6. PROPOSED MASTER PLAN PROJECTS

6.1 Implementation Approach

The selected master plan projects are divided into two program streams, namely "rehabilitation and improvement" and "expansion", according to the chronological need identified by the water demand forecast for Damascus City. Projects in the "rehabilitation and improvement" program stream will be carried out in the early stages of the master plan starting in 1997 and be completed by the year 2007, with the exception of the water leakage survey program which will continue until the year 2015. Projects in the "expansion" program which include the development of new water resources will follow sequenced construction starting in 1997 until the year 2005. The location of selected master plan projects are shown in Figure 6.1.1.

6.2 Rehabilitation and Improvement Program

Projects in this program to improve water supply and reduce system losses are classified into the following three categories:

A. Rehabilitation and Improvement Program

A-1 Distribution rehabilitation projects:

A-1.1 Water main replacement:	Pipe length 98 km, Valve 306 nos. Service pipe 2,966 sets Schedule of water main replacements proposed as shown in Figure 6.2.1. Water saved by the project is estimated at about 38,200 m^3/d or equivalent to 4.7% of total water requirement in 2003.
A-1.2 Water meter replacement:	Meter 106,486 nos.
A-1.3 Improvement in meter testing and repairing:	Meter test bench, etc 1lot, Repair shop 100m^2

A-2 Leakage reduction program:

A-2.1 District meter area (DMA) system:	70 blocks
A-2.2 Pressure control:	Reducing valve 27 sets, Valve chamber 27 nos
A-2.3 Improvements to master metering:	Flow meter 58 sets, Level gauge 1 set Meter chamber 36 nos.
A-2.4 Leakage survey:	Leak noise correlator 2 sets Leak detector 2 sets, Pipe locator 2 sets Electric listening sticks 2 nos.

A-3 Water quality and pumping equipment improvement projects:

A-3.1 Improvements to water quality testing laboratory:
Instrument 1 lot
Laboratory 300 m^2

A-3.2 Improvements of pumping equipment for existing wells in Damascus City:

- Ibn Assaker: Upgrade booster pump at 6 sites for an additional estimated 120 l/s (2.5 MCM/y)
- Kadam Railway: Upgrade well pumps at 10 sites for an additional estimated 115 l/s (2.3 MCM/y)
- Fringe Wells: Upgrade well pumps at 8 sites for an additional estimated 1.76 MCM/y

6.3 Expansion Program

Projects in the expansion program to expand water supply system are composed of the following two categories:

B. Expansion Program

B-1 Water Supply Projects for Informal Areas.

Water Supply Schemes (Implementation schedule)	Area (ha)	Population (persons)	Water Demand (m^3/day)	Pipe Length (m)
B-1.1 Kassioun Mountain Foot System (2002 to 2004)	30.9	33,977	6,562	3,550
B-1.2 Tishreen System (2001 to 2002)	36.2	15,488	2,980	7,980
B-1.3 Jobar Surrounding - Al Aksab Mosque System (2000 to 2001)	63.7	25,704	4,964	14,030
B-1.4 East - West Tabbaleh System (2003 to 2005)	135.2	12,669	2,447	8,940
B-1.5 Mokhayam Al Yarmouk System (2002 to 2003)	118.0	86,068	16,621	7,800
B-1.6 Naher Eshah - Dahhadil & Asalie Kadam Systems (1997 to 1999)	170.4	37,005	7,146	37,440
B-1.7 Al Qazzaz & Shaghour Basateen Systems (1997 to 1999)	64.2	10,692	2,065	14,130
B-1.8 Mezze - Razy & Kafar Sousch - Lawan Systems (1999 to 2000)	170.3	46,786	6,332	37,420
B-1.9 Somareyeh System (1999 to 2000)	37.6	4,590	918	7,460
B-1.10 Dummar - Wadi Al Mashare System (1998 to 1999)	41.9	14,841	2,866	9,230
B-1.11 Kudsaya System (2004 to 2005)	50.0	20,800	4,017	11,020
Total	1,050.5	407,000	81,380	159,000

B-2 Water Resources Development Projects

B- 2.1 New well center for informal area

Jaramana:	Quantity; 290 l/s or 6.12 MCM/y Submersible pump; 9 sets Collector main; 840 m Reservoir (2,500m^3); 1no.

B-2.2 New well centers for formal areas

(1) Kafar Souseh:	Quantity; 80 l/s or 1.69 MCM/y Tube well (D9"x75m) 6 nos Submersible pump; 5 sets Collector main; 350 m Reservoir (2,500m^3); 1no.
(2) Tishreen and Kywan:	Quantity; 250 l/s or 5.3 MCM/y
-Phase-1	Submersible pump; 3 sets Collector main; 360 m
-Phase-2	Tube well (D9"x80m) 2 nos Submersible pump; 2 sets Collector main; 110 m
-Phase-3	Tube well (D9"x80m) 12 nos Submersible pump; 9 sets Collector main; 465 m

B-2.3 Water resources development schemes in Hermon area

Deir al Ashayer:	Quantity; 200 l/s over a six month period which could provide an extra 3.16 MCM/y via a new pipeline to the City. Tube well (D13"x150m) 1 nos Submersible pump; 4 sets Collector main; 1,220 m Reservoir (720m^3); 1no. Transmission main; 400 mm x 12 km

B-2.4 Water resources development schemes in Damascus (New Stations)

(1) Shokry al Qouwatly:	Quantity; 170 l/s or 3.60 MCM/y Tube well (D9"x75m) 1 no. Tube well (D17"x75m) 5 nos. Submersible pump; 5 sets Collector main; 475 m Reservoir (2,500m^3); 1no.
(2) Kanawat Garden:	Quantity; 80 l/s or 1.69 MCM/y Tube well (D9"x75m) 6 no. Submersible pump; 5 sets Collector main; 270 m Reservoir (2,500m^3); 1no.

6.4 Implementation Program

A implementation program of projects as Master Plan is recommended that the rehabilitation and improvement program shall be started in 1997 and be completed by the year 2006, and the construction of expansion projects which include water supply to informal areas and the development of new water resources with water right shall be sequenced from 1997 to the year 2005. The implementation schedule for the whole plans are shown in Figure 6.4.1

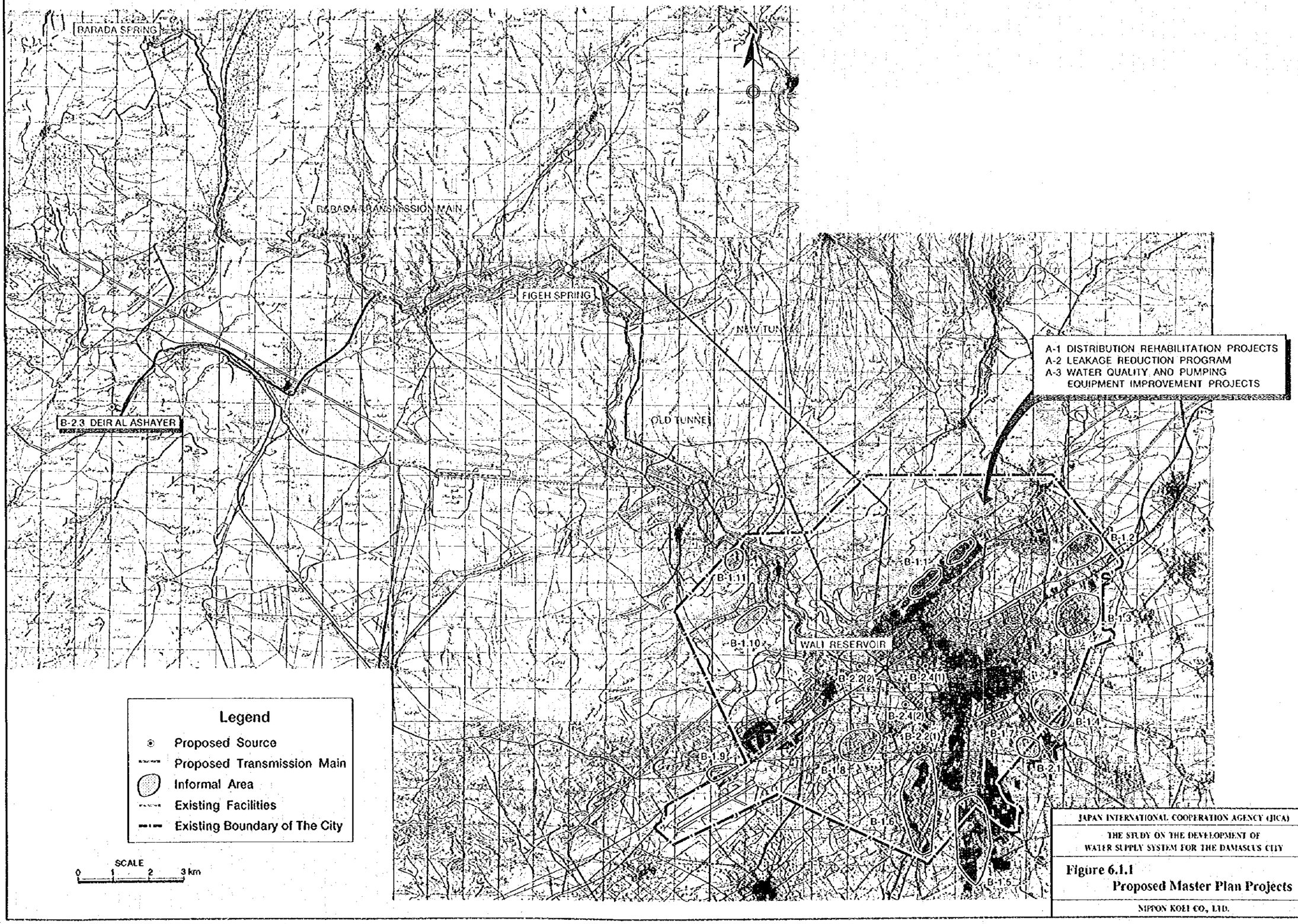
6.5 Cost Estimates

The total project costs of each proposed scheme are summarized as follows:

(Unit: US$ 1000)

Items	L.C.	F.C.	Total
1. Rehabilitation and Improvement Program			
1.1 Distribution Rehabilitation Projects	4,037	20,384	24,421
1.2 Leakage Reduction Program	299	3,417	3,716
1.3 Water Quality and Pumping Equipment Improvement Projects	444	3,835	4,279
2. Expansion Program			
2.1 Water Supply Projects for Informal Area	4,762	17,048	21,810
2.2 Water Resources Development Projects	2,625	10,111	12,736
3. Tax and Duty	6,730	0	6,730
4. Administration Cost	1,217	0	1,217
5. Engineering Cost	1,217	5,530	6,747
Sub-total (Items 1 to 5)	21,331	60,325	81,656
6. Physical Contingency	1,457	6032	7489
Sub-total (Items 1 to 6)	22,788	66,357	89,145
7. Price Contingency	804	2,904	3,708
Total	23,592	69,261	92,853

Note: 1. L.C. means local currency portion and F.C. means foreign currency portion.
2. Physical contingency is 10% of sum of items 1, 2, 4 and 5.
3. Price contingency is 5% of local currency portion and 3% of foreign currency portion of items 1, 2, 4, 5 and 6.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 6.1.1
Proposed Master Plan Projects

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A-1 DISTRIBUTION REHABILITATION PROJECTS
A-2 LEAKAGE REDUCTION PROGRAM
A-3 WATER QUALITY AND PUMPING EQUIPMENT IMPROVEMENT PROJECTS

B-2.3 DEIR AL ASHAYER

B-1.1
B-1.2
B-1.3
B-1.4
B-1.5
B-1.6
B-1.7
B-1.8
B-1.9
B-1.10
B-1.11
B-2.1
B-2.2(1)
B-2.2(2)
B-2.4(1)
B-2.4(2)

Legend

- Proposed Source
- Proposed Transmission Main
- Informal Area
- Existing Facilities
- Existing Boundary of The City

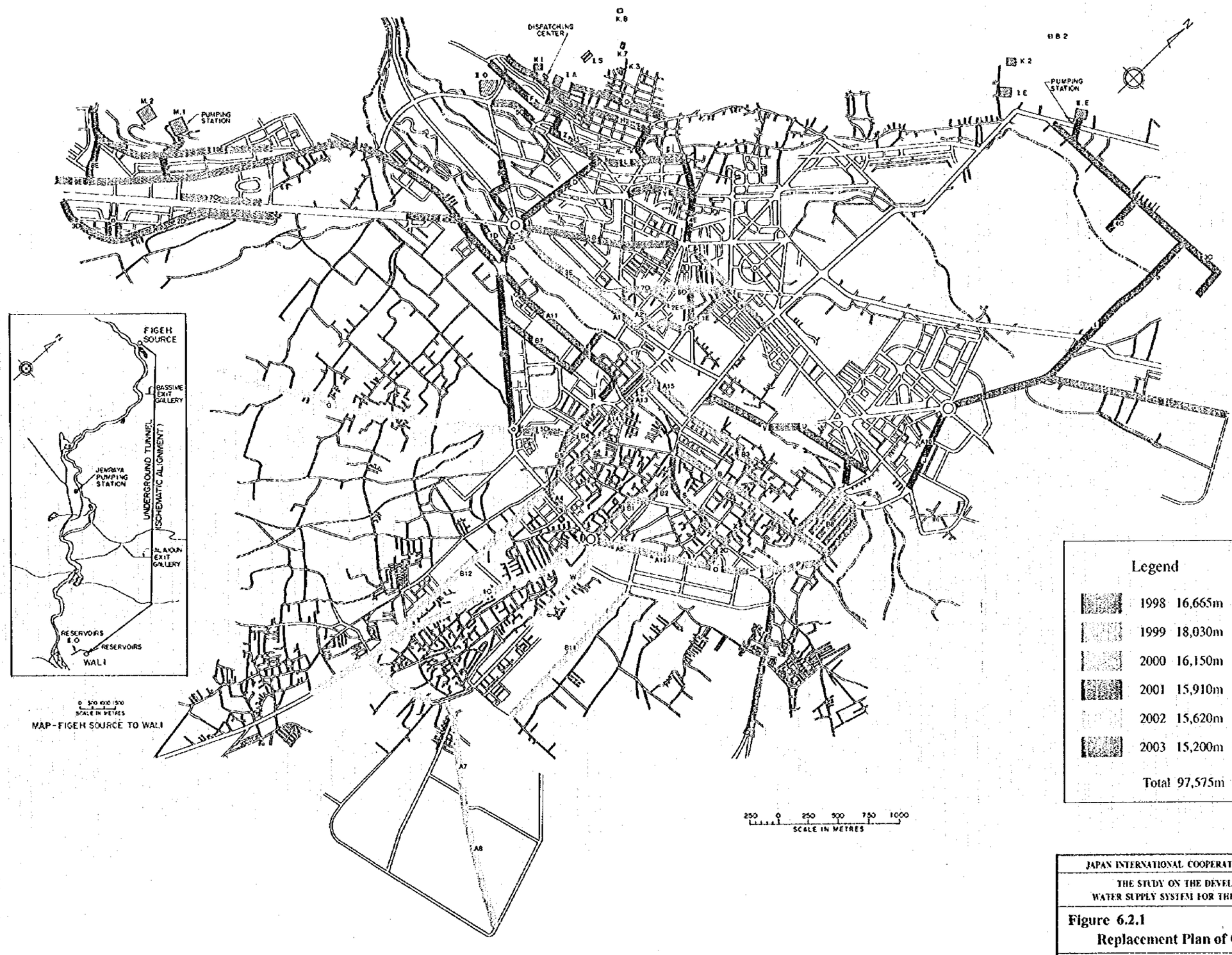
SCALE
0 1 2 3 km

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 6.1.1
Proposed Master Plan Projects

NIPPON KOEI CO., LTD.



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 6.2.1
Replacement Plan of Cast Iron Pipe

NIPPON KOEI CO., LTD.

PROJECT		COST*
ON GOING PROJECTS		
1 Protection of Figeh Spring		890
2 SCADA System		5,090
3 Reinforcement of Ain Figeh Area		4,604
4 Reinforcement of Barada & Al Sahl		4,103
5 Esh al Warwar System		443
6 Mezze #86 System		681
7 Takadom System		738
8 New Well Center for Informal area	New Kaboon	60
	Takadom	262
9 New Water Resources Schemes in Hermon and Zabadani area	Wadi Marwan	-
10 Kudsaya New Suburb Sysyem		4,257
11 Dummar Extension area (1st phase) System		488
12 Special Area Zone (State Factory) System		420
MASTER PLAN PROJECTS		
A. REHABILITATION AND IMPROVEMENT PROGRAM		
A-1 DISTRIBUTION REHABILITATION PROJECTS		
A-1.1 Water Main Replacement		23,233
A-1.2 Water Meter Replacement		11,542
A-1.3 Improvement in Meter Testing and Repairing		120
A-2 LEAKAGE REDUCTION PROGRAM		
A-2.1 District Meter Area (DMA) System		1,159
A-2.2 Pressure Control		528
A-2.3 Improvemnet of Master Meter		3,399
A-2.4 Leakage Survey		756
A-3 WATER QUALITY AND PUMPING EQUIPMENT IMPROVEMENT PROJECTS		
A-3.1 Reinforcement of Water Quality Testing		1,004
A-3.2 Reinforcement of Damascus Wells	Ibn Assakar	1,691
	Kadam Railway	1,634
	Fringe Wells	1,429
B. EXPANSION PROGRAM		
B-1 WATER SUPPLY PROJECTS FOR INFORMAL AREA		
B-1.1 Kassion Mountains Foot System		1,110
B-1.2 Tishreen System		1,499
B-1.3 Johar Surrounding-Al Aksah Mosque System		2,607
B-1.4 East-West Tahbleh System		1,364
B-1.5 Mokhayam Yarmouk System		1,722
B-1.6 Naher Esheh-Dahadil & Asalie Kadam System		6,223
B-1.7 Al Qazzaz & Shaghour Basateen System		2,266
B-1.8 Mezze-Razy & Kafar Souseh System		7,091
B-1.9 Somareyeh System		1,170
B-1.10 Dummar-Wadi Al Mashare System		1,985
B-1.11 Kudsaya System		2,381
B-2 WATER RESOURCES DEVELOPMENT PROJECTS		
B-2.1 New Well Center for Informal Areas	(1) Jaramana	3,279
B-2.2 New Well Center for Formal Area	(2) Kafar Souseh	2,012
	(3) Tishreen & Kywan	1,816
B-2.3 Water Resources Development Schemes in Hermon area	Deir al Ashayer	5,993
B-2.4 Water Resources Development Schemes in Damascus (New Stations)	(1) Shoukry al Qouwatly	2,356
	(2) Kanawat Gardens	2,021

Note *: Unit US$1,000. Source: On going project according to DAWSSA's information.
** Constant price as of September 1996 for Master Plan

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 6.4.1 Implementation Schedule

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7. PROJECT EVALUATION AND PRIORITY PROJECTS

The propose projects in this report are technical possible, and are economically and financially viable.

7.1 Economic Evaluation

The estimated economic benefit for the master plan project is $26 million in the year 2010. The estimated economic cost of the master plan project is approximately $83 million. Incremental operation and maintenance costs after implementing the master plan project at the end of 2007 will be $1.7 million.

Economic evaluation is based on the economic internal rate of return EIRR for the estimated project benefit and cost stream assuming an economic life of 25 years after the completion of the last project in mid 2007. The resulting EIRR of 34% indicates the project is economically justifiable. Details of economic evaluation for the total master plan projects are presented in Table 7.1.1.

7.2 Financial Evaluation

The incremental revenue generated by the project will be (in US$) 1.43 million in 1997, 6.5 million by 2000, and will reach a maximum of 12.2 million in 2010. The total investment cost for the project is $95 million. Incremental operation and maintenance costs including equipment replacement is $1.73 million per year. The resulting a 9.8% internal rate of return indicates the project is financially viable. The results are very sensitive to variations in the cost and benefit parameters. Therefore an increase in tariff is required to ensure the project will be viable should unfavorable conditions prevail. The average tariff required to make the project financially viable under assumed worse case conditions of a 10% increase in cost and a 10% reduction in benefits is US$ 0.15 per m^3.

The annual investment costs identified for the master plan project require an average annual investment of $9.5 million. This level of expenditure expenditures exceeds DAWSSA's previous investment spending levels by a large amount. Funding assistance will therefore be required from external sources to make the implementation of the master plan feasible.

The low income and average income households have ample capacity to absorb increases in water tariffs at current per capita consumption levels. However, an increase in per capita consumption is predicted and lower income groups could eventually be spending up to 3.36% of their income on water charges at current tariff levels. This is considered to be the

upper limit of affordability. The middle income group on the other hand would only be spending 1.05% of their income and would still have ample capacity to pay for further tariff increases. The tariff structure will have to be readjusted in the near future in to obtain a more equitable distribution of the costs to the households that can afford to pay more.

7.3 Environmental Examination of the Proposed Projects

The environmental impacts of the proposed master plan projects have been evaluated in Section 5.6. They are summarized in Table 7.3.1 Anticipated environmental problems are given in Table 7.3.2 . Project A-3.2 (Reinforcement of Damascus Wells, Kadam Railway) was rated high for the environmental impact because it involves supply of water from Kadam Railway wellfield. Water from this well field contains elevated levels of hardness and nitrate. A series of countermeasures has been proposed for this problem (Water quality control in South Damascus, Main Report, Chapter 5). Detailed EIA based on the Syrian EIA guideline shall be conducted in the Feasibility Studies.

7.4 Selection of Priority Projects

Certain projects have been identified as "Priority" projects because they are urgently required for public health or operational reasons such as reducing water losses. The scale of the selected priority project makes it relatively easy to fast track the process and complete the feasibility study and design within the given time constraints.

A selection of priority projects includes District Meter Area (DMA) system to assist in leakage detection efforts, and extending the distribution network into informal areas providing properly connected and metered services. The Mezze-Razy and Kafar Souseh-Lawan project is ranked as the highest priority. There is a large population living in this informal area which is located in the heart of Damascus City. The projects are urgently required to meet basic human needs and generate large savings in unaccounted for water. The location map of priority projects are shown in Figure 7.4.1.

Table 7.1.1 EIRR Calculation. Total of Selected Master Plan Projects

Year	Economic Benefit (US$ 000's)	Economic costs (US$ 000's)			Net Benefits (US$ 000's)
		Capital	O & M	Total	
1997	2,520	4,216	98	4,314	(1,794)
1998	5,294	19,066	245	19,311	(14,017)
1999	8,675	15,499	837	16,336	(7,661)
2000	12,667	12,324	1,097	13,421	(754)
2001	15,316	12,626	1,451	14,077	1,239
2002	21,794	8,471	1,552	10,023	11,771
2003	23,393	6,760	1,558	8,318	15,075
2004	24,128	2,356	1,563	3,919	20,209
2005	24,416	1,948	1,675	3,623	20,793
2006	25,945	84	1,713	1,797	24,148
2007	25,945	1,770	1,713	3,483	22,462
2008	25,945	1,729	1,713	3,442	22,503
2009	25,945	1,729	1,713	3,442	22,503
2010	26,066	1,467	1,713	3,180	22,886
2011	26,066	1,467	1,713	3,180	22,886
2012	26,066	1,548	1,713	3,261	22,805
2013	26,066	2,413	1,713	4,126	21,940
2014	26,066	341	1,713	2,054	24,012
2015	26,141	1,444	1,713	3,157	22,984
2016	26,141	2,652	1,713	4,365	21,776
2017	26,141	2,170	1,713	3,603	22,538
2018	26,141	1,845	1,713	3,558	22,583
2019	26,141	1,771	1,713	3,484	22,657
2020	26,141	1,890	1,713	3,603	22,538
2021	26,141	1,467	1,713	3,180	22,961
2022	26,141	1,467	1,713	3,180	22,961
2023	26,141	1,467	1,713	3,180	22,961
2024	26,141		1,713	1,713	24,428
2025	26,141		1,713	1,713	24,428
2026	26,141		1,713	1,713	24,428
2027	26,141		1,713	1,713	24,428
2028	26,141		1,713	1,713	24,428
2029	26,141		1,713	1,713	24,428
2030	26,141		1,713	1,713	24,428
2031	26,141		1,713	1,713	24,428
Total	816,710	111,987	54,614	166,321	650,389

AIC (SUS) = 0.04 EIRR = 34.0%

Sensitivity Analysis

Internal rate of return	%
1. Base case	34.0%
2. Costs +10%	29.7%
3. 2 and Benefits -10%	25.8%

Table 7.3.1 (1/2) Suggested Scope of Work for the Master Plan Projects

	IEE Result	Implementation Stage	Social Environment								Natural Environment							Pollution					
			resettlement	economic activity	public facilities	social separation	cultural asset	water right	public health	waste	risk of disaster	topology	erosion	groundwater	surface water	coast	flora, fauna	climate	landscape	air pollution	water pollution	soil pollution	noise, vibration	subsidence	odor
A-1 Rehabilitation Projects																									
1.1 Water Main Replacement	Low	construction								○										○			○		
		operation							○																
1.2 Water Meter Replacement	Low	construction																							
		operation							○																
1.3 Improvement in Meter Testing and Repairing	Low	construction																							
		operation							○																
A-2 Supply Improvements Projects (Leakage Reduction Program)																									
2.1 District Meter Area (DMA) System	Low	construction																							
		operation							○																
2.2 Pressure Control	Low	construction																							
		operation							○																
2.3 Improvement of Master Metering	Low	construction																							
		operation							○																
A-3 Supply Improvement Projects (Reinforcement)																									
3.1 Water Quality Testing Improvement	Low	construction					○	○												○			○		
		operation						○													○				
3.2. Reinforcement of Damascus Wells																									
1 Ibn Assaker	Low	construction																							
		operation							○	○				○										○	
2 Kadam Railway	High	construction																							
		operation							◎	○				○							○			○	
3. Fringe Wells	Low to Moderate	construction																							
		operation							◎	○				○										○	
B-1 Water Supply Improvement for Informal Areas																									
1.1 Kassion Mountains Foot	Low	construction					○			○													○		
		operation							○																
1.2 Tishreen	Low	construction					○			○													○		
		operation							○																
1.3 Jobar Surrounding - Al Aksab Mosque	Low	construction					○			○													○		
		operation							○																
1.4 East-West Tabbaleh	Low	construction					○			○													○		
		operation							○																

Table 7.3.1 (2/2) Suggested Scope of Work for the Master Plan Projects

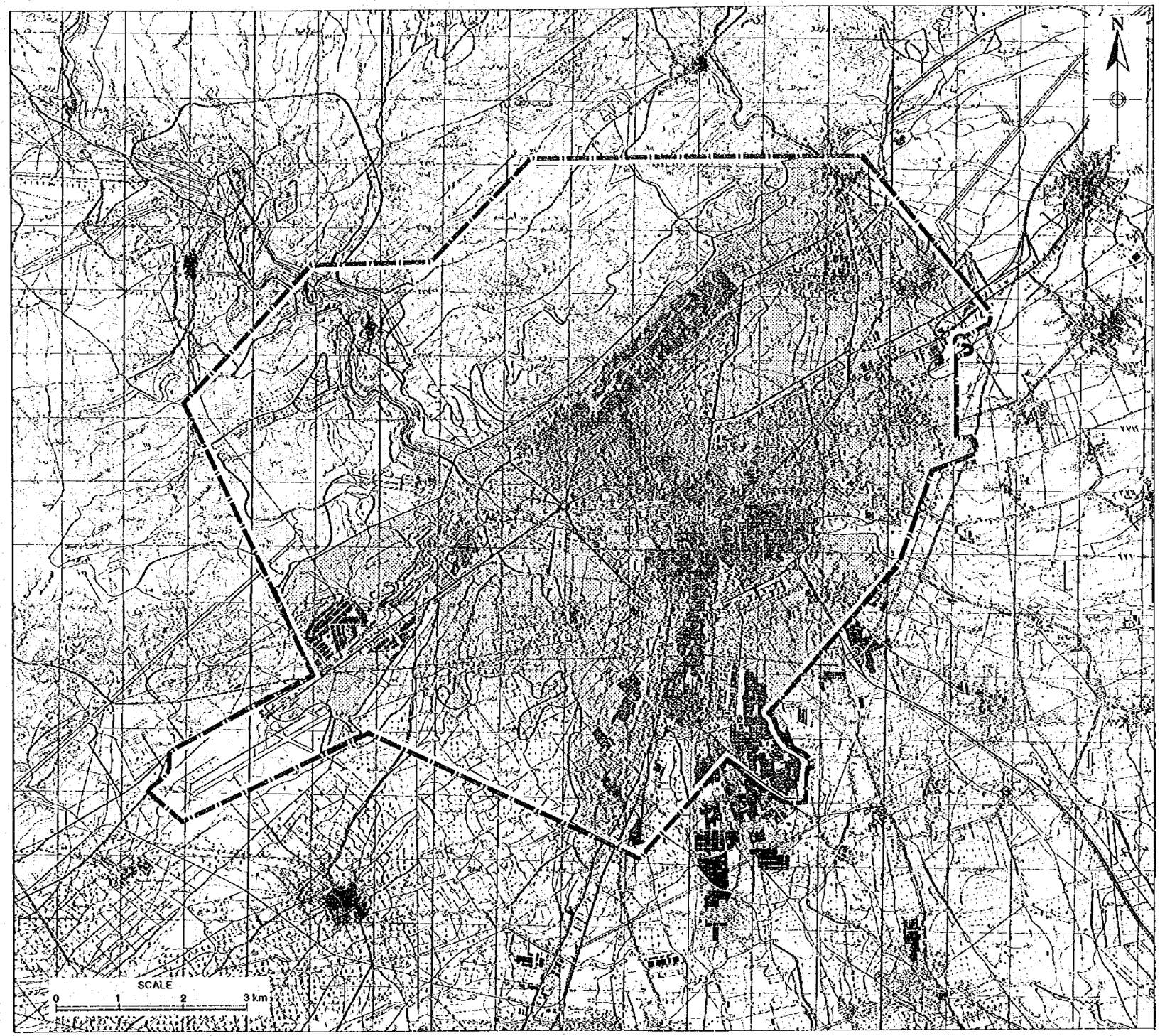
		IEE Result	Implementation Stage	Social Environment									Natural Environment								Pollution					
				resettlement	economic activity	public facilities	social separation	cultural asset	water right	public health	waste	risk of disaster	topology	erosion	groundwater	surface water	coast	flora, fauna	climate	landscape	air pollution	water pollution	soil pollution	noise, vibration	subsidence	odor
	1.5 Mokhayam Yarmouk	Low	construction					○			○													○		
			operation							○																
	1.6 Naher Esheh-Dahadil & Asalie Kadam	Low	construction					○			○													○		
			operation							○																
	1.7 Al Qazzaz & Shaghour Basateen	Low	construction					○			○													○		
			operation							○																
	1.8 Mezze-Razy & Kafar Souseh-Lawan	Low	construction					○			○													○		
			operation							○																
	1.9 Somareyeh	Low	construction					○			○													○		
			operation							○																
	1.10 Dummar-Wadi Al Mashare	Low	construction					○			○													○		
			operation							○																
	1.11 Kudsaya	Low	construction					○			○													○		
			operation							○																
8-2 Water Resources Development																										
	2.1 New Well Centers for Informal Areas	Low	construction					○			○													○		
			operation							○					○											
	2.2 New Well Centers for Formal Area																									
	1. Kafar Souseh	Low	construction					○			○													○		
			operation							○					○											
	2. Tishreen & Kywan	Low	construction					○			○													○		
			operation							○					○											
	2.3 Water Resources Development Schemes in Hermon Area	Moderate	construction																			○		○		
			operation						◎	○					○	○		○								
	2.4 Water Resources Development in Damascus (New Stations)																									
	1. Shoukry al Quowatky	Low	construction					○			○											○		○		
			operation						○	○	○				○										○	
	2. Kanawat Gardens	Low	construction					○			○											○		○		
			operation						○	○	○				○										○	

○ : limited environmental impact is anticipated

◎ : significant environmental impact is anticipated

Table 7.3.2 Anticipated Environmental Problems

Environmental Element		Remarks
Social Environment	Cultural Asset	Damascus is a historical city, and there are numerous known and yet-to-be-discovered cultural assets.
	Water Right	Conflict of interest is anticipated in some area (e.g., Hermon region).
	Public Health	The water supplied by these projects must be safe for drinking. The quality of supplied water has to be closely monitored. Projects have to be designed to minimize any pollution problems.
	Waste	Potential problems are the disposal of excavated soil and the increase in waste water.
Natural Environment	Groundwater	Projects A-3 (Supply Improvement Projects) and Projects B-2 (Water Resources Development) have to be designed carefully to prevent the exhaustion of water resources.
	Surface Water	Although the proposed projects will not use surface water, exploitation of groundwater resources will affect the surface water (e.g., Barada river, Awaj river). Surface water is rare in the study area, and loss of surface water environment will result in secondary environmental impacts, such as loss of indigenous fish and amphibian species.
	Flora and Fauna	The exploitation of groundwater resources in Hermon area may lead to the loss of indigenous flora and fauna that rely on the precious water resources in the area.
Pollution	Air Pollution	The release of dust and exhaust gas during construction has to be minimized.
	Water Pollution	The increase in the water supply leads to the increase in the waste water. The projects has to be coordinated with the construction of the sewerage system. In project A-3.1 (Water Quality Testing Improvement), a new laboratory was proposed. The disposal of waste water from the laboratory has to be regulated, as it may contain various toxic chemicals such as heavy metals and pesticides.
	Noise and Vibration	The level of noise and vibration during the construction has to be minimized.



Legend

- Mezze-Razy & Kafar Souseh Informal Area
- Leakage Reduction Program Area
- Existing Boundary of The City

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THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 7.4.1
Location Map of Priority Projects

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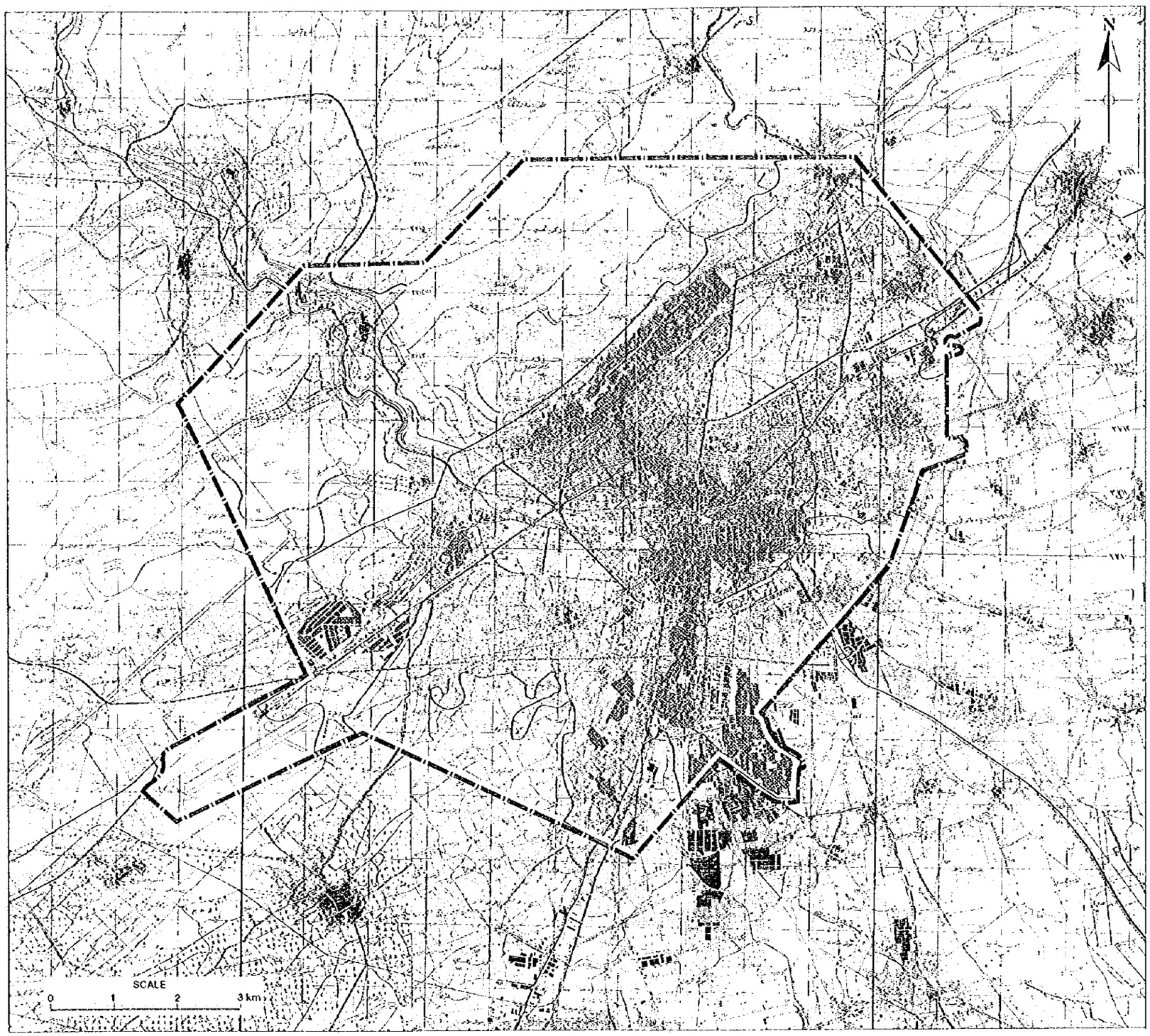

Legend

- Mezze-Razy & Kafar Souseh Informal Area
- Leakage Reduction Program Area
- Existing Boundary of The City

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 7.4.1
Location Map of Priority Projects

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8. FORMULATION OF ORGANIZATION AND FINANCIAL ASPECTS FOR EFFECTIVE WATER SUPPLY SYSTEM

8.1 Institution Development and Human Resources Management

DAWSSA faces a number of institutional problems relating to its autonomy and to the efficient development of water resources. It is only possible for us to state our views on these issues, which depend largely on influencing Government to change the setting in which DAWSSA operates, and to ask for those observations and suggestions for change to be given careful consideration.

The manpower forecasts produced take into account assumptions for growth in water connections (2.47% pa to match population growth) and future productivity improvements (2% pa after the year 2000); a 14.5% increase is in total manpower is predicted by the year 2015 (representing a fall in staff per thousand connections from 5.4 to 4).

As a result of the wide remit of the study many of the recommendations are of a general nature relating to the need for further studies and developments. Important recommendations for the medium term relate to organizational re-structuring (see Figure 8.1.1); development of functions for personnel, training, and information technology; establishment of a customer service approach; and items for specific education and training for water resources and water quality analysis.

8.2 Recommendations for Improved Financial Performance

The ability to provide cost effective services must be based on an appropriate water pricing policy aimed at recovering all the costs of providing the services including investment in new infrastructure and annual operation and maintenance costs. The financial evaluation carried out as part of this study clearly indicates the tariffs must be increased by 30-40% in order to make the master plan project financially viable. The affordability analysis indicates the current tariff structure may disadvantage lower income groups as per capita consumption increases. Therefore, a water tariff study is recommended to examine water pricing policy, tariff structure and rate levels by consumer class.

In conjunction with a review of pricing policy, it is recommended that DAWSSA pursue an aggressive water demand management program to minimize the growth in per capita water consumption. The water demand management function should be coupled with a public education program and an appropriate pricing policy aimed at reducing wasteful use of water.

As an urgent first step, it is recommended that the number of meter readers be increased to a level that will allow reading at quarterly intervals. A key factor in achieving effective financial management will be the introduction of appropriate automation tools. It is recommended that a computerized data base be implemented in the Customer Relations Department to manage meter readings and screen for errors before sending the data on to the Accounting Department. It is also recommended that the existing computerized billing system be completely replaced with a more modern, user friendly database system that can be networked and integrated with the meter reading database and other automated accounting functions. Once the new automated billing system is in place, it is recommended that bills be issued monthly on the basis of estimated consumption and quarterly to reflect actual meter readings.

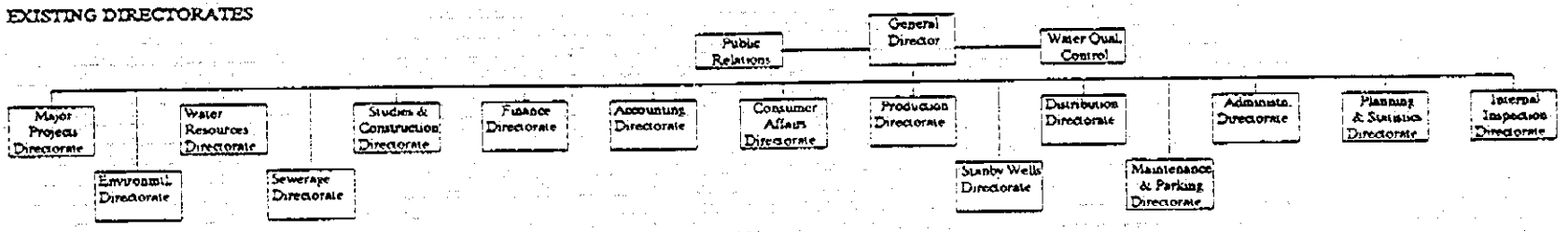
It is recommended that the whole of the accounting function also be automated. The benefits of automation include the ability to produce monthly trial balances, and trend past performance to support the fiscal management function. Automation also provides an ideal opportunity to change the existing method of accounting. It is recommended that a cost accounting system be implemented when automation takes place. Linked with the automated accounting system for timely cost data, management will develop a better picture of future investment requirements and how variations in operating costs might affect budgeting needs and pricing policy.

All of the above mentioned automation improvements should be fully integrated into one application package that can be networked and completely seamless to the users.

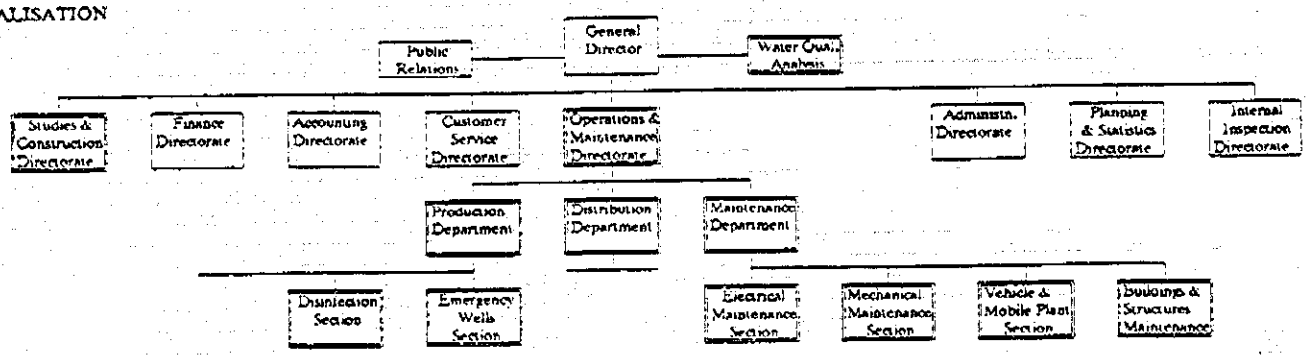
PROPOSED PROGRESSIVE CHANGES TO THE DAWSSA ORGANIZATION STRUCTURE

Notes: (i) the entire number of Directorates is shown in each case; for Departments & Sections below that level only changes are shown.
(i) changes are indicated by double lines around boxes.

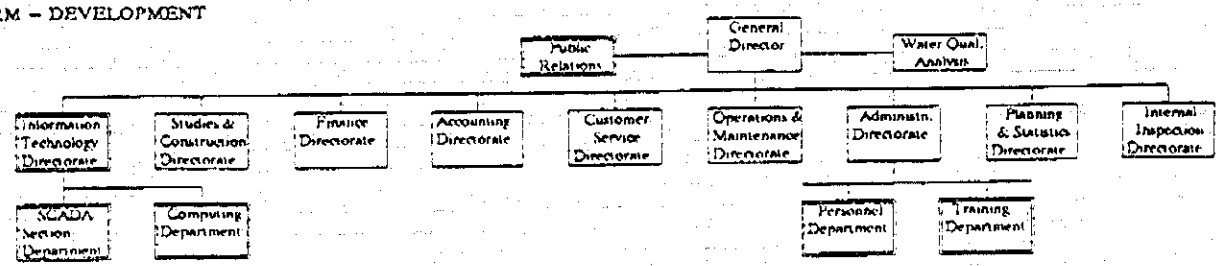
EXISTING DIRECTORATES



MEDIUM TERM – RATIONALISATION



MEDIUM TERM – DEVELOPMENT



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE STUDY ON THE DEVELOPMENT OF WATER SUPPLY SYSTEM FOR THE DAMASCUS CITY

Figure 8.1.1
Proposed Changes to DAWSSA Organization

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9. CONCLUSIONS AND RECOMMENDATIONS

The water supply master plan for the Damascus City proposes two program streams, namely "rehabilitation and improvement" and "expansion", according to the chronological needs identified by the water demand forecast for Damascus City. The proposed projects in this report are technically feasible, and are economically and financially viable. Therefore, all proposed projects are worthy of implementation. The Master Plan also recommends that the following priority projects proceed immediately to the feasibility study stage:

- water leakage reduction program based on the District Meter Area (DMA) system
- water supply project for the Mezze-Razy and Kafar Souseh-Lawan informal areas

In addition to the scope of projects identified in the master plan, it is strongly recommended that DAWSSA also proceed with the following action items:

1) Review of the Damascus City Master Plan in 2020 be made since the City Master Plan has not been finalized and approved yet by the Syrian Government, and the City development schedule adopted in this Master Plan may be changeable.

2) Implement counter measures against water deficits which are expected after the year 2005. Action needs be taken by DAWSSA. The water demand identified after 2005 will be larger than the water resources capacity currently allocated to DAWSSA. The estimated water deficit by the year 2015 will reach approximately 47 MCM. Reallocation of other resources, for example those use for irrigation, will be required in future in cooperation with Damascus Municipality and the Ministry of Irrigation (MOI) since existing water rights are insufficient to meet the forecast demand.

3) Reduce UFW to 25% of total production by the year 2015. Measures which have been recommended to reduce UFW are as follows :

a) Transfer all informal housing areas from informal status to formal status by year 2006 thus reducing the current un-billed factor of 13.6% to 0%

b) Embark on a program to replace all defective meters to be completed by year 2005, further reducing the un-billed factor from 14.4% to 0%

c) Reduce system losses by a combination of different programs which are as follows:
   - Carry out mains renewal program to replace old distribution mains
   - Carry out a program to monitor leakage levels by district metering area (DMA)

- Introduce pressure control where high pressures exist to reduce leakage discharge rates
- Intensify leakage control from passive to active control

4) Reinforce workshops in the maintenance directorate for appropriate and efficient operation and maintenance of the distribution system. Provide improvements to pipe and meter repair shops and furnishing, wireless communication system, motor vehicles, tools and equipment as recommended.

5) Monitor water levels in the observation wells at the all existing observation wells including un-used wellfileds as part of the background monitoring program. Establish a comprehensive monitoring system of the area around Barada Spring to enable a future long term study of the hydrogeology and hydrology of the source. Install dip tubes in production wells for water level measuring.

6) Share information on water resources issues with the Ministry of Irrigation. In particular MOI monitors wells in the vicinity of Damascus and in the groundwater catchments of DAWSSA sources. This would involve the collation and up-dating of information on water resources in a database .

7) Provide extensive water quality testing of supplied water. The capacity of the laboratory has to be expanded 3 to 5 times, and a toxic substances (e.g., pesticides and heavy metals) monitoring program has to be implemented immediately.

8) Improve financial performance by reducing inefficient metering, billing and collection. It is recommended that number of meter readers be increased to a level that will allow reading at quarterly intervals. The billing and accounting functions should be automated & integrated with metering. Assets shall be re-valued to reflect actual replacement cost & a study is recommended to determine appropriate values.

9) Improve financial management by implementing a cost accounting system to help track costs, a water demand management program, and to reduce capital costs and a financial management information system to provide regular and realistic measures of DAWSSA's financial performance. A tariff study is recommended to examine pricing policy, tariff structures and rate levels by consumer class.

10) Implement a computer needs study to develop a strategy for the automation and integration of the billing, accounting and financial management functions. Review the impact of automation on human resources needs and identify training plan.

11) Restructure DAWSSA in the medium term to (i) rationalize and reduce the number of operational and technical directorates by amalgamation (ii) create a new Directorate of Information Technology (I.T.) (iii) create new departments for Personnel and Training

12) Develop the customer service approach involving (i) identifying appropriate levels of service indicators and establishing recording and reporting systems (ii) establishing a new Customer Liaison Unit to handle all customer reports and complaints