6. PROJECT EVALUATION

6.1 Economic Evaluation

(1) Benefits

The main quantifiable benefits resulting from the projects will include: (a) an increase in water available for consumption through the significant reduction in unaccounted for water. (18.5 million m^3 per year); (b) significant improvement in health and hygiene of 50,000 informal residents by reducing the incidence of waterborne and water related diseases; and (c) incremental revenue from an increase in water sold. The resulting quantifiable benefits will reach $1.24 million per year by 2007.

(2) Economic Internal Rate of Return

The economic internal rate of return EIRR to the project was calculated on the basis of the quantified benefits identified above. The incremental cost and benefit streams where compared over a period of 30 years, which represents the expected life of the projects. All costs and benefits are expressed in mid 1997 constant economic prices, in which foreign exchange, labor and electricity are shadow priced. The resulting EIRR for the DMA project is 9% while the extension of distribution system of Mezze-Razy & Kafar Souseh-Lawan has an EIRR of 8%. Both projects are considered economically worthwhile investments. The sensitivity tests indicate that both projects are only marginally viable under varying cost and benefit parameters. Under the worst case scenario (costs increase 15% and benefits reduced by 10%) the DMA project has an EIRR of 5% and the Mezze-Razy & Kafar Souseh-Lawan project has an EIRR of 6%.

6.2 Financial Evaluation

(1) Financial Internal Rate of Return

Financial viability of the water supply improvement project is carried out by assessing the Financial Internal Rate of Return (FIRR) and the cash flow required to fund the project. The main financial benefit will be revenue from the sale of incremental water reaching $2.44 million per year by the completion of the project in 2007.

The FIRR of the project was calculated on the basis of the quantified benefits identified above. The incremental cost and benefit streams where compared over a period of 30 years, which represents the expected life of the project. All costs and benefits are expressed in mid 1997 constant prices using the official foreign exchange rate. The resulting FIRR for project is 16% clearly demonstrating that the project is financially viable.

(2) Affordability

Affordability and ability to pay are key parameters in assessing whether the proposed investment in the distribution system for Mezze-Razy & Kafar Souseh-Lawan area is affordable in view of the need to repay the international loans and the aim of sustaining a viable future development program. The average household income in the study area is 3500 to 6000 SL per month which is well below poverty levels (source: JICA study team, interview survey 1997). The average water charge for those households with a metered connection in the area is 125 SL which represents from 2 to 3.5% of the total monthly household income indicating there is no capacity to increase water tariffs beyond existing levels.

(3) Financial Projections

It is assumed that the DMA and the Mezze-Razy & Kafar Souseh-Lawan project will proceed concurrently, following the planned phasing of the proposed investment program from the year 2000 to 2006. The project will require a total investment of $10.9 million. The

annual funding required by the project is $3.8 million in 2000, and 2001 and $665,000 for each year from 2002 to 2006.

Financial projections for investment funding are presented in Table 6.2.1 based on the assumption that 75% of the required capital will be obtained from an international lending agency with the following on-lending conditions: (a) Interest rate = 7% p.a.; Grace period = 5 years; Repayment period = 25 years.

The financial projections show the accumulated net cash flow remains positive throughout the life of the project indicating the project is financially viable for the assumed on-lending conditions. This positive position will allow DAWSSA to build additional cash reserves for financing subsequent investments and equipment replacement. Thus, the project can be financially self-sustaining, provided that (i) water consumption grows in line with the projections; (ii) unaccounted for water is substantially reduced; and (iii) the revenue projections are fulfilled. The financial projections also indicate that an increase in tariffs will not be required to make the project financially viable.

6.3 Environmental Impact Assessment (EIA) of the Proposed Projects

(1) EIA on DMA Project

Public health (operation stage) : A set of leakage reduction programs including the DMA project will save as much as 18.5 MCM/year of the supplied water, which is equivalent to the water consumption of 253,000 capita/year (assuming 200 lpcd). In addition to the water quantity, the DMA project will improve the quality of the supplied water by 1) saving high quality water, 2) reducing secondary contamination, and 3) strategically allocating high quality water to low water quality regions. The inevitable environmental consequence of water supply project is the generation of wastewater. To deal with the wastewater problem, Damascus Municipality is currently developing a central water treatment facility in Damascus suburb, and the generated wastewater will be treated at this facility which is expected to become operational by the end of 1997 before the implementation of the proposed water supply project.

(2) EIA on Mezze-Razy & Kafar Souseh-Lawan System

Construction related environmental problems (construction stage) : In the interview survey, 80 % of the local residents expressed no environmental concern about the proposed project. The local residents are aware of the direct benefit of the water supply project, and they are anticipating large long-term benefit over the short-term adverse impacts of the project. However, the local residents want the project to be completed as fast as possible to minimize inconvenience such as noise and traffic problem. Although the analyses showed that these environmental impacts are not significant, a set of guidelines to further minimize environmental problems during construction are given in Appendix C.

(3) EIA on Construction Works in Old City

Cultural assets (construction stage) : Listed in the World Heritage List of UNESCO (UNESCO, 1996), the Old City of Damascus is historical, religious and commercial center of Damascus, and about 20,000 people live in the Old City. Although the majority of distribution pipes in the Old City are in good condition, there are a number of old cast iron pipes, and the replacement of these pipes will be inevitable in the future. Most of the existing water supply mains are laid under existing roads, and direct impact of the construction activities to the historical buildings will be limited. However, many buildings in the Old City are old and vulnerable to structural damage. DAWSSA should discuss the construction plan with the relevant authority (Committee of the Old City of Damascus and the Ministry of Culture) in advance, and follow the guidelines provided by the Committee of the Old City of Damascus.

Table 6.2.1 (1/3) Projected Cash Flow

in US $

I. Income Statement	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1.1 Revenue											
(1) Incremental Water Sales (000 m3)	-	2,637	9,034	11,671	14,308	16,945	19,582	22,219	22,219	22,219	22,219
(2) Average Water Tariff[4]	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
(3) Total Revenue	-	290,070	993,740	1,283,810	1,573,880	1,863,950	2,154,020	2,444,090	2,444,090	2,444,090	2,444,090
1.2 Expenditure											
(1) Salary	-	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462
(2) Electricity	-	175	175	175	175	175	175	175	175	175	175
(3) Depreciation	-	-	138,700	138,700	138,700	138,700	138,700	138,700	339,633	339,633	339,633
(4) Repair & Others	-	57,918	92,918	127,918	162,918	197,918	232,918	272,918	272,918	272,918	272,918
(5) Foreign Loan Interest							539,243	560,987	545,978	529,920	512,737
(6) Total Expenditures	-	70,555	244,255	279,255	314,255	349,255	923,498	985,242	1,171,166	1,155,108	1,137,925
1.3 Revenue - Expenditure	-	219,515	749,485	1,004,555	1,259,625	1,514,695	1,230,522	1,458,848	1,272,924	1,288,982	1,306,165
1.4 Profit Taxes	-	131,709	449,691	602,733	755,775	908,817	738,313	875,309	763,754	773,389	783,699
1.5 Net Revenue (after interest and taxes)	-	87,806	299,794	401,822	503,850	605,878	492,209	583,539	509,169	515,593	522,466
1.6 Accumulated Net Revenue(Deficit)	-	87,806	387,600	789,422	1,293,272	1,899,150	2,391,359	2,974,898	3,484,068	3,999,661	4,522,127
II. Cash Flow											
2.1 Cash Inflow											
(1) Cash Flow from Operations 1.5 + 1.2(3)	-	87,806	438,494	540,522	642,550	744,578	630,909	722,239	848,802	855,226	862,099
(2) Foreign Loan	2,854,661	2,854,661	498,536	498,536	498,536	498,536	498,536				
(3) Foreign Loan Accumulated	2,854,661	5,709,323	6,207,859	6,706,395	7,204,931	7,703,468	8,202,004				
(4) Government Contribution	951,554	951,554	166,179	166,179	166,179	166,179	166,179				
(5) Government Contribution Accumul.	951,554	1,903,108	2,069,286	2,235,465	2,401,644	2,567,823	2,734,001				
(6) Total Cash Inflow	3,806,215	3,894,021	1,103,209	1,205,237	1,307,265	1,409,293	1,295,624	722,239	848,802	855,226	862,099
2.2 Cash Outflow											
(1) Investment	3,806,215	3,806,215	664,715	664,715	664,715	664,715	664,715				
(2) Foreign Loan Repayment							187,910	214,401	229,409	245,468	262,651
(3) Total Outflow	3,806,215	3,806,215	664,715	664,715	664,715	664,715	852,625	214,401	229,409	245,468	262,651
2.3 Net Cash Flow											
2.1(6) - 2.2(4)	-	87,806	438,494	540,522	642,550	744,578	442,999	507,838	619,393	609,758	599,448
2.4 Accumulated Net Cash Flow	-	87,806	526,300	1,066,822	1,709,372	2,453,950	2,896,949	3,404,787	4,024,180	4,633,938	5,233,386

Table 6.2.1 (2/3) Projected Cash Flow

inUS $

I. Income Statement	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1.1 Revenue											
(1) Incremental Water Sales (000 m3)	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219
(2) Average Water Tariff	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
(3) Total Revenue	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090	2.444.090
1.2 Expenditure											
(1) Salary	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462
(2) Electricity	175	175	175	175	175	175	175	175	175	175	175
(3) Depreciation	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633
(4) Repair & Others	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918
(5) Foreign Loan Interest	494.352	474.679	453.629	431.106	407.007	381.220	353.628	324.105	292.515	258.714	222.547
(6) Total Expenditures	1.119.540	1.099.867	1.078.817	1.056.294	1.032.195	1.006.408	978.816	949.293	917.703	883.902	847.735
1.3 Revenue - Expenditure	1.324.550	1.344.223	1.365.273	1.387.796	1.411.895	1.437.682	1.465.274	1.494.797	1.526.387	1.560.188	1.596.355
1.4 Profit Taxes	794.730	806.534	819.164	832.677	847.137	862.609	879.164	896.878	915.832	936.113	957.813
1.5 Net Revenue (after interest and taxes)	529.820	537.689	546.109	555.118	564.758	575.073	586.110	597.919	610.555	624.075	638.542
1.6 Accumulated Net Revenue(Deficit)	5.051.947	5.589.636	6.135.745	6.690.863	7.255.621	7.830.694	8.416.804	9.014.723	9.625.277	10.249.352	10.887.894
II. Cash Flow											
2.1 Cash Inflow											
(1) Cash Flow from Operations 1.5 + 1.2(3)	869.453	877.322	885.742	894.751	904.391	914.706	925.743	937.552	950.188	963.708	978.175
(2) Foreign Loan											
(3) Foreign Loan Accumulated											
(4) Government Contribution											
(5) Government Contribution Accumul.											
(6) Total Cash Inflow	869.453	877.322	885.742	894.751	904.391	914.706	925.743	937.552	950.188	963.708	978.175
2.2 Cash Outflow											
(1) Investment											3.013.700
(2) Foreign Loan Repayment	281.036	300.709	321.758	344.281	368.381	394.168	421.760	451.283	482.873	516.674	552.841
(3) Total Outflow	281.036	300.709	321.758	344.281	368.381	394.168	421.760	451.283	482.873	516.674	3.566.541
2.3 Net Cash Flow											
2.1(6) - 2.2(4)	588.417	576.613	563.984	550.470	536.010	520.538	503.983	486.269	467.315	447.035	(2.588.366)
2.4 Accumulated Net Cash Flow	5.821.803	6.398.417	6.962.401	7.512.871	8.048.881	8.569.419	9.073.402	9.559.671	10.026.986	10.474.020	7.885.655

Table 6.2.1 (3/3) Projected Cash Flow

in US $

I. Income Statement	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1.1 Revenue											
(1) Incremental Water Sales (000 m3)	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219
(2) Average Water Tariff	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
(3) Total Revenue	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090	2,444,090
1.2 Expenditure											
(1) Salary	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462	12,462
(2) Electricity	175	175	175	175	175	175	175	175	175	175	175
(3) Depreciation	339,633	339,633	339,633	339,633	339,633	339,633	339,633	339,633	339,633	339,633	339,633
(4) Repair & Others	272,918	272,918	272,918	272,918	272,918	272,918	272,918	272,918	272,918	272,918	272,918
(5) Foreign Loan Interest	183,848	142,440	98,134	50,726							
(6) Total Expenditures	809,036	767,628	723,322	675,914	625,188	625,188	625,188	625,188	625,188	625,188	625,188
1.3 Revenue - Expenditure	1,635,054	1,676,462	1,720,768	1,768,176	1,818,902	1,818,902	1,818,902	1,818,902	1,818,902	1,818,902	1,818,902
1.4 Profit Taxes	981,032	1,005,877	1,032,461	1,060,905	1,091,341	1,091,341	1,091,341	1,091,341	1,091,341	1,091,341	1,091,341
1.5 Net Revenue (after interest and taxes)	654,022	670,585	688,307	707,270	727,561	727,561	727,561	727,561	727,561	727,561	727,561
1.6 Accumulated Net Revenue(Deficit)	11,541,916	12,212,501	12,900,808	13,608,078	14,335,639	15,063,200	15,790,760	16,518,321	17,245,882	17,973,443	18,701,004
II. Cash Flow											
2.1 Cash Inflow											
(1) Cash Flow from Operations 1.5 + 1.2(3)	993,655	1,010,218	1,027,940	1,046,903	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194
(2) Foreign Loan											
(3) Foreign Loan Accumulated											
(4) Government Contribution											
(5) Government Contribution Accumul.											
(6) Total Cash Inflow	993,655	1,010,218	1,027,940	1,046,903	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194
2.2 Cash Outflow											
(1) Investment											
(2) Foreign Loan Repayment	591,540	632,947	677,254	724,661							
(3) Total Outflow	591,540	632,947	677,254	724,661	-	-	-	-	-	-	-
2.3 Net Cash Flow											
2.1(6) - 2.2(4)	402,115	377,270	350,687	322,242	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194	1,067,194
2.4 Accumulated Net Cash Flow	8,287,770	8,665,040	9,015,726	9,337,968	10,405,162	11,472,356	12,539,550	13,606,744	14,673,937	15,741,131	16,808,325

7. FINANCIAL MANAGEMENT IMPROVEMENT PLAN

7.1 Implementation Priorities

A summary of the management recommendations that form the change strategy is presented in Figure 7.1.1. The figure provides an overview of the implementation priority for each recommendation and the extent to which the improvement objectives are dependent on the implementation of computer systems.

First and immediate priority : It is recognized that DAWSSA does not currently have the financial resources to embark on an extensive "automation" program. Therefore DAWSSA should begin by optimizing the billing and collection processes that are currently inefficient to yield some preliminary financial benefits by: 1) implementing meter installation standards to increase meter reading productivity; 2) entering meter reading data as soon as meter readings for one district are complete; 3) carrying out error verification only once before printing the bills; 4) issuing the bills directly to the cashiers once the bills are printed; 5) adopt a four month meter reading and billing cycle to improve cash flow; and 6) changing the payment period to 30 days, and implement active follow-up of delinquent accounts on a monthly basis, disconnecting delinquent accounts after six months.

Second priority : before any more computer systems are purchased, DAWSSA should carry out a detailed planning study to assess computer needs across the organization, and develop a strategy for implementing integrated information systems. The risks of introducing computers to obtain the desired productivity improvements can be greatly reduced by creating an information technology plan. Planning is a smart investment that provides many benefits: 1) systems can be designed to easily communicate information with each other; 2) support multiple applications; and 3) systems can be designed in a modular way to allow implementation of smaller parts over a longer period of time to reduce the burden on financial resources.

Third priority: before implementing new client server applications a new Information Technology Directorate should be created to group all activities related to planning,

implementing and supporting computer systems and other information technology based systems such as SCADA, and radio communication. The role of the existing Computer Department will change considerably from the current accounting and billing functions to supporting a wide variety of client/server applications and multi-user networks. The need for planning the development of integrated systems will require a central focus. Although some of the existing staff have a technical background and can be retrained, new staff with specialized technical skills will be required to manage the network, the database and provide support to the growing number of computer users.

7.2 Implementation Strategy

The implementation of the first three priority tasks will set the stage for implementing the computer systems that are required to complete the change strategy for improved financial management. Making changes will be much more difficult than business as usual and DAWSSA will need to devote sufficient resources to make the changes happen. Management has suggested that steering committees be tasked with overseeing the implementation of these changes - this approach is highly recommended but will require significant personal time and cooperation from the senior management team. Management will need to identify staff who are "strong and willing" and give them the mandate to champion the different tasks required to implement the changes.

An implementation team will be required to plan, coordinate and execute the work. It is recommended that DAWSSA form working groups under the leadership of a nominated Director. The working groups should begin by implementing the changes identified as first priorities. Afterwards, they will assist specialists consultant(s) and participate directly in the development of new procedures and systems. To overcome the shortage of technical staff it is recommended that detailed design and implementation be carried out by specialized consultants.

The scope of work for consulting services should consist of: (a) preparing a detailed functional design and systems specifications; (b) developing related procedures and manuals; (c) designing the system architecture required for the information systems; (d) investigating

alternatives for application software; (e) preparing tender documents for hardware and "off the shelf" software; (f) Developing a training program and providing training; and (g) implementing system.

7.3 Training

Modernization will not only involve new systems and procedures but also the integration of automation into the work place. It will have an immediate and significant impact on human resources management and training within the organization. Retraining will be required to support new systems and entirely new procedures such as cost accounting, cost analysis, budget formulation and control. The implementation of new CIS and FMIS computer systems will require that new & existing computer section staff receive training on subjects of modern computing: (1) introduction to computer systems hardware; (2) introduction to relational database management systems (DBMS); (3) DOS Operating system; (4) introduction to Client/Server computing, local and wide area networking, network management and data security.; (5) data communications. Staff who will participate in the working groups during the design of systems and applications should also take the same training to become familiar with the system concepts. In addition it is recommended that new staff with the required technical skills be hired prior to the beginning of the project in order to have them involved directly in the working groups. The training should proceed before the implementation of the new systems in order to prepare staff to participate fully in the implementation program.

The implementation of a new CIS and FMIS will also create a need for training in the areas of financial management. A training program should be aimed at senior management and selected section heads who will be involved in using the systems. Topics should include: (1) budget formulation & planning; (2) cost accounting principles; (3) cost analysis and control; (4) formulation and evaluation of projects; (5) design and application of tariff structures.

7.4 Schedule

The detailed schedule of activities for the implementation of CIS and FMIS systems is shown in Figure 7.4.1. The implementation of changes to the billing procedures should take place first and should take about one year (1998). The implementation of the information technology planning study should also proceed as soon as possible (start 1998) and should take approximately one year to complete. It is recommended that both the revisions to billing procedures and the planning study be completed before starting the implementation of the design of new systems. The work on designing both systems should proceed in parallel in order to ensure full integration between both applications. The implementation of the CIS is expected to take about 2 years to complete (years 2000 to 2001). The process of implementing the FMIS will take about 3 years to complete (years 2000 to 2002).

7.5 Costs, Benefits and Risks

Project costs are calculated based on the estimated quantity of hardware, equipment and man-month estimates for the consultancies identified. Costs for consultant services are based on using local consultants. Two consultant, work packages are anticipated. Consultancy #1 will provide a project manager for an estimated 18 man-months at a cost of US$ 270,000 and short term experts who will provide assistance in designing administrative procedures for an estimated 20 man-months at a cost of US$ 240,000. Consultancy #2 for computer system design will require an effort of approximately 100 man-months at a cost of US$ 800,000. Software costs assume the customized development of CIS and FMIS software by a local consultant. Software costs are expected to vary widely in an open international competitive bid depending on the final selection of packaged vs. completely customized development.

Computer equipment costs are based on budget estimates obtained from local suppliers in Damascus. Total hardware & equipment costs are estimated at US$ 1.6 million. Hardware installation costs are assumed to be 5% of the total hardware costs. Building modification costs are excluded since none are anticipated at this time. Total project costs are estimated at US$ 3.5 million over a 3 year period.

The modernization and automation of the customer information and financial management system will greatly simplify work processes and data collection. The economic benefits to DAWSSA are expected to be significant and will allow more sustainable development of the water supply system. It is expected that the new systems will also result in a number of other significantly important organizational and benefits such as: (a) Improved accountability and control; (b) Improved financial planning and management; (c) Improved operational planning; and finally (d) Improved customer service

The implementation of the proposed CIS and FMIS must be undertaken in a comprehensive and completely integrated way. There is the risk that some components such as computerization will appear attractive while other components involving hard decisions such as restructuring the organization or streamlining the billing procedures will be set aside. This would unbalance the proposed improvements and risk failing to realize their full benefits. There is also a risk that employees will not adapt to using new computer systems. This risk can be minimized by:

a) Setting up inter-Directorate working groups to ensure systems meet user needs
b) Providing extensive user training and support to ensure that users do can make full use of the implemented systems for their day to day work and do not revert to their manual work methods.
c) Providing an adequate number of trained technical staff available to implement and provide on-going support.

Area Affected by Change	Option No.	Recommended Change	Improvement Objectives											
			implement modular and integrated systems to meet organizational priorities	decrease decision making	clarify roles & responsibilities	improve access to account information	improve speed and accuracy of transactions	improve retrieval and analysing of customer information	reduce duration of the billing process	reduce billing errors	accelerate the collection of payments	provide accurate and timely financial information	provide cost information to control expenditures	provide the information required to prepare the budgets
Planning		Computer needs planning study	◎											
Overall Organization	1b	Move payment collection operations to Finance Directorate		●	●									
	1c	Move stores management to New Works & Stores Directorate		●	●									
	1d	Create a new information technology directorate			●									
Customer services	2a	Implement a document management system		●		●		●			●			
	2b	Implement a customer information system		●		●	●	●				●		
Metering, billing & collection	3a	Implement meter installation standards							○					
	3b	Implement hand held data entry terminals				●	●		●	●				
	3c	Enter meter data as soon as readings are completed							○					
	3d	Consolidate error detection and correction process			○				○					
	3e	Implement a billing and customer accounting system				●			●	●				
	3f	Adopt a 4 month billing cycle									○			
	3g	Reduce payment period to 30 days, and issue notices monthly									●			
Management Information	4a	Implement cost accounting										○	○	
	4b	Provide financial management information system		●								●	●	●

Priority 1 ○ can be implemented without organizational change or budget approval
Priority 2 ◎ requires funding for consultant study
Priority 3 ◉ requires approval for organizational change or budget increase
● requires the implementation of new computer systems

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

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

Figure7.1.1

Summary Of Change Strategy

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

Figure7.4.1 Implementation Schedule For Computer Systems

NIPPON KOEI CO., LTD.

8. CONCLUSIONS AND RECOMMENDATIONS

1) The installation of the District Meter Area (DMA) system should be implemented to optimize water distribution and facilitate leakage control. This implementation will be phased from 1998 until the year 2006. Integration with DAWSSA's new SCADA system is taken into consideration for planning the DMA. The DMA system consists of two layers. The first layer is grouped as SCADA 01 block that contains, transmission pipelines that connect reservoirs, and distribution mains. The second layer consists of 21 large blocks which define each service area. The large blocks are further subdivided into 37 medium blocks according to administrative boundary, road, elevation and pressure stabilization judged by network analysis. Further subdivision to smaller blocks was also examined but is not proposed, since the small block system should only be introduced after the monitoring system for the distribution network has been installed and sufficient data is available to evaluate the need for smaller blocks.

2) Leakage detection survey should be reinforced including increasing survey teams and improving tools and equipment as recommended for efficient operation and maintenance of the proposed (DMA) system.

3) The highest priority DMA blocks selected on the basis of high population density and largest potential for saving water are the medium blocks located at south of D10 and D11 in the Kafar Souseh. DMA should be implemented in these blocks first.

4) The implementation of the Mezze-Razy & Kafar Souseh-Lawan system should also include formal areas of DAWSSA's system in Mezze-Razy & Kafar Souseh-Lawan area.

5) The proposed improvement plan for Mezze-Razy & Kafar Souseh-Lawan System, which is outlined as follows, will be carried out starting in 1998 and be completed by the year 2001:

   i) The existing trunk main (ND800 mm) from Wali service reservoir will be used as a transmission pipeline. A new ND600 mm distribution main branched from the transmission pipeline will be connected with the existing distribution network at

the head of the network in the area. The total length of the ND600 mm main is estimated at 700 m. The total length of distribution pipeline is about 13.7 km with a diameter varying from ND100 mm to ND400 mm.

ii) The distribution network will serve an area of 191 ha and a population of 46,800 persons including 32,000 existing informal residents. Daily maximum water supply and peak hourly supply is 286 l/s and 357 l/s respectively.

6) The potential for pesticide pollution should be monitored periodically since pesticides including illegal ones are widely used in Syria.

7) It is recommended that DAWSSA implement the first priorities identified in the financial management improvement plan which are to streamline the billing and payment collection process to increase revenues. The following improvements will be needed:

i) Implement meter installation standards to increase meter reading productivity.

ii) Improve efficiency of the billing process by: a) forwarding meter readings for data entry as soon as meter readings are complete; b) reduce the number of error verification processes to only one before printing the bills; c) issue the bills directly to the cashiers from the computer center when the bills are printed.

iii) Adopt a four (4) month meter reading and billing cycle to improve cash flow. Prepare and issue bills for meter districts in the same sequence as the meter readings.

iv) Implement a new payment policy to speed up collection of revenue. Change the payment period to 30 days, and implement active follow-up of delinquent accounts on a monthly basis, disconnecting delinquent accounts after six (6) months.

8) DAWSSA should carry out a detailed planning study to assess computer needs across the organization, and develop a strategy for implementing integrated information systems. Before implementing new client server applications there is a need to create an Information Technology Directorate to plan and support the development of information technology throughout the organization.

9) It is recommended that DAWSSA implement new CIS and FMIS. The CIS is required to improve the accuracy and speed of customer service and improve access to account

information. The FMIS is required to provide accurate and timely financial information to management in order to control expenditures and improve budget preparation.

10) The implementation of changes to the billing procedures will take place first and should take about one year (1998). The implementation of the information technology planning study should also proceed as soon as possible (start 1998) and should take approximately one year to complete. It is recommended that both the revisions to billing procedures and the planning study be completed before starting the implementation of the recommended CIS and FMIS systems. The work of designing the CIS and FMIS should proceed in parallel in order to ensure full integration between both applications. The implementation of the CIS is expected to take about 2 years to complete (years 1999 to 2000). The process of implementing a FMIS will take about 3 years to complete (years 1999 to 2001).

11) It is recommended that DAWSSA move payment collection from Consumer Affairs to the Finance Directorate. This change will alleviate the work load on the Consumer Affairs Directorate, giving it a clear customer service focus. All cash collection activities will be under the management of the Finance Directorate allowing it to be fully accountable for collecting the revenues it needs to manage cash flow needs.