully, if per capita GRDP is less than US$ 5,000, because this means the people would not be able to afford such service. The HAIDEP Master Plan estimated the per capita GRDP in Hanoi to be US$ 3,500 in 2010 and US$ 5,000 in 2020. It is necessary to study and discuss the advantages and disadvantages of using incinerators. The case of Ho Chi Minh City which cooperates with Long An Province to set up a waste disposal site (nearly 2,000ha) in the latter, will be one of the references.

[6] It was assumed that by 2010 recyclable materials would comprise more than 10% of mixed wastes hauled to waste separation facilities. The share of recyclable materials is expected to gradually increase to 20% by 2020 due to improved recycling techniques and the development of a recycling market. However, there is no current data about waste characteristics such as physical composition, moisture content, and bulk density.

4) Recommendations

(a) **Study on Incinerators:** In the future, an incinerator for municipal solid wastes can be considered as an effective alternative for intermediate treatment. In order to confirm its sustainability and suitability, a detailed study, which will include waste quality survey, sustainable financial plan, environmental impact, etc., and stakeholder discussions, is required.

(b) **Consideration of New Landfill or Interregional Final Disposal Sites:** After its expansion, the Nam Son landfill (Nam Son Phase 3 Project) can be used at least until 2020, even if no incinerators will be introduced. However, new locations are needed to meet demands after 2020. Interregional landfill sites can also be developed but institutional difficulties should be considered.

(c) **Promotion of Public Participation for 3 R Activities:** Currently, recycling villages have developed in some areas of Hanoi City. Recyclable materials are collected by waste pickers and then sold to recycling dealers in these villages. In HAIDEP, a source separation system is proposed. To continuously and effectively operate the system, public participation is inevitable.

(d) **Septage:** Treatment of septage (the biodegradable waste from septic tanks) is one of the important issues in urban sanitation. In the long term, septage treatment plants should be constructed, with Cau Dien as one of the proposed sites. In the short term, since one WWTP was constructed in North Thang Long and two or three WWTPs are planned to be constructed within five years, the treatment of both septage and wastewater at WWTPs seems to be the most practical and logical way for septage treatment. However, because septage has higher biological oxygen demand (BOD) and settled solids than wastewater, the WWTPs should have bigger capacities and solids-handling capabilities to treat septage. It is recommended that a pilot project for septage treatment be conducted as a first step.

9.8 Cemetery

1) Main Issues

In general, cemeteries are frowned upon in the city, and probably in the whole of Vietnam, since people look at them as unhealthy (eg they believe that ground burials pollute groundwater), an outlook which is compounded by their traditional stark image. Therefore, securing land for new cemeteries around Hanoi, especially those near residential areas, has become very difficult due to objections from nearby residents. The main issues are thus as follows:

(i) Limited capacity in the existing cemeteries in and around Hanoi City.

(ii) Increasing need to relocate existing graves, which are presently scattered in and around the urban center, due to land requirements for future housing and infrastructure development.

(iii) Heightened desire among Hanoi City residents to establish family graves in and around Hanoi City rather than in their home provinces.

(iv) Less available lands for cemeteries and graveyards in new settlements due to the high land value in such areas.

2) Possible Measures based on Japan's Experiences

Referencing Japan's experiences on cemetery development and urban growth, the following are the recommendations for cemetery development in and around Hanoi City:

(i) Rational land use by relocating and integrating small cemeteries managed by local authorities and other graveyards scattered all over the city, especially those located in and around the city center which are potential development sites.

(ii) Involvement of potential project-affected communities, from planning the development of new cemeteries and/or the expansion of existing ones.

(iii) Development of cemetery gardens/parks combined with environmental buffer zones, especially for future urban development.

(iv) Enactment of laws and regulations on technical and social standards for cemetery development, including necessary environmental conditions and measures, public involvement processes in the planning stage, as well as permission procedures.

(v) Promotion of the practice of cremation for its potential to prevent environmental pollution, e.g. the spread of infectious diseases through groundwater contamination in the case of ground burials. An additional benefit is the smaller land it requires compared with traditional burial practices. However, it should be considered that the selection of burial methods is still dependent on culture and religion.

3) Proposed Options

It is proposed that the current practice of ground burials be modified in a way that high-density, large-scale cemeteries are accepted and proper locations are found within reasonable distances from Hanoi. It is the HAIDEP Study Team's opinion that the cemeteries be provided in green belts as proposed in Chapter 11 Environment.

9.9 Proposed Projects and Evaluation

1) Identified Projects

Based on study results, projects were formulated to realize the targets for each of the urban water and sanitation subsector components (see Table 9.9.1). All project costs are estimates. Thus a review is required prior to implementation.

Table 9.9.1 Proposed Water and Sanitation Projects

Component		Project Title	Unit	Project Cost 1) (US$ mil.)	Completion
Water Supply Improvement2)	WS-1	Southwestern Hanoi Surface Water Devt. and Supply Project (Ph. 1)	150,000	111.5	~ 2010
	WS-2	Southwestern Hanoi Surface Water Devt. and Supply Project (Ph. 2)	50,000	37.1	~ 2020
	WS-3	Southeastern Hanoi Surface Water Devt. and Supply Project (Ph. 1)	150,000	128.1	~ 2010
	WS-4	Southeastern Hanoi Surface Water Devt. and Supply Project (Ph. 2)	100,000	85.4	~ 2020
	WS-5	Northern Hanoi Surface Water Devt. and Supply Project (Ph. 1)	200,000	194.8	~ 2010
	WS-6	Northern Hanoi Surface Water Devt. and Supply Project (Ph. 2)	100,000	97.4	~ 2020
		Subtotal	750,000	654.4	
Drainage System Improvement3) 4)	WD-1	Drainage Project for To Lich River Basin (Stage 2)	77.5	256.7	~ 2010
	WD-2	Drainage Project for Nhue River Left Basin	53.0	479.0	~ 2015
	WD-3	Drainage Project for Nhue River Right Basin (Phase 1)	28.3	280.0	~ 2015
	WD-4	Drainage Project for Nhue River Right Basin (Phase 2)	11.7	118.3	~ 2020
	WD-5	Drainage Project for Long Bien & Gia Lam (Phase 1)	37.3	264.7	~ 2015
	WD-6	Drainage Project for Long Bien & ia Lam (Phase 2)	53.0	328.8	~ 2020
	WD-7	Drainage Project for Dong Anh	57.3	292.2	~ 2020
	WD-8	Drainage Project for Soc Son	38.9	152.3	~ 2020
	WD-9	Drainage Project for Thanh Tri	13.6	452.9	~ 2020
		Subtotal	370.6	2,206.7	
Sewerage System Development5)	WW-1	Sewerage Project for West Lake Environmental Improvement	310/42,000	26.2	~ 2010
	WW-2	Sewerage Project for Bay Mau Lake Envt'l Improvement	220/44,000	27.7	~ 2010
	WW-3	Sewerage Project for Kim Nguu River Envt'l Improvement	750/267,000	138.2	~ 2010
	WW-4	Sewerage Project for Lu River Basin Envt'l Improvement	470/142,000	102.1	~ 2015
	WW-5	Sewerage Project for Upper To Lich River Basin Envtal. Improvement	1,300/299,000	191.4	~ 2010
	WW-6	Sewerage Project for Lower Kim Nguu River basin	1,700/287,000	96.2	~ 2015
	WW-7	Sewerage Project for Lower To Lich River Basin	2,500/441,000	38.6	~ 2015
	WW-8	Sewerage Project for Nhue River Left Basin	3,980/455,000	173.5	~ 2015
	WW-9	Sewerage Project for Nhue River Righ Basin	1,700/190,000	75.8	~ 2015
	WW-10	Sewerage Project for Long Bien & Giam Districts	3,730/343,000	148.2	~ 2015
	WW-11	Sewerage Project for North Thang Long Expansion	500/60,000	24.1	~ 2020
	WW-12	Sewerage Project for Central Dong Anh	2,200/198,000	83.6	~ 2020
		Subtotal	19,360/2,748,000	1,125.6	
Lake and Pond Improvement6)	WL-1	Lake Improvement (Phase 1)	11	16.8	~ 2010
	WL-2	Lake Improvement (Phase 2)	53	62.1	~ 2020
	WL-3	Diversion System for Environmental Maintenance Flow	10 2 (rivers)	49.8	~ 2020
		Subtotal		128.7	
Flood Protection7)	WF-1	Red River Dyke Strengthening Project (Stage 2)	R	43.6	~ 2010
	WF-2	Duong River Dyke Strengthening Project (Stage 1)	R	43.6	~ 2020
	WF-3	Duong River Dyke Strengthening Project (Stage 2)	R	43.6	~ 2020
	WF-4	Redevelopment of Day River Diversion Channel	R	120.7	~ 2020
	WF-5	Development of Flood Early Warning System	TA	5.7	~ 2020
		Subtotal		257.1	
Total				4,790.7	

1) Price contingency and O&M cost are excluded.
2) Unit is m^3/day.
3) Unit refers to service area in km^2.
4) Land acquisition/ compensation costs were estimated to be US$ 656 million or 30% of the project cost. Price contingency and OM cost were excluded.
5) Unit refers to service area (ha) / population.
6) Unit refers to target number of lakes.
7) Unit refers to project types: R = rehabilitation, TA = technical assistance

2) Economic Evaluation

(1) Water Supply Projects

The economic cost of the projects was assumed to be 85% of the financial construction cost and 100% of the land cost inclusive of compensation, considering that the value-added tax in Vietnam is 10%. This assumption was also applied to other water projects. The projects plan to utilize the surface water of the Red River. If the projects are not implemented, the second-best water source shall be studied and in such a case, the Da River will be the most likely candidate because one project to use the Da River water is already ongoing. The cost of produced water using the Da River was estimated at US$ 0.42 per ton, including capital cost and O&M cost, which is 1.4 times higher than the US$ 0.30 if the Red River surface water is used. This is due to the construction of a 60-kilometer water pipe and the power cost for pumping, even though the coagulant requirement case is much less in the former case. The cost of US$ 0.42 was regarded as the economic value of purified water and the economic benefit was estimated by multiplying the value and water production volume. Here, 25% of leakage was assumed. The estimated overall IRR of the projects is 13.7% and the NPV is US$ 34.0 million, which show that they are as a whole moderately feasible. Except for WS-5 and WS-6, the other projects show individual IRRs higher than 13.7%.

Table 9.9.2 Results of Economic Evaluation of Water Supply Projects

Code	Project Title	Economic IRR (%)	NPV (US$ million)	B/C
WS-1	Southwestern Hanoi (Phase I)	16.2	18.2	1.31
WS-2	Southwestern Hanoi (Phase II)	16.4	2.1	1.29
WS-3	Southeastern Hanoi (Phase I)	14.0	9.7	1.14
WS-4	Southeastern Hanoi (Phase II)	14.3	1.6	1.10
WS-5	Northern Hanoi (Phase I)	12.1	1.0	1.01
WS-6	Northern Hanoi (Phase II)	12.4	0.5	1.00
Total		13.7	34.0	1.13

(2) Sewerage Projects

Antecedent studies on sewerage projects in Hanoi analyzed four kinds of economic benefits they generate, that is: (i) reduction in contracting such diseases as diarrhea and dysentery, (ii) tourism promotion, (iii) improvement in groundwater quality, and (iv) land value increase. Results showed that benefits from (i) to (iii) are not as significant as (iv).

In this analysis, only land value increase was taken into account for two reasons: first, the estimates for benefits (i) to (iii) involve several uncertain assumptions, and, second, since land value represents land productivity or utility, it may be double counting to consider other benefits.

Since past studies suggest that a sewerage project generally raises the land price by 3% to 5%, a 4.0% land value increase was assumed in this analysis and half of the total project area was regarded as saleable land. The results of the evaluation (see Table 9.9.3) show that the projects as a whole and individually are economically feasible. High EIRRs are observed for projects in the urban center where land prices are high and in future urban areas where land prices are expected to rise sharply.

Table 9.9.3 Economic Evaluation of Sewerage Projects

Code	Project Title	EIRR (%)	NPV (US$ mil.)	B/C
WW-1	West lake	29.1	8.9	1.36
WW-2	Bay Mau Lake	37.3	12.5	1.54
WW-3	Kim Nguu River	15.9	13.7	1.13
WW-4	Lu River	15.3	12.1	1.21
WW-5	Upper To Lich River	14.8	23.2	1.16
WW-6	Lower Kim Nguee	25.6	33.5	1.71
WW-7	Lower To Lich River	38.6	42.2	2.40
WW-8	Nhue River Left Basin	20.6	30.5	1.36
WW-9	Nhue River Right Basin	35.4	15.6	1.66
WW-10	Long Bien and Gia Lam	20.2	13.8	1.17
WW-11	North Thang Long Expansion	13.0	0.6	1.06
WW-12	Central Dong Anh	14.6	3.4	1.13
Sewerage Component		20.4	223.5	1.35

(3) Drainage Projects

Apparently, drainage improvement can also raise land values. People will not live willingly in areas with poor drainage system and therefore the planned urbanization will never be realized without an effective drainage system. The provision of a drainage system is a prerequisite for new urban areas. Therefore, it seems unreasonable to assume that the same situation of urbanization as in the “with project” case will prevail in the “without project” case. Hence, here, it was simply assumed that a drainage system will raise the land value by 3% on average.

Another benefit, that of reduction in transportation cost, was estimated in addition to land value increase. In rainy season, roads without a drainage system will frequently be submerged, causing traffic congestion and forcing detours. In the “without project” case, a 20% increase in transportation costs was assumed for the months of May to August.

The drainage projects show 21% overall EIRR which is fairly high. The benefit of reduced transportation costs accounts for 22% of total benefits. Among the projects, the EIRR of WD-1 is extraordinary high, followed by WD-9 at 22%, while others posted 12-15%. WD-1 and WD-9 are located in an existing urban area where land prices are high and roads are heavily trafficked.

Table 9.9.4 Economic Evaluation of Drainage Projects

Code	Project Title	EIRR (%)	NPV (US$ mil.)	B/C
WD-1	To Lich River Basin (Stage 2)	42.1	460.63	3.32
WD-2	Nhue River Left Basin	14.4	73.74	1.28
WD-3	Nhue River Right Basin (Phase 1)	15.6	48.13	1.39
WD-4	Nhue River Right Basin (Phase 2)	12.4	2.65	1.03
WD-5	Long Bien & Gia Lam (Phase 1)	15.3	40.56	1.27
WD-6	Long Bien & Gia Lam (Phase 2)	13.8	16.26	1.16
WD-7	Dong Anh	16.2	50.08	1.55
WD-8	Soc Son	15.7	11.75	1.32
WD-9	Thanh Tri Industrial Corridor	21.6	7.84	1.61
All Drainage Component		21.1	738.60	1.73

(4) Lake Improvement Project

- **Economic Cost:** Economic cost was assumed to be 85% of the financial cost exclusive of land and compensation costs.
- **Economic Benefit:** Using the contingent valuation method (CVM), the economic value of lake improvement in Hanoi was measured. An interview survey on the willingness to pay was conducted among 723 residents of Hanoi City, randomly selected among the HAIDEP HIS interviewees and obtaining 510 effective samples. Before entering the question on CVM, the frequency of visiting lakes, the purpose of visits, and the opinions on lake contamination were inquired. Nearly 90% of respondents believe that the lakes are contaminated and more than a third are ashamed about such a condition.

A key question in the survey is: "Will you donate some (specific) amount to the Hanoi Lake Improvement Foundation (if it exists) in order to have beautiful lakes with clean lake water?" Based on the results, a probability curve of the donation amounts was made. The median was estimated at VND 7,563 per household per month, which was regarded as the level at which Hanoi citizens are willing to pay for lake improvement.

The amount is equivalent to VND 21,300 (US$ 1.33) per person annually at 2006 prices, which was assumed to increase at the same growth rate as the per capita GRDP (12% in 2006-2010 and 8% in 2010-2020). It will become VND 33,700 (US$ 2.10) by 2010 and VND 75,780 (US$.473) by 2020.

With an economic IRR of 17.4%, the project was judged to be feasible, as the threshold in Vietnam is generally considered to be 12%.

3) Financial Evaluation

Financial evaluation was conducted on water supply projects only because the others are either non-income-generating or nonprofit-oriented even with income.

(1) Cash Flow

Key conditions aforementioned and the amounts of yearly cash flow (cost by current prices) of the water supply projects are summarized in Table 9.9.5. The yearly net and accumulated cash flows are graphed in figures 9.9.1 and 9.9.2, respectively.

Table 9.9.5 Cash Flows of the Water Supply Master Plan

(2006 to 2013)

Item	2006	2007	2008	2009	2010	2011	2012	2013
1. Water Rate (VND/m^3)	3,018	5,000	8,600	8,600	8,600	10,000	10,000	10,000
2. Household (HH) income (VND 000/mo)	2,700	2,841	2,989	3,144	3,308	3,480	3,660	3,851
3. % (water rate/HH income)	1.6	2.5	4.0	3.8	3.6	4.0	3.8	3.6
4. Incremental water produced (000 m^3/day)	0	0	0	0	0	0	500	500
5. Incremental water billed (000 m^3/day)	0	0	0	0	0	0	435	435
6. Incremental water revenue (US$ million)	0	0	0	0	0	0	98	98
7. Master plan cost (US$ million)	2	0	11	7	108	435	8	8
8. Net cash inflow (US$ million)	-2	0	-11	-7	-108	-435	90	90
9. Accumulated cash (US$ million)	-2	-2	-13	-20	-128	-563	-473	-383

Cont'd Table 9.9.5 Cash Flows of the Water Supply Master Plan

(2014 to 2020)

Item	2013	2014	2015	2016	2017	2018	2019	2000
1. Water Rate (VND/m^3)	10,000	11,600	11,600	11,600	13,500	13,500	13,500	15,700
2. Household (HH) income (VND 000/mo)	3,851	4,051	4,262	4,483	4,716	4,962	5,220	5,491
3. % (water rate/HH income)	3.6	4.0	3.8	3.6	4.0	3.8	3.6	4.0
4. Incremental water produced (000 m3/day)	500	500	500	500	500	500	500	500
5. Incremental water billed (000 m^3/day)	435	435	435	435	435	435	435	435
6. Incremental water revenue (US$ million)	98	114	114	114	132	132	132	154
7. Master plan cost (US$ million)	8	10	11	18	18	16	95	343
8. Net cash inflow (US$ million)	90	106	104	104	114	116	37	-189
9. Accumulated cash (US$ million)	-383	-278	-174	-72	42	159	196	6

Figure 9.9.1 Net Cash Flow of the Water Supply Master Plan

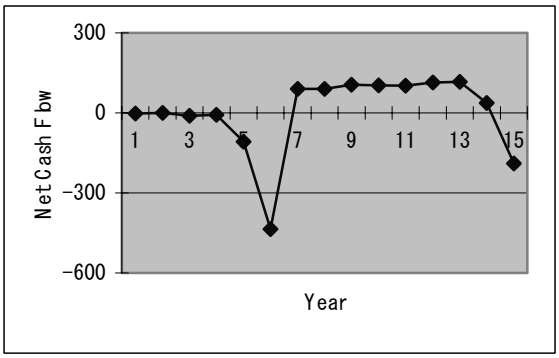
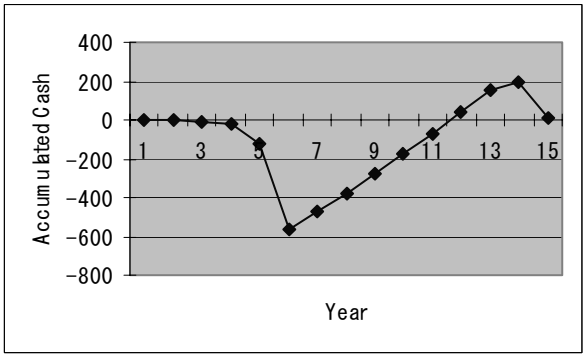


Figure 9.9.2 Accumulated Cash Flow of the Water Supply Master Plan



It is understood that the master plan will cause negative net cash flows from 2006 to 2011, and by 2020. These cash-short periods notwithstanding, the accumulated cash position will end up positive by 2020. The master plan will be financially sustainable if any funding scheme, such as loans and equity financing, will be available induring the 2006-2016 period.

(2) Net Present Value

The financial analysis of a project estimates the profit or the net benefit accruing to the project operator (HWBC or HWC).

The financial cost is a straightforward cost of the master plan, which comprises capital costs and recurrent (O&M) costs. They are expressed in 2005 constant prices, which is the same amount obtained in the base cost estimates. The timeline in the financial analysis of the master plan was set up to the year 2040, taking into account the approximate average service life of the facilities. It was therefore assumed that the capital asset components of the master plan project will be usable until 2040 and that these facilities would have no salvage value by the end of 2040.

The financial benefit (water tariff revenue) was converted to real value, at 2005 constant prices, when the financial net present value (FNPV) was computed. The discount rate for

conversion is the same as the price escalation factor used in the cost estimate of local currency portion, which is 5.2%.

Table 9.9.6 shows the results of the computation for three cases of water rates adapted in the financial analysis.

Table 9.9.6 Results of Financial Analysis

Indicator	Case 1	Case 2	Case 3
1. FIRR (%)	2.8	11.1	24.2
2. FNPV (US$ million)	-105	323.6	1,503
3. B/C	0.80	1.60	3.8

Note: The cases of water rates are explained in the table below.

Case	Adopted Water Rate
Case -1	Current water rates of weighted average by customer category (VND 3,018 /m^3)
Case -2	Two times of the current one , considering that it has a room for such rate increase (VND 6,036 /m^3)
Case -3	Increase of tariff to take place in 2007 (VND 5,000 /m^3) and triennially starting from 2008: 2008 to 2010: VND 8,600 /m^3 2011 to 2013: VND 10,000 /m^3 2014 to 2016: VND 11,600 /m^3 2017 to 2019: VND 13,500 /m^3 after 2020 : VND 15,700 /m^3

As seen above, the FIRR of Case 1 is too low than the hurdle rate of 4% set for the sake of conservativeness and also following the ADB guideline; the FNPV of Case 2 is positive, but not so attractive; that of Case 3 resulting in US$ 1,503 million is regarded as satisfactory.

(3) Sensitivity Analysis

In computing the financial indicators, some parameters may have a greater influence on the final result than others. It is useful to identify the parameters that have an important influence on the final results through a sensitivity analysis. In analyzing the master plan, the construction cost and the revenue were selected as key parameters. The FIRR was computed by varying the key parameters for cases 2 and 3. Table 9.9.7 shows the results of the computation.

Table 9.9.7 FIRR by Financial Sensitivity Analysis of the Water Supply Master Plan

Condition	FIRR (%)	
	Case 2	Case 3
1. Base Case	11.2	24.2
2. Construction cost increases by 30%	8.1	19.5
3. Revenue decreases by 30%	6.6	17.7

An increase of 30% in the construction cost reduces the base FIRR of Case 2 by 3.1 points, but this is still above the hurdle rate of 4%. Meanwhile, a 30% decrease in the revenue diminishes the base FIRR of Case 2 by 4.6 points but it is also still above 4%. Case 3 maintains favorable FIRRs even with a 30% increase in construction cost as well as a 30% decrease in revenue.

9.10 Proposed Urban Water and Sanitation Development Orientation

1) Goals and Objectives

Hanoi must enhance the provision of infrastructure, utilities, and services and ensure that they are reliable and sufficient to meet the needs of the city's residents. Hanoi must likewise develop adequate infrastructure to protect the urban areas from flood and inundations and ensure adequate sanitary conditions. In addition, Hanoi must manage water in a way that it will enhance the image of the city while mitigating its negative impacts.

2) Proposed Strategies, Actions, and Strategic Projects

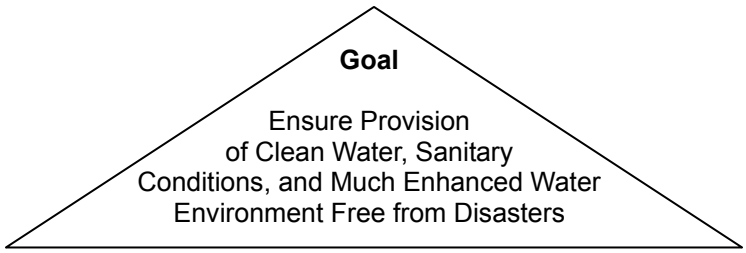
In order to promote the objectives of urban water and sanitation development, five strategies are set for which more concrete actions and strategic projects are proposed (see Figure 9.10.1). The basic strategies are as follows:

(i) Enhancement of public awareness and understanding of water, sanitation and related environmental issues
(ii) Guarantee of stable supply of safe water for all
(iii) Improvement of sanitary conditions in urban areas
(iv) Improvement of water quality of lakes, ponds, and rivers
(v) Protection of urban areas from flood and promotion of disaster preparedness

Strategic projects for priority action are the following:

(i) Development of surface water resources and related water distribution systems
(ii) Development of drainage systems with multipurpose flood protection reservoirs
(iii) Development of sewerage system for the urban core
(iv) Development of water flow diversion system for the environmental maintenance of rivers and lakes

Figure 9.10.1 Proposed Strategies, Actions, and Strategic Projects for Urban Water and Sanitation Development



Objectives	• Ensure the people's safety and healthiness • Promote sustainable use of water resources • Enhance the city's image by improving water environment and sanitation conditions

Strategy	Action	Monitoring Indicator
E1 Enhance public awareness and understanding of water, sanitation and related environmental issues	E11 Establish "Water Forum" with participation of extensive stakeholders to discuss and disseminate water, water environment and related issues E12 Conduct regular media campaign on water and sanitation	• Progress of actions
E2 Ensure stable supply of safe water for all	E21 Address water pollution issues immediately E22 Expand water supply coverage E23 Shift gradually from groundwater to surface water as raw water source E24 Improve operational efficiency of water supply	• Water quality • Water supply coverage • Water loss • % of surface water
E3 Improve sanitary conditions in urban areas	E31 Improve drainage conditions E32 Develop sewerage systems E33 Improve solid waste management E34 Establish workable mechanism for consolidation of graveyards	• Coverage • Degree of inundations • Progress of actions
E4 Improve water quality of lakes, ponds, and rivers	E41 Monitor water quality of lakes, ponds, and rivers in Hanoi E42 Develop water quality improvement measures E43 Establish common guidelines on waterfront use and management in coordination with urban land use and communities	• Water quality • Progress of actions
E5 Protect urban areas from flood and promote disaster preparedness	E51 Ensure urban areas shall be protected from flood E52 Establish effective early warning system E53 Redevelop outside-of-dyke area	• Degree of floor • No of households in outside of dyke area

Strategic Projects	PE1 Development of surface water resources and related water distribution systems PE2 Development of drainage systems with multipurpose flood protection reservoirs PE3 Development of sewerage system for the urban core PE4 Development of water flow diversion system for environmental maintenance of rivers and lakes

Source: HAIDEP Study Team.

10 HOUSING AND LIVING CONDITIONS

10.1 Introduction

Issues on living conditions, which are a relatively new concept in Vietnam, should be incorporated in the country's contemporary urban policy, although the government has done much in the past in providing housing, developing parks and green spaces, as well as in enhancing landscape. This is reflected in the results of the HIS showing that the people are generally satisfied with current levels of the living environment.

Nevertheless, there is growing concern among the people about their future living environment. This concern is not without basis, as signs of a worsening urban environment are increasingly becoming hard to ignore, such as rapid urbanization and motorization, spread of uncontrolled development, and underdevelopment of necessary infrastructures and services. Unless proper measures are taken to keep these in check, living conditions in Hanoi, and the city's image, will further deteriorate.

Housing, as the most basic factor for living conditions, is a very serious concern to the people. Housing conditions in Hanoi are generally good, compared with those in other countries partly because of the State's history of housing provision as a basic human need before the Doi Moi policy. However, as housing demand has increased both in quantity and quality along with the recent economic development, the demand-supply gap has become a serious social concern in Hanoi City. Affordable housing is not ensured under current policies especially for low-income groups. Deterioration of housing stocks due to aging of houses and inadequate maintenance and repair has also become a major cause for worry among Hanoi City residents.

10.2 Housing

1) Existing Housing Conditions

(1) Total Housing Units and Floor Area

As of 1999, Hanoi City had 28.2 million m^2 for the whole city and 17.6 million m^2 for the urban area. Most households were provided with houses. Only less than 0.1% or 384 households were homeless.

On the other hand, housing provision is still insufficient in terms of ratio of housing units to households. There were 615,839 housing units in Hanoi City as of 1999, while the total number of households was 641,864, showing a ratio of 0.96 housing units to households. The lack of housing stock was a bit more serious in urban areas where the ratio was 0.95. The lowest ratio was observed in Hoan Kiem District, followed by Cau Giay District.

Based on the total housing floor area, the housing standards of average floor area per capita and per housing unit were analyzed. In 1999 per capita floor area was $10.5m^2$ for the whole city, $11.6m^2$ for the urban area, and $9.2m^2$ for the rural area. Average floor area per housing unit was also higher in the urban area with $48.9m^2$, while it was $45.8m^2$ for the whole city.

Table 10.2.1 Housing Conditions in 1999

		Unit	Total	Urban	Rural
No. of Households (A)		(000)	642	378	264
HHs without House			0.4	0.2	0.2
No. of Housing Units (B)		(000)	616	360	256
Housing Satisfaction Rate (B)/(A)		-	0.96	0.95	0.97
Total Housing Floor Area		(mil m^2)	28.2	17.6	10.6
Floor Area	Per Housing Unit	(m^2)	45.8	48.9	41.4
	Per capita	(m^2)	10.5	11.6	9.2

Source: Population and Housing Census 1999.
Note: Urban area includes 7 urban districts and urban communes in rural districts as of 1999.

From the housing stocks in 1999, the total housing floor reached 33.7 million m^2 in 2005 or a remarkable increase of nearly 20%. On the other hand, there was little improvement in per capita floor area, which remained at 10.6 m^2 in 2005. In other words, population increase has exceeded housing supply.

Table 10.2.2 Recent Changes in Housing Stocks in Hanoi

Year	Total Housing Area	Total No. of Housing Units (000)	Average Housing Area (m^2/unit)	Floor Area /Person (m^2)
1999	28,203	616	45.8	10.5
2001	29,644	654	45.4	10.4
2003	31,864	691	46.1	10.6
2005	34,642	729	47.5	10.9

Source: DONRE (2005) Hanoi Statistic Yearbook (2004), Housing Census (1999)

(2) Housing Classification

Hanoi has various types of houses in terms of structure, space, and layout, due in part to the recent rapid socio-economic growth. While there is no clear definition for each housing type, a typology was made in order to describe the housing conditions in more specific terms and to reflect this in the future housing development orientations (see Table 10.2.3).

The housing classification was formulated following not merely the structure but also the area characteristics in Hanoi. Housing structures were classified into detached houses and apartments. Of detached houses, Hanoi has some special areas with unique characteristics like the Ancient Quarter and the French Quarter. Other detached houses are classified into those in the urban areas and those in the rural areas. Apartment buildings, which are easily distinguished from others, are KTT (old collective apartments) and apartments in newly developed areas such as those in Linh Dam and Dinh Cong. The characteristics of each type of housing are summarized below:

(a) Traditional Tube Houses in the Ancient Quarter

Typical houses in the Ancient Quarter are so-called “tube houses,” traditional abodes with narrow frontages and deep depths. While originally designed to be inhabited by a single household, many tube houses are divided into smaller sections for lease to other households. With an increase in the Ancient Quarter’s population density in the past decades, the structures and facilities of such traditional houses have degraded. The housing standard in this area is quite low, or the lowest in Hanoi, in spite of it having the highest income level. Many households share toilets and water supply facilities with

neighbors. HIS results showed the high dissatisfaction of residents with their small housing spaces and old facilities. Lower satisfaction is also observed due to the lack of open spaces and greenery.

(b) Villa-style Detached Houses in the French Quarter

The French Quarter is characterized with villa-style detached houses. Most of the actual French villas there were constructed during the French colonial period, occupy large plots, and have gardens. Because of their good location these French villas are usually used as public facilities, such as government offices and embassies, or commercial facilities, such as restaurants and retail shops with smart designs. Except for those renovated for commercial or public use, most of the housing facilities are degraded.

(c) Other Detached Houses in Urban Areas

Besides the above two identical houses, major parts of the city center are occupied by detached houses which can be classified into two: one facing major streets and the other within narrow alleys. Detached houses facing major streets are so-called shop houses. Ground floors are used as commercial spaces and the remaining floors are for living areas. Most of the newly constructed detached houses are 4-5 stories high, while old ones have 2 stories.

Other detached houses are those along small alleys. Most of these detached houses were developed unplanned along narrow alleys, forming a disorderly townscape. Particularly in the urban center, extremely dense residential areas (more than 1,000 persons/ha) with more than hundred meter depths along quite narrow roads, which only motorcycles and bicycles can access, have developed. There are insufficient access roads, few parks, and open spaces. While urban services are currently well provided, including water supply, drainage, electricity, and solid waste collection, such high densification may result in the further deterioration of living conditions. According to the HAIDEP HIS, the dissatisfaction levels with living conditions among the people living in villages near the urban center were much higher than their counterparts who lived in rural villages.

In existing villages in the urban fringe and suburban areas, it has been observed that residential plots have been subdivided and new houses have been constructed within individual residential premises. This has increased the building densities, mirroring those in existing urban areas in the urban core. The field survey has identified that the building coverage ratio per housing block in a rural village is 20-40%, while those in villages near the urban center is 75-90%. The floor area ratio per housing block in rural areas is 30-50%, while that in villages near the urban center is 210-250%.

(d) Detached Houses in Rural Areas

In suburban and rural areas, people live in specially designated residential areas, so-called villages. These villages for farmers were established more than a century ago. Typical residential units in these villages are traditional detached one-story houses. Those with large land, there are private wells from which water is drawn for washing and cooking. As described above, it is commonly observed that large land plots in rural villages are subdivided and new houses are constructed as a result of urbanization.

(e) Old Collective Apartments

Old apartment areas (KTT) occupy large areas in the urban center of Hanoi City. According to DONRE, there are 27 old apartment areas in Hanoi City with a total floor area of 1.2 million m^2 and total population of more than 180,000. The typical structure of KTTs is an apartment of 4-5 stories without elevators. Some of them are equipped with toilets and bathrooms, while some are not. Due to the lack of maintenance and age, some are at the risk of collapse, requiring immediate improvements. Moreover, many residents have illegally expanded their units, further degrading building conditions and encroaching on surrounding parks and open spaces.

(f) High-rise Apartments in New Development Areas

Many large-, medium- and small-scale high-rise apartment buildings are being constructed in new urban development areas in the city's urban fringe and suburban areas. Housing units in high-rise apartments have spacious areas with high-standard services, including elevators, security, and basic urban services. In Linh Dam urban area, one of the initial urban development areas, typical apartments are 15 stories high with floor areas ranging from $80m^2$ to $120m^2$ per housing unit. The Vietnamese, however, are not used to residing in apartment buildings.

Table 10.2.3 Classification of Housing in Hanoi City

Structure	Housing Classification	Remarks
Detached House	1. Traditional houses in Ancient Quarter	Traditional tube houses with narrow frontage and deep depth.
	2. Villa in French Quarter	Houses with gardens. Other detached houses in the FQ are included in category 3.
	3. Other detached houses in urban areas	Including villas, rowhouses[1)], and other detached houses.
	4. Rural house	Vietnamese traditional houses.
Apartment	5. KTT	Constructed in the 1970s and 1980s by the government. There are 23 KTT.
	6. Apartment in newly developed areas	Constructed in new urban areas.
	7. Other apartments	

1) Rowhouses are units attached to one another through a shared wall.

(3) Housing Standards

Housing standards vary by area. Space of housing is the most important aspect and the most serious problem for people in Hanoi. The lowest per capita floor area was found in Hoan Kiem and Soc Son districts at $8.8m^2$. Hoan Kiem District also had the lowest per housing unit floor area.

Housing standards also vary by socio-economic conditions of households, such as household size, household composition, and age of members, which were analyzed based on HIS. It showed that per capita floor area depends much on household size rather than on income level or employment of household members. Assessed by household income, there is no clear trend between household income and per capita living floor area. The clear difference is found in the assessment by size of household. In other words, the larger household has the smaller per capita floor area.

Accessibility to urban services and ownership of household and electrical goods were also analyzed. In 2005, most houses in urban districts are provided with basic urban services, such as electricity, water supply, toilet, and telephone. More than 99% of households in the urban areas have electricity, while 86% and 93% have water supply and toilet facilities, respectively. Except for electricity, there are still large gaps in service availability between rural and urban areas. Only 18% of households in the rural areas have access to water supply and 58% for toilet facilities.

The ownership of electrical goods differs by types of goods. Most households in Hanoi own TV sets. Refrigerators are also popular at 87% in the urban areas and 44% in the rural areas. On the other hand, air-conditioning units are still not commonplace in Hanoi City, where the ownership is only 27% and 3% in the urban and rural areas, respectively.

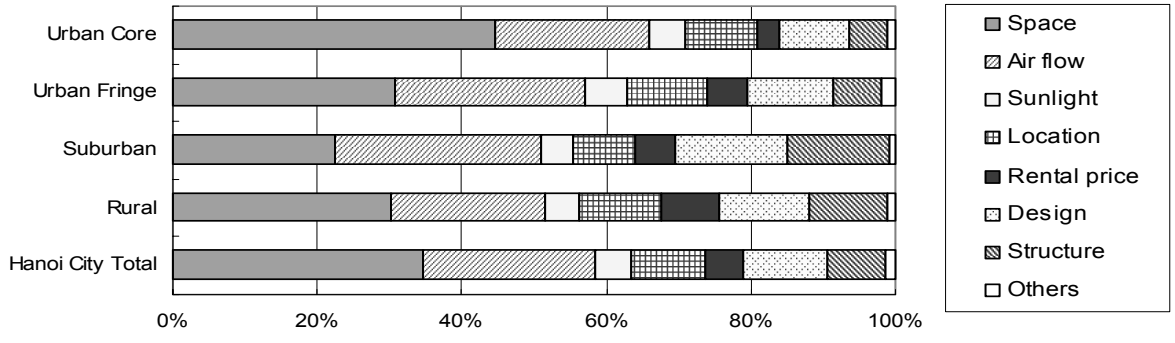
(4) People's Satisfaction with Housing Conditions

HIS results showed that the people's assessment of housing conditions was, on average, on the positive side. In general only 27% of respondents indicated dissatisfaction with their housing conditions. However, when assessed by area, housing type, and socio-economic conditions, the residents' dissatisfaction with their housing conditions became clearer.

The degree of dissatisfaction of those in the Ancient Quarter, the French Quarter, and in collective apartment areas reached 43%, 39%, and 54%, respectively. In contrast, those who live in newly developed apartments have very high satisfaction. Assessed by household income level, the poorest households are more dissatisfied, while there is no clear difference among other quintiles (or income groups). There is, however, a clear distinction on the dissatisfaction levels by floor area: 57% and 32% of households living in a total floor area of less than 25m^2 and 26-50m^2, respectively, are not satisfied with their housing conditions. On the other hand, those with wide living spaces are generally satisfied.

The reasons for the people's dissatisfaction with and their concern over housing were identified in HIS. As seen above, the people's concern over housing space is most serious. This is more evident for those in the urban core districts, particularly those living in the Ancient Quarter, where the per capita floor area is quite small. According to HIS, an average floor area per person is only 12m^2 in Hoan Kiem, while that for Hanoi City is 21m^2. People in suburban and rural areas have more complaints on the design and structure of housing as well as housing space (see Figure 10.2.1). Other variables, such as blocked airflow and sunlight, are also the concern of the people.[1]

Figure 10.2.1 People's Concern over Housing



Source: HAIDEP HIS, 2005.

[1] People who are dissatisfied with the current housing conditions were also asked about other housing issues.

2) Housing Supply Mechanism

(1) Historical Changes in Housing Policy

Housing development policy in Vietnam before and after Doi Moi policy in 1986 can clearly be distinguished. Before the Doi Moi policy was introduced, houses were provided by the State as one of the social services or as in-kind salary for state employees. Any housing businesses were not allowed prior to 1975 and thus investments in housing were monopolized by the State. Such subsidized housing policy discouraged people from caring and maintaining their houses, resulting in degradation of housing stock. Due to financial constraints, the government also spent little on maintenance.

Economic reform with the implementation of the Doi Moi policy has had a drastic impact on housing policy. The housing subsidy was stopped and replaced with a “market-based housing development” or “self-reliant housing policy.” The most significant change was found in the legislation of land-use rights and housing ownership with the Land Law in 1993 and several housing-related ordinances in the early 1990s. The housing ordinance in 1991 clearly prescribed the right to construct, own, and trade houses. The government has also introduced a new housing policy that allows the conversion of state-owned houses to commercial use.

Recently the government started to promote project-type housing investments and high-rise apartment developments, providing favorable conditions for developers. Particularly in 2001 with Decree 71/2001/ND-CP and 123/2001/QD-UB, the government stipulated housing investment incentives. For projects with more than 60% of total floor area allocated for high-rise apartments, preferential treatment is offered such as 100% levy exemption on land for high-rise buildings and 50% on other areas.

The Housing Law enacted in 2005 is a comprehensive policy on housing development, which covers basic housing-related institutions and business activities. It also describes development policy for social housing for low-income households, students, and workers in industrial parks.

(2) Major Players

The Ministry of Construction has jurisdiction over housing development and management for the whole country. It is in charge of formulating housing laws, establishing a housing development program, and issuing decrees on housing development and management.

The city-level core authority on housing development administration is the Department of Natural Resources and Environment (DONRE) under the Hanoi People’s Committee (HPC). DONRE is in charge of the overall housing development and management in the city, including the formulation of the city’s housing development program, redevelopment of former public apartment areas, resettlement housing, and formulation of necessary housing regulations. DONRE’s other functions include land management, such as the formulation of land-use plans and the issuance of land-use rights certificates (LURCs), resettlement, and general environmental preservation.

Other departments involved in housing development include the Hanoi Authority for Urban Planning and Architecture (HAUPA), which is in charge of urban planning and approval of new urban area development, and the Department of Constriction (DOC) which is in charge of construction management.

Large-scale housing development project in new urban area is mostly conducted by state-owned enterprises (SOEs) under ministries or city governments and joint-venture companies between foreign companies and SOEs. These SOEs are mostly big companies with larger capital and labor than private ones and are somehow supported by their respective mother government agencies.

(3) Assessment of Housing Development Activities

In response to population increase, large amounts of houses are being developed these days. In the late 1990s, annually built housing floor areas were around 300,000 or 400,000m^2. In 2003 it has exceeded 1 million m^2.

In housing construction, there are two types of development model, namely a project-type housing development model and an individual housing development model. Particularly, project-type housing development by developers, who are mostly SOEs and joint ventures, contributed to this recent remarkable increase in housing stocks. As shown in Table 10.2.5, the proportion of project-type housing investment has increased recently. According to DONRE[2)], it shows that government regulation, orientation, and management of housing development have improved.

On the other hand, the share of housing development by individuals has gradually decreased in the last five years, while the amount of individual developments constantly accounted for a considerable amount of over 400,000m^2 per year. In this context, the government is required to establish an appropriate mechanism to manage this type of housing construction in terms of technical and urban design, as well as urban planning.

Table 10.2.4 New Housing Floor Areas by Capital Source, 1999 - 2004

Unit: 000m^2

	1999		2000		2001		2002		2003		2004	
	000	%	000	%	000	%	000	%	000	%	000	%
Central Construction	**36**	**9**	**82**	**14**	**155**	**18**	**335**	**36**	**541**	**42**	**324**	**23**
Local Construction	**380**	**91**	**515**	**86**	**688**	**82**	**601**	**64**	**743**	**58**	**1,094**	**77**
Central Budget	-	-	-	-	-	-	-	-	-	-	-	-
Local Budget	3	1	-	-	85	10	111	12	162	13	167	12
Other Capital	15	4	-	-	-	-	-	-	-	-	-	-
Joint Venture Capital	76	18	105	18	178	21	175	19	221	17	457	32
Self-building by People	286	69	410	69	426	50	415	44	360	28	470	33
Total	**417**	**-**	**598**	**-**	**843**	**-**	**937**	**-**	**1,284**	**-**	**1,418**	**-**

Source: Hanoi Statistical Yearbook (2004, 2003, 2002).
1) Housing construction by companies or institutions related to the central agencies.
2) Housing construction not related to central agencies.

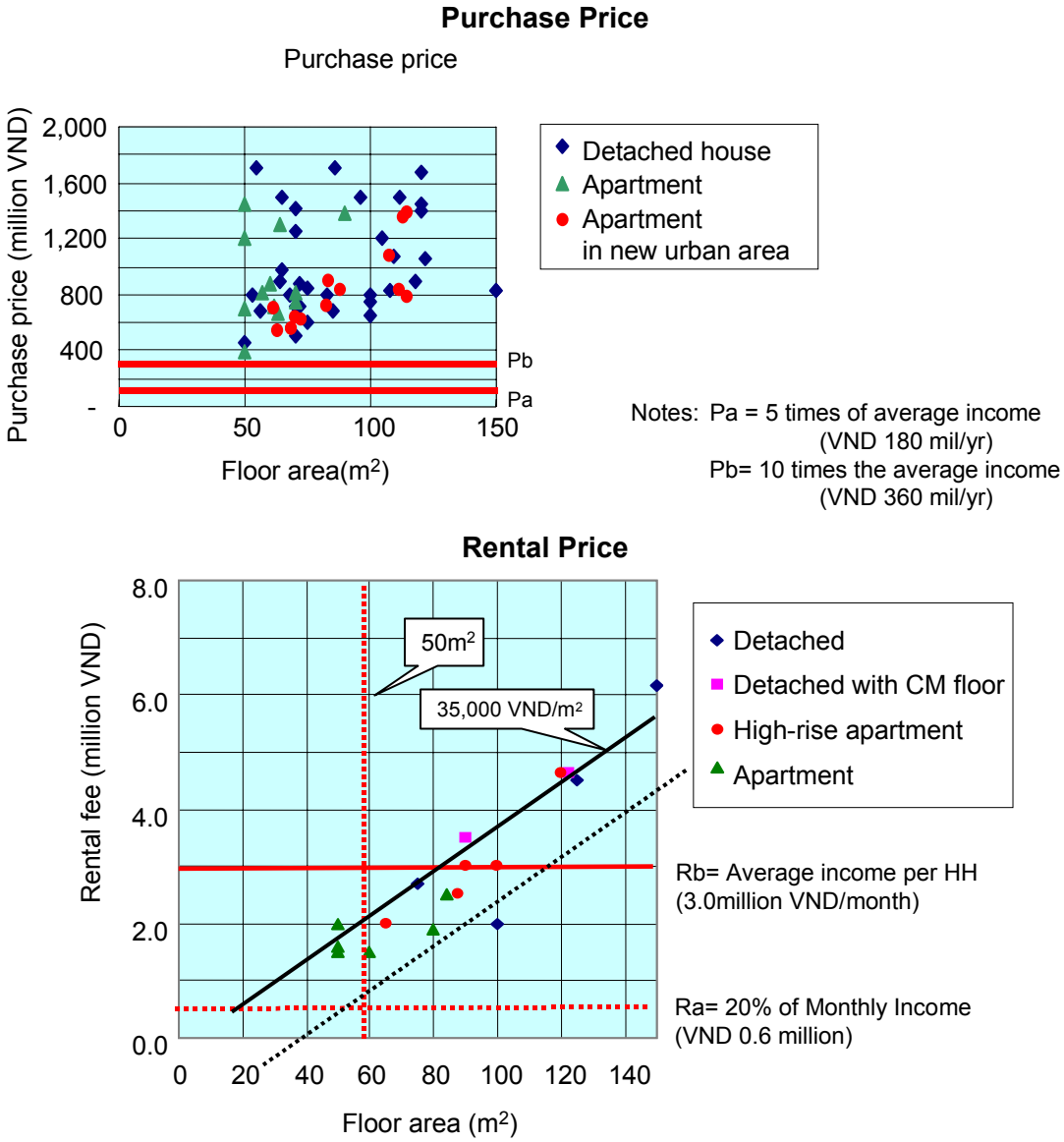
(4) Housing Affordability

The affordability of adequate housing is an emerging issue. Survey results conducted in HAIDEP indicate that housing stocks supplied in the market are mostly beyond the reach of average households. All types of housing for purchase cost more than 5 to 10 times of the annual incomes of average households, while those for rental housing exceed more than 20% of their monthly incomes (see Figure 10.2.2). Even for higher-income households, such housing units are still costly. While most households

[2] Housing Development Programme for All Types of Citizens Within Hanoi Capital Until 2005 and Following Years (DONRE, 2004).

own houses in Hanoi, such a demand-supply gap is a more serious concern for households who migrate from other provinces, the number of whom is expected to increase in future.

Figure 10.2.2 Housing Affordability Levels of Average Households



3) Future Housing Demand

(1) Required New Development Housing

(a) New Development Housing Floor Area

New housing demand will derive from population and household increases in urbanization promotion areas and urbanization control areas due to migration from rural to urban areas rather than population increases in the whole city.

The requirement for new floor area was thus examined based on the target for average per capita floor area. The average per capita housing floor area in urban area is expected to increase to 18-20m^2 by 2020 from 8.5m^2 in 1997, according to the 1998 Master Plan. With this 2020 target and the 1999 census, target per capita floor area by

2010 was estimated at 15-16m^2. Per capita floor area for rural area was assumed at 12.5m^2 in 2010 and 16m^2 in 2020, based on the 1999 census and the target for urban areas.

In order to accommodate an urban population of 3.05 million in 2010 and 3.95 million in 2020, the total required housing floor area in Urbanization promotion areas will be 45.7 million m^2 in 2010 and 75.1 million m^2 in 2020. Since the total housing floor area is 28.2 million m^2 in urbanization promotion areas in 2005[3], the additional floor area to be newly constructed in 2005-2010 and 2010-2020 will be 17.5 million m^2 and 29.3 million m^2, respectively.

Outside of urbanization promotion areas, housing demand will derive from the increased requirement for housing floor area, even as the population will slightly decrease. Required additional housing floor area will be 1.8 million m^2 by 2010 and 1.2 million m^2 by 2020.

Accordingly, the 1.43 times increase in population in Hanoi City from 2005 will mean the total required housing floor area will be 80-88 million m^2 in 2020. The required additional housing demand is expected to be 19.5 million m^2 by 2005-2010 and 25-33 million m^2 in 2010-2020. This huge demand will require the development of 3.9 million m^2 annually in 2005-2010 and 2.7-3.5 million m^2 in 2010-2020.

Considering that the total floor area developed in 2003 and 2004 was only 1.12 million m^2 and 1.42 million m^2, the above targets for Hanoi City are very ambitious. It shows that housing will be a perennially serious issue in the coming 20 years.

(b) New Development Housing Units

New housing development demand was also examined in terms of housing unit. In the housing development program for Hanoi City prepared in 1998 and in other housing development plans, housing demand was forecasted only in terms of total floor area, i.e. housing unit demand was not dealt with. Housing standards should be assessed in terms of housing unit per household as well as per capita floor area. Since floor area per house has changed along with the rapid change of lifestyles in Hanoi, the total floor area does not always reflect actual housing supply situations.

The number of households will increase along with the trend toward nuclear families and migration from rural areas. The number of households will increase to 1.27 million by 2020 from 0.8 million in 2005 for the whole city, where average household members will decrease to 3.54 from 3.94 in the same period. In addition, as of 1999, 26,000 households did not own or rent their own houses. Accordingly the required additional housing units to accommodate the increases in households and those households without houses will be 190,000 units in 2005-2010 and 310,000 units in 2010-2020. Since the number of households will decrease outside of rural areas, all demand for new housing units is assumed to derive only in urbanization promotion areas.

Based on the results of the aforesaid housing demand projections, including total floor areas and total units, the overall picture of housing demand until 2020 is summarized.

[3] Total housing floor area in 2005 is 33.7 million (Census 1999, Statistical Book). That within urbanization promotion areas was calculated by assuming that the per capita housing floor area outside of such areas has been the same as that for rural area in Census 1999, 11.0m^2.

The total housing floor areas and housing units in 2020 are projected to be 1.92 times (65 million m^2) and 1.52 times (1.11 million units) as much as those in 2005, respectively.

Table 10.2.5 Required Floor Area and Housing Units by 2010 and 2020

		2005	2010	2020
Population (000)	Total	3,150	3,650	4,500
	UDA	2,530	3,050	3,950
Total Number Household (000)	Total	800	960	1,270
	UDA	650	810	1,120
Total Housing Floor Area (million m^2)	Total	33.7	53.2	80- 88
	UDA	28.0	45.7	71 - 79
Required Additional Floor Area (Annual Requirement)	Total	n.a.	19.5 (3.9)	27- 35 (2.7-3.5)
	UDA	n.a.	17.8 (3.5)	25- 33 (2.5-3.3)
Total Housing Units (000)	Total	770	960	1,270
	UDA	620	810	1,120
Required Additional Housing Unit (Annual Requirement)	Total 1)		190 (38)	310 (31)

Source: HAIDEP Study Team.

1) Demand for new housing units outside of urbanization promotion areas (UDAs) is not included, since the number of households in rural areas will continuously decrease.

(2) Demand for Redevelopment of Existing Housing

Demand for redevelopment or replacement of existing housing units was estimated based on building age and the floor area of existing housing stocks, which are the major causes for the replacement of housing. Existing housing stocks were categorized into four types according to age and floor area, with the assumption that the critical age for a house to be replaced is 30 years and the area is $30m^2$ (see Table 10.2.6). By area, the urban core has the largest share of Type I houses which have the highest potential for rebuilding, or 4.8% of the total housing stocks in the area, while the whole city accounted for only 2.1%. Suburban and rural areas have a very low share of Type I housing.

Table 10.2.6 Rebuilding Demand by Housing Floor Area and Age

		Floor Area	
		Small ← ($30m^2$) → Spacious	
Age of House	New ↑ (30 years)	Type III: Some potential to rebuild due to lack of floor area	Type IV: Lowest potential for rebuilding
	↓ Old	Type I: Highest potential for rebuilding	Type II: High potential to rebuild due to old structure/facility

Source: HAIDEP HIS (2005).

Based on the share of each housing type and the total number of housing units by area in 2005, the demand for replacement of housing was estimated. Results show that in the whole city there are 16,000 units of Type I housing, of which 81% are in the urban core. Type II housing, which also need to be rebuilt, account for 99,800 units and is equally distributed in the whole city. There are 40,000 units of Type III housing, which do not require urgent replacement but still has to be rebuilt due to a lack of floor area. More than half of this type is located in the urban core. Accordingly, the total demand for replacement is 155,800 housing units for the whole city (see Table 10.2.7).

Table 10.2.7 Demand for Rebuilding by Housing Type

Area	Housing Unit (2005)	Rebuilding Demand (unit)					
		Type I		Type II		Type III	
Urban Core	270,399	12,900	(81%)	39,900	(40%)	22,000	(55%)
Urban Fringe	224,252	3,000	(19%)	23,100	(23%)	11,100	(28%)
Suburban	99,507	700	(4%)	14,000	(14%)	3,600	(9%)
Rural	173,386	800	(5%)	23,600	(24%)	4,800	(12%)
Total	767,544	16,000		99,800		40,000	

Source: HAIDEP HIS (2005).

(3) Housing Demand among Low-Income Groups

Currently, majority of the people in Hanoi cannot afford to rent or buy a house at market prices. As practiced in other countries, such as Japan and Singapore, it is a crucial role for the government to establish a supporting mechanism and ensure the provision of housing at affordable prices for any classes of residents. In order to formulate a housing policy for the short, medium, and long terms, the demand for affordable housing was forecasted, which is expected to change along with socio-economic conditions improvement. The demand forecast for affordable housing was conducted in the following stages:

(a) **Minimum housing market prices for rent and purchase:** It was assumed that housing prices will increase at a growth rate lower than the economic growth, considering the current rapid increase in housing market prices and the expected improvement in land and urban management capabilities of all levels of government.

(b) **Monthly income level required for the minimum housing market prices:** The housing market price-income ratio is affordable at 20% of monthly income of households, based on the experiences of other cities. Based on this ratio, the monthly income needed by households for them to afford the minimum housing market price was examined.

(c) **Number of households below each affordable level:** This was estimated based on the future income structure, which was forecasted assuming that income levels will increase along with economic growth.[4]

As seen in Table 10.2.8, people's affordability will remain quite low under the current level of housing market. In 2005, 77% of households could not afford to rent houses with a floor area of $30m^2$ at market prices. This share is expected to decrease to 38% by 2020. Meanwhile, only 32% of households could afford renting rooms with a $50m^2$ floor area, but this will decrease from 95% in 2005 to 68% by 2020. As for house purchases, almost 70% of households as of 2005 could not afford houses with a floor area of $30m^2$, but this will become 69% by 2020.

With the minimum standard for social housing is $30m^2$/unit[5], there will be 520 thousand households in need of government support in order to afford the minimum standard housing. Among them, 290 thousand households need support even for renting houses with the minimum standard.

[4] It is assumed that income distribution is same as that in 2005.
[5] It is stipulated in Housing Law in 2005.

Table 10.2.8 Forecast of Minimum Rental Housing Prices and Affordability Ratios

	Floor Area (m^2)		30	40	50	70
2005	Rental cost [1]	VND 000 /month	720	960	1,200	1,680
	Necessary minimum monthly income		**3,600**	**4,800**	**6,000**	**8,400**
	Households below affordable level	000 (%) [2]	580 (77)	670 (89)	710 (95)	740 (98)
2010	Rental cost [1]	VND 000 /month	864	1,152	1,440	2,016
	Necessary minimum monthly income		**4,320**	**5,760**	**7,200**	**10,080**
	Household below affordable level	000 (%) [2]	520 (54)	690 (72)	800 (84)	910 (95)
2020	Rental cost [1]	VND 000 /month	1,440	1,920	2,400	3,360
	Necessary minimum monthly income		**7,200**	**9,600**	**12,000**	**16,800**
	Household below affordable level	000 (%) [2]	410 (32)	590 (47)	770 (60)	1,010 (80)

Source: HAIDEP Study Team.

1) Monthly rental fee per sqm was estimated based on VND 24,000 in 2005, VND 28,800 in 2010, and VND 48,000 in 2020.

2) Percentage to total households for each year, 750 thousand in 2005, 960 thousand in 2010, and 1,270 thousand in 2020.

Table 10.2.9 Forecast of Minimum Housing Purchase Prices and Affordability Ratios

	Floor Area (m^2)		30	40	50	70
2005	Housing Price	VND mil	210	280	350	490
	Loan Repayment per month [1]	VND 000 /month	1,225	1,633	2,042	2,858
	Necessary minimum monthly income		**6,130**	**8,170**	**10,200**	**14,300**
	Household below affordable level	000 (%) [2]	720 (95)	740 (98)	740 (99)	750 (99)
2010	Housing Price	VND mil	250	340	420	590
	Loan Repayment per month [1]	VND 000 /month	1,470	1,960	2,450	3,430
	Necessary minimum monthly income		**7,350**	**9,800**	**12,250**	**17,150**
	Household below affordable level	000 (%) [2]	810 (85)	890 (93)	920 (96)	940 (99)
2020	Housing Price	VND mil	420	560	700	980
	Loan Repayment per month [1]	VND 000 /month	2,450	3,267	4,083	4,900
	Necessary minimum monthly income		**12,250**	**16,300**	**20,400**	**24,500**
	Household below affordable level	000 (%) [2]	790 (62)	990 (78)	1,130 (89)	1,170 (92)

Source: HAIDEP Study Team.

1) Monthly loan payment is estimated on the assumption of loan for 70% of the housing cost at 0% interest rate and 10-year payment.

2) Percentage to total household in each year, 750 thousand in 2005, 960 thousand in 2010, and 1,270 thousand in 2020.

4) Main Issues

Considering the above-described current problems in housing development, current and emerging housing development issues were consolidated in order to meet future housing demands.

(1) Need for Establishing Sustainable Policy and Mechanism to Meet Large Housing Demand

The most important and urgent issue to be tackled is to develop housing stocks in response to increasing housing demand which accompanies rapid population increases. As forecasted in the previous chapter, the annual required housing stocks will far exceed the housing developed in the last few years. Government is required to support and promote housing development through various ways and channels, including large housing as well as individual housing developments, in order to respond to massive demands. Main issues to be tackled are: (i) Lack of housing providers, especially qality private sector developers, (ii) lack of supply of lands for individual housing, and (iii) lack of financing.

(2) Need for Establishing Sustainable Mechanism for Provision of Affordable Housing for Low-Income Households

As described in the previous chapters, there are many households who cannot afford housing at market prices. About 90% of households are below the affordable level of the housing at market prices, even for rental housing (80% of households). There is no sufficient housing development system to deal with the forecasted large demand for affordable housing.

Even in countries that have adopted a market-oriented economy, including Japan, the government has supported housing development. Particularly in the early development period, when a large demand for affordable housing arose, the government played a crucial role in dealing with such social needs. The government in Vietnam and Hanoi has to establish a new housing support system to meet the pressing demands.

Main issues to be tackled are: (i) demand-supply gap in affordable housing, (ii) lack of policy and institutional support for the provision of rental housing, and (iii) poor state of rental housing for workers and students.

(3) Need for Effective Management of Housing Stocks

The management of housing stocks, which include construction management, operation and maintenance of emerging high-rise buildings, and repair of old housing stocks both, particularly for KTT apartment, is an urgent issue to be tackled for the effective use of housing stocks.

Particularly for high-rise apartments, which have rapidly increased both in urban and suburban areas, the deterioration of housing quality has become a serious social concern. There is a regulation on the operation and management of high-rise buildings including the collection of management fees, as well as requirement for short-term and long-term repair.

In 2003, the Ministry of Construction promulgated the regulation on the management of condominiums. It specifies the area for management of common ownership and private ownership, and management organization and its responsibility, and funding for management. However, there is no systematic or consistent management system applied

in Hanoi City. Each management board has a different management system. While most of them collect more or less a management fee from residents, there is no specific contract describing what shall be included in the management services. More strict enforcement of the management system on condominiums is required.

(4) Need for Integrated Housing Policy with Land Policy

As indicated above, there is a large gap between current market housing prices and people's income levels. The factor that influences the current high housing prices the most is the level of land use fee. Land use fees in the city center are almost the same as those in developed countries. Consequently, the high land use fees have become the foremost bottleneck in the provision of affordable housing.

Although city authorities currently manage land matters, they cannot appropriately control the prices of land use fees. The speculative activities of land transaction dominate the current real estate market, which causes the soaring land use fees in some areas in the city. Although the government tries to control the level of land use fees by amending tax systems, they seem hard pressed to reduce the existing high levels of land use fees to suitable levels due to the limited supply of lands.

On the other hand, following the increase in housing demand, city authorities are promoting housing development, which includes controlled price lands and houses. However, since the provision of such low-priced houses and residential lands are limited, the current housing policy will not be able to deal with the aforesaid large demands on affordable housing. Therefore, the government has to take some measures to control land use fees as an important housing policy.

5) Proposed Housing Development Policies

Housing development orientations are proposed in order to respond to the issues identified in the previous chapters. The top priority is to provide housing to meet increasing housing demands and to ensure housing for households who cannot access housing through the real estate market, which have been also tackled in Japan during the postwar recovery period and the following rapid economic growth period. Therefore lessons learned are taken from Japanese housing development experiences, which will be incorporated to the proposed housing policy in Hanoi City.

(1) Establishment of Target by Household Status and by Development Stage

As a benchmark on housing development policy, housing standards should be formulated both for minimum requirement and target level. Target housing standard will be guidelines for housing developers to follow and provide monitoring mechanism on housing development, which help to achieve housing target effectively. The following have to be considered in the housing standard.

(i) To secure minimum living space by household status to ensure citizens to have ideal spaces and healthy lives

(ii) To apply an attainable target standard due consideration of the existing housing stocks and future socio-economic framework.

(iii) To set incremental standards according to development stages

- **Housing Target by Development Stage:** Housing standard should be reviewed and adjusted by each development stage, where the changing social needs and the

financial and administrative capacities of the government should be considered as seen in other countries' experiences. The short- and mid-term housing standards are supposed to promote the development of housing with minimum size by both the public and private sectors to deal with housing shortages in the near future. On the other hand, housing standard can be improved after both people's purchasing capacity and government financial capacity is well developed.

- **Housing Standard by Household Structure:** Household structure in Hanoi City has become diversified in recent years, which include the increase in single households (or shared houses with friends), such as among workers in industrial parks and university students, and the trend toward nuclear families. In order to meet various demands for houses in terms of size and type, it is essential to establish various housing standards by household structure.

(2) Phased Housing Policies for Hanoi City

In order to achieve the above-set housing standard, the government has to review and adjust the housing development policies along with economic development and changes in socio-economic conditions including people's lifestyles and household structure. In reference to the experiences of Japan and other countries on how to adjust housing policies and respond to the changing socio-economic conditions, a phased housing development program for Hanoi City is proposed, which is summarized in Table 10.2.10.

Table 10.2.10 Summary of Proposed Phased Housing Policies

	Short-term Policy (~2010)	Medium-term Policy (2010-2020)	Long-term Policy (2020 ~)
Forecasted Socio-economic Condition	• Most of the people cannot buy or rent housing at market prices. • Public sector's financial and administrative capacities are limited.	• Increase in demand for affordable housing due to massive population influx and an increase in generations who were not granted properties.	• The poor and low- income population will decrease and individual spending power will increase. • Public sector's capacities will also be improved.
Necessary Housing Policies	• Provide low-cost rental apartments & low- / medium-cost housing, targeting the poor / low-income classes, utilizing limited available resources (lands). • Start enacting "Five Year Housing Construction Program"	• Provide large amounts of affordable housing by establishing public housing development institutions. • Promote housing development by establishing housing financial institution for individual financing. • Examine measures to reduce housing costs.	• To provide planning and design guidelines and establish financial support to develop high-quality housing stocks with good living environments • Continue to implement policies for the poor/ low-income classes.
Other Countries' Housing Policies	• Japan ('50s): Coped with housing shortage of 3.4 million (Period for creating the foundation of housing development). • Singapore ('60s): Developed emergency flats less than 30m^2.	• Japan ('60s-'70s): Mass-supplied public housing (Enacting housing construction programs). Developed housing-related technology. • Singapore ('70s-'80s): Mass-supplied standard flats (50-90m^2).	• Japan ('70s/'80s-): Shifted policy from quantity-oriented to quality-oriented, and set target standards for living environments. • Singapore ('80s-): Provided varied housing types (60 to more than 100m^2).

Source: HAIDEP Study Team.

(3) Housing Development Mechanism

In order to narrow the current demand-supply gap and provide affordable housing, it is necessary to provide various kinds of development mechanism with necessary

government support for housing suppliers. Housing development mechanism are divided into three: (i) redevelopment of existing urban areas, (ii) development of land for housing, and (iii) new urban development. Recommendations related to urban planning management and land management area incorporated in the chapter 11 of main text on the urban institutional development in detail.

(a) Redevelopment of Existing Urban Areas

Houses in existing urban areas, such as Hoan Kiem and Hai Ba Trung districts, have high requirements for housing replacement due to ageing and small housing, as well as the areas' highly dense urban structure. Their premier location in the city center has further increased the demand for housing redevelopment.

Current redevelopment activities are observed in existing urban areas, most of which are high-rise office building or commercial facilities. They are mostly developed on ad hoc basis rather than area-wide. There is no effective or not workable guidelines for redevelopment of existing urban area, some of them have caused unexpected burden on the surrounding infrastructure and resulted in the negative impact on surrounding urban environment.

An effective redevelopment methodology integrated with infrastructure development to develop public infrastructure should be formulated in order to sustain CBD competitiveness as well as improve living conditions. It includes, among others: (i) provision of Incentives for area-wide development, (ii) formulation of guidelines and regulations for development, (iii) provision of incentives for residential area development, and (iv) necessary assistance for coordination.

Special attention is required for the redevelopment of old apartment areas. The following three points should be considered in redeveloping such areas: (i) on-site resettlement and equivalent exchange method of original property value to newly developed floor; (ii) area-wide development to ensure infrastructure improvement together with housing stocks; and (iii) reserved additional floor area to cover construction cost.

(b) Promotion of Land Supply for Housing

Another big issue in housing development in Hanoi is the promotion of land supply for housing. At present the development mechanism to provide land for housing is very limited in Vietnam. Government tends to promote housing provision rather than land provision.

While it requires a change in the land management system, some of the proposed mechanisms that can be instituted more include: (i) formulation of guidelines to develop land for housing, (ii) formulation of development mechanism, and (iii) provision of incentives for residential area development within urban areas.

(c) Project-type New Urban Development

In order to accelerate housing development and meet various current and future housing demands, there is a need to increase the variety of "players" in the housing market to cover planning, investment, construction, and maintenance. Government sector is expected to continuously provide favorable arrangement to promote housing

development project in the city, as follows: (i) provision of state-owned land for housing development at low costs, (ii) exemption of tax payment under certain conditions, such as percentage of housing units at minimum standards; (iii) prioritization of integrated development with public transportation development; (iv) provision of low-interest housing finance from land development funds; and (v) establishment of effective planning permission system.

(d) Standardization of Housing

Standardized housing-plan is another important role of public sector to reduce housing construction costs and to ensure certain levels of housing quality. The standards that public sector shall develop include: (i) housing technical standards (desirable living standards, waterproofing and insulation, materials, utilities, electrical appliances, exterior and interior finishing, etc.); (ii) standard plan for various sizes and types to meet people's diverse needs; (iii) guidelines for housing area development (lot size, road allocation, green/ open space allocation, infrastructure development, parking area, etc.); and (iv) laws and regulations on management and maintenance of apartments.

(3) Development of Housing for Low-income Households

In addition to above-mentioned housing development mechanism, another important policy for housing development is to provide social housing for those who cannot afford housing through real estate market. As seen in many other countries, public sector provides, or supports to develop, public housing for low-income households, in order to ensure that all households have access to housing. Social housing can be provided either directly by the public sector or by the private sector with government support.

(a) Development of Low-cost Housing

In order to provide housing for low-income households at affordable prices, low-cost housing should be applied. The "Study of Social Housing Development" by MOC examined the total development cost of apartment per area for different types of apartment. It covered construction cost, administrative cost, land acquisition, land use fee and infrastructure construction. While Construction cost is higher for high-rise building, land acquisition cost and land use fee per unit is cheaper for high-rise building. The result showed that apartment building with 4-6 stories can be constructed the most cost effectively. Based on this analysis, the Law on Housing describes the standard for social housing for Hanoi at 5-6 story apartment and with floor area of each unit is not larger than 60m^2 and not smaller than 30m^2

(b) Formulation of Public Housing Development Cooperation

It is required to identify the implementation body for social or public housing development, either by assignment existing one or establishing new one. The necessary function includes: (i) to develop and manage public housing (e.g. UDC and local housing supply corporations in Japan); (ii) to provide housing finance for individual financing (e.g. GHLC in Japan); (iii) to regulate housing development mainly within the City PC. These new institutions and departments will be the basis for the development and management of good housing stocks for all income classes, particularly social and affordable housing.

(c) Institutional Arrangement

Considering the stringent financial conditions of Hanoi City government, it is essential to utilize private sector investment for social housing development. Public sector is supposed to provide incentives for private sector. As described in the Housing Law, the possible supporting measures of the government include subsidy on the land acquisition and reduction or exemption of land use fees and relevant taxes.

(d) Development of Rental Housing Market

The first step of public housing development is to provide rental housing, as experienced in other countries. Currently there is very limited market to provide rental houses in Hanoi City. Rental housing is managed only at personal base, which has caused difficulty for tenants to access to information and to find the reasonable one. In order to respond to increasing demand for rental housing, The market for rental housing should be developed with an adequate information system.

(e) Criteria for Distribution of Social Housing

In order to ensure the equity of distribution of housing provided by public or subsidized by public, clear criteria for eligibility of applicants are essential, either by income level, social status, or family formation. As seen in Singapore, the typical criterion of eligibility for social housing is income level, which is difficult to apply in Vietnam. Since there is not official income management system, government cannot identify the eligibility. However, accompanied with globalization, it is expected to establish income tax, increase salary for public officers, and demolish informal income, thus improve income management. It is required to identify the specific criteria to apply social housing.

Another criterion that the city authority has also applied is housing floor area per capita. Currently the criterion for floor area is set at 2.5m^2 per person, while that for income level is VND 250,000 per month. It is also proposed to apply the above two criteria to identify the eligibility for social housing. Public housing for poor household or household requiring support of social welfare should be separated from housing for government employees, which are now listed together in the policy privileged household.

(4) Institutional Arrangement

(a) Establishment of Effective Housing Management System

In order to establish an effective housing management system, the following actions are required:

(i) **Strengthened Housing Registration:** Relevant registration system is essential not only to offer protection for the purchaser/mortgagee but also to ensure tax revenue base and to develop market value for land and property.

(ii) **Establishment of Housing Information System:** Efficient housing management requires reliable information on housing stocks, which are not available in Hanoi CityThe required data for housing database include the number of housing stocks and housing units, floor area, construction year, housing type, and status of ownership.

(iii) **Housing Performance Indicators:** Housing management system requires the housing performance indicators, in order to evaluate housing stocks adequately. It

shall provide the minimum requirement and targeted standard for housing quality, including structural strength, sound insulation, property, and energy efficiency.

(b) Development of Formal Housing Market

Formal housing market is essential, which include effective enforcement of legal procedure of housing transaction such as sales, leasing, transfer, and mortgage, and (ii) formulation of real estate market for second-hand and rental housing, including development of performance indicator and support system for renters.

(c) Housing Financing for Individuals

Access to housing financing such as long-term loan with low interest will increase people's purchasing power and thus activate real estate market. It will also facilitate re-housing, through so-called "filtering process" and improve housing quality in turn. In the long run, it will undermine the current demand-supply gap. Possible resources that will provide the needed funds have to be examined.

(i) **Stable Financing Sources in Japan:** In Japan, the governmental loan system, entitled "Fiscal Investment and Loan Program (FILP)," has provided the Government Housing Loan Cooperation "GHLC" with majority of their necessary capitals, which has provided favourable housing loans for individuals. The financial sources of FILP are secured with postal savings, pension reserves, and surpluses in special accounts and other public entities. Its interest rates are set at the similar level of Japanese government bonds because the FILP bonds are issued in coordination with Japanese government bonds.

(ii) **Savings System in Other Countries:** In Singapore, Malaysia and several cities in China, a compulsory savings system has been used for securing stable housing fund. Under such a system, people who work at public institutions, or foreign enterprises, compulsorily join the savings system in the name of social security pension. These reserves are used to purchase and improve housing for their members. In Singapore, under the savings system called "Employment Provident Fund (EPF)," both employees and employers have to compulsorily save a certain amount of money deducted from their wages. The EPF has contributed to the provision of a large amount of public housing in Singapore, accounting for more than 80% of the total housing in the 1980s.

(d) Housing Management System

Currently, there is no effective system for operation and maintenance for apartment in Vietnam. Old collective apartments are seriously deteriorated and at the risk of collapse. As high-rise condominiums are being developed, the MOC issued one degree on regulation on the use and management of condominiums that stipulates regular and periodical maintenance are management. However, actual work of management board limited largely to simple daily maintenance such as cleaning in the public space and collection of solid waste. Management service fee is not adequately corrected for periodical large-scale repair work. It is essential to develop effective management board system in each condominium and to establish reserved fund for periodical repair in each 10 or 15 years.

10.3 Living Conditions

1) Analytical Framework: Urban Karte

While the improvement of living conditions is an important policy agenda for the government, the people, and the entire society, it is not easy to evaluate the living conditions in a way that the government can specifically identify why the living conditions are bad and implement appropriate measures for improvement. It is also important to know whether the people can feel that the measures have been effective and living conditions have improved. For the government to implement measures correctly to the satisfaction of the people, an analytical method must be established. In HAIDEP, on the basis of existing and collected data and opinions of the people gathered through the comprehensive HIS, a practical method was developed and adopted for more analysis of the living conditions.

Living conditions are defined as a composite of four factors, namely: (i) safety and security, (ii) healthiness, (iii) convenience, (iv) amenity, as defined by WHO. Another factor, capability, which refers to the ability of households /communities to improve the situation was added. Each factor is represented by a number of indicators for which the data is available and easy to understand. Based on the indicators, each factor was assessed and the score was calculated. The total score for the above 5 factors is the integrated score which explains the level of overall living conditions based on objective indicators.

At the same time, the satisfaction of the people with each factor was gathered from HIS respondents who numbered 20,000 household heads. Satisfaction was also translated into scores depending on the level of satisfaction. By comparing the scores obtained from the objective analysis and the subjective (satisfaction) judgment of the people, both the government and the people can share an understanding on the gap between the two levels and develop the right actions and measures to improve the living conditions.

The analysis was made for all communes in Hanoi City and compiled into an Urban Karte which gives a summary of existing conditions and a diagnosis of living conditions. This is the first attempt to analyze the living conditions of the entire urban and rural areas in Hanoi City. Although there are still areas that must be improved, this will provide a useful input to the effective improvement of the living conditions. It is also a more scientific and effective way of preparing urban and land-use plan as well as other infrastructure development plans.

Figure 10.3.1 Method for Analysis of Living Conditions

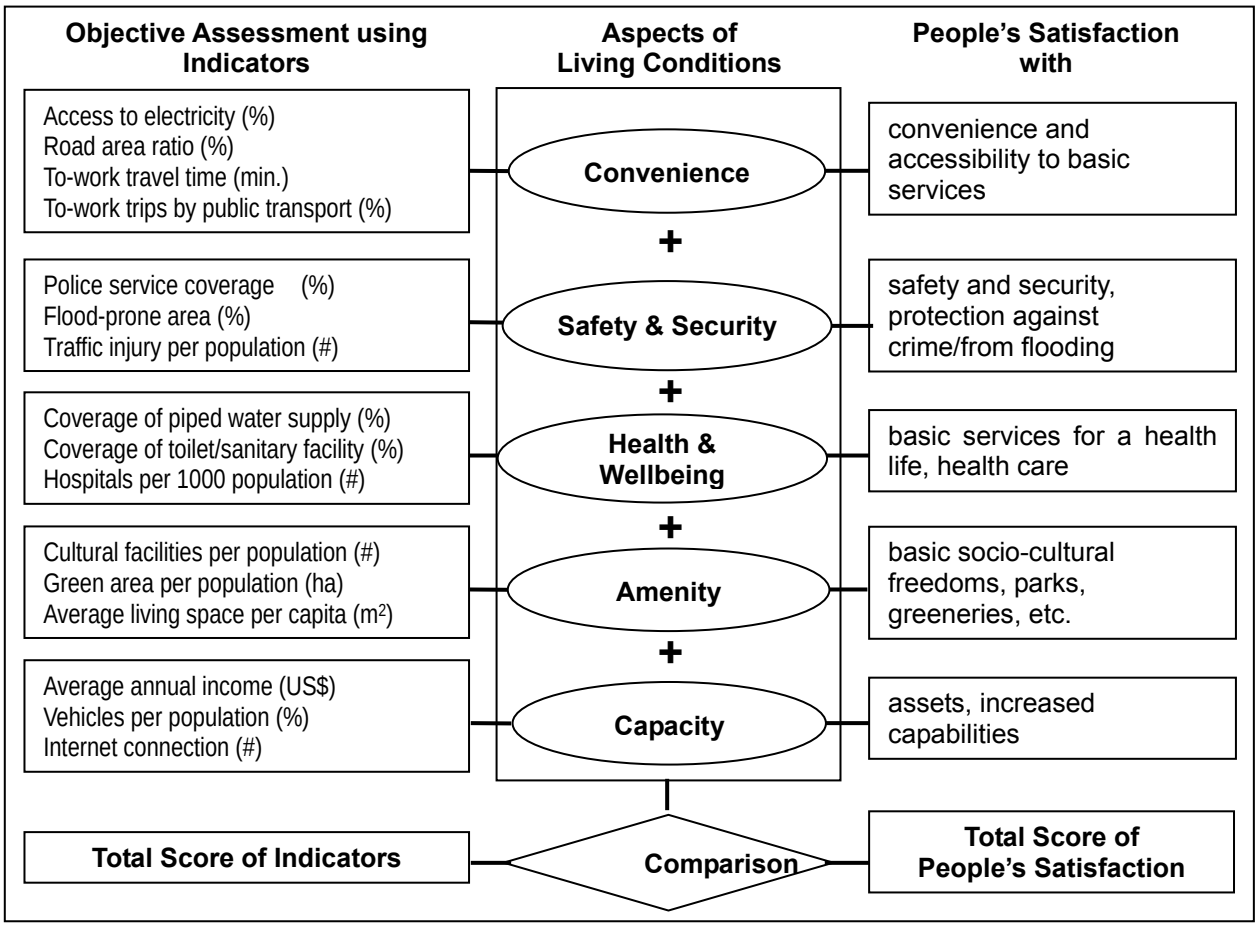
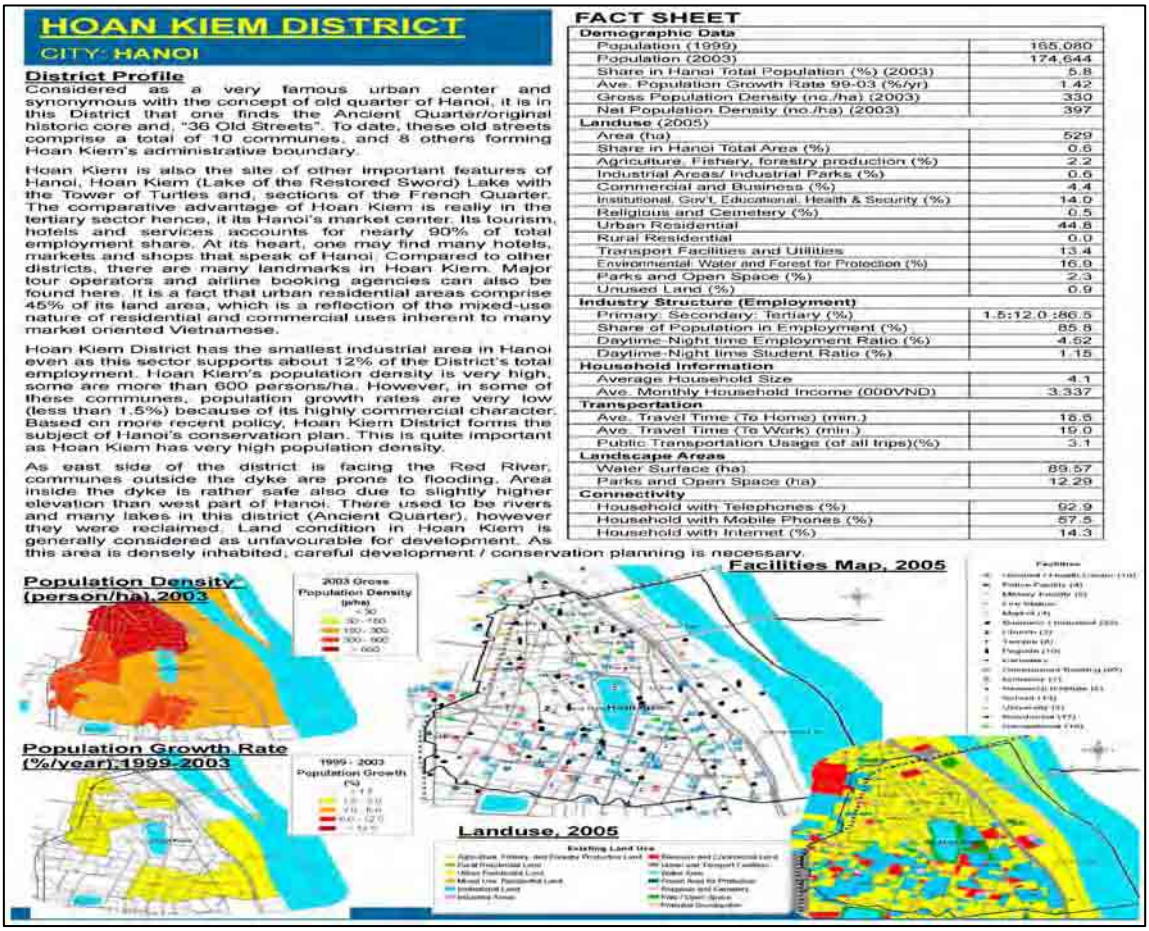


Table 10.3.1 Contents of Urban Karte

1. Fact Sheet: District profile, demographic conditions, current land use, current facilities map
2. Living Conditions Assessment: Objective and subjective indicators, overall assessment
3. Summary Diagnosis

Figure 10.3.2 Examples of Urban Karte



HOAN KIEM DISTRICT

CITY: HANOI

District Profile

Considered as a very famous urban center and synonymous with the concept of old quarter of Hanoi, it is in this District that one finds the Ancient Quarter/original historic core and, "36 Old Streets". To date, these old streets comprise a total of 10 communes, and 8 others forming Hoan Kiem's administrative boundary.

Hoan Kiem is also the site of other important features of Hanoi, Hoan Kiem (Lake of the Restored Sword) Lake with the Tower of Turtles and, sections of the French Quarter. The comparative advantage of Hoan Kiem is really in the tertiary sector hence, it its Hanoi's market center. Its tourism, hotels and services accounts for nearly 90% of total employment share. At its heart, one may find many hotels, markets and shops that speak of Hanoi. Compared to other districts, there are many landmarks in Hoan Kiem. Major tour operators and airline booking agencies can also be found here. It is a fact that urban residential areas comprise 45% of its land area, which is a reflection of the mixed-use nature of residential and commercial uses inherent to many market oriented Vietnamese.

Hoan Kiem District has the smallest industrial area in Hanoi even as this sector supports about 12% of the District's total employment. Hoan Kiem's population density is very high, some are more than 600 persons/ha. However, in some of these communes, population growth rates are very low (less than 1.5%) because of its highly commercial character. Based on more recent policy, Hoan Kiem District forms the subject of Hanoi's conservation plan. This is quite important as Hoan Kiem has very high population density.

As east side of the district is facing the Red River, communes outside the dyke are prone to flooding. Area inside the dyke is rather safe also due to slightly higher elevation than west part of Hanoi. There used to be rivers and many lakes in this district (Ancient Quarter), however they were reclaimed. Land condition in Hoan Kiem is generally considered as unfavourable for development. As this area is densely inhabited, careful development / conservation planning is necessary.

FACT SHEET

Demographic Data	
Population (1999)	165,080
Population (2003)	174,644
Share in Hanoi Total Population (%) (2003)	5.8
Ave. Population Growth Rate 99-03 (%/yr)	1.42
Gross Population Density (no./ha) (2003)	330
Net Population Density (no./ha) (2003)	397
Landuse (2005)	
Area (ha)	529
Share in Hanoi Total Area (%)	0.6
Agriculture, Fishery, forestry production (%)	2.2
Industrial Areas/ Industrial Parks (%)	0.6
Commercial and Business (%)	4.4
Institutional, Gov't, Educational, Health & Security (%)	14.0
Religious and Cemetery (%)	0.5
Urban Residential	44.8
Rural Residential	0.0
Transport Facilities and Utilities	13.4
Environmental: Water and Forest for Protection (%)	16.9
Parks and Open Space (%)	2.3
Unused Land (%)	0.9
Industry Structure (Employment)	
Primary: Secondary: Tertiary (%)	1.5:12.0 :86.5
Share of Population in Employment (%)	85.8
Daytime-Night time Employment Ratio (%)	4.52
Daytime-Night time Student Ratio (%)	1.18
Household Information	
Average Household Size	4.1
Ave. Monthly Household Income (000VND)	3,337
Transportation	
Ave. Travel Time (To Home) (min.)	18.5
Ave. Travel Time (To Work) (min.)	19.0
Public Transportation Usage (of all trips)(%)	3.1
Landscape Areas	
Water Surface (ha)	89.57
Parks and Open Space (ha)	12.29
Connectivity	
Household with Telephones (%)	92.9
Household with Mobile Phones (%)	57.5
Household with Internet (%)	14.3

Population Density (person/ha),2003

2003 Gross Population Density (p/ha)

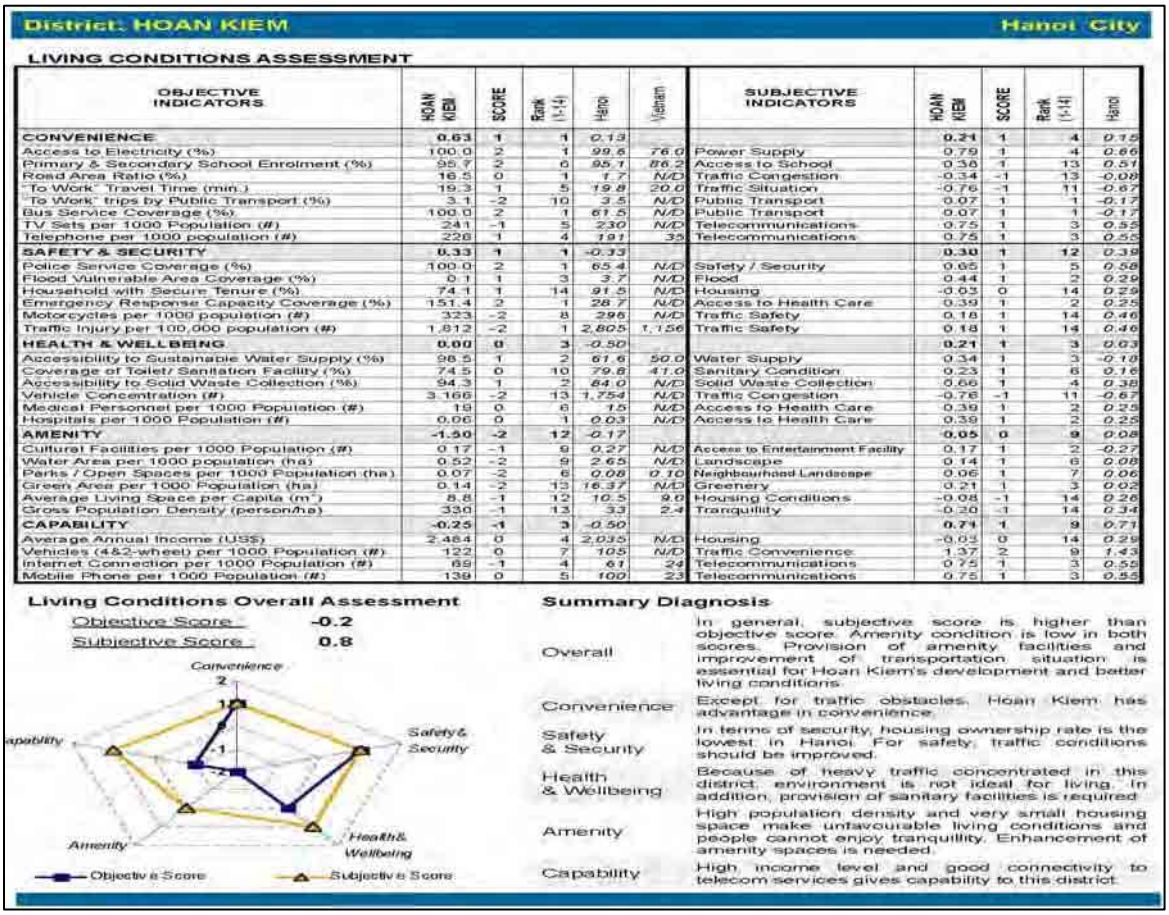
Population Growth Rate (%/year),1999-2003

1999 - 2003 Population Growth (%)

Facilities Map, 2005

Landuse, 2005

Existing Land Use



District: HOAN KIEM — **Hanoi City**

LIVING CONDITIONS ASSESSMENT

OBJECTIVE INDICATORS	HOAN KIEM	SCORE	Rank (1-14)	Hanoi	Vietnam	SUBJECTIVE INDICATORS	HOAN KIEM	SCORE	Rank (1-14)	Hanoi
CONVENIENCE	**0.63**	**1**	**1**	*0.13*			**0.21**	**1**	**4**	*0.15*
Access to Electricity (%)	100.0	2	1	*99.6*	*76.0*	Power Supply	0.79	1	4	*0.66*
Primary & Secondary School Enrolment (%)	95.7	2	6	*95.1*	*86.2*	Access to School	0.36	1	13	*0.51*
Road Area Ratio (%)	16.5	0	1	*1.7*	*N/D*	Traffic Congestion	-0.34	-1	13	*-0.09*
"To Work" Travel Time (min.)	19.3	1	5	*19.8*	*20.0*	Traffic Situation	-0.76	-1	11	*-0.67*
"To Work" trips by Public Transport (%)	3.1	-2	10	*3.5*	*N/D*	Public Transport	0.07	1	1	*-0.17*
Bus Service Coverage (%)	100.0	2	1	*61.5*	*N/D*	Public Transport	0.07	1	1	*-0.17*
TV Sets per 1000 Population (#)	241	-1	5	*230*	*N/D*	Telecommunications	0.75	1	3	*0.55*
Telephone per 1000 population (#)	226	1	4	*191*	*35*	Telecommunications	0.75	1	3	*0.55*
SAFETY & SECURITY	**0.33**	**1**	**1**	*-0.33*			**0.30**	**1**	**12**	*0.39*
Police Service Coverage (%)	100.0	2	1	*65.4*	*N/D*	Safety / Security	0.65	1	5	*0.58*
Flood Vulnerable Area Coverage (%)	0.1	1	3	*3.7*	*N/D*	Flood	0.44	1	2	*0.29*
Household with Secure Tenure (%)	74.1	1	14	*91.5*	*N/D*	Housing	-0.03	0	14	*0.29*
Emergency Response Capacity Coverage (%)	151.4	2	1	*28.7*	*N/D*	Access to Health Care	0.39	1	2	*0.25*
Motorcycles per 1000 population (#)	323	-2	8	*296*	*N/D*	Traffic Safety	0.18	1	14	*0.46*
Traffic Injury per 100,000 population (#)	1,812	-2	1	*2,805*	*1,156*	Traffic Safety	0.18	1	14	*0.46*
HEALTH & WELLBEING	**0.00**	**0**	**3**	*-0.50*			**0.21**	**1**	**3**	*0.03*
Accessibility to Sustainable Water Supply (%)	98.5	1	2	*61.6*	*50.0*	Water Supply	0.34	1	3	*-0.10*
Coverage of Toilet/ Sanitation Facility (%)	74.5	0	10	*79.8*	*41.0*	Sanitary Condition	0.23	1	6	*0.16*
Accessibility to Solid Waste Collection (%)	94.3	1	2	*84.0*	*N/D*	Solid Waste Collection	0.66	1	4	*0.38*
Vehicle Concentration (#)	3,166	-2	13	*1,754*	*N/D*	Traffic Congestion	-0.76	-1	11	*-0.67*
Medical Personnel per 1000 Population (#)	19	0	6	*15*	*N/D*	Access to Health Care	0.39	1	2	*0.25*
Hospitals per 1000 Population (#)	0.06	0	1	*0.03*	*N/D*	Access to Health Care	0.39	1	2	*0.25*
AMENITY	**-1.50**	**-2**	**12**	*-0.17*			**-0.05**	**0**	**9**	*0.08*
Cultural Facilities per 1000 Population (#)	0.17	-1	9	*0.27*	*N/D*	Access to Entertainment Facility	0.17	1	2	*-0.27*
Water Area per 1000 population (ha)	0.52	-2	9	*2.65*	*N/D*	Landscape	0.14	1	6	*0.08*
Parks / Open Spaces per 1000 Population (ha)	0.07	-2	6	*0.08*	*0.10*	Neighbourhood Landscape	0.06	1	7	*0.06*
Green Area per 1000 Population (ha)	0.14	-2	13	*16.37*	*N/D*	Greenery	0.21	-1	3	*0.02*
Average Living Space per Capita (m²)	8.8	-1	12	*10.5*	*9.0*	Housing Conditions	-0.08	-1	14	*0.26*
Gross Population Density (person/ha)	330	-1	13	*33*	*2.4*	Tranquility	-0.20	-1	14	*0.34*
CAPABILITY	**-0.25**	**-1**	**3**	*-0.50*			**0.71**	**1**	**9**	*0.71*
Average Annual Income (US$)	2,484	0	4	*2,035*	*N/D*	Housing	-0.03	0	14	*0.29*
Vehicles (4&2-wheel) per 1000 Population (#)	122	0	7	*105*	*N/D*	Traffic Convenience	1.37	2	9	*1.43*
Internet Connection per 1000 Population (#)	69	-1	4	*61*	*24*	Telecommunications	0.75	1	3	*0.55*
Mobile Phone per 1000 Population (#)	139	0	5	*100*	*23*	Telecommunications	0.75	1	3	*0.55*

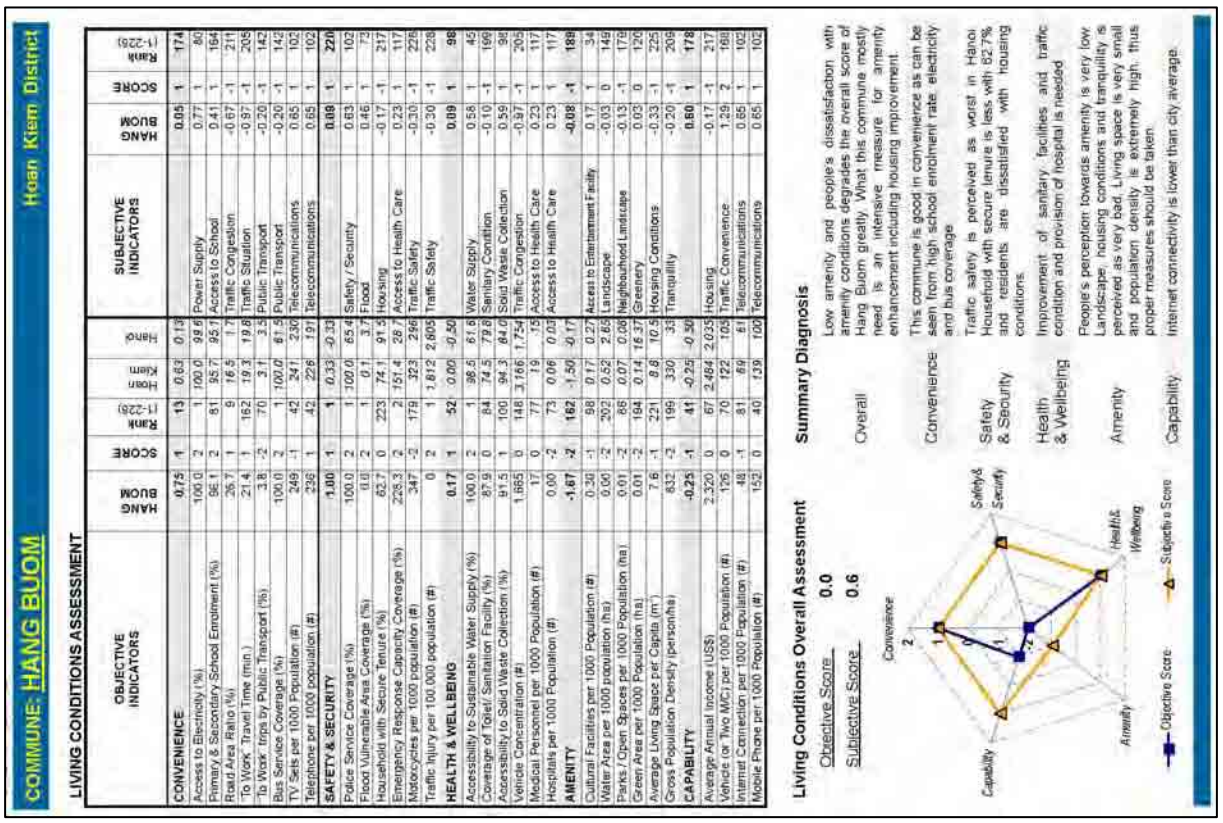
Living Conditions Overall Assessment

Objective Score: -0.2

Subjective Score: 0.8

Summary Diagnosis

Overall	In general, subjective score is higher than objective score. Amenity condition is low in both scores. Provision of amenity facilities and improvement of transportation situation is essential for Hoan Kiem's development and better living conditions.
Convenience	Except for traffic obstacles, Hoan Kiem has advantage in convenience.
Safety & Security	In terms of security, housing ownership rate is the lowest in Hanoi. For safety, traffic conditions should be improved.
Health & Wellbeing	Because of heavy traffic concentrated in this district, environment is not ideal for living. In addition, provision of sanitary facilities is required.
Amenity	High population density and very small housing space make unfavourable living conditions and people cannot enjoy tranquility. Enhancement of amenity spaces is needed.
Capability	High income level and good connectivity to telecom services gives capability to this district.



COMMUNE: HANG BUOM — Hoan Kiem District

LIVING CONDITIONS ASSESSMENT

OBJECTIVE INDICATORS	HANG BUOM	SCORE	Rank (1-25)	Hoan Kiem	Hanoi	SUBJECTIVE INDICATORS	HANG BUOM	SCORE	Rank (1-25)
CONVENIENCE	**0.75**	**1**	**13**	*0.63*	*0.13*			**0.05**	**1** **174**
Access to Electricity (%)	100.0	2	1	*100.0*	*93.6*	Power Supply	0.77	1	80
Primary & Secondary School Enrolment (%)	96.1	2	81	*93.7*	*93.1*	Access to School	0.41	1	164
Road Area Ratio (%)	26.7	1	9	*16.5*	*1.7*	Traffic Congestion	-0.67	-1	211
To Work Travel Time (min.)	21.4	1	162	*19.3*	*19.8*	Traffic Situation	-0.97	-1	205
To Work trips by Public Transport (%)	3.8	-2	70	*3.1*	*3.5*	Public Transport	-0.20	-1	142
Bus Service Coverage (%)	100.0	2	1	*100.0*	*81.5*	Public Transport	-0.20	-1	142
TV Sets per 1000 Population (#)	249	-1	42	*241*	*230*	Telecommunications	0.65	1	102
Telephone per 1000 population (#)	236	1	42	*226*	*191*	Telecommunications	0.65	1	102
SAFETY & SECURITY	**1.00**	**1**	**1**	*0.33*	*-0.33*			**0.09**	**1** **220**
Police Service Coverage (%)	100.0	2	1	*100.0*	*85.4*	Safety / Security	0.83	1	102
Flood Vulnerable Area Coverage (%)	0.0	2	1	*0.1*	*3.7*	Flood	0.46	1	73
Household with Secure Tenure (%)	62.7	0	223	*74.1*	*91.5*	Housing	-0.17	-1	217
Emergency Response Capacity Coverage (%)	226.3	2	2	*151.4*	*28.7*	Access to Health Care	0.23	1	117
Motorcycles per 1000 population (#)	347	-2	179	*323*	*296*	Traffic Safety	-0.30	-1	226
Traffic Injury per 100,000 population (#)	0	2	1	*1,812*	*2,605*	Traffic Safety	-0.30	-1	228
HEALTH & WELLBEING	**0.17**	**1**	**52**	*0.00*	*-0.50*			**0.09**	**1** **98**
Accessibility to Sustainable Water Supply (%)	100.0	2	1	*98.5*	*61.6*	Water Supply	0.58	1	45
Coverage of Toilet/ Sanitation Facility (%)	97.9	0	84	*74.5*	*79.8*	Sanitary Condition	-0.10	-1	199
Accessibility to Solid Waste Collection (%)	91.5	1	100	*94.3*	*84.0*	Solid Waste Collection	0.59	1	98
Vehicle Concentration (#)	1,665	0	146	*3,166*	*1,754*	Traffic Congestion	-0.97	-1	205
Medical Personnel per 1000 Population (#)	17	0	77	*19*	*15*	Access to Health Care	0.23	1	117
Hospitals per 1000 Population (#)	0.00	-2	73	*0.06*	*0.03*	Access to Health Care	0.23	1	117
AMENITY	**-1.67**	**-2**	**162**	*-1.50*	*-0.17*			**-0.08**	**-1** **189**
Cultural Facilities per 1000 Population (#)	0.30	-1	98	*0.17*	*0.27*	Access to Entertainment Facility	0.17	1	34
Water Area per 1000 population (ha)	0.00	-2	202	*0.52*	*2.65*	Landscape	-0.03	0	149
Parks / Open Spaces per 1000 Population (ha)	0.01	-2	86	*0.07*	*0.06*	Neighbourhood Landscape	-0.13	-1	179
Green Area per 1000 Population (ha)	0.01	-2	194	*0.14*	*16.37*	Greenery	0.03	0	120
Average Living Space per Capita (m²)	7.6	-1	221	*8.8*	*16.5*	Housing Conditions	-0.33	-1	225
Gross Population Density (persons/ha)	832	-2	199	*330*	*33*	Tranquility	-0.20	-1	209
CAPABILITY	**-0.25**	**-1**	**41**	*-0.25*	*-0.30*			**0.50**	**1** **178**
Average Annual Income (US$)	2,320	0	67	*2,484*	*2,035*	Housing	-0.17	-1	217
Vehicle for Two Mbr per 1000 Population (#)	126	0	70	*122*	*105*	Traffic Convenience	1.29	2	168
Internet Connection per 1000 Population (#)	48	-1	81	*69*	*81*	Telecommunications	0.65	1	102
Mobile Phone per 1000 Population (#)	152	0	40	*139*	*100*	Telecommunications	0.65	1	102

Living Conditions Overall Assessment

Objective Score 0.0

Subjective Score 0.6

Summary Diagnosis

Low amenity and people's dissatisfaction with amenity conditions degrades the overall score of Hang Buom greatly. What this commune mostly need is an intensive measure for amenity enhancement including housing improvement.

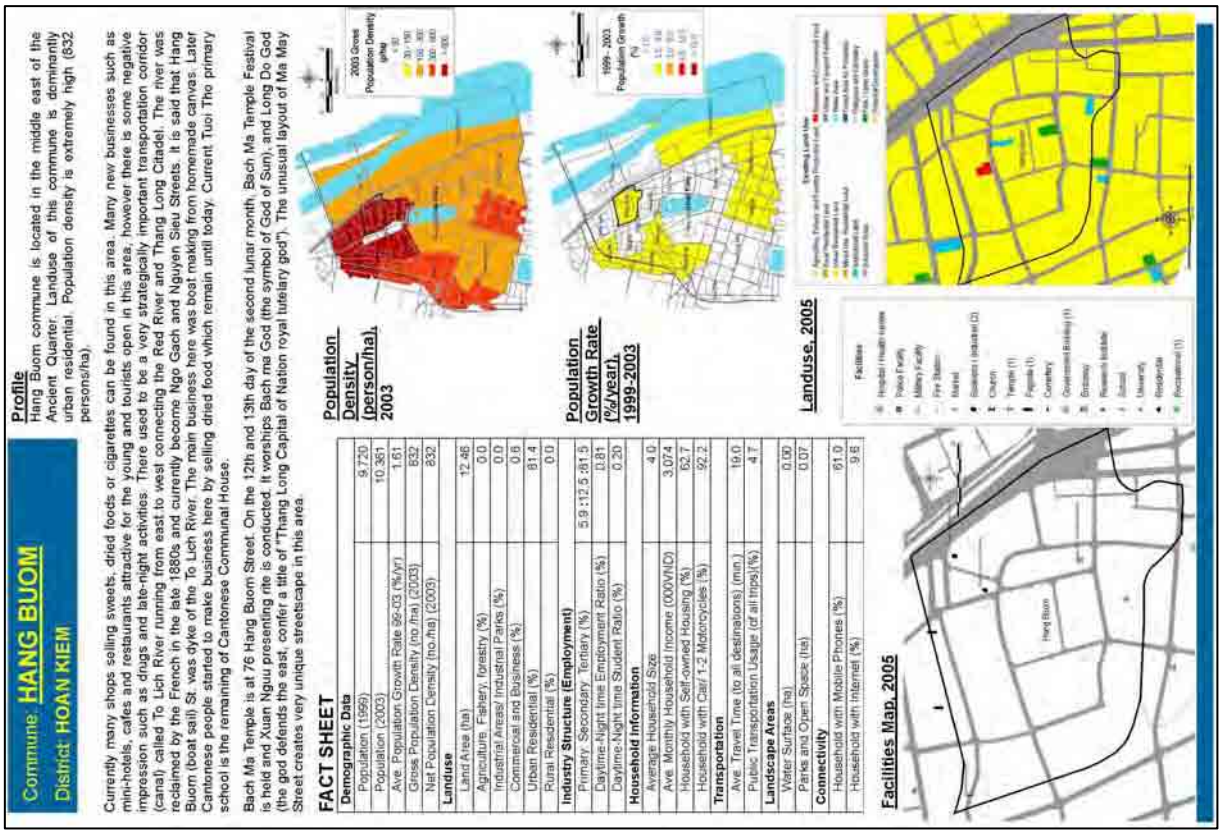
Convenience: This commune is good in convenience as can be seen from high school enrolment rate, electricity and bus coverage.

Safety & Security: Traffic safety is perceived as worst in Hanoi. Household with secure tenure is less with 82.7% and residents are dissatisfied with housing conditions.

Health & Wellbeing: Improvement of sanitary facilities and traffic condition and provision of hospital is needed.

Amenity: People's perception towards amenity is very low. Landscape, housing conditions and tranquility is perceived as very bad. Living space is very small and population density is extremely high, thus proper measures should be taken.

Capability: Internet connectivity is lower than city average.



Commune: HANG BUOM
District: HOAN KIEM

Profile
Hang Buom commune is located in the middle east of the Ancient Quarter. Landuse of this commune is dominantly urban residential. Population density is extremely high (832 persons/ha).

Currently many shops selling sweets, dried foods or cigarettes can be found in this area. Many new businesses such as mini-hotels, cafes and restaurants attractive for the young and tourists open in this area; however there is some negative impression such as drugs and late-night activities. There used to be a very strategically important transportation corridor (canal) called To Lich River running from east to west connecting the Red River and Thang Long Citadel. The river was reclaimed by the French in the late 1880s and currently become Ngo Gach and Nguyen Sieu Streets. It is said that Hang Buom (boat sail) St. was dyke of the To Lich River. The main business here was boat making from homemade canvas. Later Cantonese people started to make business here by selling dried food which remain until today. Current Tuoi Tho primary school is the remaining of Cantonese Communal House.

Bach Ma Temple is at 76 Hang Buom Street. On the 12th and 13th day of the second lunar month, Bach Ma Temple Festival is held and Xuan Nguu presenting rite is conducted. It worships Bach ma God (the symbol of God of Sun), and Long Do God (the god defends the east, confer a title of "Thang Long Capital of Nation royal tutelary god"). The unusual layout of Ma May Street creates very unique streetscape in this area.

FACT SHEET

Demographic Data	
Population (1999)	9,720
Population (2003)	10,361
Ave. Population Growth Rate 99-03 (%/yr)	1.61
Gross Population Density (no./ha) (2003)	832
Nat Population Density (no./ha) (2003)	832
Landuse	
Land Area (ha)	12.46
Agriculture, Fishery, forestry (%)	0.0
Industrial Areas/ Industrial Parks (%)	0.0
Commercial and Business (%)	0.6
Urban Residential (%)	81.4
Rural Residential (%)	0.0
Industry Structure (Employment)	
Primary: Secondary: Tertiary (%)	5.9 :12.5 :81.5
Daytime-Night time Employment Ratio (%)	0.81
Daytime-Night time Student Ratio (%)	0.20
Household Information	
Average Household Size	4.0
Ave. Monthly Household Income (000VND)	3,074
Household with Self-owned Housing (%)	62.7
Household with Car/ 1-2 Motorcycles (%)	92.2
Transportation	
Ave. Travel Time (to all destinations) (min.)	19.0
Public Transportation Usage (of all trips)(%)	4.7
Landscape Areas	
Water Surface (ha)	0.00
Parks and Open Space (ha)	0.07
Connectivity	
Household with Mobile Phones (%)	61.0
Household with Internet (%)	9.6

Population Density (person/ha), 2003

Population Growth Rate (%/year), 1999-2003

Landuse, 2005

Facilities Map, 2005

10.4 Proposed Housing and Living Conditions Development Orientation

1) Goals and Objectives

The improvement of living conditions must be attended to comprehensively, because the quality of living conditions can only be guaranteed when key elements, such as safety, convenience, healthiness, and amenity, are improved in a balanced manner. It is also of note that the required measures to improve the living conditions of an area require both city- and local-level action.

At the city level, various projects of the different sectors, e.g. roads, drainage, roadside urban developments, etc., must be implemented in a coordinated manner. The development of housing estates/complexes, for example, must also improve the environment of adjoining areas. Moreover, an urban area development must not focus on buildings and physical infrastructure alone, but should cover services and management matters to realize the desired living environment. Proper planning and institutional framework are therefore of paramount importance.

A big part of the improvement of the living environment can be done at the community level, as is already practiced in many parts of Hanoi such as street sweeping, drainage cleaning, and garbage collection. Whatever their respective situations, communities should take the initiative in identifying problems and issues which they can resolve by themselves or by the city authorities.

As for housing, which embodies the critical components of living conditions such as safety/security, convenience, comfort, and healthiness, the government's role covers the following: (i) to formulate comprehensive and phased housing development programs with attainable development targets; (ii) to establish a sustainable mechanism particularly on the supply of affordable housing; (iii) to improve current institutional mechanisms for the private sector to supply affordable housing; (iv) to expand financial access for affordable housing provision; and (v) to prepare realistic design standards for affordable housing.

2) Proposed Strategies, Actions, and Strategic Projects

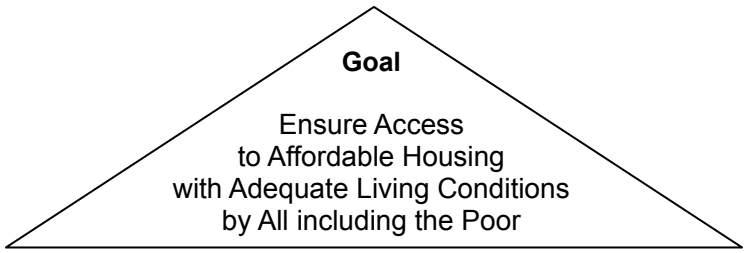
In order to promote the objectives of a sustainable housing and living conditions development, five strategies are set for which more concrete actions and strategic projects are proposed (see Figure 10.4.1). The basic strategies are as follows:

(i) Establish coordinated housing policy
(ii) Establish concrete mechanism to ensure affordable housing for low-income groups
(iii) Provide adequate supportive measures to rebuild old public housing
(iv) Establish improved mechanism for smooth supply of lands for housing
(v) Establish practical living environmental improvement mechanism based on comprehensive assessment of living conditions at community level

Strategic projects for priority action are the following:

(i) Establishment of policy and institutional framework for sustainable provision of affordable housing
(ii) Establishment of participatory monitoring system of living conditions at community level
(iii) Improvement of technical standards for buildings and their maintenance

Figure 10.4.1 Proposed Strategies, Actions, and Strategic Projects for Housing and Living Conditions Development



Objectives	• Provide affordable housing especially the poor • Provide institutional and fiscal support to upgrade old housing stocks • Ensure smooth provision of land for housing

Strategy	Action	Monitoring Indicator
F1 Establish coordinated housing policy	F11 Identify existing and future housing market together with housing supply mechanism to define issues and agenda F12 Establish clear policy on role-sharing between public and private sectors in housing supply F13 Establish adequate institutions to promote private sector participation in the housing market	• Effective housing policy • Effective institutional framework • Share of private sector in formal housing provision
F2 Establish concrete mechanism to ensure affordable housing for low-income groups	F21 Identify types of affordable housing for different categories of customers F22 Develop adequate design standards of affordable housing to improve living conditions F23 Establish adequate mechanism to supply affordable housing by both public and private sectors	• Matching demand • Adequacy of design standards • Workable supply mechanism
F3 Provide adequate supportive measures to rebuild old public housing	F31 Formulate basic sustainable redevelopment methods for old public housing areas on equitable sharing of costs and benefits between residents and government F32 Redevelop old public housing areas to benefit residents and serve public interest F33 Introduce PFI (private financing initiatives) schemes	• Workable redevelopment mechanism • Number of redeveloped houses
F4 Establish improved mechanism for smooth supply of lands for housing	F41 Improve existing registration system F42 Introduce land readjustment mechanism to define land issues and develop housing areas	• Establishment of supply system
F5 Establish practical living environmental improvement mechanism based on comprehensive assessment of living conditions at community level	F51 Develop comprehensive living conditions assessment methods (ie urban karte) F52 Establish practical mechanism to improve the living environment based on F51 F53 Establish participatory mechanism to improve living conditions at community level	• Introduction and use of Urban Karte • Number of participating residents

Strategic Projects	PF1 Establishment of policy and institutional framework for sustainable provision of affordable housing PF2 Establishment of participatory monitoring system of living conditions at community level PF3 Improvement of technical standards for buildings and their maintenance

Source: HAIDEP Study Team.