2.2 DESIGN CAPACITY

The water demand for this project was forecasted in the preceding section. Design capacity of facilities which shall meet the water demand is decided as given below:

- Intake facilities : Q = 60,000 m3/d (= Daily Maximum Intake capacity)
- Treatment facilities : Q = 60,000 m3/d (= Daily Maximum Production capacity)
- Distribution facilities : Q = 57,000 m3/d (= Daily Maximum Distribution capacity)

(Plant loss : Q = 3,000 m3/d)

The capacity is broken down by the service area into the following:

(m3/d)

Item	Service Area	(A) To Project Area	(B) Supplement to Mai Dich	(C) To New Development Area
Daily Maximum	(1) Intake capacity	60,000		
	(2) Treatment capacity	60,000		
	(3) Plant loss	3,000		
	(4) Distribution capacity	57,000		
	(5) Distribution by area	20,000	20,000	17,000
Average Daily	(6) Distribution by area	14,800	20,000	12,900
	(7) Demand	12,600	20,000	11,000

Note: (1) = (2)
(3) = (2) x 5%
(4) = (2) - (3)
(6) = (5) / 1.35 (Peak day factor = 135%)
(7) = (6) x (1- 0.15) (Physical loss = 15%)
(In the case of "Supplement to Mai Dich Treatment Plant", 20,000 m3/d is to be distributed constantly with 24 hours basis everyday.)

2.3 FACILITY PLAN

2.3.1 Location of Facilities

(1) Wellfield

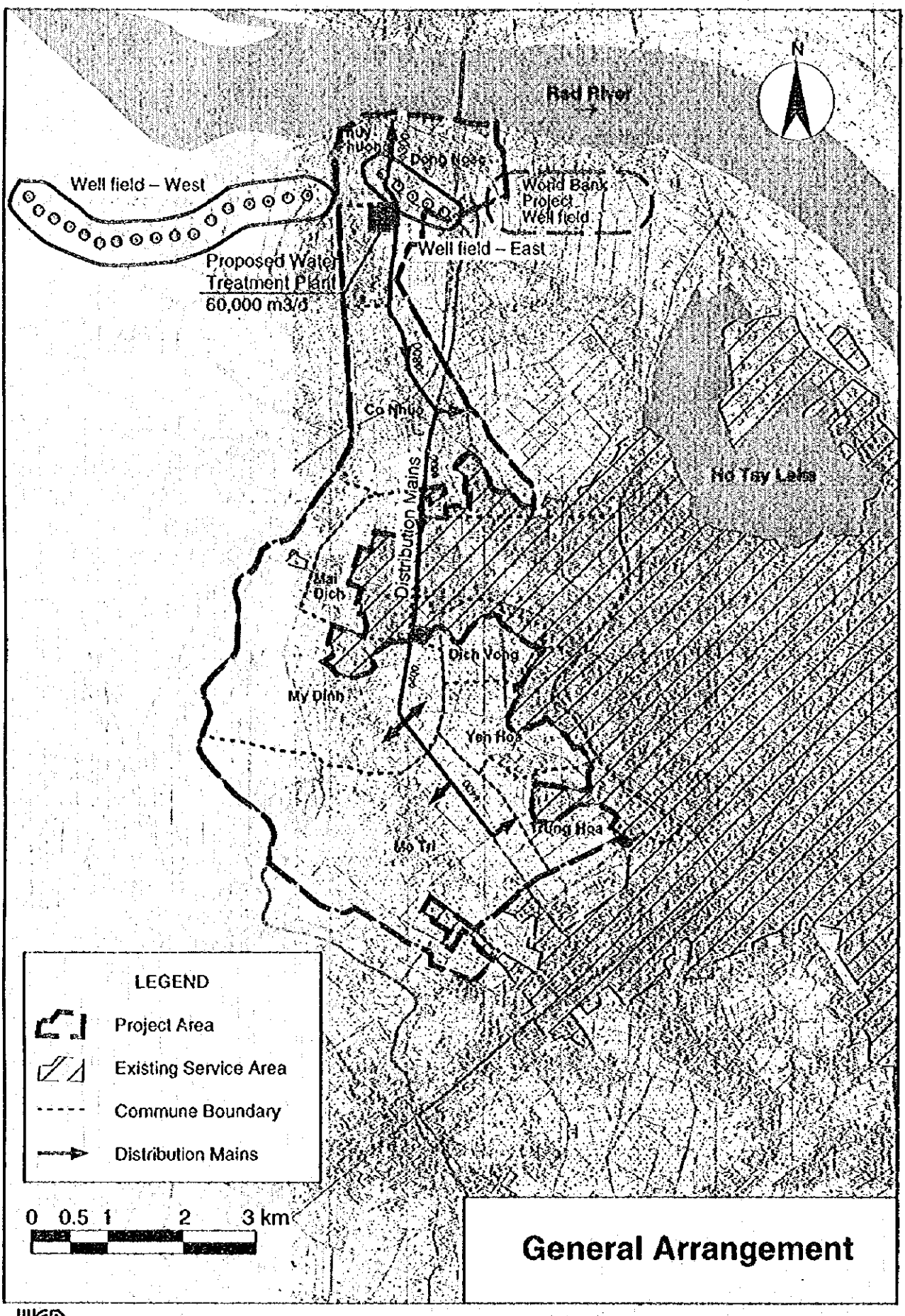
The wells have been arranged on a line which is almost parallel to the Red River dike, keeping the distance more than 700 m (ten times of the proposed well depth) from the dike. Although the arrangement on plural lines is supposed alternatively, as the lowering of drawdown of the wells arranged on the land side and the bad influence to the land side existing wells seem to occur, because of the groundwater flow line from the river to the land as stated in the M/P, the wells were arranged on a single line. Furthermore, the use of the existing roads for construction and maintenance of the proposed wells has been considered as much as possible.

(2) Location of Treatment Plant

For the location of a proposed treatment plant, three sites were taken into consideration: Site A in Xa Dong Ngac, Site B in Xa Lien Mac and Site C in Xa Co Nhue. Comparing various elements among them, Site A can be recommended for the location of the proposed treatment plant; and Site C is secondly recommended.

Site Comparison of Proposed Treatment Plant

Item	Site A	Site B	Site C
(1) Location	In Xa Dong Ngac, East of Nhue River	In Xa Lien Mac, West of Nhue River	In Xa Co Nhue, East of Nhue River
(2) Inside or outside of service area	Inside	Outside	Inside
(3) Present land use	Paddy field	Paddy field	Paddy field
(4) Land cost	Site C (Expensive) > Site A > Site B (Low)		
(5) Distance from service area	Short	Farest	Shortest
(6) Accessibility and transportation from Hanoi downtown	Good	Not convenient	Convenient
(7) Power supply possibility	Possible	Possible	Possible
(8) Raw water transmission cost	C (Expensive) > A > B (Low)		
(9) Water distribution cost	B (Expensive) > A or C (Low)		
(10) Negative impact to environment	Small	Small	Medium
Recommendation for treatment plant site	Prior recommendation	Not recommendable	Secondly recommended


N
Red River
Huy Phuong
Dong Ngac
World Bank Project Well field
Well field – West
Well field – East
Proposed Water Treatment Plant
60,000 m3/d
Co Nhue
Distribution Mains
Ho Tay Lake
Mai Dich
Dich Vong
My Dinh
Yen Hoa
Trung Hoa
Do Tri
LEGEND
Project Area
Existing Service Area
Commune Boundary
Distribution Mains
0 0.5 1 2 3 km
General Arrangement

2.3.2 Treatment process

(1) Requirement

The raw water does not satisfy the Vietnamese criteria for drinking water quality in substances of iron and manganes. The table below compares between raw water quality and drinking water criteria.

Item	Raw Water Quality	Drinking Water Criteria
Total Iron	Maximum 9.2 mg/l	Maximum 0.3 mg/l
Manganese	Maximum 0.5 mg/l	Maximum 0.1 mg/l

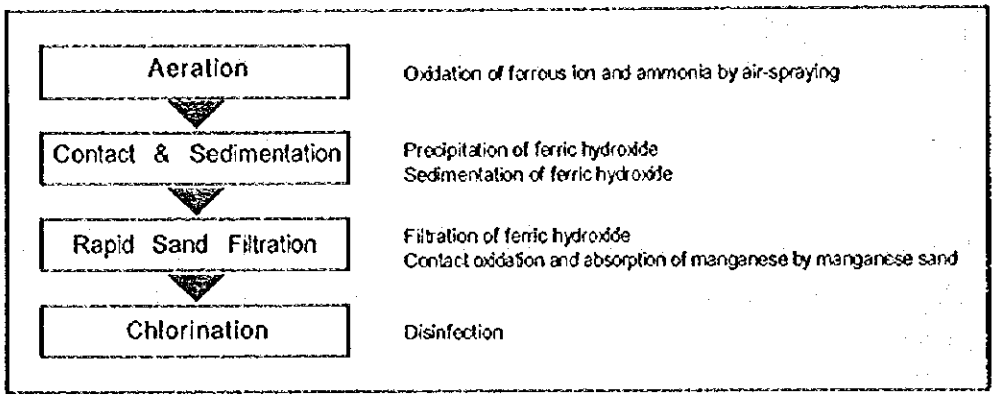
To achieve the criteria, proper treatment process should be employed. The system should be designed in terms both of technical and economical aspects.

Besides the above process, the ammonia removal should be considered because ammonia consumes chlorine used for disinfection although ammonia concentration of 1.2 mg/l clears 3.0 mg/l of the criteria.

(2) System

Aeration System is proposed for treatment process. This system has been conventionally taken into operation in Hanoi. The aeration and contact process is able enough to oxidize iron with the contact time of about 30 minutes. The longer retention time would enable a part of ferric hydroxide precipitation to settle in the bottom.

To remove manganese, the contact oxidation and adsorption by manganese sand is designed. In order to keep manganese sand in active, break-point chlorination is required.



(3) Number of Series

To supply water coincident with the water demand, it is necessary to consider the number of series and blocks of the treatment facility. Considering the water demand components in amount, the capacity of one block was decided to be 10,000 m3/d. Three blocks constitutes one series of 30,000 m3/d treatment capacity. Consequently, the maximum operational capacity of 60,000 m3/d is performed from the two series.

The multi-series system is in general more advantageous than the single-series system, because the former system can operate continuously while one series stops in repairing, cleaning or the other maintenance works.

2.4 PRELIMINARY DESIGN

2.4.1 Water Source

(1) Hydrogeological conditions and well design

Typical hydrogeological conditions of the wellfield and the proposed well design are shown in the following page. They were estimated and decided referring to the existing wells around the proposed wellfield and in the main wellfields.

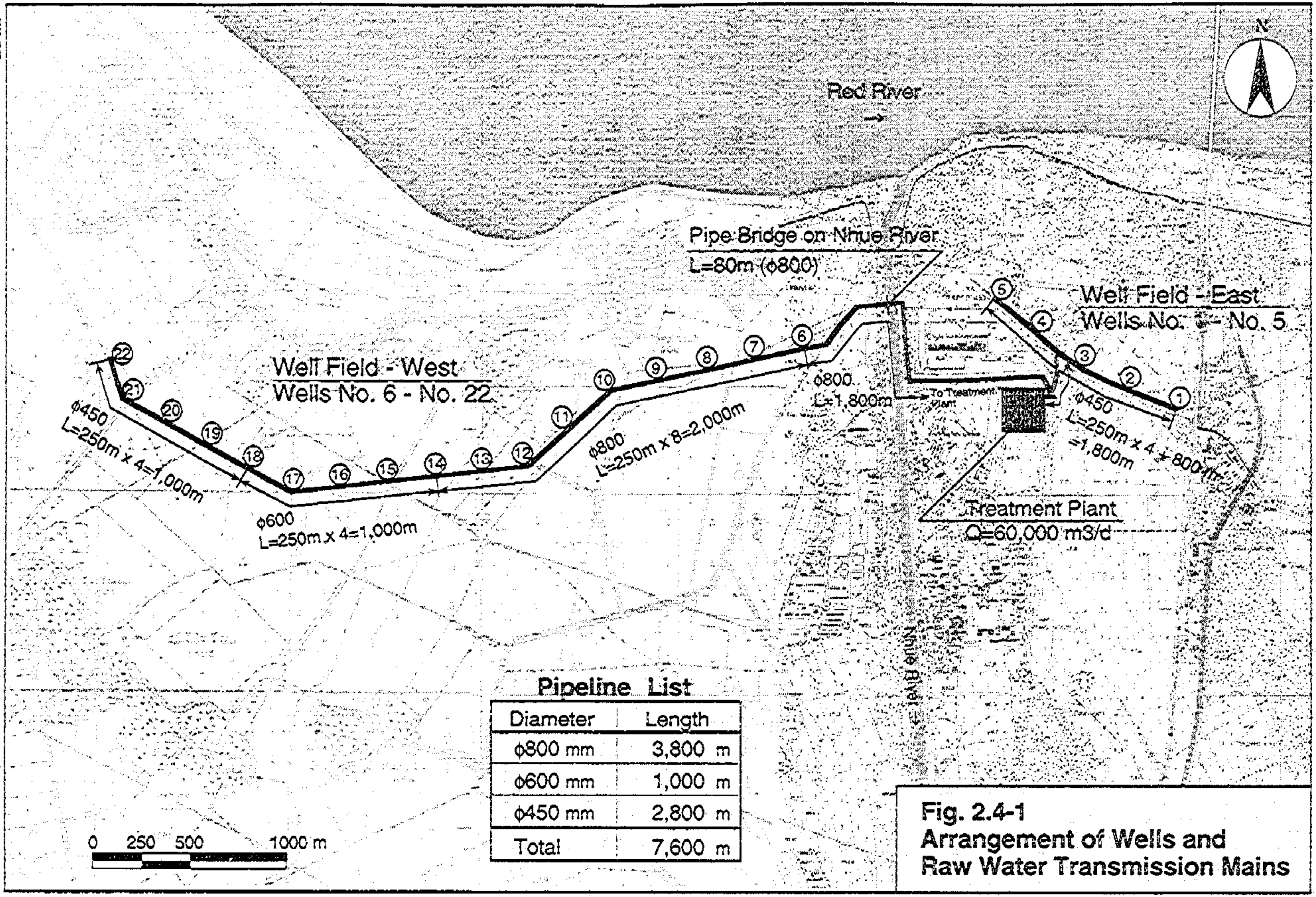
(2) Distance between wells

The distance between the adjacent wells was set 250 m referring to the existing main wellfields in the south Hanoi. If the distance between wells is 250 m, the drawdown at the middle point of the adjacent wells is calculated with the hydrogeological equation.

The calculated drawdown at the middle point of the adjacent wells is 1.18 m.

(3) Required well number

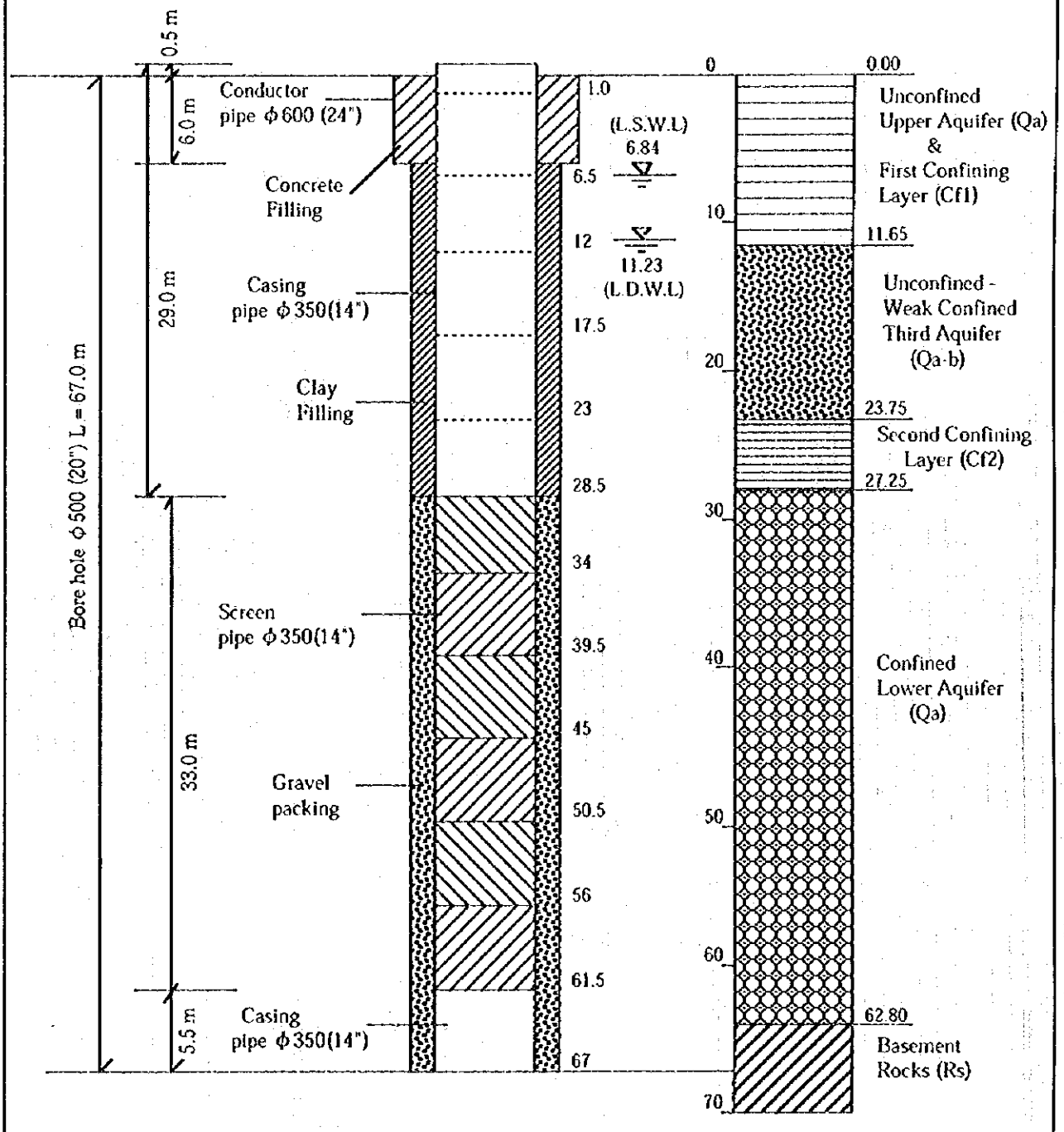
Proposed daily maximum production is 60,000 m3/d. Proposed discharge is 3,600 m3/d/well (50 lit/sec, 20 hrs pumping), and required well number is 22 {(60,000/3,600) x 130 % (including 30 % for standby)}.



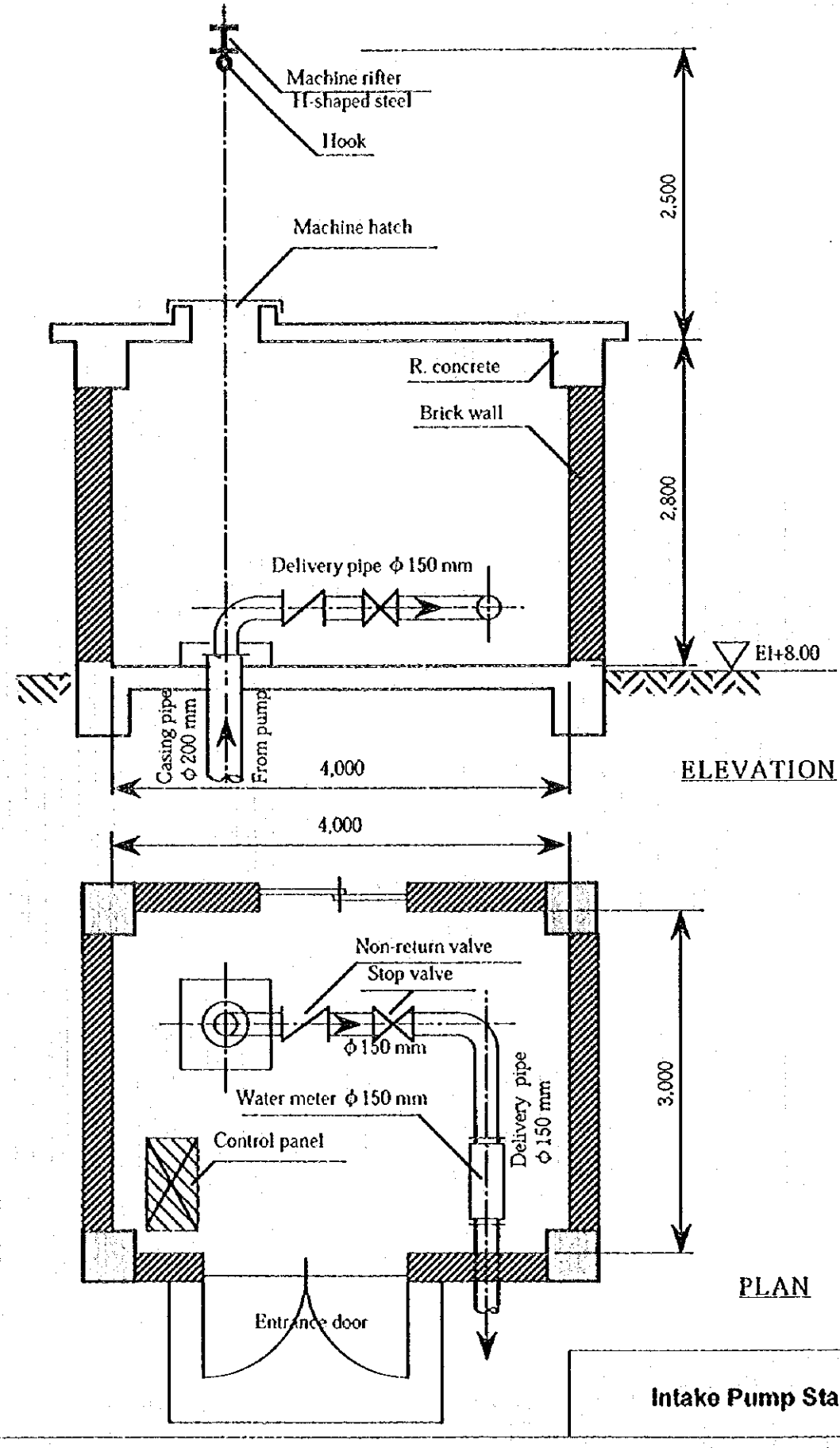
Pipeline List

Diameter	Length
φ800 mm	3,800 m
φ600 mm	1,000 m
φ450 mm	2,800 m
Total	7,600 m

Fig. 2.4-1
Arrangement of Wells and Raw Water Transmission Mains



Well Design for the Project



Intake Pump Station

2.4.2 Water Treatment Plant

(1) Design water capacity

Maximum design water capacity of the treatment plant is 60,000m3/day. The drain water from plant is estimated to be 5% of the total treatment capacity with 3,000m3/day. Therefore, the capacity of the sludge treatment facility is based on the drain water volume. For the saving of the water source, the over-flow water from the thickener is transferred to the aeration tower and, is treated for reuse. Maximum distribution water capacity at outlet of the plant is to be 57,000m3/day.

(2) Equipment

The outline of the main components are described as below :

Aeration	
Structure	Aeration tower, concrete made
	4m height with one intermediate floor
Aeration area	165 m2 x 3 blocks x 2 series
Air-spraying	Perforated spray pipes, Stainless steel

Contact Sedimentation Basin	
Criteria	
Contact period	60 minutes
Surface load	55 mm/min
Specifications	
Structure	Up-flow type concrete basin
Volume	420 m3 x 3 basins x 2 series
Sludge removal	Mechanical sludge scraper

Filtration

Criteria	
Filtration rate	120 m/d (Maximum 143 m/d)
Specifications	
Structure	Rapid sand filter, concrete made
Filtration area	42 m2 x 12 beds
Filter media	0.9 - 1.6 mm grain size sand
Filter beds	Sand layer : 1.5 m depth
	Supporting layer : gravel, 150 mm depth
Water collecting system	Nozzle type
	Supporting layer : 20 - 30 mm gravel, 150 mm depth
Backwash system	Air-scouring type
	Backwash pump : double suction centrifugal pump
	45 kW x 2 units (including one standby pump)
	Air scouring blower : roots blower
	59 kW x 2 units (including one standby blower)

Chlorination

Chemical	Liquid chlorine
Dosing equipment	Vacuum-type chlorinators
Dosage	14 mg/l (Maximum)
	5 mg/l (Average)

Distribution Reservoir

Criteria	
Capacity	20 % of the treatment capacity (= 12,000 m3/d)
Specifications	
Structure	Partly underground concrete reservoir
Volume	6,000 m3 x 2 basins

Distribution Pumps

Pump type	Single stage horizontal centrifugal pumps
Number of pumps	7 units (including 2 standby units)
Discharge capacity	10 m3/min, Total head : 58 m
Motor output	140 kW/unit

Sludge Treatment System

Sludge Reservoir Basin	160 m2 x H3.2 m x 2 basins
Sludge Thickener	ϕ14m x 2 basins
Coagulation Chemical	Alum
Dosage	50 mg/l
Sludge Drying Bed	Sun-drying type
	W16m x L32m x H2m x 5 beds

Electrical Equipment

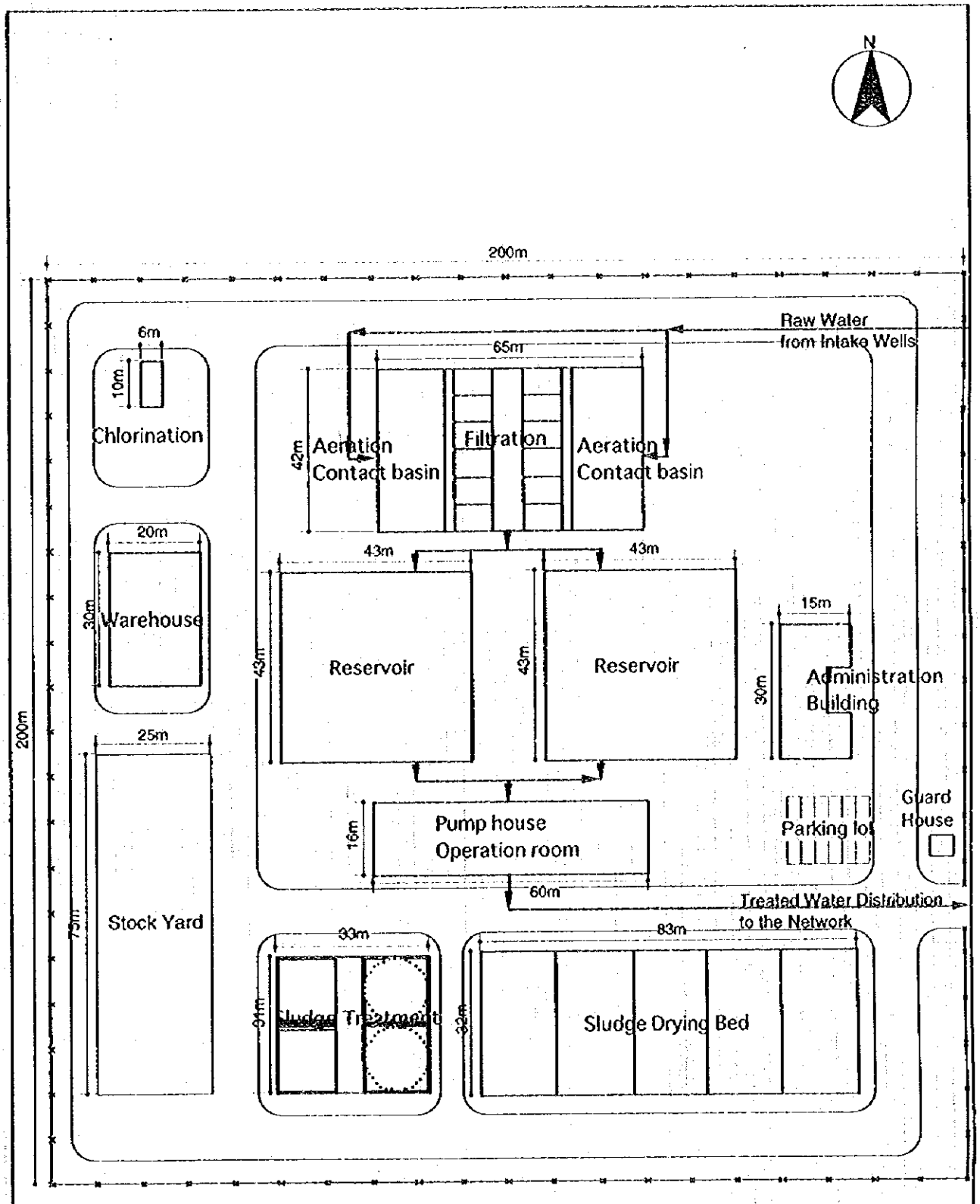
High-voltage power supply	22 kV, 3-phase, 4 wire
Low-voltage power supply	AC 380 V, 3-phase, 4 wire
	AC 220 V, single-phase
Emergency power supply	Engine generator
	Maximum 1,000 kVA x 1 unit
Center control panel with graphic board	
	Intake pumps
	Water treatment facilities
	Distribution pumps
Local panel	Backwash pump and air blower
	Chlorination equipment
	Sludge treatment equipment
	Filter console
	Sludge drying bed

Administration Building

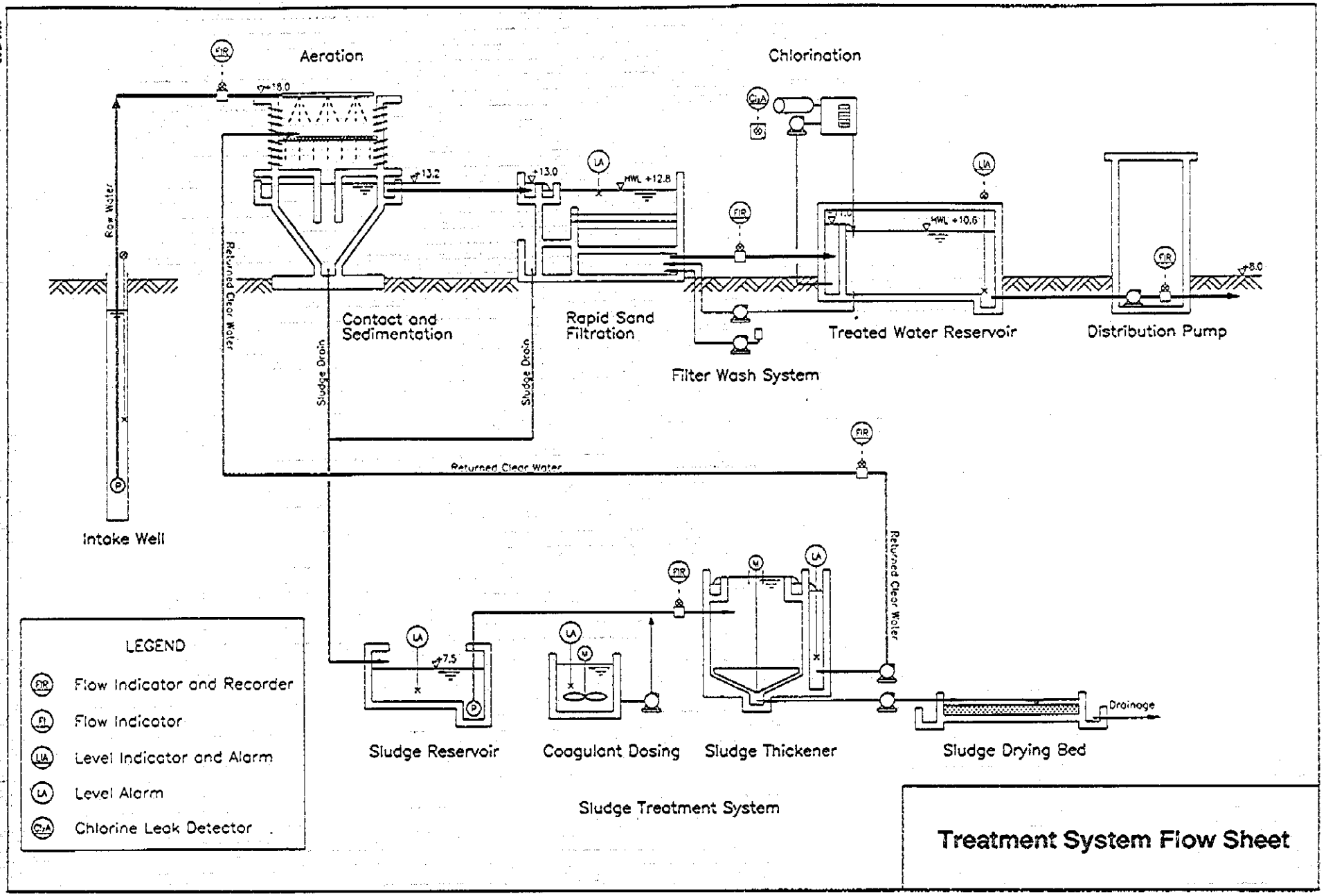
Director's room	1 room	(20 m2)
Officers' room	4 rooms	(160 m2 = 40 m2 x 4)
Staff room	2 rooms	(80 m2 = 40 m2 x 2)
Meeting room	1 room	(80 m2)
Laboratory	1 room	(200 m2)
Storage	4 rooms	(120 m2 = 30 x 4)
Rest room	1 room	(40 m2)
Shower room	1 room	(10 m2)
Toilet	2 places	(20 m2 = 10 m2 x 2)
Entrance hall	1 hall	(40 m2)
Total floor		770 m2

Pump House

Operation room	1 room	(200 m2)
Pump room	1 room	(440 m2)
Electrical room	1 room	(120 m2)
Transformer room	1 room	(60 m2)
Engine Generator room	1 room	(80 m2)
Total floor		900 m2



Tentative Layout Plan of Treatment Plant (Q = 60,000 m3/d)


Aeration
Chlorination
Raw Water
Returned Clear Water
Sludge Drain
Contact and Sedimentation
Rapid Sand Filtration
Filter Wash System
Treated Water Reservoir
Distribution Pump
Intake Well
Returned Clear Water
Returned Clear Water
Sludge Reservoir
Coagulant Dosing
Sludge Thickener
Sludge Drying Bed
Drainage
Sludge Treatment System
LEGEND
Flow Indicator and Recorder
Flow Indicator
Level Indicator and Alarm
Level Alarm
Chlorine Leak Detector
Treatment System Flow Sheet

2.4.3 Distribution Pipelines

(1) Route of the Distribution Main

The service area is long in the direction of north towards south and the treatment plant is located in the northern part of the service area. There is a wide road of the Ring Road No.3, the northern part of which is already existing and its remaining southern part is to be expanded in the future, in the middle of the service area. Accordingly, the distribution mains (Diameter: 800-400 mm) are planned to be installed on the Ring Road No.3.

(2) Pipe Diameters

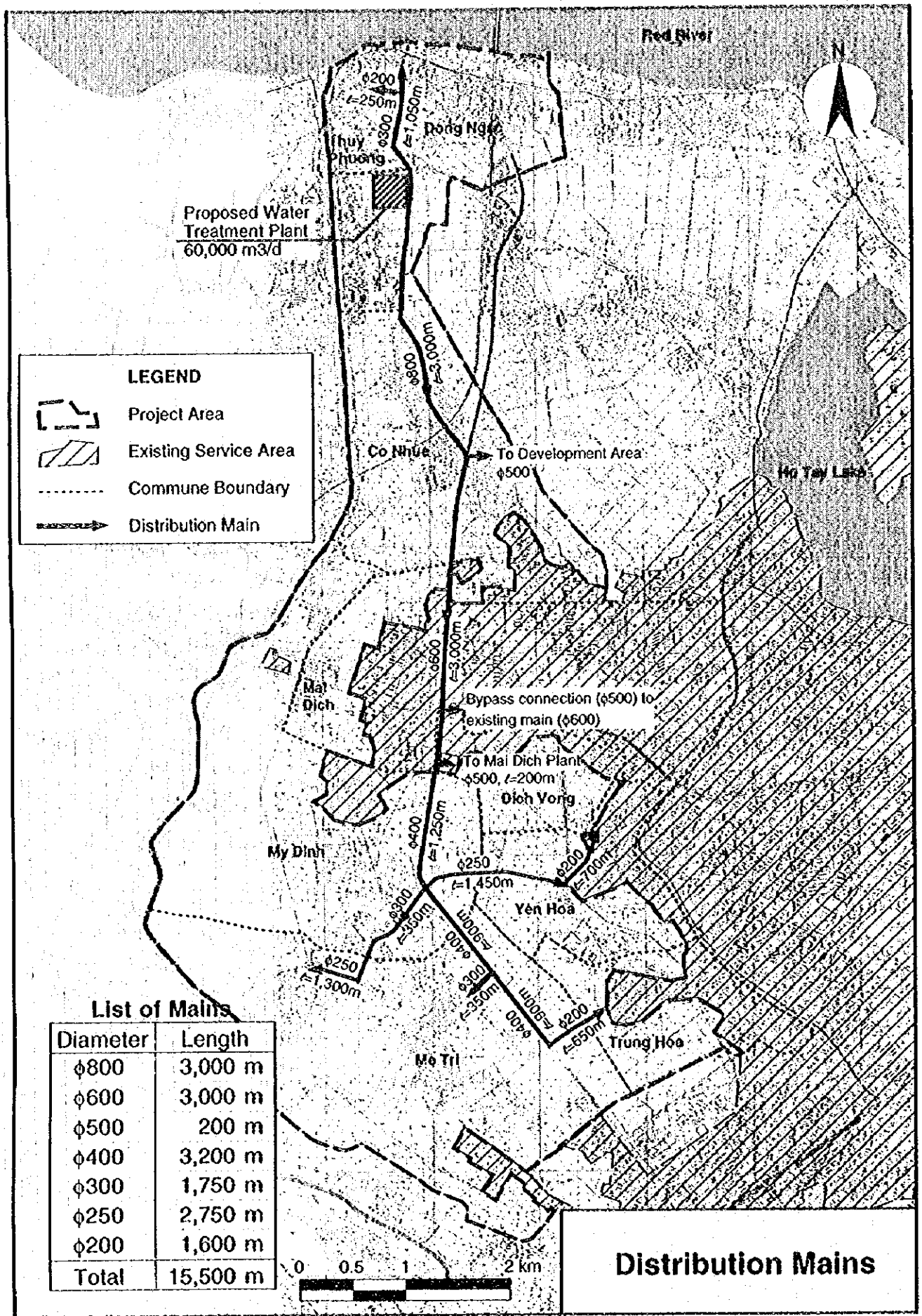
Diameters of the distribution mains were decided based on the Hazen-Williams formula, taking hydraulic gradient and flow velocity in the pipeline into due consideration, as well as residual pressure. The diameters were decided in order to meet the peak hour demand. The maximum diameter was calculated at 800 mm. The minimum diameter was determined to be 400 mm with the consideration of emergency supply to or from other adjacent service areas.

(3) Supply to Communes

Supply to communes (Xa of Dong Ngac, Thuy Phuong, Co Nhue, My Dinh, Me Tri, Dich Vong, Yen Hoa, Trung Hoa and Mai Dich) is planned to be done through distribution networks branched from the distribution mains. The branched pipes range 250-150mm in diameters and the distribution networks consist of 250-50 mm. The branched pipelines will be equipped with water flow meters (one meter to one commune) for the maintenance and operation purpose.

(4) Bulk Water Supply

The project aims to supply not only to communes above mentioned, but also to the New Development Area and to Mai Dich Supplement by way of bulk water supply. It was planned that the both would receive treated water from the distribution main (ϕ800 mm) at branched points with branch pipes of ϕ500 mm. On the branch pipes, water flow meters will be installed in order to record the water volume supplied.



List of Mains

Diameter	Length
ϕ800	3,000 m
ϕ600	3,000 m
ϕ500	200 m
ϕ400	3,200 m
ϕ300	1,750 m
ϕ250	2,750 m
ϕ200	1,600 m
Total	15,500 m

Distribution Mains

List of Distribution Networks

Network	ϕ250	ϕ200	ϕ150	ϕ100	ϕ75	ϕ50	Total Distance
① Dong Ngac (1)	630 m	880 m	3,420 m	6,150 m	2,730 m	1,270 m	15,080 m
② Thuy Phuong	-	210 m	940 m	1,690 m	750 m	370 m	3,960 m
③ Dong Ngac (2)	-	-	1,360 m	2,660 m	1,180 m	590 m	5,790 m
④ Co nhue	-	2,050 m	3,860 m	6,950 m	3,090 m	1,540 m	17,490 m
⑤ My Dinh	-	570 m	940 m	1,700 m	760 m	380 m	4,350 m
⑥ Me Tri (2)	-	720 m	1,050 m	1,900 m	840 m	420 m	4,930 m
⑦ Me Tri (1)	590 m	740 m	2,260 m	4,070 m	1,810 m	950 m	10,420 m
⑧ Others*	-	-	1,650 m	2,980 m	1,320 m	660 m	6,610 m
Total	1,220 m	5,170 m	15,480 m	28,100 m	12,480 m	6,180 m	68,630 m

Note : ⑧ Others consists of Dich Vong, Yen Hoa, Trung Hoa and Mai Dich. Most of their existing inhabited areas have existing distribution pipelines. The networks mentioned in the above list are for future residential areas. Therefore, distances of the networks pipelines in the above list were estimated in proportion to population to be served.

2.5 COST ESTIMATION

Project cost consisting of costs for facilities construction, pipelines construction, land use, engineering services and physical contingency was estimated at the year of 1997 price level. (Exchange rate: US$1.00 = VND11,000 (Vietnamese Dong)).

The total project cost estimated is:

489,034 million VND: equivalent to 44.46 million US$,

as given in Table of "Project Cost (Summary)".
For more detail, please refer to Tables of "Water Source and Treatment Plant Construction Cost", "Pipelines Construction Cost (Summary)" and its breakdowns.

Note:

As for financing, price contingency shall be added to the above cost, for future price escalation (inflation). The total financing required will be:

587,548 million VND: equivalent to 53.42 million US$.
(Please refer to Table of " Investment Schedule (Summary)".

Project Cost (Summary)

Component	Quantity	Cost (Mil VND)
(A) Facilities construction		
1) Treatment plant	60,000 m3/day x 1	112,365
2) Water source	22 well stations	34,190
	Total (A)	146,555
(B) Pipelines construction		
1) Raw water pipelines	L=7,600 m	48,241
2) Distribution mains	L=15,500 m	58,809
3) Distribution networks	L=68,600 m and 16,700 water meters	78,545
	Total (B)	185,595
(C) Land cost	L.S.	78,000
(D) Engineering services		
1) Detail design	L.S.	18,268
2) Construction supervision	L.S.	23,250
	Total (D)	41,518
(E) Base Cost (A+B+C+D)		451,668 (= 41.06 mil US$)
(F) Physical contingency		37,366
(G) Project Cost (E+F)		489,034 (=44.46 mil US$)
(H) Price contingency		98,514
(I) Total financing required (G+H)		587,548 (=53.42 mil US$)

Note:

- Cost: 1997 year price level
- Exchange rate: US$ 1.00 = VND 11,000 (VND: Vietnamese Dong)

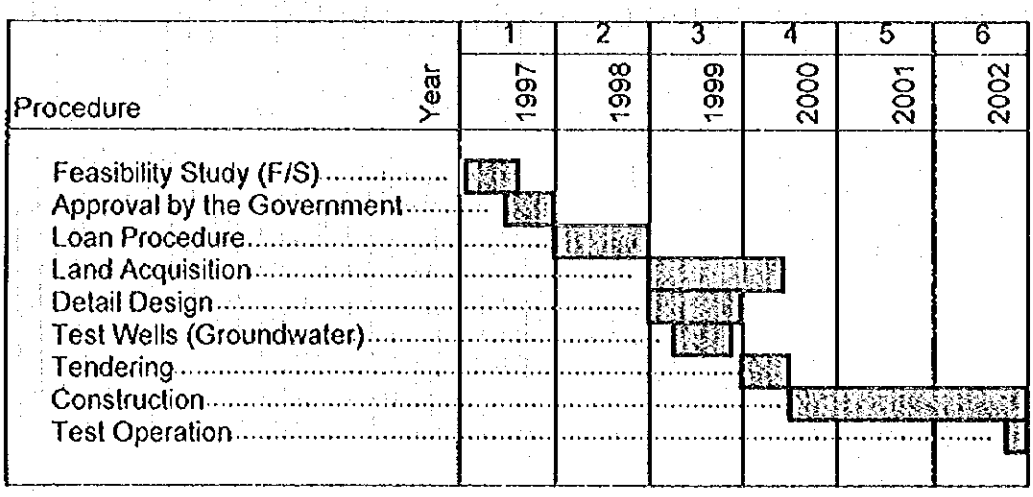
2.6 CONSTRUCTION PLAN

2.6.1 Implementation Schedule

The construction work is schedule to be done during year of 2000-2002, as shown in a chart of "Implementation Schedule". Before the construction work, various administrative procedures and preparatory activities will be required, as follows:

1) Approval and decision of the project implementation by the Government of Vietnam	By the end of 1997
2) Loan procedure including application to an international lending agency	In 1998
3) Detail design including construction of test wells for groundwater	Jan.1999 - Dec. 1999 (12 months)
4) Land acquisition or land use negotiation/ approval	Jan. 1999 - June 2000 (18 months)
5) International tendering (From tender call to award of the Contractor)	Jan. 2000 - June 2000 (6 months)
6) Construction work	July 2000 - Dec. 2002 (30 months)
7) Commencement of operation and maintenance	Early 2003

Implementation Schedule



2.6.2 Investment Schedule

Project cost, consisting of cost for facilities construction, pipelines construction, land use, and engineering services is estimated in the section of "Cost estimation". The cost estimated is the price level of the year 1997. However, the project will be implemented in years of 1999-2002; accordingly, the cost will be increased due to price escalation (inflation). Therefore, the inflation cost shall be considered for the purpose of finance preparation.

The price inflation rates predicted are 2.0% per annum for foreign currency component and 9.0% for local one, for coming future years.

The cost including price escalation will be disbursed in the manner presented in the Table of "Investment Schedule (Summary)" which corresponds to the "Implementation Schedule".

That is:

Year				
1999	83,726	million VND	(= 7.61	million US$)
2000	103,840	million VND	(= 9.44	million US$)
2001	195,419	million VND	(= 17.77	million US$)
2002	204,563	million VND	(= 18.60	million US$)
Total =	587,548	million VND	(= 53.42	million US$)

Investment Schedule (Summary)

(Unit: Million VND)

Item	Year / Component	1999 F/C	1999 L/C	2000 F/C	2000 L/C	2001 F/C	2001 L/C	2002 F/C	2002 L/C
① Construction cost		-	-	36,892	14,882	95,768	44,420	95,768	44,420
Cost = 332,150 mil VND		-		51,774		140,188		140,188	
② Land cost		-	52,000	-	26,000	-	-	-	-
Cost = 78,000 mil VND		52,000		26,000		-		-	
③ Engineering		11,874	6,394	2,790	1,860	5,580	3,720	5,580	3,720
Cost = 41,518 mil VND		18,268		4,650		9,300		9,300	
④ Base cost (① + ② + ③)		11,874	58,394	39,682	42,742	101,348	48,140	101,348	48,140
Cost = 451,668 mil VND		70,268		82,424		149,488		149,488	
= 41.06 mil US$									
⑤ Physical contingentcy		1,187	639	3,968	1,674	10,135	4,814	10,135	4,814
Cost = 37,366 mil VND		1,826		5,642		14,949		14,949	
⑥ Total cost (④ + ⑤)		13,061	59,033	43,650	44,416	111,483	52,954	111,483	52,954
Cost = 489,034 mil VND		72,094 mil VND		88,066 mil VND		164,437 mil VND		164,437 mil VND	
=44.46 mil US$		= 6.55 mil US$		= 8.01 mil UD$		= 14.95 mil US$		= 14.95 mil US$	
⑦ Price contigentcy		528	11,104	2,671	13,103	9,186	21,796	11,605	28,521
Cost = 98,514 mil VND		11,632		15,774		30,982		40,126	
⑧ Total financing required (⑥ + ⑦)		13,589	70,137	46,321	57,519	120,669	74,750	123,088	81,475
Cost = 587,548 mil VND		83,726 mil VND		103,840 mil VND		195,419 mil VND		204,563 mil VND	
= 53.42 mil US$		= 7.61 mil US$		= 9.44 mil US$		= 17.77 mil US$		= 18.60 mil US$	

Note:

- Cost: 1997 year price level
- Exchange rate: US$1.00 = VND11,000
- F/C = Foreign component and L/C = Local component
- ① "Construction cost" consists of costs for procurement of materials, freight charge (international ocean freight and island transportation), insurance and construction/ installation; however, does not include import duties for imported materials.
- ③ "Engineering" consists of costs for detail design and construction supervision.
- ⑦ "Price contigency" is for future price escalation (inflation).

Price inflation factor: 2% per annum for F/C
9% " " for L/C

Future Price Index (%, Base year: 1997 =100)

Year	1997	1998	1999	2000	2001	2002	2003
For F/C	100.00	102.00	104.04	108.24	106.12	110.41	112.62
For L/C	100.00	109.00	118.81	129.50	141.16	153.86	167.71

2.6.3 Method of Construction and Tendering

The construction work is to be carried out by the construction company/s (contractor), and the contractor will be selected and awarded through the international tender. The tenderers will be foreign companies which are capable of facilities construction of water supply projects, as well as local companies, or including local companies. Local companies may participate in the tender either independently or in the joint with a foreign company/s.

The tendering will be made in either one package or plural packages as suggested below :

Case 1 : One package (including all works)

Case 2 : Two packages

Package 1 = Facilities construction (treatment plant and water source)
Package 2 = Pipelines construction (raw water pipelines, distribution mains and distribution networks)

Case 3 : Three packages (1)

Package 1 = Construction of treatment plant (60,000m3/day)
Package 2 = Construction of water source (22 well stations)
Package 3 = Pipelines construction

Case 4 : Three packages (2)

Package 1 = Facilities construction (treatment plant and water source)
Package 2 = Raw water pipelines and distribution mains
Package 3 = Distribution networks

Case 5 : Four packages

Package 1 = Construction of treatment plant
Package 2 = Construction of water source
Package 3 = Raw water pipelines and distribution mains
Package 4 = Distribution networks

Case 6 : Five packages

Package 1 = Construction of treatment plant
Package 2 = Construction of water source
Package 3 = Raw water pipelines
Package 4 = Distribution mains
Package 5 = Distribution networks

Any case of the above is considered feasible and the decision will be made at the stage of detail design and preparation of tender documents. However, it shall be noted that any tender consist of procurement of materials and construction work. Separation of procurement and construction work will not be recommended.

CHAPTER 3 MANAGERIAL APPROACH AND ECONOMIC ANALYSIS

3 MANAGERIAL APPROACH AND ECONOMIC ANALYSIS

3.1 POSSIBLE ORGANIZATION STRUCTURE

(1) The priority project area should have one water plant and one water business enterprise in the near future (Fig.3.1-1). This is useful in order to carry out the efficient operation in production and marketing. Water plants and business enterprises should be redefined as different internal profit units because of motivating workers to reduce water leakage and increase collecting water charges. In this situation, the water plant in the priority project area should get revenue by wholesaling water to the business enterprise at the internal tariff. This tariff should be consisted of production unit cost and transmission unit cost and small profit margin. As a result, the future tariff structure should be reviewed to meet the financial objectives of HWBC.

(2) The business enterprise in this area will have the following three types of the sales transaction.

A. Retailing to the household in the project service area.

The retail tariff should be set up to the level to cover its costs which include the internal tariff, the transmission (=distribution main) unit cost, the distribution (=network) unit cost and small profit margin. The lower levels of consumption should be charged at levels in line with the full costs. On the other side the higher levels of consumption should be charged at levels higher above the full costs, with excessive consumption or wastage discouraged by charging tariff. Therefore, the progressive tariff structure should be introduced for demand management. There may be many variations but basically tariff increases in successive steps as consumption rises.

B. Wholesaling to Mai Dich water plant for supplement.

The wholesale tariff should be set up to the level to cover its costs which include the internal tariff, the transmission unit cost and the small profit margin. The distribution unit cost should not be included owing to the wholesale transaction.

C. The third is the bulk retailing to the new development area

The new development area is composed of large-sized customers such as factories and firms including foreign investment. The bulk retailing tariff should be set up to the level to get the good revenue which includes the internal tariff, the transmission unit cost and the sufficient profit margin. The bulk retailing tariff is an important source of fund in order to provide cross-subsidy to the small-sized customers in the project service area and get external funds in the midst of reducing the subsidies from HPC.

The internal tariff could be approved by Hanoi People's Committee for in the future. On the other side, the retail tariff, the wholesale tariff and the bulk retailing tariff could be approved by Hanoi People's Council.

The benchmark of adequate profit of the water plant and the water business enterprise in the priority project area should be at 5% of total costs, which is indicated by ADB and the World Bank.

In the new development area, the administration agency will be established on behalf of residential companies. The water business enterprise should provide the operation and maintenance service based on the agreement with the administration agency in the new development area.

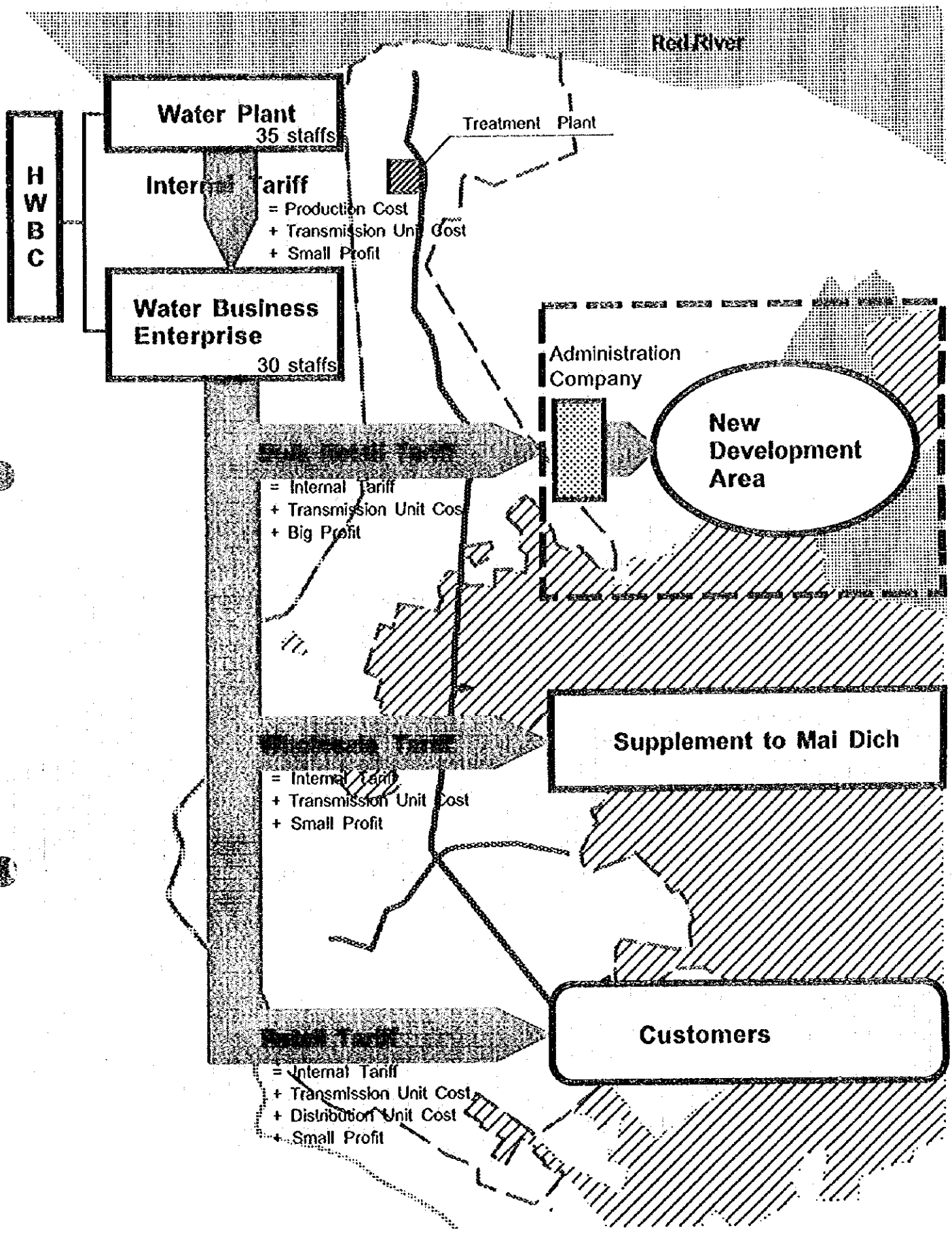


Fig. 3.1-1 Future Business Transaction (Year 2005)

3.2 WORK FORCE PLANNING

(1) For the proposed facility which has the treatment capacity of 60,000 m3/d, the work force engaged in the priority project area is assumed at 35 staff at the water plant and 30 staff at the business enterprise. This assumption is based on the following calculation.

1) Water Plant

HWBC has about 450 staff per 340,000 m3/d raw water intake capacity in 1995, which means 1 staff for 765 m3/d. On the other hand, Ho Chi Minh City Water Supply Company has about 390 staff per 675,000 m3/d raw water intake capacity in 1995, which means 1 staff for 1730 m3/d. This implies that Ho Chi Minh City Water Supply Company has the 2.3 times efficiency in the water plant work force compared with that of HWBC. According to estimation, 60,000 m3/d intake capacity will be needed in the year 2005 at the priority project area of Cau Giay in Hanoi. When we take the efficiency of work force, for example, in Ho Chi Minh City into account, 60,000 m3/d will need 35 staff at water plant.

2) Water Business Enterprise

HWBC has 727 marketing and maintenance staff per 1,275,000 people in the piped water supply area in 1995, which means 1 staff for 1,753 people. On the other hand, Ho Chi Minh City Water Supply Company has 864 marketing and maintenance staff per 2,450,000 people in the piped water supply area in the same year, which means 1 staff for 2,835. This implies that Ho Chi Minh City Water Supply Company has the 3.3 times efficiency in the work force of the water business enterprise compared with that of HWBC. According to estimation, 68,000 people will inhabit in the year 2005 at the project service area. When we take the efficiency of work force, for example, in Ho Chi Minh City into account, 68,000 people will need 25 staffs for the retail sale operation and additional five staffs for the bulk sale and wholesale operation.

3.3 DETERMINATION OF THE PROJECT COST

(1) O&M Cost

In addition to the Construction (Investment) Related Costs explained in Chapter 2.5, there are Operational and Maintenance (O&M) Costs incurred in the project.

Considering the nature of operation, same analysis method in the Mater Plan can be applied. Meaning three types of O&M Costs are to be involved. Namely, (a) O&M Costs born in the new Water Plant of 60,000 m3/d capacity (Plant O&M), (b) O&M Costs accrued for the new Water Business Enterprise in the priority project area (WBE O&M) and (c) O&M Costs allocated to the HWBC Head Office (Head Office O&M).

(2) Funding Source

Investment (Construction) related costs are presented in Chapter 2.5, and total financing amount required turns out to be 587,548 million VND (US$ 53.4 million).

Due to the current financial strain in Vietnam at both National and Municipal level in Vietnam, it is reasonable to assume that funding of the project shall be basically provided from outside the country. At this stage, OECF (The Overseas Economic Cooperation Fund) is positive to provide Yen Loan to this project. The terms of Yen Loan to the Government of Vietnam is quite generous as below.

Tenor	:	30 years (grace period 10 years)
Repayment	:	semi-annual installment
Interest Rate	:	2.3 % p.a.

It should be noted that according to the OECF guidance, funding cap of projects is 85% of total costs. This implies 15% or 88,132 million VND (US$8.0 million) equivalent of equity should be contributed from the Vietnam side. Therefore in this report, the rest amount of 499,416 million VND (US$45.4 million) funded by the OECF Loan is assumed.

3.4 DETERMINATION OF THE WATER TARIFF

(1) Water Tariffs of Three Types

A. Retail Tariff

In the project service area, customers are composed of domestic and non-domestic ones, and the latter can be broken down to state enterprises / public services, private businesses and foreigners. This is same as the present HWBC's customer portfolio, which means application of the Retail Tariff for this area.

B. Wholesale Tariff

For the supplement to Mai Dich, an internal tariff shall be applied. The WBE covering Mai Dich purchases water at this tariff and sell off to retail customers in the area. This internal tariff can be called Wholesale Tariff.

C. Bulk Retail Tariff

For the new development area, another internal tariff will be introduced. As explained in Chapter 3.1, it is assumed that an administration company shall be established in the area and the company sell water to the customers. The company enters into an O&M contract with HWBC where HWBC undertakes O&M of the new development area. So the administration company buys water at Bulk Retail Tariff from HWBC.

(2) Calculation Base

1) Annualized Water Price

Annualized Water Prices mean unit water prices for each year to cover the all project related costs given O&M Costs per AFW figures.

(a) Depreciation	Lifetime 20 years for all Constructions Straight Line Method
(b) Loan Repayment	30 years installments (Starting 1999)
(c) Interest Payment	2.3 % p.a. (Starting 1999)
(d) Regulated Profit	5% of Total O&M Costs

Based on the above assumptions, annualized water prices for three types of operations are calculated as follows :

A. Annualized Retail Price for the Project Service Area

[Annualized Retail Price (VND/m3)] = [O&M Cost (Plant + WBE + HO)]
+ [Debt Services (Principal + Interest)]
+ [Regulated Profit : 5%]

(Note)
[Debt Services (VND/m3)] = [Annual Repayment Amount (Principle and Interest) (VND/year)]
/ [Accounted for Water (m3/day)] / 365 (days/year).

B. Annualized Wholesale Price for Mai Dich Supplement

[Annualized Wholesale Price (VND/m3)] = [Annualized Retail Price]
– [WBE O&M]
– [Network Related Debt Service]

(Note) Debt Services owing to the network construction are estimated at 23.5% of total construction costs.

C. Annualized Bulk Retail Price for the New Development Area

[Annualized Wholesale Price (VND/m3)] = [Annualized Retail Price]
– [Network Related Debt Service]

(3) Tariff Setting

For financial calculations, the M/P water tariffs are applied as the basis of the Retail Water Tariffs for the project service area. Based on the M/P Tariff Table, suggested water tariffs for the priority project are presented in Table 3.4-1.

In accordance with the water consumption forecast by category, the weighted average of the M/P tariff is calculated as the Retail Water Tariff. Wholesale Tariffs and Bulk Retail Tariffs are estimated at 82% and 86% of the Retail Tariffs respectively for each year.

Table 3.4-1 Water Tariff by Categories

(VND/m3)

Year	Project Service Area				Mai Dich Supplement	New Development Area
	Retail Tariff				Wholesale Tariff	Bulk Retail Tariff
	Domestic	Sale & Public	Private & Foreign	Weighted Average		
1997	1,375	2,750	5,500	2,338	1,917	2,010
1998	1,650	3,300	6,000	2,697	2,212	2,319
1999	2,000	4,000	6,750	3,175	2,604	2,731
2000	2,425	4,850	8,000	3,817	3,130	3,282
2001	2,775	5,550	8,400	4,232	3,470	3,639
2002	3,050	6,100	9,200	4,645	3,809	3,995
2003	3,350	6,700	10,000	5,083	4,168	4,371
2004	3,625	7,750	10,800	5,577	4,573	4,796
2005	3,750	8,135	11,340	5,818	4,771	5,003
2006	3,900	8,550	11,900	6,084	4,989	5,232
2007	4,100	8,970	12,500	6,391	5,241	5,496
2008	4,300	9,420	13,120	6,707	5,500	5,768
2009	4,500	9,900	13,790	7,036	5,770	6,051
2010	4,700	10,390	14,470	7,369	6,043	6,337
↓						
2030	4,700	10,390	14,470	7,369	6,043	6,337

(Notes)
From year 2010 until 2030, water tariffs are assumed remain the same for calculation purpose.
[Retail Tariff] : The weighted average of the M/P tariff
[Wholesale Tariff] : [Retail Tariff] x 82%
[Bulk Retail Tariff] : [Retail Tariff] x 86%

3.5 FINANCIAL ANALYSIS

(1) Cash Flow Analysis

Table 3.5-1 demonstrates the Free Cash Flows until year 2030 and resulted IRR of moderate 9.03 % as a base case.

Table 3.5-1 Free Cash Flows of the Project

(million VND)

Year	Cash In Flow	Cash Out Flow		Free Cash Flow
	Total Revenue	Investment	O&M	
1999		72,094		-72,094
2000		88,066		-88,066
2001		164,437		-164,437
2002		164,437		-164,437
2003	54,276		22,294	31,982
2004	66,290		25,338	40,952
2005	76,087		29,597	46,490
2006	79,533		30,582	48,951
2007	83,549		31,624	51,925
2008	87,677		32,726	54,951
2009	91,960		33,891	58,069
2010	96,287		35,124	61,163
2011	96,287		35,124	61,163
2012	96,287		35,124	61,163
2013	96,287		35,124	61,163
2014	96,287		35,124	61,163
2015	96,287		35,124	61,163
2016	96,287		35,124	61,163
2017	96,287		35,124	61,163
2018	96,287		35,124	61,163
2019	96,287		35,124	61,163
2020	96,287		35,124	61,163
2021	96,287		35,124	61,163
2022	96,287		35,124	61,163
2023	96,287		35,124	61,163
2024	96,287		35,124	61,163
2025	96,287		35,124	61,163
2026	96,287		35,124	61,163
2027	96,287		35,124	61,163
2028	96,287		35,124	61,163
2029	96,287		35,124	61,163
2030	96,287		35,124	61,163

IRR=	9.03%

(2) Profit & Loss Projection

Table3.5-2 presents the Profit & Loss statement of the priority project until year 2030 based on the assumptions explained above. The result shows break-even point is estimated year 2004, quite early given the operation start year 2003.

Table3.5-2 Profit & Loss Statement

(million VND)

Year	Revenue	O&M Costs	Depreciation	Interest Costs	Profit & Loss
1999			3,605	13,514	-17,119
2000			8,008	13,064	-21,072
2001			16,230	12,613	-28,843
2002			24,452	12,163	-36,615
2003	54,276	22,294	24,452	11,712	-4,182
2004	66,290	25,338	24,452	11,262	5,238
2005	76,087	29,597	24,452	10,811	11,227
2006	79,533	30,582	24,452	10,361	14,138
2007	83,549	31,624	24,452	9,910	17,563
2008	87,677	32,726	24,452	9,460	21,039
2009	91,960	33,891	24,452	9,009	24,608
2010	96,287	35,124	24,452	8,559	28,152
2011	96,287	35,884	24,452	8,108	27,843
2012	96,287	36,669	24,452	7,658	27,508
2013	96,287	37,480	24,452	7,207	27,148
2014	96,287	38,319	24,452	6,757	26,759
2015	96,287	39,184	24,452	6,307	26,344
2016	96,287	40,079	24,452	5,856	25,900
2017	96,287	41,003	24,452	5,406	25,426
2018	96,287	41,958	24,452	4,955	24,922
2019	96,287	42,945	20,847	4,505	27,990
2020	96,287	43,965	16,444	4,054	31,824
2021	96,287	44,945	8,222	3,604	39,516
2022	96,287	45,955	3,605	3,153	43,574
2023	96,287	46,995	8,008	2,703	38,581
2024	96,287	48,066	16,230	2,252	29,739
2025	96,287	49,169	24,452	1,802	20,864
2026	96,287	50,305	24,452	1,351	20,179
2027	96,287	51,476	24,452	901	19,458
2028	96,287	52,681	24,452	450	18,704
2029	96,287	53,923	24,452	13,514	4,398
2030	96,287	53,953	24,452	13,064	4,818

(3) Fund Applications & Sources Projection

Table3.5-3 demonstrates the applications and sources of funds until year 2030. Overall, the table implies smooth cash flows. During the period of 2002 - 2005, there will be small negative cash positions, however, it can be easily covered by various manners such as repayment grace to the Governmental Financial Institution.

Table 3.5-3 The Applications and Sources of Funds

(million VND)

Year	Application				Source			Net Cash Position
	Total O&M Costs	Investment	Interest Costs	Loan Repayment	Cash Position from the Previous Year	Water Revenue	Loan Advance	
1999		72,094	13,514	19,585	0		587,548	482,355
2000		88,066	13,064	19,585	482,355		0	361,640
2001		164,437	12,613	19,585	361,640		0	165,005
2002		164,437	12,163	19,585	165,005		0	-31,180
2003	22,294		11,712	19,585	-31,180	54,276	0	-30,495
2004	25,338		11,262	19,585	-30,495	66,290	0	-20,390
2005	29,597		10,811	19,585	-20,390	76,087	0	-4,296
2006	30,582		10,361	19,585	-4,296	79,533	0	14,709
2007	31,624		9,910	19,585	14,709	83,549	0	37,139
2008	32,726		9,460	19,585	37,139	87,677	0	63,045
2009	33,891		9,009	19,585	63,045	91,960	0	92,520
2010	35,124		8,559	19,585	92,520	96,287	0	125,539
2011	35,884		8,108	19,585	125,539	96,287	0	158,249
2012	36,669		7,658	19,585	158,249	96,287	0	190,624
2013	37,480		7,207	19,585	190,624	96,287	0	222,639
2014	38,319		6,757	19,585	222,639	96,287	0	254,265
2015	39,184		6,307	19,585	254,265	96,287	0	285,476
2016	40,079		5,856	19,585	285,476	96,287	0	316,243
2017	41,003		5,406	19,585	316,243	96,287	0	346,536
2018	41,958		4,955	19,585	346,536	96,287	0	376,325
2019	42,945		4,505	19,585	376,325	96,287	0	405,577
2020	43,965		4,054	19,585	405,577	96,287	0	434,260
2021	44,945		3,604	19,585	434,260	96,287	0	462,413
2022	45,955		3,153	19,585	462,413	96,287	0	490,007
2023	46,995		2,703	19,585	490,007	96,287	0	517,011
2024	48,066		2,252	19,585	517,011	96,287	0	543,395
2025	49,169		1,802	19,585	543,395	96,287	0	569,126
2026	50,305		1,351	19,585	569,126	96,287	0	594,172
2027	51,476		901	19,585	594,172	96,287	0	618,497
2028	52,681		450	19,585	618,497	96,287	0	642,068
2029	53,923	72,094	13,514	19,585	642,068	96,287	587,548	1,166,787
2030	53,953	88,066	13,064	19,585	1,166,787	96,287	0	1,088,406

(4) Affordability Consideration

As for affordability of the customers against the suggested Water Tariffs, Affordability Analysis in the Master Plan proves that even Low Income Household will be able to pay the suggested charges until year 2010.

(5) Sensitivity Analysis

Regarding items to be reviewed, (a)O&M Costs, (b)UFW and (c)Water Tariffs are selected as the most influential parameter.

Table 3.5-4 shows the calculation outcomes. Naturally, Water Tariff change has the biggest impact on IRR of the project. The table points out that in order to achieve high IRR, drastic jump up of Water Tariff is required.

Table 3.5-4 Sensitivity Analysis

O & M Costs

Factor	IRR(%)
0.90	10.04
0.95	9.47
1.00	9.03
1.05	7.95
1.10	6.70

UFW

Factor	IRR(%)
0.80	10.46
0.90	9.70
1.00	9.03
1.10	8.26
1.20	7.54

Tariffs

Factor	IRR(%)
1.20	13.64
1.10	11.45
1.00	9.03
0.90	6.58
0.80	4.01

(6) Conclusion

(a) The proposed priority project will have moderate Financial IRR (FIRR) of 9.03%, which is higher than the suggested funding cost and is higher than the prevailing long-term interest rate in Vietnam.
(b) The repayment of the loan principal and interest can be covered by the anticipated free cash flows.
(c) The suggested water tariff table is within the affordability target.

Therefore, from the view point of financial analysis, the priority project is feasible.

3.6 ECONOMICAL ANALYSIS

For the project evaluation from the economic aspect, Economic Internal Rate of Return (EIRR) shall be calculated for the period until 2030, same as the calculation on FIRR.

For economic costs, Investment Cost and O&M Costs calculated in the financial analysis in Chapter 3.5 will be utilized.

In this study, regarding the economic evaluation, solely direct economic benefits to the priority project area shall be considered. Indirect quadratic benefits to Hanoi City such as facilitation of CBD development and cubic benefits to Countrywide such as multiplier effect of construction component purchases are rather difficult to be quantified due to lack of sufficient information.

(1) Economic Benefits

By installing the new water supply system in the priority project area, the following economic benefits can be expected :

(a) Reduction of waterborne diseases contraction
(b) Reduction of the infant mortality
(c) Land value hike
(d) Improvement of living standard
(e) Contribution to tourism promotion

However, improvement of living standard like facilitation of washing cloths/dishes, and bath taking are not suitable for quantification. And tourism statistics for this area is not available as of June 1997. Therefore, benefits (a), (b) and (c) shall be focused to determine the quantified economic benefits.

A. Reduction of Waterborne Diseases Contraction

Economic benefit from the reduction of waterborne diseases is calculated as follows :

[Population (persons)] x [Contraction Rate : 0.0117] x [Opportunity Medical Cost (US$)] x [Reduction Rate : 0.4] x 11,000 (VND/US$)

B. Reduction of Infant Mortality

Economic benefit from the reduction of infant mortality shall be :

[Population (persons)] x [Mortality Rate : 0.044] x [PV of Opportunity Lifetime Income per Person (US$)] x [Reduction Rate : 0.15] x 11,000 (VND/US$)

c. Land Value Hike

The value of land (to be precise, value of land usage) shall be increased if new water supply system is provided. For this calculation, assumptions made in the Study on Wastewater Disposal System in Hanoi are taken into consideration.

(a) Project service area is 2,342 ha.
(b) Current land value of urban area is US$400/m2.
(c) Expected increase in value will be 2.0%p.a. until year 2010, more conservative than 5.0% of the wastewater study.

(2) Cost – Benefit Analysis

Table 3.6-1 demonstrates quantified economic Cost - Benefit Analysis for the priority project area. The bottom line shows medium level EIRR of 9.60%.

Table 3.6-1 Economic Cost - Benefit Analysis

(million VND)

	Benefit			Cash Out Flow		Net Benefit
	Diseases Reduction	Mortality Reduction	Land Value Increase	Investment	O&M	
1999				72,094		-72,094
2000				88,066		-88,066
2001				164,437		-164,437
2002				164,437		-164,437
2003	127	18,209	51,524		22,294	47,566
2004	135	20,958	52,554		25,338	48,309
2005	142	23,840	53,606		29,597	47,991
2006	148	26,224	54,678		30,582	50,466
2007	152	28,846	55,771		31,624	53,145
2008	155	31,731	56,887		32,726	56,047
2009	159	34,904	58,024		33,891	59,196
2010	162	38,395	59,185		35,124	62,618
2011	162	38,395	59,185		35,124	62,618
2012	162	38,395	59,185		35,124	62,618
2013	162	38,395	59,185		35,124	62,618
2014	162	38,395	59,185		35,124	62,618
2015	162	38,395	59,185		35,124	62,618
2016	162	38,395	59,185		35,124	62,618
2017	162	38,395	59,185		35,124	62,618
2018	162	38,395	59,185		35,124	62,618
2019	162	38,395	59,185		35,124	62,618
2020	162	38,395	59,185		35,124	62,618
2021	162	38,395	59,185		35,124	62,618
2022	162	38,395	59,185		35,124	62,618
2023	162	38,395	59,185		35,124	62,618
2024	162	38,395	59,185		35,124	62,618
2025	162	38,395	59,185		35,124	62,618
2026	162	38,395	59,185		35,124	62,618
2027	162	38,395	59,185		35,124	62,618
2028	162	38,395	59,185		35,124	62,618
2029	162	38,395	59,185		35,124	62,618
2030	162	38,395	59,185		35,124	62,618

EIRR = 9.60%

(3) Conclusions

The calculated EIRR is not so high at best. However, considering the 'said to be' around 10% opportunity cost of capital in Vietnam and the urgent social purpose of the project, this figure is within the acceptable level. Therefore, from the view point of economic analysis, the priority project is feasible.

CHAPTER 4 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

4 ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

As for the priority project to be examined in detail in the phase of the feasibility study, methodology of environmental impact assessment (EIA) were considered and consulted with the Vietnamese authorities.

4.1 ENVIRONMENTAL SITUATION OF THE PROJECT AREA

The priority project area consists of some suburban settlements and agricultural land at present. However, this area is the most potential area in the west Hanoi and is expected to be rapidly developed, because there exist many important transportation systems such as national roads No.32 and No.6 which connects future new city areas as well as existing cities, Thang Long Road which connects Noi Bai international airport and is to be a part of Ring Road No.3, and Thang Long Bridge which connects the south Hanoi (SARR) and the north Hanoi (NARR) by a road and a railroad. Therefore, several development plans have been proposed in this area.

At the north end of the project area, the Red River flows and provide the area with water for irrigation or for recharging groundwater. At the west end of the project area, the Nhue River flows and functions as irrigation and drainage channel.

There are a small settlement, some official institutes and some factories around the proposed water treatment plant.

According to the IEE study, there is no restricted area for development project in the project area.

4.2 IMPACT OF THE PROJECT IMPLEMENTATION TO THE ENVIRONMENT

(1) Preconstruction stage

The plan of safe and stable water supply to the area would bring beneficial effects on social environment, namely it would strongly lead residential, industrial and commercial development of the area.

The facilities are proposed in the area where they will never cross the reserved/restricted area, never divide the existing communities, or never affect the existing transportation systems.

The exploitation discharge of groundwater proposed in the project is about 50,000 m^3/day, which falls within the limited exploitable capacity in the area. Therefore, the groundwater exploitation would never cause land subsidence and never damage the existing structure. On the other hand, a part of exploited water in this area will transferred to the existing Mai Dich water supply system as a supplementary support and will help the system to reduce discharge volume from its wellfield, which would contribute to recover severely depressed groundwater level in the Mai Dich wellfield. The wellfield is proposed at the sites sufficiently distant from the river bank, according to the Vietnamese Law of Dike.

Wellfield and water treatment plant are planned in the existing rice paddies and transmission mains are planned to be laid under the existing roads. Therefore, no houses will be demolished or no people will be displaced by this project, though about six (6) hectares of site acquisition will reduce an agricultural productivity and the farmers' earnings to some extent.

The sites for facilities proposed by the project are in the existing rice paddies and the extent of site clearing and demolition will be limited to about six (6) hectares. Therefore, the project would not affect topography, geology, soil or wildlife.

(2) Construction stage

Drilling wells will be operated under the ordinary control not to disturb hydraulic condition in the ground, which would never contaminate groundwater or never disturb the water use in the surrounding area. The work will generate noise and vibration to some extent, however its impact to the surrounding area would be limited because there scarcely exist houses around the proposed wellfield.

Raw water taken from the proposed wellfield on the west side of the Nhue River will be transmitted to the proposed water treatment plant. A transmission pipe will cross the Nhue River through a pipe-bridge and it will never damage the river structures. It will run underground before/after crossing the Nhue River, and its construction works would temporarily damage a few house lots on the east side of the river. It would also cause noise and interfere the traffic on the both sides. However those impacts would be quite slight and temporary. Because the number of houses and the traffic volume affected by the construction works would be limited and the construction sites will be restored to its former state after laying a pipe in the ground.

Construction works of water treatment plant will increase traffic volume on the surrounding roads to carry construction materials. However present traffic volume on the roads is very few, and the impact would not so serious as a traffic jam would happen. The works would generate noise and vibration and affect inhabitants or institutes in the adjacent area to some extent.

Construction works of distribution mains would interfere the traffic on the narrow road running through the existing settlement such as Co Nhue. The works would also generate noise and vibration to some extent, however its impact to the surrounding area would be limited. Because, the construction site will move at an ordinary pace of about 30 meters per day and the working time will be limited only in the daytime of weekdays. All construction sites will be restored to its former state after laying a pipe in the ground.

(3) Operation Stage

Excessive groundwater discharge would lower the groundwater level seriously which would result in land subsidence and increase of inundation risk, if the operation will be poorly managed.

New water supply system proposed by the project will increase sewage volume in proportion to the increase of supplied water. It would affect the quality of water bodies in the area, if the sewage will not be properly treated.

Water will be continuously supplied to customers with enough pressure at least twice as much as the existing water supply systems in Hanoi. Therefore not only the existing risk of using polluted water drawn from shallow wells but also the risk of being polluted by wastewater due to insufficient water pressure will be avoided even at the end of service area. It would undoubtedly improve hygienic condition in the area.

(4) Summary of Negative Impacts

The estimated negative impacts are summarized as below :

Summary of the Negative Impacts

Stage	Viewpoints	Negative Impacts
Preconstruction Stage	Scio-Economy	A loss of agricultural productivity and earnings
Construction Stage	Noise and Vibration	Noise and Vibration by construction work
	Traffic Interruption	Traffic interruption by construction work
Operation Stage	Sewage	Increase of Sewage

4.3 MEASURES AGAINST THE NEGATIVE IMPACT

Monitoring level and quality of groundwater around the proposed wellfield is recommended to take all possible measures against land subsidence and deterioration of water quality, even if a risk of such environmental impacts is not predicted. At the beginning stage of the project implementation, test well survey should be implemented to hydrogeological conditions at the wellfield which will be used for a groundwater simulation using the existing model developed by the Vietnamese authority. After that, the wells would be utilized to monitor the groundwater level and quality periodically.

As for the acquired land of about six hectares and the persons who will lose earnings gotten from the agricultural activities at the land, an appropriate compensation will be made. The land and the persons to be affected temporarily by the construction will be also compensated.

During the construction period of laying pipes under the roads, watchmen will be put at the site and control the traffic. Construction wastes will be dumped to a landfill. As a general rule, construction works will not be done in the nighttime nor on a holiday not to cause a problem of noise and vibration.

The proposed water treatment plant will install sludge treatment process and backwash water will be never discharged directly to a drain. At the sludge drying bed, water in sludge will be filtered and discharged to a drain. Remained sludge will be dried and dumped to a landfill. Facilities which are tall or generate noise/odor will be constructed at an enough distance from adjacent houses or institutes.

4.4 GENERAL ASSESSMENT

Even if this water supply project would not be implemented, the area would be rapidly urbanized and its environmental conditions would change so much because of its high potential. Under such conditions, commercial or industrial users would exploit groundwater uncontrollably which might cause land subsidence, or domestic users would draw water from a shallow well or install a private water tank which might cause hygienic problems. The area would not be able to realize a sound urban development without safe and stable water supply systems.

In general, most impacts caused by the project are considered to be positive. Negative impacts are predicted to be small. Therefore the project is feasible from the viewpoint of environmental consideration if the aforementioned negative impacts will be carefully taken into consideration and necessary mitigating measures will be implemented.

CHAPTER 5 SOCIAL ANALYSIS

5 SOCIAL ANALYSIS IN THE PROJECT

The study team has selected the priority project area for the city water supply project. The location of the priority project area consists of 9 communes : Thuy Phuong, Dong Ngac, Co Nhue, My Dinh and Me Tri in the Tu Liem District (5 communes), and Mai Dich, Dich Vong, Yen Hoa and Trung Hoa in the Cau Giay District (4 communes).

5.1 OBJECTIVES OF SOCIAL ANALYSIS

The objectives of the social analysis are to obtain information on the present situation of the proposed priority area, and to feed back the findings to the feasibility study which will be made balanced in the implementation plan of priority projects in the future.

5.2 RESULTS OF SOCIAL ANALYSIS

(1) Beneficiaries and Advantageousness by the Priority Project

A. Improvement of Health

According to data from the economical analysis, in quantifying the economic benefit of the hygienic aspect by the projected water supply, two elements shall be considered, namely, reduction of waterborne diseases and reduction of infant mortality.

B. Improvement of Convenience

According to the questionnaire survey on non piped-water service area, 76% of housewives in DID and rural areas have the duty for taking water in total of DID and Rural areas, 43% spend 20 - 40 minutes, 25% spend 40 - 60 minutes to spend to access water every day.

After construction of the piped-water supply system, most women will be free from this hard work duty.

(2) Disadvantages to Residents by the Priority Project

According to the IEE study, there is no restricted area for development project in the project area. The facilities are proposed in the area where they will have no effect on the reserved/restricted area, no effect on existing communities, or no effect on the existing transportation systems. But there are several small negative impacts during each stage of pre-construction, construction and operation.

(3) Residents Participation for the Project

Based on the survey in the workshop, the residents have ambitious to participate in the project. Their activities, for examples, are to check water leakage inside houses and notify the Water Business Company. Campaign for saving water should be participated in by local residents.

(4) Practical Use of the Resources in the Project Area

Permission for taking groundwater is executed by the Ministry of Industry. At the initial stage of the project implementation, test wells will be drilled to confirm hydrological conditions at the well field which will be used for groundwater simulation using the existing model developed by the Vietnamese authorities.

Well fields and water treatment plants are planned in the existing cultivation lands and transmission main are planned to be laid under the existing road. Therefore, no houses will be demolished or people displaced by this project. Under this situation it project coordination is necessary for the land use and acquired land among the related government agencies.

(5) Receptivity on the Cultural Background

Their change of water use by house connection may produce surplus time, that can be used for other activities. Instead of it, their relationship through housewives' gossips that have been taken place everyday may become weaker.

In conclusion, execution of this project will be receptive to resident's in cultural behavior and retain permanency of the project.

5.3 EVALUATION AND RECOMMENDATIONS OF SOCIAL ANALYSIS

Evaluation of the social analysis is summarized in Table 5.3-1.

Table 5.3-1 Summary for Evaluation of Social Analysis

Items	Evaluation	Remarks
Beneficiaries and advantages	A	Improvement of health condition & convenience
Disadvantageousness residents	A	Nothing remove the existing communities
Fairness of effects	B	Affordable water charges to be considered
Residents participation	A	Residents have positive opinion on cooperation for maintain of the supply system and save-water campaign
Practical use of resources	A	To coordinate rights to use of groundwater and land
Receptivity on the cultural background	A	Project will be receptive by the residents with traditional customs

(Note)
A : No affect, B : Small affect, C : Causing affect

Results from the above-mentioned evaluation, if small affects are carefully taken into consideration and mitigating measures are implemented, most impacts caused by the project to be positive. Especially, clean water supply will make healthy living condition and convenience for daily life of bathing, washing and sanitation. And there are no conflict for relocation of the residents, and traditional customs on the religious and their own lifestyle.

Therefore the project is recommendable from the viewpoint of social analysis.

PART IV

RECOMMENDATIONS

SUPPORTING REPORT D RECOMMENDATIONS

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CHAPTER 1 RECOMMENDATIONS FOR THE MASTER PLAN

1 RECOMENDATIONS FOR THE MASTER PLAN

(1) Periodical Review of the Master Plan

The Master Plan for the public water supply systems in this report was formulated at the time of the middle of 1996. It is based on the growth of population and water demand as well as development of economical activities and public infrastructures to be constructed according to future city planning. However, they would tend sometime to be changed year by year. It is necessary to review and revise the water supply master plan taking actual status of the city into account. It is therefore recommended that the master plan be revised to be updated periodically, every three to five years, reflecting the actual development of the city and actual increase of population and water demand.

(2) Promotion of Rural Water Supply Systems

In order to realize construction of the water supply systems in the rural areas, strong assistance by Hanoi Peoples Committee with finance (for example: subsidy for construction cost to rural communes) would be necessary. Propaganda or campaign for promotion of the public water supply systems also would be required.

(3) Control of Groundwater

Laws and regulations related to the development of the water resources, particularly from the viewpoint of water resources protection, have not been enacted yet. Therefore, at present, there is no actual control of the development of the water resources.

In water resources development, particularly in the groundwater development through the private wells, it is required to be controlled theoretically from the view point of hydrogeology, in order to avoid serious environment impacts. Therefore, immediate enactment and effect of the laws and regulations are recommended.

(4) Water Resources Development

1) Groundwater

A. South Hanoi

In South Hanoi, a computerized groundwater model has been established and it enables to simulate groundwater conditions in future using the regularly monitored data through the established network of observation wells. As described in the "Water Master Plan" of FINNIDA in 1993, exploitable groundwater of 700,000 m^3/d is estimated with the simulation.

Although present water use in the South Hanoi is within the approval of the State (700,000 m^3/d), some extent of environment problem such as land subsidence, which seems to be caused with the excessive groundwater exploitation, is seen partially. Therefore, continuous observation of the groundwater level, groundwater quality and land subsidence through the existing monitoring network are required. The inspection or revise, if necessary, of the groundwater model should be carried out using new observation data.

B. North Hanoi

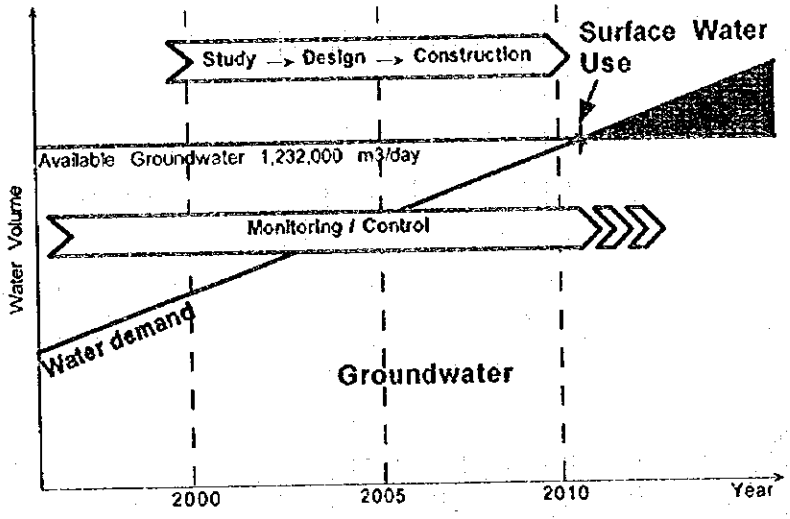
In this study, exploitable groundwater in the North Hanoi in future is estimated through the analysis based on the results of the simulation study in the South Hanoi mentioned above.

According to the Hydrogeological Division K2 of the Geological Survey of Vietnam, a computerized groundwater model has been established already also in the North Hanoi. A sufficient network of observation wells, however, has not been established yet in the North Hanoi, therefore, the groundwater model has not been calibrated enough.

Immediate establishment of the network of observation wells and data collection through them are desired. The confirmation of the estimated exploitable groundwater in the North Hanoi with sufficient calibration using the collected data is recommended.

2) Surface Water

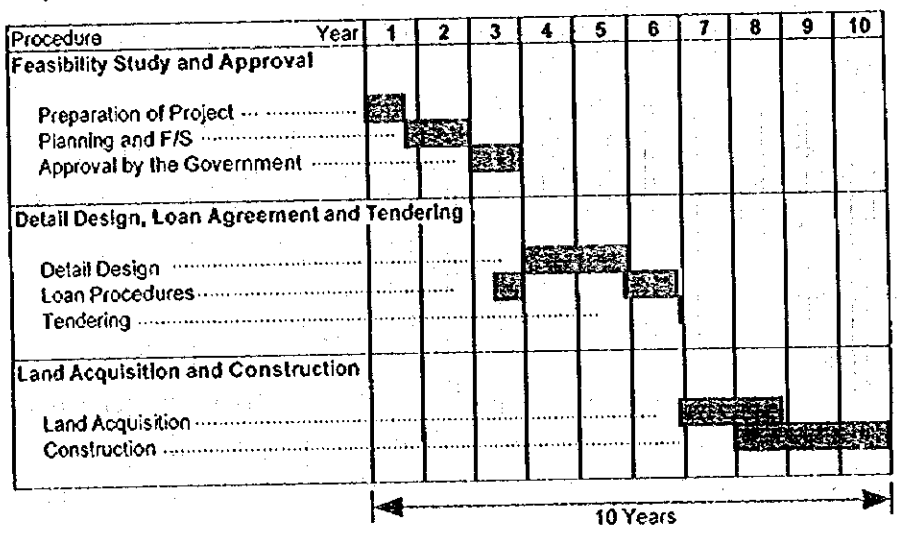
Up to the year 2010, the groundwater can be available for the source of the water supply system in the whole Hanoi. However, as the budget of the groundwater will reach its limit soon after 2010 (See Figure below).



Water Sources Development

The implementation of the surface water intake project would take more or less seven-eight years or so, including detailed study and feasibility study period, in addition to construction period (see Table below: Implementation Schedule). Therefore, commencement of the study for the surface water use at the early time, in the year 2000 at the latest, is recommended. The earlier commencement of the study is recognized better.

Implementation Schedule



(5) Monitoring of Water Quality

For the present, groundwater is safer, cheaper and more convenient water source than surface water. However, a contamination risk caused by insufficient control of wastewater and solid waste seems to increase endangering the aquifer. It is recommended to continue the systematic groundwater monitoring of water quality as well as water level and to supplement monitoring items which can show a contamination by human activities.

Existing monitoring data and the survey results of river water quality show high concentration values of arsenic, lead, phenol and organophosphate compared with the water quality criteria. These data were obtained from occasional samplings and from monthly samplings for only one year. Therefore, further consecutive monitoring of river water is recommended for more reliable conclusions.

(6) Necessary Measures for Utilizing River Water

It is predicted that it would be necessary to use surface water after the year 2010, because the total volume of exploitable groundwater will become insufficient for the rapidly growing needs. Therefore, it is strongly recommended to take necessary measures against water pollution before utilizing the rivers for water supply, if sufficient monitoring data will conclude water pollution of the Red River, the Da River and the Cau River.

Firstly, it is needed to analyze the mechanisms of river water pollution and to identify the pollution sources. Secondly, a goal of water quality to be maintained should be clarified according to the criteria for water supply. Thirdly, it is needed to identify effective and feasible measures including legal controls. Finally, all measures should be urgently commenced and water quality of the rivers should meet the requirements for water supply at latest by the year 2010.

(7) Preparation of Drainage Systems

Development of water supply systems will result in an increase of corresponding volume of wastewater. If the wastewater will be never properly drained or treated, it will percolate into aquifers and a contamination risk of groundwater will increase.

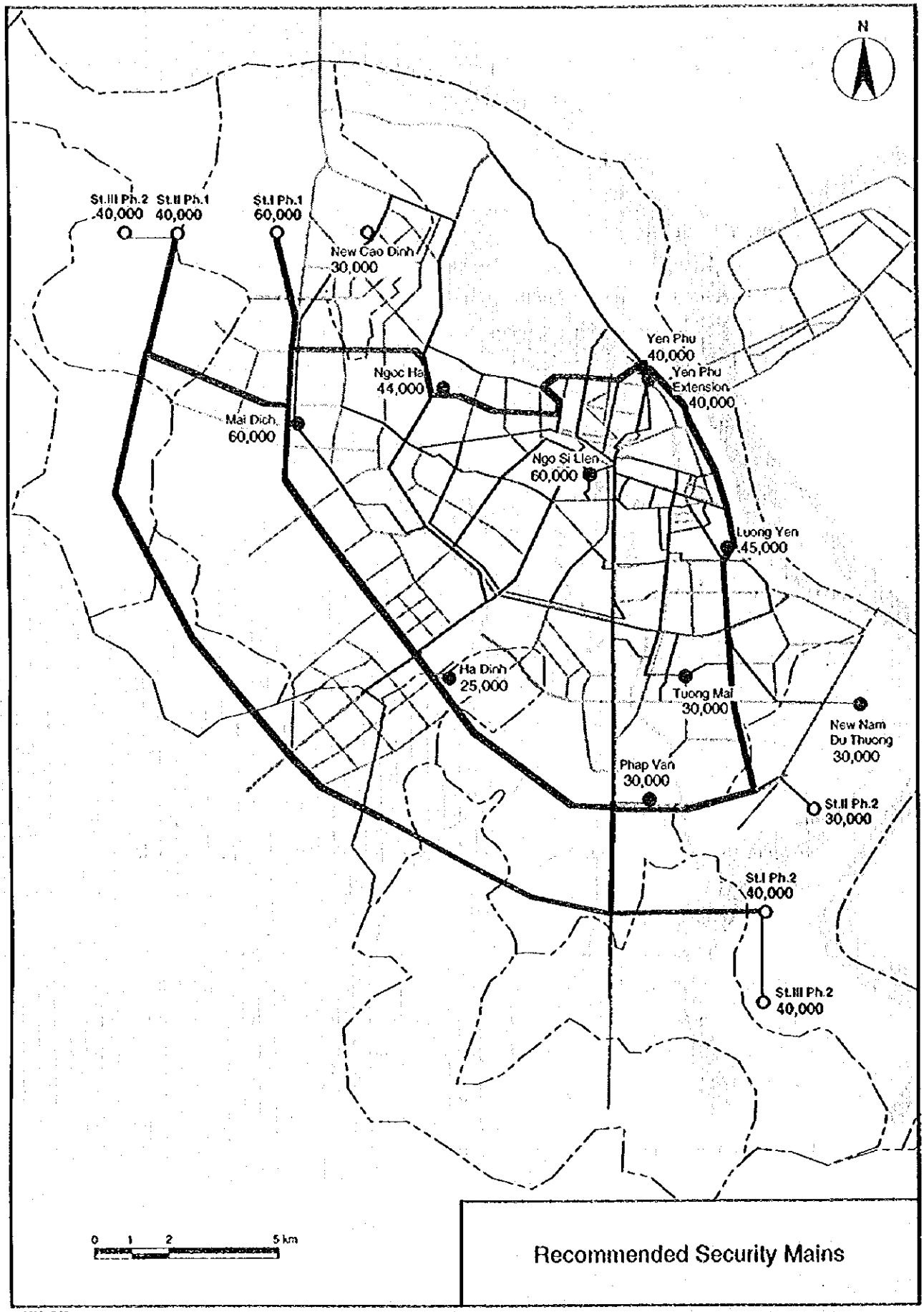
Therefore, it is recommended to prepare drainage or sewerage systems in parallel with the development of water supply systems.

(8) Increase of Reservoir Capacity

According to the design criteria, the capacity of a distribution reservoir is 20%-volume, or 4.80 hours' equivalent volume, of the daily maximum production. This capacity seems to be rather small comparing with other countries' standards. The reservoir is a storage which regulates hourly-fluctuation of water use. The storage function has currently depended on consumers' private tanks, since most houses have their own water tanks for storage purpose. In the future when service level of water supply is much improved, consumers would rely on the waterworks and they would not feel necessity for storage by their private tanks. Such situation would be welcome. On the other hand, HWBC shall prepare enough storage capacity in reservoirs to be placed in treatment plants. Generally, capacity of the reservoir is 40 – 50% volume: that is about two times than the present capacity. It is therefore recommended to construct large-volume reservoirs.

(9) Construction of Looped Security Mains in West-South Area

So far, so called "security main" which connects two treatment plants have been constructed; for example, between Mai Dich and Ngo Si Lien plants and Loung Yen and Mai Dich plants. These security mains might contribute to emergency operation at the time of water shortage happened in a particular area. They, however, exist in the central and north-eastern parts in the central Hanoi, and do not connect necessarily the west-south area directly. In the future, service area will be expanded to the west-south part of Hanoi proper. This area also will require such security mains. Therefore, construction of additional security mains in the west-south area is recommended, which connect treatment plants of Mai Dich, Ha Dinh, Phap Van and Luong Yen, so as to form a loop in the west-south outer fringe of Hanoi as shown in the figure of the following page. If public traffic roads would be newly constructed in this area in the future, it would be a suitable chance for construction of the new security mains which should be installed simultaneously with construction of new roads.


N
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St.II Ph.1
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St.I Ph.1
60,000
New Cao Dinh
30,000
Yen Phu
40,000
Yen Phu
Extension
40,000
Ngoc Ha
44,000
Mai Dich
60,000
Ngo Si Lien
60,000
Luong Yen
45,000
Ha Dinh
25,000
Tuong Mai
30,000
New Nam
Du Thuong
30,000
Phap Van
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0 1 2 5 km
Recommended Security Mains

(10) Assistance for Rural Water Supply Systems

Some rural communes might have insufficient ability to manage the whole water supply systems independently. In such cases, HPC should give assistance to them. It is recommended that HPC establish a special board under TUPWS to coordinate and adjust water supply development plans proposed by the rural communes. The board should also assist the rural communes to make their financial plans and to take necessary procedures for subsidies.

(11) Restructuring

HWBCs should restructure the working staff and increase the operational efficiency at least to the same level that the company in Ho Chi Minh city has. The restructuring to such extent would result in slightly increase of work force by 10% from 1995 till 2010 and great expansion of water distribution capacity three times as much as the present one. However, restructuring should be carried out not in the manner of mass dismissal of employees, but in the manner of rearranging the work forces reinforced through training and education.

(12) Accounting System following IAS

In order to use foreign funds in the future, SHWBC and NHWBC will need to establish a strong balance sheet, sufficient cash flows, and to obtain a good rate of return. In addition to this sound financial condition, SHWBC and NHWBC will need to provide adequate financial statement to lenders, financial institutions. Financial statements must be prepared in accordance with international accounting standards. It is necessary that fixed assets should be re-valuated and under-estimation of depreciation cost should be corrected. It is not sufficient for SHWBC and NHWBC to provide its financial statements audited and certified by a government internal auditor. Financial statements should be audited each year by competent, independent auditors.

(13) Development of Human Resources

In order to keep the work forces required for the proposed future water supply systems, both rationalization and employment of staff will be needed. At the same time, training and education for the staff would be necessary to maintain and develop the water supply systems. Training and education courses are strongly recommended for managing staff, water supply engineer, staff in charge of construction and maintenance of facilities, staff in charge of business and public relations and staff in charge of finance and accounting.

CHAPTER 2 RECOMMENDATIONS FOR IMPLEMENTAITON OF THE PRIORITY PROJECT

2 RECOMENDATIONS FOR IMPLEMENTATION OF THE PRIORITY PROJECT

(1) Managerial Aspect

In order to carry out the efficient operation in the water business, it is recommended to establish new organizations, namely, one water plant and one water business enterprise.

(2) Tariff Setting

In tariff setting, two contradictory objectives must be achieved. Water tariff should cover all the relating costs to make the companies financially sound, yet at the same time, the tariff should be kept within the affordable level for all customers.

(3) Environment

Development of water supply systems will result in an increase of corresponding volume of wastewater. If the wastewater is never properly drained or treated, it would deteriorate the quality of water bodies such as aquifer, lakes or river. Drainage or sewerage systems are not included in this project, because its development has been already taken into consideration by the existing master plan for drainage and sewerage. Although sewerage project in the priority project area will be implemented after the year 2005 according to the schedule, earlier implementation is strongly expected in parallel with the development of water supply systems.