V. IMPLEMENTATION SCHEDULE

5. IMPLEMENTATION SCHEDULE

The implementation of the present project is carefully planned and arranged for the purpose of satisfactory execution taking into consideration the present conditions for the on-going projects, including contractors, procurement of construction materials and labor force the manner of procurement of water supply equipment and materials and the manner of construction.

5.1 Procurement of Construction Materials and Labor Force

At present, the outskirts of the City of Amman are being developed and lots of multistory residences and office buildings have been built. As shown in these construction works, the construction materials necessary for the construction of pump houses and service reservoirs are locally available. The main materials are cement, reinforcing steel bars, aggregate, form-work timber, structural steel, paints, and pipes of polyethylene, unplasticised polyvinyl chloride and galvanized steel (1/2 " to 6" in diameter).

The local labor force is skilled enough to build the pump houses and service reservoirs. There should be an abundance of unskilled laborers for trench excavation and back-filling during the pipe laying works.

5.2 *Contractor Capability*

Contractors and suppliers who intend to undertake the construction works and the supply of construction equipment and materials for public works shall be registered with the government agencies concerned. The Ministry of Public Works is responsible for contractors classification and registration. The contractors are registered in five fields of engineering activities and classified into five ranks which depending on their financial aspects, equipment capability, number of qualified engineers and experience in the field.

In the water supply and sewerage field, First and Second ranked contractors are nominated for tendering on WAJ projects. Around twenty contractors are registered in the First rank. WAJ has experienced contractor capabilities through many projects already executed.

5.3 Manner of Procurement for Construction Works and Equipment and Materials

The following manner for procurement is proposed:

1) blanket contract for the entire construction works through international tendering
2) several contracts packages for construction works including pipe materials and pipe laying works, pump equipment and installation and service reservoirs and appurtenances through international tendering
3) contracts separated into international tendering for procurement of pump equipment and pipe materials and local tendering for construction works

For the procurement of items 1) and 2), local contractors have little chance to participate in construction works because of the large scale of the works and the high capital costs for the purchase of pump equipment and pipe materials. Therefore item 3) will be used for the construction works. Pipe materials will be supplied by WAJ

The manner of procuring the pipeline materials will be as follows:

International tendering

Pipes, fittings and valves for transmission and distribution pipelines are to be procured through international tendering in accordance with guidelines from the lending agencies.

The following equipment and materials are grouped into one procurement package:

- Transmission pipe materials and appurtenances
- Distribution pipe materials and appurtenances
- Pipe materials and appurtenances for service reservoirs
- Supply and installation works of pumps and electrical equipment and appurtenances, including control valves, gate valves, flow meters, chain hoists etc.

Local tendering

Civil engineering works are grouped into one package for local tendering by registered contractors.

- Transmission pipe laying works
- Distribution pipe laying works
- Construction works of service reservoirs and pipe installation works
- Construction works of pump houses

5.4 Implementation Schedule

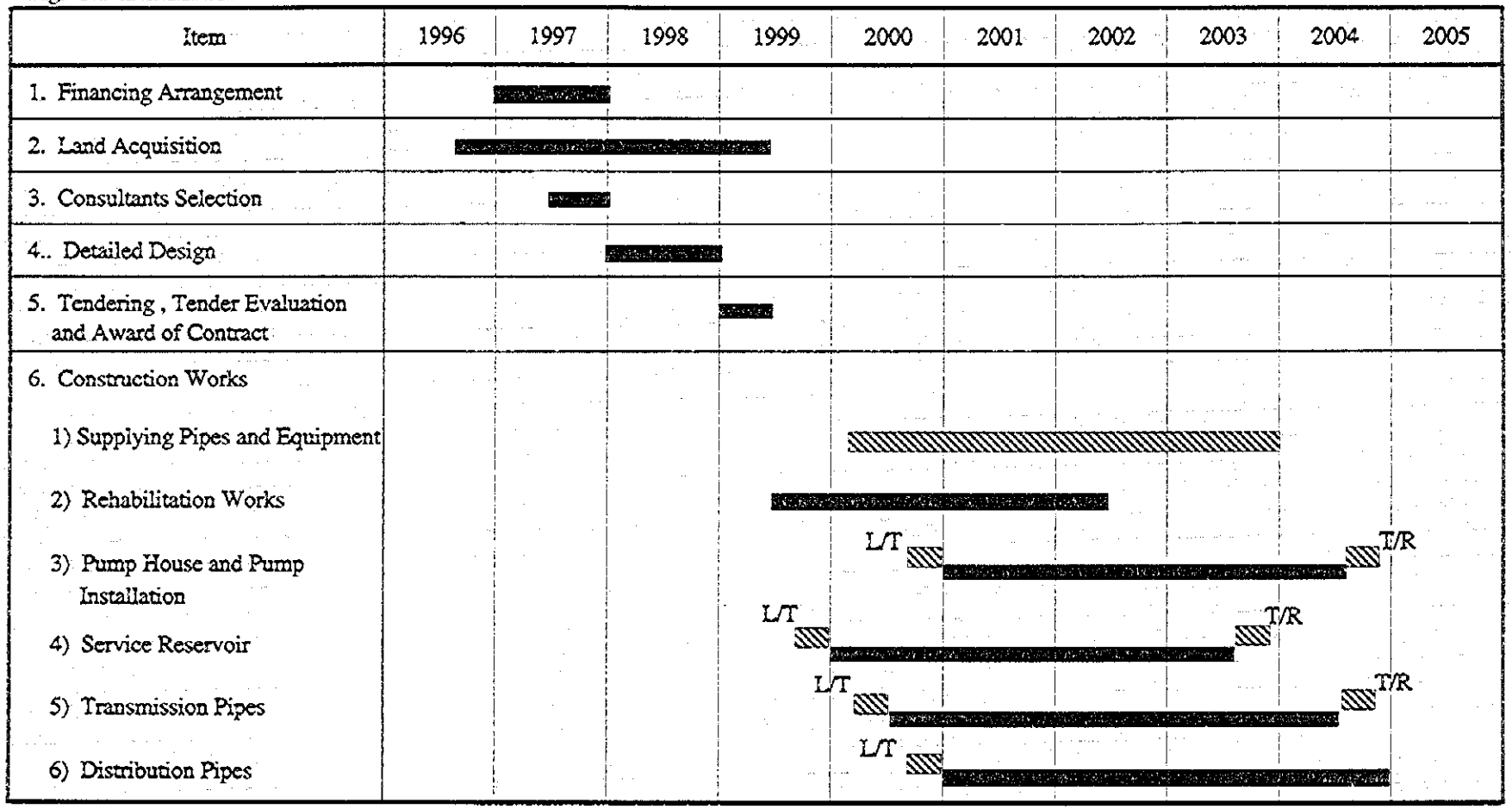
In preparing a realistic schedule for the implementation of the project, WAJ will organize the construction activities. Most construction works will be conducted by contractors and supervised by WAJ or it's designated consultant. However, activities as such rehabilitation works for the existing facilities will be undertaken directly by WAJ staff.

The implementation periods for each activity during the Stage 1 project is assumed as follows:

1) Financing arrangements with lending agency:	12 months
2) Land acquisition for service reservoir sites:	6 months
3) Selecting consultants for detailed design engineering:	6 months
4) Detailed design engineering and approval of tender documents by lending agency:	12 months
5) International tendering, tender evaluation, award of contracts and approval of the contracts by lending agency:	8 months
6) Construction works	
- Supply of pipe materials and pump/electrical equipment:	46 months
- Rehabilitation works:	3 months
- Local tendering for construction and pipe laying works, tender evaluation, award of contract:	3 months
- Pump houses and installation of pump/electrical equipment :	42 months
- Service reservoirs:	44 months
- Transmission pipelines:	48 months
- Distribution pipelines:	48 months

The implementation schedule is shown on Fig. 5.1.

Fig.- 5.1 IMPLEMENTATION SCHEDULE



L/T: Local Tendering. T/R: Test Running

Table 5.1 DISBURSEMENT SCHEDULE FOR PROJECT COST (STAGE-1)

Unit: US$ 1,000

Work Items	Costs	1997	1998	1999	2000	2001	2002	2003	2004
1. Rehabilitation Works	9,767			2,989	2,989	3,789			
2. Land Acquisition	330			330					
3. Transmission Pumps	4,684				790	1,216	888	1,254	536
4. Transmission Pipes	15,935				2,979	5,653	4,765	1,305	1,233
5. Service Reservoirs	3,862				837	513	855	719	938
6. Distribution Pipes	16,446					2,601	4,179	5,214	4,452
Sub-total	51,024			3,319	7,595	13,772	10687	8,492	7159
7. Engineering and Adnimi-									
stration Costs	6,560		1,843	1,507	402	702	702	1,002	402
8. Physical Contingency	5,416		167	454	753	1,356	1,071	896	719
TOTAL COSTS	**63,000**		**2010**	**5,280**	**8,750**	**15,830**	**12460**	**10,390**	**8280**
F/C	44,600		1,524	4,417	6,400	11,622	8,285	7,026	5,326
L/C	18,400		486	863	2,350	4,208	4,175	3,364	2,954

VI. PROJECT EVALUATION

6. PROJECT EVALUATION

6.1 Economic Evaluation

6.1.1 General

Economic evaluation of the project is made by calculating Economic Internal Rate of Return (EIRR) on the basis of the estimated economic benefit and economic cost. For the estimate of the economic benefit and cost the following principles or assumptions are made:

1) Economic benefit is estimated based on the "with and without project principle".
2) All costs and benefits are expressed in constant price and exclude taxes and duties.
3) Cost and benefit are estimated on "incremental basis".
4) Only quantifiable benefit is included in the EIRR calculation though considerable nonquantified benefits are expected.

6.1.2 Economic Benefit

Upon the implementation of the project, available water for consumption in the Study Area will increase considerably partly through reduction of UFW and partly thorough network expansion. This increase of available water is a majour source of the economic benefit, which will contribute to enhance regional economy and welfare of the residents in the following manners:

1) Improved network with increased water supply will alleviate water shortage and rationing;
2) Cost saving for getting water will be realized for the residents since they rely on expensive water tanker during the rationing time;
3) Through the introduction of new zoning and efficient distribution system with newly located reservoirs, electricity consumption is expected to be reduced compared with that under without the project condition, and;
4) Regional development will be facilitated with improved water supply through industrial and commercial development, and property value will increase due to easy access to drinking water.

Estimate of Quantifiable Benefit

For the EIRR calculation, only the benefit from increased water supply is counted as "quantifiable benefit". Benefit of water supply increase is estimated by using the following methods:

1) Increase in water supply through improvement of UFW is the net increase of water supply without any incremental cost in water resources. This net increase is, therefore, valued at the marginal production cost of water* .

2) Remaining portion of the water supply increase is valued by estimating the difference between the economic cost of water production by tanker* and the marginal production cost*1.

This estimated economic benefit for the increased water supply is US$8.03 million in 2005. (Details are presented in Table 5.1).

6.1.3 Economic Cost

The estimated construction cost is converted to the economic cost by applying the shadow exchange rate* to the local cost components. The estimated economic cost is as follows.

Economic Construction Cost

(US$1,000)

Item	Economic Cost
RehabilitationWorks	9,686
Transmission, Reservoir and DistributionSystem	39,916
Engineering, Administration and Contingency	11,738
Total	61,340

Incremental operation and maintenance cost after implementing Stage 1 project is also estimated on the basis of with-project and without-project condition as presented below.

Operation and Maintenance Cost

(US$1,000)

	With-Project	Without-Project	Incremental
Salary	2,234	2,031	203
Electricity	4,034	3,399	644
Repair and Maintenance	984	884	100
Total	7,261	6,314	947

6.1.4 Economic Evaluation

Economic evaluation of the project is made by calculating EIRR based on the estimated economic benefit, economic construction cost and OM cost assuming that the economic life of the project is 25 years after completion of Stage I project. The estimated EIRR is 8.7%, which indicates that the project is economically justifiable (Details of the calculation is presented in Table 5.2).

Sensitivity analysis is conducted to check the project feasibility under the following conditions:

Case 1 Project cost increase by 15 %
Case 2 OM cost increases by 15 %
Case 3 Case (1) + Case (2)

The estimated EIRRs are 7.3 %, 8.5 % and 7.2 % for case 1, case 2 and case 3, respectively (Details of the analysis are presented in Table 5.3 to Table 5.5).

The results indicate that the economic feasibility of the project is quite sensitive to the construction cost increase rather than OM cost increase, and the project still keep marginally acceptable economic return even under the case 3.

6.2 Financial Evaluation

6.2.1 General

Firstly, capacity to pay for water charge is assessed based on the current water tariff and household income in Zarqa. Then, financial evaluation is made by assessing Financial Internal Rate of Return (FIRR) on the basis of the estimated incremental revenue for WAJ Zarqa and the project cost.

Cash flow table is also prepared on the assumed financial conditions incorporating all the revenues and costs of WAJ Zarqa to check the level of the water tariff to cover OM cost under the assumed financial conditions.

Finally, the fund requirement is assessed from the view point of WAJ investment.

6.2.2 Capacity to Pay for Water Charge

(1) Distribution of Water Consumption

For the assessment of the consumers' capacity to pay for water charge, distribution of household water consumption in WAJ Zarqa is prepared and summarized as follows:

Distribution of Household Water Consumption in WAJ Zarqa (1993)

Block (m3)*	No. of bills	%
0 - 20	92,573	32.7
21 - 40	98,246	34.7
41 - 70	62,114	22.0
71 - 100	18,032	6.4
more than 100	11,957	4.2
Total	282,922	100.0

* : Consumption during 3 months Source : WAJ, Finance Directorate

As shown in the above table, almost 90 % of the consumers use less than 70 m3 and about 70 % use less than 40 m3 during 3 months period. Approximately one third of the consumers use less than 20 m3 in Zarqa.

(2) Income Distribution

Distribution of household income in Zarqa is as presented below.

Household Income Distribution

Income Range (JD)	Zarqa
I<1,200	5.6 %
1,200<I<2,400	28.4 %
2,400<I<3,600	25.8 %
3,600<I<4,800	16.1 %
4,800<I<6,000	10.2 %
6,000<I<7,200	5.0 %
I>7,200	8.9 %
Total	100 %

Source : Household Expenditure and Income Survey, 1992

As indicated above, about 50 % of the households get annual income less than JD 3,600 in Zarqa.

About one third or 34 % of the households get the income less than JD 2,400. Weighted average household income is estimated at around JD 3,600.

(3) Assessment of Capacity to Pay

Based on the above figures, capacity to pay is assessed for tow classes of the household, namely, low income class with the annual income of JD 1,500 and middle income class of JD 3,000.

For estimating water charge of the tow classes, the following assumptions are made:

1) Present water consumptions per household are
- 33 m3/3 months for the low income household
- 50 m3/3 months for the middle income household

2) Expected future water consumption per household is estimated at around 66 m3 on the basis of the per capita daily consumption of 80 liter and average number of family.

Water Charge and Income

Income Class		Water Consumption	Water Charge (JD/year)	Water Charge/Annual Income
Low Income	Present	33 m3/3M	10.0	0.7%
	Future	66 m3/3M	43.6	2.9%
Middle Income	Present	50 m3/3M	24.4	0.8%
	Future	66 m3/3M	43.6	1.5%

Source : JICA Team Estimate

As presented above, the costs of water consumption share only 0.7 - 0.8 % of the household income at present both for the low income and the middle income. Even if the consumption will increase to the expected average level (80 liter), the shares will be 2.1 % and 1.5 %, respectively. These ratios seem still low compared with that of affordable level of 3 to 4 %. If income increase in the future is taken into account, the ratios would be further go down. From this, it is considered that the households in the Study Area have sufficient capacity to pay for the water charges and further increase of the water tariff is financially feasible.

6.2.3 Financial Internal Rate of Return (FIRR)

Financial viability of the Stage 1 Project is assessed by calculating Financial Internal Rate of Return on the basis of the estimated incremental revenue and incremental costs for WAJ Zarqa.

(1) Incremental Revenue for WAJ Zarqa

Through the rehabilitation and expansion of the facilities and implementation of the leakage control plan, available water for consumption will increase and the revenue from water sales will increase correspondingly. Average revenue from the water charge is estimated at JD

0.21/m3 or US$ 0.30/m3 in WAJ Zarqa at present. Incremental revenue from the water sales is estimated by applying this unit value to the incremental water consumption in the future is presented in Table 5.6. Summary of the water consumption and revenue is shown below.

Incremental Water Consumption and Incremental Water Revenue for WAJ Zarqa

	2002	2003	2004	2005 and after
Incremental Water Consumption (1,000m3/year)	2,056	2,313	2,570	9,771
Incremental Revenue (US$1,000)	617	694	771	2,931

(2) Incremental Cost for WAJ Zarqa

The incremental cost for WAJ Zarqa consists of the following cost items:

1) Investment cost for rehabilitation and expansion : US$ 63,000 thousand
2) Incremental OM cost including the cost for leakage control : US$ 947 thousand /year

(3) FIRR Calculation

Based on the incremental revenue and incremental cost estimated above, cash flow table is prepared for calculation of FIRR as presented in Table 5.7. However, total incremental cost is larger than total incremental revenue and positive FIRR cannot be estimated.

This means that the project is not financially viable under the present water tariff structure and further increase of the tariff seems indispensable for making the project financially feasible.

For ascertaining the level of water tariff to make the project financially viable, the following sensitivity analysis is made:

Case 1 Raise water tariff by 50 % (US$ 0.45/m3 on an average)
Case 2 Raise water tariff by 75 % (US$5.25/m3 on an average)
Case 3 Raise water tariff by 100 % (US$ 0.60/m3 on an average)

The results of the calculation are presented in Table 5.8 to 5.10 and are summarized below.

	FIRR
Case 1 :	2.3 %
Case 2 :	3.8 %
Case 3 :	5.1 %

The sensitivity analysis indicates that the present level of water tariff is too low and considerable increase in the tariff is necessary to make this project financially viable. To attain the minimum level of 5 % FIRR, present water tariff is to be increased by two times.

6.2.4 Cash Flow Analysis

(1) Assumptions and Conditions

Cash flow table of WAJ Zarqa is prepared for assessing the financial viability of the project. Majour assumptions and conditions applied are explained below:

1) Revenue of WAJ Zarqa consists of water charge and sewer charge. Water charge will increase corresponding to increase in water consumption, while sewer charge remains constant at present level.

2) Depreciation cost is estimated on the basis of the following depreciation ratios.

Pump and water hammer device	6.6 % per year
Equipment, tools and service pipe	5 0 % per year
Transmission and distribution pipe	3.3 % per year
Reservoir, pump house and other related works	3.3 % per year

3) 75 % of the project construction cost will be financed by an international financial organization with the following loan conditions.

Interest rate	:	3 % p.a.
Grace period	:	10 years
Repayment period	:	20 years

4) The remaining 25 % of the cost will be financed by the government subsidy.

5) Repayment of the foreign loan will be made by the government contribution and only interest cost for the loan will be included in the WAJ budget.

(2) Cash Flow Analysis

Based on the assumptions mentioned above cash flow table is prepared as presented in Table 5.11. Projected revenue and expenditure for WAJ Zarqa in the target year (2005) are summarized below.

Projected Revenue and Expenditure of WAJ Zarqa

(US$1,000)

Item	Year 2005
Revenue	
Water Revenue	6,478
Sewer Charge	1,388
Total Revenue	7,866
Expenditure	
(1) Salary	2,234
(2) Electricity	4,043
(3) Depreciation	2,076
(4) repair and Others	984
Total Expenditure	9,337
Revenue - Expenditure	-1,471
Interest on Foreign Loan	1,418
Net Revenue	-2,889

The result of the cash flow analysis indicates that the revenue of WAJ Zarqa covers only operation and maintenance cost excluding depreciation even under the condition that the projected water sales increase considerably. Interest on foreign loan is also not to be covered by the projected revenue. It is, therefore, projected that the accumulated net revenue and accumulated net cash will be minus US$64.5 million and minus US$12.9 million, respectively, in year 2030.

In order to cover the OM cost including depreciation water and sewerage tariff is to be increased by 19 % up to the level of US$0.43/m3 on an average. Revised cash flow table is prepared for the recovery of all the OM cost as presented in Table 5.12. In this case, the accumulated deficit will be decreased to US$23.1 million and the accumulated net cash will become US$28.4 million in year 2030.

Required increase rate of water and sewerage tariff for covering all the OM cost plus interest on foreign loan is 37 % (US$0.50/m3 on an average). The cash flow table incorporating this increase is prepared as presented in Table 5.13. Under this assumption, the accumulated net

revenue will reach US$16.7 million in year 2030. The accumulated net cash will amount to US$68.3 million.

An another cash flow table is prepared assuming that the repayment of the foreign loan will be made by WAJ Zarqa instead of government contribution. As presented in Table 5.14, net cash still keeps positive figures except the initial construction period due to the payment for the interest during construction under the case of 37 % tariff increase.

6.2.5 Fund Requirement and WAJ Investment

Required fund or investment cost for the project is to be assessed from the view point of WAJ investment. As indicated in Table 5.7 annual required fund for the project varies from US$ 2.0 million to US$ 15.8 million during the implementation period of 1998 - 2004. For checking the financial viability of the investment, historical investment amount of WAJ is studied.

WAJ Investment

(1,000 JD)

Year	Investment
1989	75,800
1990	39,732
1991	33,181
1992	37,477
1993	56,033
Average	48,444

Source : WAJ, Finance Directorate

As recorded in the above table, WAJ has spent about JD 48.4 million or US$69.1 million annually on an average during the past 5 years.

Compared with this figure, the estimated annual fund requirement for the project corresponds to 2.9 - 22.9% of the annual WAJ investment. The annual fund requirements is less than 20 % of WAJ investment except that of 2001 and is considered within the reasonable investment level of WAJ.

6.3 Socio-economic Impacts and Overall Evaluation

6.3.1 Socio-economic Impacts

As mentioned in the economic evaluation, considerable socio-economic impacts are expected from the implementation of the project.

Alleviation of water shortage and rationing might be the first socio-economic impact and most important one, which will improve sanitary and hygiene environment and contribute to the regional health in the Study Area. Rusaifa municipality located in south-west part of the Study Area is being seriously affected by water shortage, where income of the residents are relatively low compared with those of Zarqa municipality. The expected benefit for the improvement of the basic human needs will be realized particularly in these lower income areas, that will contribute to the income redistribution in the region.

Facilitation of the regional development would be the second socio-economic impact. The expansion of the water supply network and increase of the available water will promote industrial and commercial development in the Study Area. Urban development will, thus, be accelerated further to the north and north-west direction.

As mentioned in the preceding chapter, existence of the high unemployment is one of the serious socio-economic problems in the Study Area. The expected development in industry and commerce will improve this situation. Thus, the project will contribute to the heightening of the living standard for the residents through the economic development and environmental improvement, and to enhancement of the social welfare in the Study Area.

6.3.2 Overall Evaluation

As explained in the preceding section, the project will produce reasonable economic return and the investment is economically justified. However, due to the low water tariff, the project is not financially justified. Considerable increase of water tariff will be necessary for attaining financial feasibility. The cash flow analysis indicates that at least 19 % increase is required for covering the OM cost including depreciation. The annual fund requirement for the implementation of the project is within the justifiable range of WAJ investment.

Besides, substantial socio-economic impacts are expected from the implementation of the project. The improvement of the basic human needs through the alleviation of water shortage and rationing is considered a great benefit to the Study Area as well as the resulting regional development. Taking into account all the above the project is justified economically and socially and its early implementation is to be recommended.

Table 6.1 Estimae of Economic Benefit

Year	UFW Reduction			New Source			Total Benefit
	Incrementatl Water ($1,000m^3$)	Unit Value (US$)	Sub-total (1,000US$)	Incrementatl Water ($1,000m^3$)	Unit Value (US$)	Sub-total (1,000US$)	(1,000US$)
2002	2,056	0.74	1,521	0	0.86	0	1,521
03	2,313	0.74	1,712	0	0.86	0	1,712
04	2,570	0.74	1,902	0	0.86	0	1,902
05	3,084	0.74	2,282	6,687	0.86	5,751	8,033
06	3,084	0.74	2,282	6,687	0.86	5,751	8,033
07	3,084	0.74	2,282	6,687	0.86	5,751	8,033
08	3,084	0.74	2,282	6,687	0.86	5,751	8,033
09	3,084	0.74	2,282	6,687	0.86	5,751	8,033
2010	3,084	0.74	2,282	6,687	0.86	5,751	8,033
11	3,084	0.74	2,282	6,687	0.86	5,751	8,033
12	3,084	0.74	2,282	6,687	0.86	5,751	8,033
13	3,084	0.74	2,282	6,687	0.86	5,751	8,033
14	3,084	0.74	2,282	6,687	0.86	5,751	8,033
15	3,084	0.74	2,282	6,687	0.86	5,751	8,033
16	3,084	0.74	2,282	6,687	0.86	5,751	8,033
17	3,084	0.74	2,282	6,687	0.86	5,751	8,033
18	3,084	0.74	2,282	6,687	0.86	5,751	8,033
19	3,084	0.74	2,282	6,687	0.86	5,751	8,033
2020	3,084	0.74	2,282	6,687	0.86	5,751	8,033
21	3,084	0.74	2,282	6,687	0.86	5,751	8,033
22	3,084	0.74	2,282	6,687	0.86	5,751	8,033
23	3,084	0.74	2,282	6,687	0.86	5,751	8,033
24	3,084	0.74	2,282	6,687	0.86	5,751	8,033
25	3,084	0.74	2,282	6,687	0.86	5,751	8,033
26	3,084	0.74	2,282	6,687	0.86	5,751	8,033
27	3,084	0.74	2,282	6,687	0.86	5,751	8,033
28	3,084	0.74	2,282	6,687	0.86	5,751	8,033
29	3,084	0.74	2,282	6,687	0.86	5,751	8,033
2030	3,084	0.74	2,282	6,687	0.86	5,751	8,033
Total	87,123		64,471	173,862		149,521	213,992

Table 6.2 EIRR Calculation

(US$1,000)

Year	Econ. Const. Cost	OM Cost	Cost Total	Econ. Benefit	B - C
1998	1,966	0	1,966	0	-1,966
99	5,202	0	5,202	0	-5,202
2000	8,538	0	8,538	0	-8,538
01	15,451	0	15,451	0	-15,451
02	12,084	178	12,262	1,521	-10,741
03	10,087	200	10,287	1,712	-8,575
04	8,012	222	8,234	1,902	-6,332
05	0	947	947	8,033	7,086
06	0	947	947	8,033	7,086
07	0	947	947	8,033	7,086
08	0	947	947	8,033	7,086
09	0	947	947	8,033	7,086
2010	0	947	947	8,033	7,086
11	0	947	947	8,033	7,086
12	0	947	947	8,033	7,086
13	0	947	947	8,033	7,086
14	0	947	947	8,033	7,086
15	0	947	947	8,033	7,086
16	0	947	947	8,033	7,086
17	0	947	947	8,033	7,086
18	0	947	947	8,033	7,086
19	0	947	947	8,033	7,086
2020	2,086 *	947	3,033	8,033	5,000
21	0	947	947	8,033	7,086
22	0	947	947	8,033	7,086
23	0	947	947	8,033	7,086
24	0	947	947	8,033	7,086
25	2,486 *	947	3,433	8,033	4,600
26	0	947	947	8,033	7,086
27	0	947	947	8,033	7,086
28	0	947	947	8,033	7,086
29	0	947	947	8,033	7,086
2030	0	947	947	8,033	7,086
Total	65,912	25,222	91,134	213,992	122,858

* Replacement cost
IRR = 8.7%

Table 6.3 EIRR Calculation (Case 1)

(US$1,000)

Year	Econ. Const. Cost	OM Cost	Cost Total	Econ. Benefit	B - C
1998	2,261	0	2,261	0	-2,261
99	5,982	0	5,982	0	-5,982
2000	9,819	0	9,819	0	-9,819
01	17,769	0	17,769	0	-17,769
02	13,897	178	14,075	1,521	-12,553
03	11,600	200	11,800	1,712	-10,088
04	9,214	222	9,436	1,902	-7,534
05	0	947	947	8,033	7,086
06	0	947	947	8,033	7,086
07	0	947	947	8,033	7,086
08	0	947	947	8,033	7,086
09	0	947	947	8,033	7,086
2010	0	947	947	8,033	7,086
11	0	947	947	8,033	7,086
12	0	947	947	8,033	7,086
13	0	947	947	8,033	7,086
14	0	947	947	8,033	7,086
15	0	947	947	8,033	7,086
16	0	947	947	8,033	7,086
17	0	947	947	8,033	7,086
18	0	947	947	8,033	7,086
19	0	947	947	8,033	7,086
2020	2,399 *	947	3,346	8,033	4,687
21	0	947	947	8,033	7,086
22	0	947	947	8,033	7,086
23	0	947	947	8,033	7,086
24	0	947	947	8,033	7,086
25	2,859 *	947	3,806	8,033	4,227
26	0	947	947	8,033	7,086
27	0	947	947	8,033	7,086
28	0	947	947	8,033	7,086
29	0	947	947	8,033	7,086
2030	0	947	947	8,033	7,086
Total	75,799	25,222	101,021	213,992	112,972

* Replacement cost
IRR = 7.3%

Table 6.4 BIRR Calculation (Case 2)

(US$1,000)

Year	Econ. Const. Cost	OM Cost	Cost Total	Econ. Benefit	B - C
1998	1,966	0	1,966	0	-1,966
99	5,202	0	5,202	0	-5,202
2000	8,538	0	8,538	0	-8,538
01	15,451	0	15,451	0	-15,451
02	12,084	205	12,289	1,521	-10,767
03	10,087	230	10,317	1,712	-8,605
04	8,012	255	8,267	1,902	-6,366
05	0	1,089	1,089	8,033	6,944
06	0	1,089	1,089	8,033	6,944
07	0	1,089	1,089	8,033	6,944
08	0	1,089	1,089	8,033	6,944
09	0	1,089	1,089	8,033	6,944
2010	0	1,089	1,089	8,033	6,944
11	0	1,089	1,089	8,033	6,944
12	0	1,089	1,089	8,033	6,944
13	0	1,089	1,089	8,033	6,944
14	0	1,089	1,089	8,033	6,944
15	0	1,089	1,089	8,033	6,944
16	0	1,089	1,089	8,033	6,944
17	0	1,089	1,089	8,033	6,944
18	0	1,089	1,089	8,033	6,944
19	0	1,089	1,089	8,033	6,944
2020	2,086 *	1,089	3,175	8,033	4,858
21	0	1,089	1,089	8,033	6,944
22	0	1,089	1,089	8,033	6,944
23	0	1,089	1,089	8,033	6,944
24	0	1,089	1,089	8,033	6,944
25	2,486 *	1,089	3,575	8,033	4,458
26	0	1,089	1,089	8,033	6,944
27	0	1,089	1,089	8,033	6,944
28	0	1,089	1,089	8,033	6,944
29	0	1,089	1,089	8,033	6,944
2030	0	1,089	1,089	8,033	6,944
Total	65,912	29,005	94,917	213,992	119,075

* Replacement cost
IRR = 8.5%

Table 6.5 EIRR Calculation (Case 3)

(US$1,000)

Year	Econ. Const. Cost	OM Cost	Cost Total	Econ. Benefit	B - C
1998	2,261	0	2,261	0	-2,261
99	5,982	0	5,982	0	-5,982
2000	9,819	0	9,819	0	-9,819
01	17,769	0	17,769	0	-17,769
02	13,897	205	14,101	1,521	-12,580
03	11,600	230	11,830	1,712	-10,118
04	9,214	255	9,469	1,902	-7,567
05	0	1,089	1,089	8,033	6,944
06	0	1,089	1,089	8,033	6,944
07	0	1,089	1,089	8,033	6,944
08	0	1,089	1,089	8,033	6,944
09	0	1,089	1,089	8,033	6,944
2010	0	1,089	1,089	8,033	6,944
11	0	1,089	1,089	8,033	6,944
12	0	1,089	1,089	8,033	6,944
13	0	1,089	1,089	8,033	6,944
14	0	1,089	1,089	8,033	6,944
15	0	1,089	1,089	8,033	6,944
16	0	1,089	1,089	8,033	6,944
17	0	1,089	1,089	8,033	6,944
18	0	1,089	1,089	8,033	6,944
19	0	1,089	1,089	8,033	6,944
2020	2,399 *	1,089	3,488	8,033	4,545
21	0	1,089	1,089	8,033	6,944
22	0	1,089	1,089	8,033	6,944
23	0	1,089	1,089	8,033	6,944
24	0	1,089	1,089	8,033	6,944
25	2,859 *	1,089	3,948	8,033	4,085
26	0	1,089	1,089	8,033	6,944
27	0	1,089	1,089	8,033	6,944
28	0	1,089	1,089	8,033	6,944
29	0	1,089	1,089	8,033	6,944
2030	0	1,089	1,089	8,033	6,944
Total	75,799	29,005	104,804	213,992	109,188

* Replacement cost
IRR = 7.2%

Table 6.6 Incremental Water Consumption and Incremental Water Revenue (WAJ Zarqa)

Year	Incremental Water Consumption ($1,000m^3$)	Unit Value *1 (US$)	Incremental Water Revenue (1,000US$)
2002	2,056	0.3	617
03	2,313	0.3	694
04	2,570	0.3	771
05	9,771	0.3	2,931
06	9,771	0.3	2,931
07	9,771	0.3	2,931
08	9,771	0.3	2,931
09	9,771	0.3	2,931
2010	9,771	0.3	2,931
11	9,771	0.3	2,931
12	9,771	0.3	2,931
13	9,771	0.3	2,931
14	9,771	0.3	2,931
15	9,771	0.3	2,931
16	9,771	0.3	2,931
17	9,771	0.3	2,931
18	9,771	0.3	2,931
19	9,771	0.3	2,931
2020	9,771	0.3	2,931
21	9,771	0.3	2,931
22	9,771	0.3	2,931
23	9,771	0.3	2,931
24	9,771	0.3	2,931
25	9,771	0.3	2,931
26	9,771	0.3	2,931
27	9,771	0.3	2,931
28	9,771	0.3	2,931
29	9,771	0.3	2,931
2030	9,771	0.3	2,931
Total	260,985		78,296

*1 : JD0.21/m^3 = US$0.30/$m^3$

Table 6.7 FIRR Calculation

Year	Investment Cost	Incremental OM Cost	Total Cost	Incremental Water Revenue	R - C
1998	2,010	0	2,010	0	-2,010
99	5,280	0	5,280	0	-5,280
2000	8,750	0	8,750	0	-8,750
01	15,830	0	15,830	0	-15,830
02	12,460	178	12,638	617	-12,021
03	10,390	200	10,590	694	-9,896
04	8,280	222	8,502	771	-7,731
05	0	947	947	2,931	1,984
06	0	947	947	2,931	1,984
07	0	947	947	2,931	1,984
08	0	947	947	2,931	1,984
09	0	947	947	2,931	1,984
2010	0	947	947	2,931	1,984
11	0	947	947	2,931	1,984
12	0	947	947	2,931	1,984
13	0	947	947	2,931	1,984
14	0	947	947	2,931	1,984
15	0	947	947	2,931	1,984
16	0	947	947	2,931	1,984
17	0	947	947	2,931	1,984
18	0	947	947	2,931	1,984
19	0	947	947	2,931	1,984
2020	2,105 *	947	3,052	2,931	-121
21	0	947	947	2,931	1,984
22	0	947	947	2,931	1,984
23	0	947	947	2,931	1,984
24	0	947	947	2,931	1,984
25	2,711 *	947	3,658	2,931	-727
26	0	947	947	2,931	1,984
27	0	947	947	2,931	1,984
28	0	947	947	2,931	1,984
29	0	947	947	2,931	1,984
2030	0	947	947	2,931	1,984
Total	67,816	25,222	93,038	78,296	-14,742

* Replacement cost
IRR = #DIV/0!

Table 6.8 FIRR Calculation (Case 1)

Year	Investment Cost	Incremental OM Cost	Total Cost	Incremental Water Revenue	R - C
1998	2,010	0	2,010	0	-2,010
99	5,280	0	5,280	0	-5,280
2000	8,750	0	8,750	0	-8,750
01	15,830	0	15,830	0	-15,830
02	12,460	178	12,638	925	-11,713
03	10,390	200	10,590	1,041	-9,549
04	8,280	222	8,502	1,157	-7,345
05	0	947	947	4,397	3,450
06	0	947	947	4,397	3,450
07	0	947	947	4,397	3,450
08	0	947	947	4,397	3,450
09	0	947	947	4,397	3,450
2010	0	947	947	4,397	3,450
11	0	947	947	4,397	3,450
12	0	947	947	4,397	3,450
13	0	947	947	4,397	3,450
14	0	947	947	4,397	3,450
15	0	947	947	4,397	3,450
16	0	947	947	4,397	3,450
17	0	947	947	4,397	3,450
18	0	947	947	4,397	3,450
19	0	947	947	4,397	3,450
2020	2,105 *	947	3,052	4,397	1,345
21	0	947	947	4,397	3,450
22	0	947	947	4,397	3,450
23	0	947	947	4,397	3,450
24	0	947	947	4,397	3,450
25	2,711 *	947	3,658	4,397	739
26	0	947	947	4,397	3,450
27	0	947	947	4,397	3,450
28	0	947	947	4,397	3,450
29	0	947	947	4,397	3,450
2030	0	947	947	4,397	3,450
Total	67,816	25,222	93,038	117,445	24,407

* Replacement cost
IRR = 2.3%

Table 6.9 FIRR Calculation (Case 2)

Year	Investment Cost	Incremental OM Cost	Total Cost	Incremental Water Revenue	R - C
1998	2,010	0	2,010	0	-2,010
99	5,280	0	5,280	0	-5,280
2000	8,750	0	8,750	0	-8,750
01	15,830	0	15,830	0	-15,830
02	12,460	178	12,638	1,079	-11,559
03	10,390	200	10,590	1,214	-9,376
04	8,280	222	8,502	1,349	-7,153
05	0	947	947	5,130	4,183
06	0	947	947	5,130	4,183
07	0	947	947	5,130	4,183
08	0	947	947	5,130	4,183
09	0	947	947	5,130	4,183
2010	0	947	947	5,130	4,183
11	0	947	947	5,130	4,183
12	0	947	947	5,130	4,183
13	0	947	947	5,130	4,183
14	0	947	947	5,130	4,183
15	0	947	947	5,130	4,183
16	0	947	947	5,130	4,183
17	0	947	947	5,130	4,183
18	0	947	947	5,130	4,183
19	0	947	947	5,130	4,183
2020	2,105 *	947	3,052	5,130	2,078
21	0	947	947	5,130	4,183
22	0	947	947	5,130	4,183
23	0	947	947	5,130	4,183
24	0	947	947	5,130	4,183
25	2,711 *	947	3,658	5,130	1,472
26	0	947	947	5,130	4,183
27	0	947	947	5,130	4,183
28	0	947	947	5,130	4,183
29	0	947	947	5,130	4,183
2030	0	947	947	5,130	4,183
Total	67,816	25,222	93,038	137,022	43,984

* Replacement cost
IRR = 3.8%

Table 6.10 FIRR Calculation (Case 3)

Year	Investment Cost	Incremental OM Cost	Total Cost	Incremental Water Revenue	R - C
1998	2,010	0	2,010	0	-2,010
99	5,280	0	5,280	0	-5,280
2000	8,750	0	8,750	0	-8,750
01	15,830	0	15,830	0	-15,830
02	12,460	178	12,638	1,234	-11,404
03	10,390	200	10,590	1,388	-9,202
04	8,280	222	8,502	1,542	-6,960
05	0	947	947	5,863	4,916
06	0	947	947	5,863	4,916
07	0	947	947	5,863	4,916
08	0	947	947	5,863	4,916
09	0	947	947	5,863	4,916
2010	0	947	947	5,863	4,916
11	0	947	947	5,863	4,916
12	0	947	947	5,863	4,916
13	0	947	947	5,863	4,916
14	0	947	947	5,863	4,916
15	0	947	947	5,863	4,916
16	0	947	947	5,863	4,916
17	0	947	947	5,863	4,916
18	0	947	947	5,863	4,916
19	0	947	947	5,863	4,916
2020	2,105 *	947	3,052	5,863	2,811
21	0	947	947	5,863	4,916
22	0	947	947	5,863	4,916
23	0	947	947	5,863	4,916
24	0	947	947	5,863	4,916
25	2,711 *	947	3,658	5,863	2,205
26	0	947	947	5,863	4,916
27	0	947	947	5,863	4,916
28	0	947	947	5,863	4,916
29	0	947	947	5,863	4,916
2030	0	947	947	5,863	4,916
Total	67,816	25,222	93,038	156,602	63,564

* Replacement cost
IRR = 5.1%

Table 6.11 Cash Flow of WAJ Zarqa

(US$1,000)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
I. Income Statement																	
1.1 Revenue																	
(1) Water Sales (1,000m³)	0	0	0	0	13,878	14,135	14,392	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
(3) Water Charge	0	0	0	0	4,163	4,241	4,318	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478
(4) Sewer Charge *2	0	0	0	0	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388
(5) Total Revenue	0	0	0	0	5,551	5,629	5,706	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866
1.2 Expenditure																	
(1) Salary	0	0	0	0	2,031	2,045	2,065	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	0	0	0	0	3,647	3,662	3,674	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	0	0	0	0	0	0	0	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	0	0	0	0	884	884	884	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	23	105	262	539	857	1,114	1,324	1,418	1,418	1,418	1,418	1,347	1,276	1,205	1,134	1,063	992
(6) Total Expenditure	23	105	262	539	7,419	7,705	7,947	10,755	10,755	10,755	10,755	10,684	10,613	10,542	10,471	10,400	10,329
1.3 Revenue - Expenditure	-23	-105	-262	-539	-1,868	-2,077	-2,242	-2,889	-2,889	-2,889	-2,889	-2,818	-2,747	-2,676	-2,605	-2,534	-2,463
1.4 Accumulated Net Revenue/Deficit	-23	-127	-390	-929	-2,797	-4,873	-7,115	-10,004	-12,892	-15,781	-18,670	-21,487	-24,234	-26,910	-29,515	-32,049	-34,513
II. Cash Flow																	
2.1 Cash Inflow																	
(1) Cash Flow from Operation 1.3 + 1.2(3)	-23	-105	-262	-539	-1,868	-2,077	-2,242	-813	-813	-813	-813	-742	-671	-600	-529	-458	-387
(2) Foreign Loan	1,508	3,960	6,563	11,873	9,345	7,793	6,210	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	1,508	5,468	12,030	23,903	33,248	41,040	47,250	47,250	47,250	47,250	44,888	42,525	40,163	37,800	35,438	33,075	30,713
(4) Government Contribution																	
i) Local Portion	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	0	0	0	0	0	0
ii) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
iii) Total	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
(5) Total Cash Inflow	1,987	5,175	8,488	15,291	10,592	8,313	6,038	-813	-813	-813	-813	1,621	1,692	1,763	1,833	1,904	1,975
2.2 Cash Outflow																	
(1) Investment	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	0	0	0	0	0	0	0
(2) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363	2,363
(3) Total Outflow	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363	2,363
2.3 Net Cash Flow																	
2.1(5) - 2.2(3)	-23	-105	-262	-539	-1,868	-2,077	-2,242	-813	-813	-813	-3,175	-742	-671	-600	-529	-458	-387
2.4 Accumulated Net Cash	-23	-127	-390	-929	-2,797	-4,873	-7,115	-7,928	-8,740	-9,553	-12,728	-13,470	-14,141	-14,741	-15,270	-15,728	-16,115

Note *1: water charge (JD 0.21/m³ = US$0.3/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.1/m³

Table 6.11 Cash Flow of WAJ Zarqa

(US$1,000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
I. Income Statement																
1.1 Revenue																
(1) Water Sales (1,000m³)	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
(3) Water Charge	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478	6,478
(4) Sewer Charge *2	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388	1,388
(5) Total Revenue	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866	7,866
1.2 Expenditure																
(1) Salary	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	921	851	780	709	638	567	496	425	354	284	213	142	71	0	0	0
(6) Total Expenditure	10,258	10,188	10,117	10,046	9,975	9,904	9,833	9,762	9,691	9,621	9,550	9,479	9,408	9,337	9,337	9,337
1.3 Revenue - Expenditure	-2,392	-2,322	-2,251	-2,180	-2,109	-2,038	-1,967	-1,896	-1,825	-1,755	-1,684	-1,613	-1,542	-1,471	-1,471	-1,471
1.4 Accumulated Net Revenue/Deficit	-36,905	-39,227	-41,478	-43,657	-45,766	-47,804	-49,772	-51,668	-53,493	-55,248	-56,932	-58,545	-60,087	-61,558	-63,029	-64,500
II. Cash Flow																
2.1 Cash Inflow																
(1) Cash Flow from Operation 1.3 + 1.2(3)	-316	-246	-175	-104	-33	38	109	180	251	321	392	463	534	605	605	605
(2) Foreign Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	28,350	25,988	23,625	21,263	18,900	16,538	14,175	11,813	9,450	7,088	4,725	2,363	0	0	0	0
(4) Government Contribution																
i) Local Portion	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
ii) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
iii) Total	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
(5) Total Cash Inflow	2,046	2,117	2,188	2,259	2,330	4,505	2,471	2,542	2,613	2,684	5,466	2,826	2,897	605	605	605
2.2 Cash Outflow																
(1) Investment	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
(2) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
(3) Total Outflow	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
2.3 Net Cash Flow																
2.1(5) - 2.2(3)	-316	-246	-175	-104	-33	38	109	180	251	321	392	463	534	605	605	605
2.4 Accumulated Net Cash	-16,432	-16,677	-16,852	-16,956	-16,989	-16,951	-16,842	-16,663	-16,412	-16,091	-15,698	-15,235	-14,701	-14,096	-13,491	-12,886

Note *1: water charge (JD 0.21/m³ = US$0.3/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.1/m³

Table 6.12 Cash Flow of WAJ Zarqa (Case 1)

(US$1,000)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
I. Income Statement																	
1.1 Revenue																	
(1) Water Sales (1,000m³)	0	0	0	0	13,878	14,135	14,392	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356
(3) Water Charge	0	0	0	0	4,941	5,032	5,124	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687
(4) Sewer Charge *2	0	0	0	0	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648
(5) Total Revenue	0	0	0	0	6,588	6,680	6,771	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335
1.2 Expenditure																	
(1) Salary	0	0	0	0	2,031	2,045	2,065	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	0	0	0	0	3,647	3,662	3,674	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	0	0	0	0	0	0	0	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	0	0	0	0	884	884	884	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	23	105	262	539	857	1,114	1,324	1,418	1,418	1,418	1,418	1,347	1,276	1,205	1,134	1,063	992
(6) Total Expenditure	23	105	262	539	7,419	7,705	7,947	10,755	10,755	10,755	10,755	10,684	10,613	10,542	10,471	10,400	10,329
1.3 Revenue - Expenditure	-23	-105	-262	-539	-831	-1,026	-1,176	-1,420	-1,420	-1,420	-1,420	-1,349	-1,278	-1,207	-1,136	-1,065	-995
1.4 Accumulated Net Revenue/Deficit	-23	-127	-390	-929	-1,760	-2,786	-3,962	-5,382	-6,801	-8,221	-9,641	-10,990	-12,268	-13,475	-14,612	-15,677	-16,672
II. Cash Flow																	
2.1 Cash Inflow																	
(1) Cash Flow from Operation 1.3 + 1.2(3)	-23	-105	-262	-539	-831	-1,026	-1,176	656	656	656	656	727	798	869	940	1,011	1,081
(2) Foreign Loan	1,508	3,960	6,563	11,873	9,345	7,793	6,210	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	1,508	5,468	12,030	23,903	33,248	41,040	47,250	47,250	47,250	47,250	44,888	42,525	40,163	37,800	35,438	33,075	30,713
(4) Government Contribution																	
i) Local Portion	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	0	0	0	0	0	0
ii) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
iii) Total	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
(5) Total Cash Inflow	1,987	5,175	8,488	15,291	11,629	9,364	7,104	656	656	656	656	3,090	3,160	3,231	3,302	3,373	3,444
2.2 Cash Outflow																	
(1) Investment	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	0	0	0	0	0	0	0
(2) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
(3) Total Outflow	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
2.3 Net Cash Flow																	
2.1(5) - 2.2(3)	-23	-105	-262	-539	-831	-1,026	-1,176	656	656	656	-1,706	727	798	869	940	1,011	1,081
2.4 Accumulated Net Cash	-23	-127	-390	-929	-1,760	-2,786	-3,962	-3,306	-2,649	-1,993	-3,700	-2,973	-2,175	-1,306	-366	644	1,726

Note *1: water charge (JD 0.249/m³ = US$0.356/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.119/m³

Table 6.12 Cash Flow of WAJ Zarqa (Case 1)

(US$1,000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
I. Income Statement																
1.1 Revenue																
(1) Water Sales (1,000m³)	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356	0.356
(3) Water Charge	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687	7,687
(4) Sewer Charge *2	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648	1,648
(5) Total Revenue	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335	9,335
1.2 Expenditure																
(1) Salary	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	921	851	780	709	638	567	496	425	354	284	213	142	71	0	0	0
(6) Total Expenditure	10,258	10,188	10,117	10,046	9,975	9,904	9,833	9,762	9,691	9,621	9,550	9,479	9,408	9,337	9,337	9,337
1.3 Revenue - Expenditure	-924	-853	-782	-711	-640	-569	-498	-428	-357	-286	-215	-144	-73	-2	-2	-2
1.4 Accumulated Net Revenue/Deficit	-17,595	-18,448	-19,230	-19,941	-20,582	-21,151	-21,649	-22,077	-22,434	-22,719	-22,934	-23,079	-23,152	-23,154	-23,156	-23,159
II. Cash Flow																
2.1 Cash Inflow																
(1) Cash Flow from Operation 1.3 + 1.2(3)	1,152	1,223	1,294	1,365	1,436	1,507	1,578	1,648	1,719	1,790	1,861	1,932	2,003	2,074	2,074	2,074
(2) Foreign Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	28,350	25,988	23,625	21,263	18,900	16,538	14,175	11,813	9,450	7,088	4,725	2,363	0	0	0	0
(4) Government Contribution																
i) Local Portion	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
ii) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
iii) Total	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
(5) Total Cash Inflow	3,515	3,586	3,657	3,727	3,798	5,974	3,940	4,011	4,082	4,153	6,935	4,294	4,365	2,074	2,074	2,074
2.2 Cash Outflow																
(1) Investment	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
(2) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
(3) Total Outflow	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
2.3 Net Cash Flow																
2.1(5) - 2.2(3)	1,152	1,223	1,294	1,365	1,436	1,507	1,578	1,648	1,719	1,790	1,861	1,932	2,003	2,074	2,074	2,074
2.4 Accumulated Net Cash	2,878	4,101	5,395	6,760	8,196	9,703	11,280	12,929	14,648	16,438	18,299	20,231	22,234	24,307	26,381	28,455

Note *1: water charge (JD 0.249/m³ = US$0.356/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.119/m³

Table 6.13 Cash Flow of WAJ Zarqa (Case 2)

(US$1,000)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
I. Income Statement																	
1.1 Revenue																	
(1) Water Sales (1,000m³)	0	0	0	0	13,878	14,135	14,392	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
(3) Water Charge	0	0	0	0	5,690	5,795	5,901	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853
(4) Sewer Charge *2	0	0	0	0	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899
(5) Total Revenue	0	0	0	0	7,589	7,694	7,800	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752
1.2 Expenditure																	
(1) Salary	0	0	0	0	2,031	2,045	2,065	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	0	0	0	0	3,647	3,662	3,674	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	0	0	0	0	0	0	0	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	0	0	0	0	884	884	884	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	23	105	262	539	857	1,114	1,324	1,418	1,418	1,418	1,418	1,347	1,276	1,205	1,134	1,063	992
(6) Total Expenditure	23	105	262	539	7,419	7,705	7,947	10,755	10,755	10,755	10,755	10,684	10,613	10,542	10,471	10,400	10,329
1.3 Revenue - Expenditure	-23	-105	-262	-539	170	-11	-148	-3	-3	-3	-3	68	139	210	281	352	423
1.4 Accumulated Net Revenue/Deficit	-23	-127	-390	-929	-759	-770	-918	-921	-923	-926	-929	-860	-721	-511	-230	122	544
II. Cash Flow																	
2.1 Cash Inflow																	
(1) Cash Flow from Operation 1.3 + 1.2(3)	-23	-105	-262	-539	170	-11	-148	2,073	2,073	2,073	2,073	2,144	2,215	2,286	2,357	2,428	2,499
(2) Foreign Loan	1,508	3,960	6,563	11,873	9,345	7,793	6,210	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	1,508	5,468	12,030	23,903	33,248	41,040	47,250	47,250	47,250	47,250	44,888	42,525	40,163	37,800	35,438	33,075	30,713
(4) Government Contribution																	
i) Local Portion	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	0	0	0	0	0	0
ii) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
iii) Total	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363
(5) Total Cash Inflow	1,987	5,175	8,488	15,291	12,630	10,379	8,132	2,073	2,073	2,073	2,073	4,507	4,578	4,649	4,719	4,790	4,861
2.2 Cash Outflow																	
(1) Investment	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	0	0	0	0	0	0	0
(2) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363	2,363
(3) Total Outflow	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363	2,363
2.3 Net Cash Flow																	
2.1(5) - 2.2(3)	-23	-105	-262	-539	170	-11	-148	2,073	2,073	2,073	-289	2,144	2,215	2,286	2,357	2,428	2,499
2.4 Accumulated Net Cash	-23	-127	-390	-929	-759	-770	-918	1,155	3,229	5,302	5,013	7,157	9,372	11,658	14,015	16,443	18,942

Note *1: water charge (JD 0.287/m³ = US$0.41/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.137/m³

Table 6.13 Cash Flow of WAJ Zarqa (Case 2)

(US$1,000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
I. Income Statement																
1.1 Revenue																
(1) Water Sales (1,000m³)	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
(3) Water Charge	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853
(4) Sewer Charge *2	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899
(5) Total Revenue	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752
1.2 Expenditure																
(1) Salary	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	921	851	780	709	638	567	496	425	354	284	213	142	71	0	0	0
(6) Total Expenditure	10,258	10,188	10,117	10,046	9,975	9,904	9,833	9,762	9,691	9,621	9,550	9,479	9,408	9,337	9,337	9,337
1.3 Revenue - Expenditure	494	564	635	706	777	848	919	990	1,061	1,131	1,202	1,273	1,344	1,415	1,415	1,415
1.4 Accumulated Net Revenue/Deficit	1,038	1,602	2,238	2,944	3,721	4,569	5,487	6,477	7,538	8,669	9,871	11,145	12,489	13,903	15,318	16,733
II. Cash Flow																
2.1 Cash Inflow																
(1) Cash Flow from Operation 1.3 + 1.2(3)	2,570	2,640	2,711	2,782	2,853	2,924	2,995	3,066	3,137	3,207	3,278	3,349	3,420	3,491	3,491	3,491
(2) Foreign Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	28,350	25,988	23,625	21,263	18,900	16,538	14,175	11,813	9,450	7,088	4,725	2,363	0	0	0	0
(4) Government Contribution																
i) Local Portion	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
ii) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
iii) Total	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
(5) Total Cash Inflow	4,932	5,003	5,074	5,145	5,216	7,391	5,357	5,428	5,499	5,570	8,352	5,712	5,783	3,491	3,491	3,491
2.2 Cash Outflow																
(1) Investment	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
(2) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
(3) Total Outflow	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
2.3 Net Cash Flow																
2.1(5) - 2.2(3)	2,570	2,640	2,711	2,782	2,853	2,924	2,995	3,066	3,137	3,207	3,278	3,349	3,420	3,491	3,491	3,491
2.4 Accumulated Net Cash	21,511	24,152	26,863	29,645	32,498	35,422	38,417	41,483	44,619	47,827	51,105	54,454	57,874	61,365	64,856	68,347

Note *1: water charge (JD 0.287/m³ = US$0.41/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.137/m³

Table 6.14 Cash Flow of WAJ Zarqa (Case 3)

(US$1,000)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
I. Income Statement																	
1.1 Revenue																	
(1) Water Sales (1,000m³)	0	0	0	0	13,878	14,135	14,392	27,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
(3) Water Charge	0	0	0	0	5,690	5,795	5,901	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853
(4) Sewer Charge *2	0	0	0	0	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899
(5) Total Revenue	0	0	0	0	7,589	7,694	7,800	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752
1.2 Expenditure																	
(1) Salary	0	0	0	0	2,031	2,045	2,065	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	0	0	0	0	3,647	3,662	3,674	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	0	0	0	0	0	0	0	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	0	0	0	0	884	884	884	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	23	105	262	539	857	1,114	1,324	1,418	1,418	1,418	1,418	1,347	1,276	1,205	1,134	1,063	992
(6) Total Expenditure	23	105	262	539	7,419	7,705	7,947	10,755	10,755	10,755	10,755	10,684	10,613	10,542	10,471	10,400	10,329
1.3 Revenue - Expenditure	-23	-105	-262	-539	170	-11	-148	-3	-3	-3	-3	68	139	210	281	352	423
1.4 Accumulated Net Revenue/Deficit	-23	-127	-390	-929	-759	-770	-918	-921	-923	-926	-929	-860	-721	-511	-230	122	544
II. Cash Flow																	
2.1 Cash Inflow																	
(1) Cash Flow from Operation 1.3 + 1.2(3)	-23	-105	-262	-539	170	-11	-148	2,073	2,073	2,073	2,073	2,144	2,215	2,286	2,357	2,428	2,499
(2) Foreign Loan	1,508	3,960	6,563	11,873	9,345	7,793	6,210	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	1,508	5,468	12,030	23,903	33,248	41,040	47,250	47,250	47,250	47,250	44,888	42,525	40,163	37,800	35,438	33,075	30,713
(4) Government Contribution																	
i) Local Portion	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	0	0	0	0	0	0
ii) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
iii) Total	503	1,320	2,188	3,958	3,115	2,598	2,070	0	0	0	0	0	0	0	0	0	0
(5) Total Cash Inflow	1,987	5,175	8,488	15,291	12,630	10,379	8,132	2,073	2,073	2,073	2,073	2,144	2,215	2,286	2,357	2,428	2,499
2.2 Cash Outflow																	
(1) Investment	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	0	0	0	0	0	0	0
(2) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363	2,363
(3) Total Outflow	2,010	5,280	8,750	15,830	12,460	10,390	8,280	0	0	0	2,363	2,363	2,363	2,363	2,363	2,363	2,363
2.3 Net Cash Flow																	
2.1(5) - 2.2(3)	-23	-105	-262	-539	170	-11	-148	2,073	2,073	2,073	-289	-218	-147	-76	-6	65	136
2.4 Accumulated Net Cash	-23	-127	-390	-929	-759	-770	-918	1,155	3,229	5,302	5,013	4,795	4,647	4,571	4,565	4,631	4,767

Note *1: water charge (JD 0.287/m³ = US$0.41/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.137/m³

Table 6.14 Cash Flow of WAJ Zarqa (Case 3)

(US$1,000)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
I. Income Statement																
1.1 Revenue																
(1) Water Sales (1,000m³)	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593	21,593
(2) Average Water Charge *1	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
(3) Water Charge	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853	8,853
(4) Sewer Charge *2	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899	1,899
(5) Total Revenue	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752	10,752
1.2 Expenditure																
(1) Salary	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234	2,234
(2) Electricity	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043	4,043
(3) Depreciation	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076	2,076
(4) Repair and Others	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984	984
(5) Interest on Foreign Loan	921	851	780	709	638	567	496	425	354	284	213	142	71	0	0	0
(6) Total Expenditure	10,258	10,188	10,117	10,046	9,975	9,904	9,833	9,762	9,691	9,621	9,550	9,479	9,408	9,337	9,337	9,337
1.3 Revenue - Expenditure	494	564	635	706	777	848	919	990	1,061	1,131	1,202	1,273	1,344	1,415	1,415	1,415
1.4 Accumulated Net Revenue/Deficit	1,038	1,602	2,238	2,944	3,721	4,569	5,487	6,477	7,538	8,669	9,871	11,145	12,489	13,903	15,318	16,733
II. Cash Flow																
2.1 Cash Inflow																
(1) Cash Flow from Operation 1.3 + 1.2(3)	2,570	2,640	2,711	2,782	2,853	2,924	2,995	3,066	3,137	3,207	3,278	3,349	3,420	3,491	3,491	3,491
(2) Foreign Loan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(3) Foreign Loan Accumulated	28,350	25,988	23,625	21,263	18,900	16,538	14,175	11,813	9,450	7,088	4,725	2,363	0	0	0	0
(4) Government Contribution																
i) Local Portion	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
ii) Foreign Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
iii) Total	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
(5) Total Cash Inflow	2,570	2,640	2,711	2,782	2,853	5,029	2,995	3,066	3,137	3,207	5,989	3,349	3,420	3,491	3,491	3,491
2.2 Cash Outflow																
(1) Investment	0	0	0	0	0	2,105	0	0	0	0	2,711	0	0	0	0	0
(2) Foreign Loan Repayment	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	2,363	0	0	0
(3) Total Outflow	2,363	2,363	2,363	2,363	2,363	4,468	2,363	2,363	2,363	2,363	5,074	2,363	2,363	0	0	0
2.3 Net Cash Flow																
2.1(5) - 2.2(3)	207	278	349	420	491	561	632	703	774	845	916	987	1,058	3,491	3,491	3,491
2.4 Accumulated Net Cash	4,974	5,252	5,601	6,020	6,511	7,072	7,704	8,408	9,182	10,027	10,942	11,929	12,987	16,477	19,968	23,459

Note *1: water charge (JD 0.287/m³ = US$0.41/m³)
*2: sewer charge is estimated based on the average sewer charge of US$0.137/m³

VII. ENVIRONMENTAL IMPACT ASSESSMENT

7. ENVIRONMENTAL IMPACT ASSESSMENT

Through the IEE process conducted in the Master Plan, the following environmental elements are nominated for further study.

1) Resettlement
2) Economic Activity (Impacts on existing tenant or lower income people)
3) Traffic and Public Facilities
4) Archaeological Treasures
5) Water Pollution

In this section, impacts to the above elements are analyzed and evaluated.

7.1 Resettlement

Resettlement may occur at the planned pumping stations or reservoirs site. The location of those planned facilities are shown in Fig. 7.1. The following table summarizes the facilities.

Table 7.1 REQUIRED SIZE FOR RESERVOIRS

Zone	Reservoir Name	Required Capacity (m^3)	Required Area (m^2)
Zarqa High	Res 715	4,000	60 m x 30 m = 1,800
Zarqa Low	Batrawi 650	12,500	100 m x 55 m = 5,500
Sukhna	Res 580	1,000	30 m x 20 m = 600
Hashemeyeh	Res 600	2,000	35 m x 30 m = 1,050
Awajan High	Awajan 695	5,500	52 m x 25 m = 1,300
Awajan Low	Res 635	2,000	30 m x 35 m = 1,050
Rusaifa High	Res 815	5,000	65 m x 30 m = 1,950
Rusaifa Low	Res 750	10,000	90 m x 50 m = 4,500
Awajan 21 P/S	Awajan 21	5,000	60 m x 60 m = 3,600
Total		47,000	21,350

Fundamentally WAJ does not recommend resettlement in any cases. In order to comply with this policy, some locations in the Rusaifa south zone which are hydraulically suitable for reservoir sites were abandoned and the originally proposed south and north Rusaifa zones were merged into one. Consequently there are no houses within the planned areas

.

There are no written rules about land acquisition or expropriation. However, WAJ does compensate landowners at prices estimated on a case by case basis.

There is no possibility for resettlement in this project. However, if the locations of the facilities are changed to correspond with changes of planning then WAJ's basic policy should be followed.

7.2 Impacts on existing tenant or lower income people

Residential development patterns reflect a separation between the wealthy class and the general population. In general, the residential area for the general population has a relatively high population density and narrow roads (inconvenient situation). The wealthy class has settled down in the hilly area, where open space is still available. The impacts of improving the water supply system are expected to be as follows:

In the populated area, land prices e may not increase

The wealthy class will not move to more populated areas

Thus, we conclude that the negative impacts on existing tenants and lower income people will be minimal is very rare. The improvement of the water system is expected to have socio-economic benefits.

7.3 Traffic and Public Facilities

The pipe-laying works may have negative impacts on the existing traffic and public facilities. Since the soil type of the study area is rock or rocky sand, the open cut method for pipe-laying works will be used.

Fig. 7.2 shows routes for the planned transmission lines. Most transmission lines will be located under side-walks, or existing rights of way. Most of roads where the lines will run are not subject to heavy traffic except for Wasfi Tal street (800 m, part of the line from Awajan 21 PS to Rusaifa Res 750).

Pipe -laying works will be done with proper traffic control. The section of 800 m in the Wasfi Tal Street shall be considered carefully at the construction stage. This street is a main street between Zarqa and Rusaifa and there are many existing pipes under this road which will require careful survey at the detailed design stage.

7.4 Archaeological Treasures

In general, Jordan is rich in archaeological treasures. These archaeological treasures are potential sources for tourism, which is one of the important sources for the acquisition of foreign currency. The following table shows GDP distribution in sectors.

Table 7.2 ORIGIN OF GROSS DOMESTIC PRODUCT AT FACTOR COST

(% of total; current prices)

	1983	1988	1993
Agriculture, forestry & fishing	6.3	6.0	8.0
Mining & quarrying	2.6	4.3	3.3
Manufacturing	12.9	10.9	14.7
Electricity & water	1.4	2.7	2.4
Construction	12.2	6.2	5.9
Wholesale & retail trade, restaurants & hotels	**16.8**	**13.5**	**9.3**
Transport & communications	13.0	15.5	15.3
Financing, real estate & business services	16.0	18.3	19.0
Community, social & personal services	2.1	2.4	2.4
Government services	17.3	21.8	20.9
Other services	1.4	1.4	1.2
Imputed bank service charge	-2.1	-2.6	-2.4
Total	100.0	100.0	100.0

Tourism is included in Wholesale & retail trade, restaurants & hotels. As shown in the table, the proportion of that sector is relatively high each year. Thus, impacts on archaeological treasures as well as legislation are considered in this section.

(1) Legislation

In Jordan there exists an 'Antiquities Law'. In this Law, antiquity is defined in article 2 as follows,

A. Any object, whether movable or immovable, which has been constructed, shaped, inscribed, erected, excavated, or otherwise produced or modified by humankind earlier than the year 1700 AD

B. Any object, movable or immovable, as defined in the previous subsection referring to a date subsequent to the year 1700 AD, which the Minister may declare to be antique by order published in the Official Gazette.

C. Human, plant and animal remains going back to a date earlier than the year 600 AD

Moreover regarding construction projects, article 13 & 15 say,

Article 13

No permit should be granted for any construction project, including buildings and fences, unless a distance of 5-10 meters is left between them and any antiquity, according to the Director's decision (article 13).

Article 15

A. Any person, who discovers or finds any antiquity without being granted a license to excavate, or has knowledge of such discovery or finding, must give notice to the Director or the nearest General Security Center within 10 days from the date of discovery, finding, or having knowledge of it.
B. The Director may, within his discretion, grant a reasonable compensation to any person who discovers, finds or informs' about any antiquity, according to the provisions of this law.

(2) Antiquities in the Study Area and Vicinities

There are around 300 antiquities in the study area. These antiquities are mostly flint scatters and cairns as shown in Table 7.3.

Table 7.3 ANTIQUITIES TYPES AND NUMBERS

	TYPE OF USE	NUMBER
	GENERAL ARCHAEOLOGICAL INFORMATION	
01	Sherd/flint scatter	210
02	Sherd/flint scatter(uncertain presence)	31
03	Sherd/flint scatter(main presence)	10
04	Sherd/flint scatter(one-period site)	17
05	Material culture remains found with no structures	1
06	Multi-period stratified site	3
	Sub-total	272
	HABITATION,MILITARY SITES:	
11	Village site(no fortifications)	18
12	Fortified settlement	4
13	Possibly fortified settlement	7
14	Fortress	5
17	Tower	3
18	Rujm	2
21	Nomadic camp	8
22	Cave/shelter	12
24	Isolated structure/house	7
25	Other/unspecified structure or wall foundations	45
	Sub-total	111
	CULTIC STRUCTURES:	
36	Stone circle	27
	AGRICULTURAL STRUCTURES:	
41	Hamlet/Farmstead	5
43	Mill	1
44	Agricultural terrace	1
45	Oil press	1
	Sub-total	8
	OTHER STRUCTURES:	
51	Aqueduct/water channel	1
52	Cistern	9
53	Birket/water reservoir	2
62	Animal pen	13
64	Storage facility/silo	1
65	Cairn	128
67	Stone fences/enclosures	37
	Sub-total	191
	INDUSTRIAL/MANUFACTURING SITES:	
76	Flintknapping site	1
78	Hijaz railway station	2
	Sub-total	3
	FUNERARY STRUCTURES:	
81	Cemetery	3
82	Rock-cut shaft tomb	1
88	Grave	1
89	Burial cairn/tumulus	3
96	Other tomb	3
	Sub-total	11
	INSCRIPTION:	
B1	Arabic	1
	TOTAL	624

Among the listed antiquities, Qasr Shabib is located in Zarqa city. This antiquity was built in the Ottoman Empire era and is located in the corner of high school ground.

Regarding the excavation situation in general, Department of Antiquities comments are summarized below,

A. In Jordan, antiquities might be found in any place.
B. Especially, Petra, Karak, Jerash, Mafraq are areas famous for archeological treasures.
C. Zarqa area has a relatively low possibility for antiquities' excavation.
D. By experiences so far, most antiquities are located 2-15 m below the surface.

The proposed construction sites for pumping stations and reservoirs have no major antiquities except for one near Reservoir 715 in the Zarqa High Zone The antiquity is categorized as 'unspecified structure or wall foundation & cairn ' and is located to the west (about 50 m) from the proposed reservoir site.

From the above stated considerations, the construction works will not damage or destroy any antiquities. It would, however, be prudent to meet with the Department of Antiquities regarding the antiquity near Reservoir 715 to confirm the antiquity's existence and establish it's condition before construction begins

7.5 Water Pollution

Improving the availability of water will increase domestic or industrial wastewater discharges. In this section, the impact on water quality, especially for river and groundwater, is examined.

(a) Domestic Wastewater

It is reported that 58 % of the population is sewered in Zarqa Governorate is. However, in the Study Area, this percentage is higher at about 76 %. WAJ plans 100 % coverage by the year 2000. In the unsewered areas, septic tanks or vacuumed system are commonly in use.

(b) As-Samra Sewage Treatment Plant

The As-Samra treatment plant was built in 1985 to treat wastewater from the study area as well as Amman. The treated wastewater is discharged into Wadi Dhuleil, which joins Zarqa river and finally reaches King Talal Reservoir (40 km downstream). The treatment method consists of waste stabilization ponds. Designed parameters are as follows,

Influent(Daily average) : 68,000 m3/day
Influent BOD5 : 526 mg/l
Effluent BOD5 : 30 mg/l
Suspended Solid Loading: 42,000 kg/day

Actual influent BOD5 is as high as 600 mg/l and average influents have gradually increased. Inflow into the plant in 1991 was about 97,833 m3/day (average base) as can be seen in Table 7.4, which is about 1.5 times of the designed capacity.

Table 7.4 AS-SAMRA POND SYSTEM LOADING (1986-1991)

Year	Daily Influent (m3/day)	Daily Effluent (m3/day)	TSS (mg/l)		BOD5 (mg/l)		COD (mg/l)	
			IN	OUT	IN	OUT	IN	OUT
1986	56,753	48,129	754	161	623	113	1,376	381
1987	63,386	32,690	734	188	739	120	1,596	392
1988	82,568	67,107	584	189	854	137	1,332	352
1989	90.816	72,606	638	160	706	90	1,424	333
1990	96,216	82,370	555	177	728	105	1,362	321
1991	97,833	82,164	647	189	802	111	1,572	346

* Pond Train No.1 was commissioned during Year 1987

** 'IN' denotes at As-Samra inlet structure
'OUT' denotes at As-Samra outlet flume

The inadequacy of the existing stabilization ponds has been cited by Eng. Helen Bannayayan, University of Jordan. He mentioned the well water near the treatment plant is contaminated, and concluded that since the groundwater flows in the direction of Wadi Dhuleil, the treatment plant could clearly have a large negative effect of on groundwater quality.

To address this problem, a study was carried out in 1993 and the plant was redesigned. Table 7.5 compares original and revised planning.

Table 7.5 PLANNING OF AS-SAMRA TREATMENT PLANT

	Original Design Criteria	1992	Short Term Improvements Design Criteria
1. Ain Ghazal Headworks			
Average Daily Flow (m3/d)	68,000	97,770	148,500
Peak Flow (m3/d)	148,000	172,730	327,000
2. As-Samra WSP Facility			
(INFLUENT)			
Average Daily Flow (m3/d)	68,000	127,992	
Peak Flow (m3/d)	148,000	189,635	462,000
BOD5 Concentration (mg/l)	526	505	
BOD5 Load (kg/d)	36,750		
Suspended Solids Concentration (kg/d)	42,000		
Water Temperature (oC)	12.5		
Summer Air Temperature (oC)	25.0		
(EFFLUENT)			
BOD5 (filtered) (mg/l)	30		
Fecal Coliforms (MPN/100ml)	100		
Nematode Eggs (N/100 ml)	<1		
(POND TREATMENT)			
Average Daily Flow (m3/d)			145,000
Peak Flow (m3/d)			210,000
BOD5 Concentration (mg/l)			30 - 60
(DISINFECTION)			
Fecal Coliforms (MPN/100ml)			100
Nematode Eggs (N/100 ml)			<1

Source: As-Samra Wastewater Stabilization ponds Emergency Short-Term Improvement Program Design Report.

1. The decision to add Zarqa and Hashmeyeh flows to the system was made after the IRP design was completed.
2. If the short term needs require expansion of the existing chlorine contact basin, the expanded basin will be designed for long term flow rates as described later in this section.
3. Short term design flow rates were estimated assuming a straight line interpolation of the ESI flow projections between years 1995 and 2000

(c) Industrial Discharges

Part of the study area is a major industrial zone in Jordan. It is reported that ninety percent of the country's light industries and services are located in the Zarqa basin. There are 43 industries in the area. Most of industries have their own wells and water recycling systems which have a low recycle ratio as shown on Table 7.6. All wastewater is discharged into the Zarqa river.

Table 7.6 RECYCLE RATIO OF WASTEWATER

No	Name of Factory	Recycling Ratio of Wastewater
1.	Jordan Petroleum Co.	0% of wastewater, recycling of cooling water
2.	Pepsi Cola Co.	-
3.	Jordan Spinning & Weaving Co.	0% of wastewater
4.	I.C.A. Co.	100% of wastewater
6.	Hussein Thermal Power Station	-
7.	Jordan Paper and Cardboard Factories Co.	75% recycled, 25% evaporation
10.	Jordan Dairy Co.	0% of wastewater
11.	Jordan Worsted Mills Co.	0%
12.	Jordan Tanning Co.	No recycling
13.	Sulphochemicals	No recycling
14.	Eagle Distilleries Co.	24% (80% of cooling water)
15.	Jordan Pipes Co.	75%
16.	Tissue Paper Factory	70% of wastewater
17.	Jordan for Mineral Explorant Co.	80%
18.	Yeast Industries Co.	0%
21.	Jordanian Beer Co.	None (cooling water 100%)

Source: Study Team

The quality of effluents from these facilities does not comply with existing Jordanian Wastewater Standard 202. WAJ has determined to connect the effluent from industries with public sewers according to the content of organic matter or total suspended solid (TSS).

One industrial event was reported in 1988 by Dr.Murad J.Bino, of the Royal Scientific Society. Approximately 6,000 cu.m3 of soil contaminated with mercury was piled on vacant land near Jordan Chemical Industries located between Awajan and Zarqa. News papers reported that the contaminated soil is still piled in the vicinity of the plant and poses a potential hazard in the King Talal Reservoir basin and also to some groundwater aquifers in the area.

As stated above, the are no anticipated negative impacts from this project. In order to safeguard the quality of water resources, it is strongly recommended that As-Samra treatment plant be improved, and industrial wastewater be treated properly. Legislation and administrative controls for reducing industrial wastewater effluent are especially important and should be established as soon as possible. At the same time, continuous monitoring for industrial wastewater and research for potential pollution sources are very important.

VIII. CONCLUSION AND RECOMMENDATIONS

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8.1 Conclusion

The financial viability of "the improvement of the water supply system for the Zarqa district" is dependent on the tariff rate. The current tariff rate is well below the affordability level. The results of the case study with incremental rate increases in tariff, indicates that the "Improvement" project will be viable if the tariff rate is doubled.

The project aims at improving the energy efficiency in the pumping stations and reducing UFW in the Zarqa water supply system. Therefore, existing limited water resources will be effectively allocated.

8.2 Recommendations

Recommendations towards the implementation of the Project are summarized in order of importance and priority as follows:

1) Taking necessary measures for ensuring the feasibility and financial viability of the Project

The present depressed water tariff system will need to be reviewed to increase the tariff to a reasonable level considering the affordability of the consumers in Zarqa district. The viability of the Project will then be assured.

2) Reduction of UFW

Reduction of UFW is of significant importance in the Zarqa district water supply system. It will, if successfully implemented, increase the revenue and reduce the operation costs. The most efficient and economical measures for reducing UFW are recommended as follows:

1. Setting up leakage control units in the WAJ Zarqa
2. Conducting efficient meter reading and billing collection
3. Controlling illegal connections

Reduction in leakage will be achieved through rehabilitation of the deteriorated pipes and meters. However, it is stressed that, without routine leakage detection, the effect of the rehabilitation is limited and will not last.

Further, reduction of UFW not only in the Zarqa district but also in all of Jordan is of major importance to maximize the use of the scarce water resources. If successfully implemented, leakage control could defer the high cost of water resources development projects.

3) Proper allocation of the water resources

Allocation of water resources is a complicated issue. As a result of scarce water resources, water rationing has been practiced regularly. Recently, as a result of the Peace Treaty, negotiations with Israel, additional water resources will become available. The additional amount will likely be used to supply the water demand in Amman. In connection with this, effective and efficient allocation of the water resources, for existing and new water resources, needs to be studied.