

APPENDIX R

ORGANIZATION AND INSTITUTIONAL ARRANGEMENT

APPENDIX R ORGANIZATION AND INSTITUTIONAL ARRANGEMENT

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Table R.1 Example of Tools for Repair Workshops

Name of Tool	No. Needed
Insulation tester	5 Nos
Clamp Ampere meter	5 Nos
Earth tester	5 Nos
Revolution marking meter	2 Nos
Multi tester	5 Nos
Winding former single	2 sets
Winding former three phase	2 sets
Wheel puller	2 Nos
Pipe wrench	10 nos
Chain tongs	10 nos
Chain block	1 set
Pulley	4 sets
Electrical instrumental set	6 sets
Hand drill	6 Nos
Hand grunder	6 Nos
Heavy machinery tool box set	4 sets
L-key set	4 sets
Hammer set	2 sets

Table R.2 Example of Repair Accesories

Asscesory	Unit	Quantity per Year
Riser pipe and assceories	Nos	300
Insulated, water proof winding wire	Meters	30,000
Line cable	Meters	2,000
Insulation paper	Yards	100
Gun powder	lbs	1,000
Polyterafluardethylene (Teflon)	lbs	1,000
Enamel winding wire SW (17)	kg	120
Enamel winding wire W (19)	kg	150
Enamel winding wire SW (21)	kg	150

Table R.3 Status of Repair Machinery and Tools

Machine / Tool Type	No of units	working well (1), partially working (2) or not working(3)
Box Spanner Set	1	2
chain block	2	2
Chain Tong	4	2
Clamp Meter	1	1
Cutter	1	1
Dbutz Air compressor	1	2
Drill m/e o-1 size	1	2
Drilling Machine	1	2
Grinding Machine	1	2
Hammer	2	1
Heavy mechnary Tool box	1	2
Hydrautie press 50 Ton	1	2
Komatsu compressor model Ec 502-3 serial 10582	1	2
Korea drill M/e SD600	1	2
L Key Set	1	1
Lathe m/e (5)	1	2
Lathe Machine	1	2
Long nose plyer	2	1
Pipe Wrench	4	2
Plyer	5	4 No. (2); 1 No. (1)
Porta drill m/e model 521 serial 521531	1	2
Pulley Set	1	2
Ring spanner set	2	2
Screw Driver Set	1	2
Tester	3	(1) 1 No.; (2) 2 No.
Welding m/e	2	2
Welding Machine	1	2
Winding Former (single)	1	1
Winding Fosmer (Three Phase)	1	1

List of Machinery needed for Facility Repair

Machinery Type	No. Units
Truck-mounted drill for tube well drilling	2 units
Air compressor	2 units
Lathe	1 No.
Gas welding set	2 sets
welding machine	1 set
forklift	1 No.
Water jet	1 set

Note: Does not include requirment for Hlwaga and Yegu Pumping Stations

Table R.4 Proposed Scope of Work for Technical Assistance

Specialist title	Major tasks	Assignment duration	Expected Output	When?	Qualification/s	Remarks
Senior Planning advisor	Set up planning division; organize staffing; staff training; advise planning units in other divisions/townships; advise on co-ordination and establish appropriate mechanisms; advise on target setting for both corporate and activity specific, and goal achievement	33 months	Planning division established and functional; 2 staff members trained on planning; report on staffing for planning; report on co-ordination mechanisms and resources	2003	Over 15 years experience in planning and co-ordination in developing countries; university degree in economics, project management or planning	
Monitoring advisor	Establish monitoring section including staffing; develop and implement a monitoring programme suitable for the project which would subsequently be transformed into departmental programme; advise and design monitoring forms and data/information collection and management begun; staff of the section trained on monitoring	26 months in 4 phases	Functional monitoring section; report outlining monitoring programme including key areas for monitoring and a set of forms designed; 1 staff member trained on monitoring	2003 (end)	Over 10 years of experience in monitoring including the capability for design of forms	
Training specialist (short-term)	Plan, advise and implement a programme of training in connection with urgent training needs of departmental staff	12 months	Syllabus for crash training programmes; criteria for selection of trainees; develop a training database; establishment of training evaluation including the formats as appropriate; a report making recommendations for future follow-up action	2004	Masters Degree in social science with speciality in training or relevant subject. Over 15 years experience in the field of training; Experience in form design, monitoring and water supply/water resources would be of special advantage	
Training advisor (long-term)	Plan and conduct a training needs assessment within the WSS department; formulate a training master plan	26 months	Report on training needs assessment; Training Master Plan up to 2020	2005	Over 10 years of experience in training in developing countries; Masters Degree (or higher) in social science subject; experience in water supply/irrigation; report writing ability	
Human Resources Management advisor	Set up organizational development; prepare plan for the process; plan and conduct job analysis; identify all human resources issues for strengthening as per master plan and develop the system	22 months	Set up HR organization; reports on specified human resources issues including recommendations	2004	Over 15 years of experience in HRM in developing country; organizations; Masters Degree (or higher) in social science subject and a higher degree in human resources; report writing ability	
Procurement and inventory management specialist	Advise on strengthening the procurement & stores section; staff training; establish procurement and store management procedures in consultation with YCDC and other public sector institutions in Yangon	2 months (local)	Report on staffing, set up, inventory, recording and database	2006	Over 10 years experience in set up of stores, procurement plans and inventory management. Degree is commerce	
Curriculum development specialist	In consultation and working closely with the training specialist/advisor, identify curricula for different courses established; prepare curricula and translate to Myanmar	5 months (local)	Curricula prepared for all identified training courses; translated to Myanmar	2005	Appropriate experience; degree in education	Local specialist working in close consultation with the training specialist
Operations & maintenance advisor	In consultation with other specialists, prepare O&M procedures needed; prepare a manual incorporating all O&M details, specification of materials and procedures	2 months (local)	O&M manual	2005	Degree in civil/water supply/irrigation engineering with 10 years experience in O&M related work	
Customer relations specialist	In consultation with other specialists, in particular the planning advisor and the relevant staff of customers & clients section, determine the areas for work together between department staff and the customers. Identify specific activities; prepare a work plan and develop costs; highlight the main benefits (in financial terms) accrued to an effective customer relations plan. Propose cost-effective and implementable strategies to build customer/community awareness, training and education on water supply related activities. Identify some educational materials needed to facilitate customer education, awareness and training activities. Advise on monitoring of customer relations including indicators; advise on the development of a database including the design of forms to collect data.	2 months (local)	Report consisting policy, guidelines and strategies for building customer awareness; examples of educational materials; identify local organizations who could facilitate customer relations building; a work plan with priorities identified; cost estimates	2005	Degree in social science with 10 years experience in customer/community management programmes building, monitoring and implementation.	Local specialist working in close consultation with the relevant specialists

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Specialist title	Major tasks	Assignment duration	Expected Output	When?	Qualification/s	Remarks
IEC advisor	In close consultation with the customer relations specialist, planning advisor, training specialist and the relevant staff of customer service section and the townships, identify educational and training materials for customer/community education and training activities. Prepare materials and develop policy/ strategies to effective use of such materials.	3 months (local)	Report outlining the policy and strategy; samples of cauflets, posters and other educational materials recommended for the department	2005 & 2006	Degree in communication/journalism or mass media with 10 years experience in the acutal preparation of educational/training materials	
Meter reading, billing and collection specialist	The specialist will study, develop, propose and advise on testing of an effective and efficient system for meter reading, billing and revenue collection. Should study and propose inovative methods of revenue collection strategies tested and used for collection of service charges by other agencies. Specialist should consult relevant advisors, departmental staff and customers belonging to different categories.	2 months	Report describing the policy, strategies and man power needed to implement the proposed strategy; advise on set up of computerised billing system; examples of indicators for monitoring	2005	Degree in commerce and practical experience in designing revenue collection systems from the public. Experience in the development of computer-based billing. Experience in developing countris is a must.	
Evaluation specialist (Human Resources Management)	In consultation with advisors, head of divisions/sections and staff from different levels of the department, evaluate the performance of human resources management initiatives that have been in operation. Identify the main constraints and make recommendations to overcome them. Intensive consultation of all the staff is an important component of the assignment. Propose new developments and modifications to existing practices of human resources management needed up until the year 2020.	2 months	Report containing assessment of HRM initiatives, strengths, areas for improvement and, other policy recommendations for future follow up.	2008		
Evaluation specialist (planning & monitoring)	In consultation with the planning advisor, training specialist and staff of all other planning sections/units of the department, conduct an assessment of the performance of planning and monitoring undertaken. Identify strengths and weaknesses and propose policy/strategy needed to overcome the problems. Review of the monitoring strategies and database developed should form an innegral component of the assignment.	1 month	A report outlining the results of training and policy and implementation recommendations	2006	Masters (or higher) Degree in social science with speciality in programme evaluation. Over 15 years of experience in planning and conducting programme/project evaluation in developing countries.	
Evaluation specialist (training)	In close consultation with the training specialist and the staff of training section and other relevant sections, conduct an evaluation to assess the performance of training conducted. Review monitoring system/s, training database and training materials and advise on improvement.	1 month	A report outlining the performance of training, training materials and facilities, and showing areas for improvement and recommendations.	2006	Masters (or higher) Degree in social science with speciality in programme evaluation. Over 15 years of experience in planning and conducting programme/project evaluation in developing countries.	
Communal Facilities and Ponds Study	The team will consist of a water resource planner, ponds specialist, sanitation specialist and a institutional specialist with strong community management expertise. The team will study, assess and propose improvements needed and recommendations with regard to these facilities.	1 month	A report outlining the current status, numbers of people benefitted, problems, potentials, recommendations and proposals for future consideration.	2005	All specialists to possess a post graduate Degree and over 15 years of experiences in the relevant field/s	
Tools, instruments & parts specialist	Assess the status of workshops, repair facility, instruments and tools; assess tools and materials needed by township staff; prepare a list of tools, instruments, equipment and other facilities needed by workshop and township staff	2 months (local)	List of tools, instruments etc and the number needed for whom	2005	Appropriate experience and university degree in mechanical engineering or related subject	

Table R.5 Staff Numbers and Category for Operation and Maintenance of Facilities

Work Area	Present Staff Numbers					Staff Numbers (2005) O&M only					Staff Numbers (2010)				
	Engineers	Other professionals	Technicians	Supporting Staff	Total	Engineers	Other professionals	Technicians	Supporting Staff	Total	Engineers	Other professionals	Technicians	Supporting Staff	Total
Reservoirs ¹	15	0	33	190	238	39	4	110	342	495	40	5	140	340	525
Water Distribution ²	77	0	122	570	769	96	9	189	675	969	150	34	189	1025	1398
Electrical & Mechanical	25	0	16	162	203	30	0	45	262	337	30	0	45	262	337
Supporting Branch ⁴	5	0	3	13	21	*	*	*	*	0	*	*	*	*	0
Planning, Co-ordination & Monitoring ⁵					0	9	5	11	19	44	10	12	11	18	51
Unaccounted for Water	0	0	0	0	0	4	0	15	40	59	4	0	25	2	31
Procurement & Stores ⁶						3	0	2	4	9	3	0	3	5	11
Administration & Finance	0	0	0	164	164	0	0	0	244	244	0	0	0	404	404
All	122	0	174	1099	1395	181	18	372	1586	2157	237	51	413	2056	2757

Notes:

- 1 Five reservoirs in 2006
- 2 Division re-organized and staff increased
- 3 Pipeplant division is not directly involved in project implementation
- 4 Does not exist in 2005
- 5 New division created
- 6 Present staff included in supporting branch
- * Doesn't exist

Table R.6 Estimates of Staff Numbers by Work Area and Category

Work Area	Staff Numbers (present)					Staff Numbers (2005) O&M only					Staff Numbers (2010) O&M					Staff Numbers (2005) Construction					Staff Numbers (2010) Construction				
	Engineers	Other professionals	Technicians	Supporting Staff	Total	Engineers	Other professionals	Technicians	Supporting Staff	Total	Engineers	Other professionals	Technicians	Supporting Staff	Total	Engineers	Other professionals	Technicians	Supporting Staff	Total	Engineers	Other professionals	Technicians	Supporting Staff	Total
Reservoirs *	15	0	33	190	238	39	4	110	342	495	40	5	118	299	462	1	5	118	299	423	65	5	118	299	487
Water Distribution #	53	0	92	420	565	55	5	126	517	703	60	6	176	815	1057	65	5	126	517	713	65	5	126	517	713
Townships #	24	0	30	150	204	45	32	60	1094	1231	30	64	160	952	1206	45	32	60	1094	1231	45	32	60	1094	1231
Electrical & Mechanical	25	0	18	182	203	30	0	45	262	337	30	0	38	192	260	30	0	38	192	260	30	0	38	192	260
Supporting Branch *	5	0	3	13	21	*	*	*	*	0	*	*	*	0	0	*	*	*	*	0	*	*	*	*	0
Planning, Construction & Monitoring #				0	0	9	5	11	18	44	10	12	11	22	55	10	12	10	25	57	10	12	15	30	67
Unaccounted for Water #	0	0	0	0	0	8	0	38	60	106	4	0	25	2	31	4	0	25	2	31	4	0	25	2	31
Procurement & Stores #						3	0	2	4	9	3	0	6	10	19	3	0	3	5	11	3	0	3	5	11
Administration & Finance	0	0	0	164	164	0	0	0	244	244	0	0	0	364	364	0	0	0	364	364	0	0	0	364	364
Service sites #						5	0	15	810	830	10	0	20	1053		5	0	400	2000	2405	8	0	500	3000	3508
Meternity *						10	0	0	0	10	15	0	0	0	0	3	0	230	450	683	4	0	300	600	904
All work areas	122	0	174	1099	1395	204	46	407	3352	4009	202	87	554	3709	3454	166	54	1010	4958	6188	234	54	1185	6103	7576

Notes:

- 1 Five reservoirs in 2006
- 2 Division re-organized and staff increased
- 3 includes meter reading staff
- 4 Does not exist in 2005
- 5 New division created
- 6 Unaccounted for water includes URW control, planning & design staff and repair teams
- 7 Present staff included in supporting branch
- 8 Present staff included in water distribution staff
- 9 Present staff included in water distribution staff
- Staff of Pipeplant and Sewage divisions excluded
- * Doesn't exist

Table R.7 Material Cost for Operation & Maintenance by Year (\$)

Activity Area	Description	Approximate Cost (US \$)	2003	2004	2005	2006	2007	2008	2009	2010
Planning, Co-ordination & Monitoring	8 Computers, equipment & software	240,000		240,000						
	Refurbishment, furniture & display material	10,000		10,000						
	Other supplies	7,000		5,000	2,000					
	Planning & co-ordination workshops for YCDC-Ministry staff, @\$500 per workshop	2,000		500	500	500			500	
	Contingencies (5%)	12,950		12,775	125	25			25	
	Sub-total	271,950		268,275	2,625	525			525	
	Refurbishment, furniture & display material	0								
	Workshops @ \$100	0								
	Chemicals & supplies	0								
	Contingencies (5%)	0								
	Sub-total (\$)	0								
Procurement & Stores	Equipment	15,000			10,000	5,000				
	Materials	13,000			10,000	3,000				
	Tools & Instruments	30,000		5,000	25,000					
	Other supplies	5,000		2,000	1,000	1,000	1,000			
	Contingencies (5%)	3,150		350	2,300	450	50			
	Sub-total (\$)	66,150		7,350	48,300	9,450	1,050			
Electrical & Mechanical workshops	Tools & instruments	0								
	Workshop refurbishment & equipment	0								
	Contingencies (5%)	0								
	Sub-total (\$)	0								
Operation & Maintenance	Building/refurbishing stores in 33 townships @\$5,000 per unit	0								
	Tool kits for transmission/service reservoir O&M teams (3 units) @ \$ 2000 per unit	6,000			6,000					
	Tool kits for township O&M staff @ \$ 500 per unit	10,000			5,000					5,000
	Contingencies (5%)	800			550					250
	Sub-total	16,800			11,550					5,250
Water Supply Legislations & Regulations	Staff familiarisation workshops, 4 Nos. @200 / unit	0								
	Manual/procedures printing cost	4,000				2,000				2,000
	Contingencies (5%)	200				100				100
	Sub-total	4,200				2,100				2,100
Customer education & awareness building	NGO contracts	6,500				500	1,000	1,000	2,000	2,000
	Contingencies (5%)	325				25	50	50	100	100
	Sub-total	6,825				525	1,050	1,050	2,100	2,100
Training	Building & furniture	10,000		10,000						
	Training aids & equipment	15,000		15,000						
	Material support for training	5,000		2,000	2,000	1,000				
	Contingencies (5%)	1,500		1,350	100	50				
	Sub-total	31,500		28,350	2,100	1,050				
Vehicles	Vehicles & mobile repair vans (10 units @ 20,000 per unit)	200,000		100,000	100,000					
All	Grand Total (\$)	597,425	0	403,975	164,575	13,650	2,100	1,050	2,625	9,450

Table R.8 Details of Technical Assistance and Cost

Work Area	Unit cost \$(2001) \$/month	Work Area cost	Setup 2003		2004		2005		2006		2007		2008		2009		2010	
			month	\$	month	\$	month	\$	month	\$	month	\$	month	\$	month	\$	month	\$
Long-Term Technical Assistance		2,420,000	11	242,000	30	660,000	36	792,000	22	484,000	9	198,000	2	44,000				
Senior Planning advisor	22,000	792,000	6	132,000	12	264,000	12	264,000	3	66,000	3	66,000						
Monitoring advisor	22,000	572,000	5	110,000	12	264,000	6	132,000	3	66,000								
Training advisor	22,000	572,000					6	132,000	12	264,000	6	132,000	2	44,000				
Human Resources Management advisor	22,000	484,000			6	132,000	12	264,000	4	88,000								
Short-Term Experts		640,000		40,000		200,000		245,000		75,000				40,000				40,000
O&M		100,000																
O&M advisor	20,000	40,000					2	40,000										
Tools, instruments & parts advisor	20,000	40,000					2	40,000										
Procurement & Stores specialist	5,000	10,000							2	10,000								
Customer relations specialist	5,000	10,000					2	10,000										
Training		280,000																
Training specialist	20,000	240,000	2	40,000	10	200,000												
Curriculum development	5,000	25,000					1	5,000	4	20,000								
IEC advisor	5,000	15,000					2	10,000	1	5,000								
Revenue Collection		40,000																
Meter reading, billing & collection specialist	20,000	40,000					2	40,000										
Evaluation		120,000																
Evaluation specialist (training)	20,000	60,000							1	20,000								2
Evaluation specialist (human resources)	20,000	40,000											2	40,000				
Evaluation specialist (planning & monitoring)	20,000	20,000							1	20,000								
Communal Facilities & ponds Management		100,000																
Study team		100,000						100,000										
Technical Assistance Total		3,060,000		282,000		860,000		1,037,000		559,000		198,000		84,000				40,000

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Technical assistance Consultants

Item	Unit cost	Unit
Foreign Component		
Expert	20,000	month
Local Component		
Estimate local costs of 10% of Foreign costs		10%
Local specialists	5,000	month

APPENDIX S
**COST ESTIMATE
AND
IMPLEMENTATION
PLAN**

APPNDIX S COST ESTIMATE AND IMPLEMENTATION PLAN

List of Tables

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Table S.1 Rehabilitation of Aged Pipe by Township

Township	Zone no	Nominal dia (mm)	Pipe Diameter (mm)										Total Cost (US\$)			
			75	100	125	150	200	225	250	300	350	400	450	L/C	F/C	total
1 Ahlone	1		0	2,277	0	15,378	0	0	0	457	0	0	1,410			19,520
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			0	20,721	0	319,821	0	0	0	51,616	0	0	271,481	356,698	306,945	663,641
2 Bahan	1		5,243	11,034	0	32,339	1,372	0	2,804	8,077	0	0	0			60,869
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			34,080	100,409	0	672,651	55,292	0	250,453	912,297	0	0	0	920,589	1,104,613	2,025,182
3 Botataung	1		0	869	0	17,678	366	0	448	11,275	0	0	576			31,209
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			0	7,881	0	367,702	14,750	0	40,015	1,273,511	0	0	110,903	481,554	1,353,208	1,814,762
4 Dagon	1		1,719	5,257	0	10,201	0	0	5,637	2,577	279	0	0			25,670
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			11,174	47,839	0	212,181	0	0	503,497	291,072	37,472	0	0	312,785	790,439	1,103,234
15 Kyauktada	1		2,611	0	0	11,736	262	0	676	4,915	0	0	0			20,200
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			16,972	0	0	244,109	10,559	0	60,380	555,149	0	0	0	302,415	584,753	887,168
16 Kyeemyindaing	1		0	6,104	0	15,920	0	0	1,448	0	0	0	0			23,472
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			0	55,546	0	331,136	0	0	129,335	0	0	0	0	393,149	122,869	516,018
17 Lanmadaw	1		1,153	958	0	8,357	0	0	4,730	2,948	0	0	0			18,146
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			7,495	8,718	0	173,826	0	0	422,484	332,977	0	0	0	227,811	717,697	945,498
18 Latha	1		959	0	0	6,708	0	0	1,065	2,597	0	0	0			12,127
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			6,234	0	0	139,485	0	0	166,582	293,331	0	0	0	168,714	436,917	605,631
21 Mingalartaungnyunt	1		0	1,931	0	12,924	0	0	701	7,126	0	0	945			23,627
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			0	17,572	0	268,819	0	0	62,613	804,882	0	0	181,950	338,864	996,973	1,335,637
23 Pabedan	1		0	0	0	9,022	0	0	991	6,126	0	0	0			16,139
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			0	0	0	187,658	0	0	88,516	691,932	0	0	0	226,680	741,425	968,105
24 Pazundaung	1		198	2,103	0	14,105	0	0	914	3,566	0	0	762			21,648
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			1,287	19,137	0	293,384	0	0	81,638	402,780	0	0	146,715	345,365	599,577	944,942
25 Sanchaung	1		0	5,161	0	21,744	0	0	4,372	0	0	398	0			31,875
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			0	46,965	0	452,275	0	0	390,507	0	0	64,540	0	521,993	432,294	954,287
30 Tamwe	1		960	7,632	0	18,596	0	0	2,019	0	0	0	991			30,198
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			6,240	69,451	0	386,797	0	0	180,337	0	0	0	190,607	481,045	352,587	833,632
33 Yankin	1		1,415	7,362	0	2,465	292	0	1,040	1,720	0	0	0			14,284
Unit Cost			6.50	9.10	15.60	20.80	40.30	89.32	112.95	134.31	162.16	192.54				
Cost			9,198	66,994	0	51,272	11,768	0	92,893	184,274	0	0	0	153,590	272,808	426,398
														Total		14,024,337
																Pipe Length
																348,794

1.1.1		
L/C	F/C	Total
1,732,539	4,433,568	6,166,108

1.1.2		
L/C	F/C	Total
481,045	352,587	833,632

1.1.3		
L/C	F/C	Total
749,846	429,813	1,179,659

1.2.1		
L/C	F/C	Total
521,993	432,294	954,287

1.2.2		
L/C	F/C	Total
338,864	996,973	1,335,837

1.2.3		
L/C	F/C	Total
1,386,954	2,167,861	3,554,815

Total		
L/C	F/C	Total
5,211,240	8,813,097	14,024,337

Table S.2 Yearly Installation Work of Primary Mains

Distribution Zone Name	No.	Yearly new secondary main installation length and cost							
		2004	2005	2006	2007	2008	2009	2010	Total
Downtown	1	0	3,910	4,410	3,560	3,560	3,560	3,550	22,550
L/C		0	101,373	114,336	92,298	92,298	92,298	92,039	584,643
F/C		0	1,926,080	2,172,382	1,753,669	1,753,669	1,753,669	1,748,743	11,108,211
Downtown East	2	0	0	0	2,960	2,960	2,970	2,180	11,070
L/C		0	0	0	59,354	59,354	59,554	43,713	221,976
F/C		0	0	0	1,127,725	1,127,725	1,131,535	830,554	4,217,539
Central West	3	0	0	2,840	3,480	3,480	3,480	3,480	16,760
L/C		0	0	58,659	71,878	71,878	71,878	71,878	346,172
F/C		0	0	1,116,615	1,368,247	1,368,247	1,368,247	1,368,247	6,589,603
Hlawga	4	0	0	0	0	3,680	3,680	3,680	11,040
L/C		0	0	0	0	96,888	96,888	96,888	290,665
F/C		0	0	0	0	1,840,880	1,840,880	1,840,880	5,522,641
Central North	5	0	0	0	0	0	0	0	0
L/C		0	0	0	0	0	0	0	0
F/C		0	0	0	0	0	0	0	0
East South	6	0	0	0	0	1,480	1,480	1,480	4,440
L/C		0	0	0	0	33,547	33,547	33,547	100,642
F/C		0	0	0	0	637,400	637,400	637,400	1,912,199
East Central	7	0	0	0	0	0	3,280	3,280	6,560
L/C		0	0	0	0	0	31,562	31,562	63,124
F/C		0	0	0	0	0	599,683	599,683	1,199,365
East North	8	0	0	0	0	2,150	2,150	2,150	6,450
L/C		0	0	0	0	24,373	24,373	24,373	73,118
F/C		0	0	0	0	463,079	463,079	463,079	1,389,238
West South	9	0	0	0	0	0	0	0	0
L/C		0	0	0	0	0	0	0	0
F/C		0	0	0	0	0	0	0	0
West Central	10	0	0	0	0	0	0	0	0
L/C		0	0	0	0	0	0	0	0
F/C		0	0	0	0	0	0	0	0
West North	11	0	0	1,760	1,760	1,760	1,760	1,760	8,800
L/C		0	0	27,608	27,608	27,608	27,608	27,608	138,040
F/C		0	0	524,550	524,550	524,550	524,550	524,550	2,622,751
L/C		0	101,373	200,603	251,138	405,947	437,710	421,609	1,818,380
F/C		0	1,926,080	3,813,547	4,774,191	7,715,550	8,319,043	8,013,136	34,561,547
Total		0	2,027,453	4,014,151	5,025,329	8,121,497	8,756,752	8,434,745	36,379,927

Table S.3 Yearly Installation Work of Secondary Mains

Distribution Zone		Total length (m)	Primary mains new installation plan by diameter (mm)						Total
Name	No.		300	350	400	500	600	700	
Downtown	1	22,550	0	0	0	5,000	3,370	3,340	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	0	1,121,100	996,239	1,274,243	#REF!
Downtown East	2	32,920	0	0	3,630	6,770	8,670	1,410	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	588,641	1,517,969	2,563,025	537,929	#REF!
Central West	3	51,640	0	3,360	13,670	5,340	2,370	7,080	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	451,282	2,216,727	1,197,335	700,619	2,701,091	#REF!
Hlawga	4	47,760	0	0	2,030	18,860	2,490	0	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	329,185	4,228,789	736,094	0	#REF!
Central North	5	4,360	0	0	2,060	780	0	1,210	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	334,050	174,892	0	461,627	#REF!
East South	6	13,280	0	0	1,770	1,730	2,660	810	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	287,023	387,901	786,349	309,023	#REF!
East Central	7	39,330	25,660	0	5,170	1,880	1,220	820	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			2,898,297	0	838,367	421,534	360,656	312,838	#REF!
East North	8	27,980	8,800	0	6,820	1,880	7,900	0	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			993,960	0	1,105,931	421,534	2,335,398	0	#REF!
West South	9	1,760	500	0	880	380	0	0	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			56,475	0	142,701	85,204	0	0	#REF!
West Central	10	0	0	0	0	0	0	0	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	0	0	0	0	#REF!
West North	11	26,370	0	0	4,970	9,680	0	6,850	
Unit Cost			112.95	134.31	162.16	224.22	295.62	381.51	
Cost			0	0	805,935	2,170,450	0	2,613,344	#REF!
		267,950	34,960	3,360	41,000	52,300	28,680	21,520	

APPENDIX T

ECONOMIC AND FINANCIAL ANALYSIS

Appendix T

Economic and Financial Analysis

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Appendix T.1 Average Household Income and Expenditure by Township

Name of township	Household expenditure										Detail of expenditures on utilities												
	Average family size (persons)	Working member (persons)	Average HH income (Kyaat/month)	Food and beverage	Clothing	House rent and repairs	Utilities	Charity and Education	Transportation	Medical care	Tax	Total	Potable water	Waste water disposal	Solid waste	Telephone	Gas	Electricity	Fuel	Total	Balance		
01. Athone	3.00	1.71	29,586	23,571	1,571	343	2,919	2,171	3,957	3,314	1,286	0	39,034	179	0	45	657	24	1,657	357	2,919	-9,448	
02. Bahan	4.91	1.73	85,464	25,091	3,545	327	10,565	1,773	7,864	3,773	1,909	0	54,865	204	0	37	2,218	183	7,941	0	##	30,599	
03. Bokataung	4.63	1.63	47,125	1,938	738	0	3,344	675	1,188	3,313	813	0	22,007	127	0	180	975	0	2,063	0	3,344	25,118	
04. Dagon	6.43	1.14	24,971	40,071	639	186	9,099	2,500	4,357	2,443	1,514	552	61,361	439	0	51	1,186	226	7,000	197	9,099	-36,390	
05. Dagon Myothit East	6.44	2.33	48,144	21,889	711	433	3,764	583	5,822	3,173	1,156	0	37,532	1,009	46	22	756	422	736	772	3,764	10,613	
06. Dagon Myothit North	5.23	2.69	49,947	20,154	338	415	3,466	1,692	2,308	2,892	562	2,054	33,882	1,035	60	32	715	172	615	838	3,466	16,065	
07. Dagon Myothit Seikkan	5.20	1.60	70,240	24,200	1,000	1,660	3,740	1,600	4,800	1,740	2,200	80	41,020	1,360	85	30	400	150	959	756	3,740	29,220	
08. Dagon Myothit South	6.11	2.64	28,404	16,304	429	354	2,660	546	1,204	1,786	836	60	24,177	857	24	16	214	54	184	1,311	2,660	4,227	
09. Dala	5.13	2.06	13,844	3,875	531	0	2,389	225	1,219	706	456	0	14,402	152	0	0	0	0	513	1,725	2,389	-558	
10. Dawbon	6.00	1.27	32,055	24,182	1,009	564	3,526	1,255	3,641	2,473	1,341	226	38,216	1,055	0	30	182	227	513	1,518	3,526	-6,161	
11. Hlaing	4.83	1.43	31,841	26,563	1,437	1,253	3,461	1,739	3,357	3,548	2,430	891	44,681	711	0	48	298	111	1,471	822	3,461	-12,840	
12. Hlaingthaya	6.71	2.29	29,492	16,750	375	254	3,178	558	1,717	1,577	463	20	24,891	175	0	38	7	338	2,621	3,178	4,601		
13. Insein	5.93	1.93	40,413	28,696	1,267	254	5,398	1,374	5,707	2,957	3,872	920	49,645	289	0	40	698	429	1,355	787	3,598	-8,230	
14. Kamayut	6.36	2.07	34,321	8,643	757	21	2,342	371	2,964	2,150	1,929	91	18,669	142	15	60	538	119	775	593	2,342	15,653	
15. Kyaokadae	5.17	1.33	45,233	41,667	1,217	317	3,889	1,750	2,567	1,717	933	0	54,056	146	0	60	1,217	0	1,867	600	3,889	-8,822	
16. Kyeemyindang	5.81	1.25	39,088	30,000	606	87	3,616	1,194	7,344	3,713	5,406	0	41,965	148	0	70	538	448	1,894	519	3,616	-2,878	
17. Lanmadaw	4.14	1.14	69,443	25,000	2,557	229	2,957	1,671	10,714	9,600	2,357	7,471	62,557	262	0	51	943	486	1,100	174	2,957	6,886	
18. Latpa	3.20	1.60	30,400	13,700	1,000	114	3,799	900	1,600	1,500	1,400	448	24,461	149	0	196	554	200	2,700	0	3,799	5,939	
19. Mayangone	5.17	1.00	37,079	23,483	610	234	3,419	1,621	4,310	2,400	314	1,211	37,112	198	0	30	297	100	1,357	1,438	3,419	-33	
20. Mingalardon	5.30	2.00	34,277	15,938	615	65	2,473	479	2,096	2,048	174	85	25,970	146	1	53	882	21	407	983	2,473	10,286	
21. Mingalardongyibit	5.36	1.36	31,123	13,373	423	24	1,776	386	1,219	2,219	469	356	21,863	148	0	135	563	0	931	0	1,776	9,263	
22. North Okkalapa	6.37	2.16	43,876	20,722	622	123	2,258	444	2,184	1,766	850	928	25,693	344	14	25	138	62	303	1,364	2,258	16,324	
23. Pabedan	5.25	2.50	39,350	18,000	1,100	198	1,920	500	625	250	1,250	1,500	25,143	210	100	60	325	0	1,225	0	1,920	14,208	
24. Pazundaung	4.29	1.57	18,100	9,643	586	1,500	2,241	471	429	1,786	343	0	16,998	132	0	180	1,071	0	857	0	2,241	1,102	
25. Sanchaung	3.62	1.08	42,615	15,538	854	831	3,019	1,577	1,485	2,608	1,793	846	28,488	140	15	45	880	615	1,140	182	3,019	14,127	
26. Seikan Port																							
27. Seikkyi Kanungo	6.67	1.33	19,575	19,333	1,200	267	2,742	6,733	7,500	2,453	2,067	0	42,275	0	0	0	100	0	275	2,567	2,742	-22,700	
28. Shwepyitha	4.67	1.48	30,715	10,824	299	1,627	2,825	350	1,498	837	576	375	19,228	117	2	50	310	999	400	1,748	2,825	11,487	
29. South Okkalapa	5.58	2.17	19,541	10,942	1,046	59	1,825	523	1,354	810	722	534	17,616	226	48	88	202	73	500	687	1,825	1,925	
30. Tanwe	5.67	2.00	36,461	19,389	311	0	2,395	378	667	3,472	467	0	27,079	179	0	144	389	0	1,183	500	2,395	9,383	
31. Thaketa	6.05	1.74	19,861	12,474	221	13	707	276	934	2,046	200	0	16,872	119	4	89	71	0	332	92	707	2,989	
32. Thigangyan	5.97	1.72	83,015	28,017	2,424	3,610	5,813	5,328	6,428	4,738	2,305	1,167	57,830	638	136	120	470	524	3,076	850	5,813	25,185	
33. Yanbin	6.50	2.00	48,730	21,917	675	5	4,008	1,083	792	2,792	683	0	31,949	264	0	135	900	0	2,083	625	4,008	16,801	
Overall average	5.44	1.76	39,260	19,965	960	480	3,430	1,272	3,245	2,578	1,338	562	33,829	367	17	67	585	152	1,492	761	3,430	5,431	
Average in HHs who connect with YCDC water supply systems	5.41	1.78	##	##	##	188.35	2,824	1,077.16	2,942.58	2,538.60	1,276.44	482.08	##	292.99	15.09	74.07	488.77	##	1,238.12	##	##	##	
Average in HHs who do not connect with YCDC water supply systems	6.01	1.95	38,692	19,343	819	1,026	3,620	959	3,017	2,184	1,392	503	32,862	579	23	38	411	163	1,079	1,393	3,686	5,830	
Per capita income in overall average			22,364																				

(Note 1)

Average in HHs who connect with YCDC water supply systems.

Average in HHs both who connect and do not connect with YCDC water supply systems.

Average in HHs who do not connect with YCDC water supply systems.

(Note 2)

Average in HHs who do not connect with YCDC water supply systems.

Private piped water	841	6
Common Tube Well	827	9
Protected dug well	13	3
Private water tanker	1,025	2
Neighbor's tap/well	1,512	31
Bottled water	1,052	24

Sources: Result of Consumer Survey made by JICA Study Team, July 2001.

Appendix T.2 Basic Unit for Estimation of Saved Amount of Medical Expenditure

A. Estimation of Saving Amount of Medicament							(As of 1998)				
Number of cases in overall diseases	Outpatients*	Inpatients incl. death*			Total patients	Share rate to populatio	Percentage (%)				
		Inpatients	Death	Total							
Population in total in Yangon(as of 1998)					3,691,941						
Total administration					241,871	227,218	10,355	237,573	469,089	12.71%	100.00%
Water borne disease in total								34,701		7.40%	
Others								434,388		92.60%	
Revenue of hospitals received consisting of treatment charges, and subsidies (Million Kyats)**											
1998/99								33.90			
1999/00								368.40			
2000/01								600.00	Amount of medical expenditure to be saved by clean water supply:		
2001/02								620.00			
Annual average since 1999/00								529.47			
Average amount allocated to water borne diseases (Thousand Kyats/annum)								39,168		5,875	
Source: * Hospital Statistics Annual Report 1998, Ministry of Health.							(Note 2)				
** Ministry of Health.							Improved ratio of water borne diseases by improvement of water environment consisting of clean water supply and sewerage treatment systems based on similar projects in developing				
(Note 1)							30%				
							Improved ratio of water borne diseases by clean water supply:				
Water Borne Diseases in Yangon							of the above.				
Year	Diarrhoea	Dysentery	Viral hepatitis	Typhoid	Total						
1991	28,808	19,686	749	244	49,487						
1992	24,552	15,355	657	161	40,725						
1993	26,433	14,649	660	236	41,978						
1994	30,711	11,826	821	193	43,551						
1995	28,349	10,380	670	224	39,623						
1996	24,649	8,209	444	210	33,512						
1997	20,253	8,112	489	196	29,050						
1998	17,988	7,040	386	161	25,575						
1999	15,615	5,787	300	156	21,858						
2000	14,721	6,399	338	194	21,652						
Average per year	23,208	10,744	551	198	34,701						
Source: Ministry of Health.											
(Note) ** In Myanmar, they have no health insurance systems until present time.											
B. Saved Amount of Income to be decreased by water borne disease											
Average duration of stay of inpatients:											
Total number of patient days:				1,903,482							
Number of discharges and deaths:				237,573							
						Average duration of stay of inpatient	8.01 (days/annum)				
Average number of days of outpatients visited to hospitals:											
Total number of outpatient attendances:				576,756							
Average number of outpatients per day:				2,383							
Total number of outpatient attendances caused by water borne disease:				241,871							
						Average number of days of outpatients visited to hospitals:	2.38 (days/annum)				
Basic unit of saved amount of income to be decreased caused by water borne diseases:											
Basic unit of income per person*:				22,364 (Kyats/month) =		1,017 (Kyats/day) (22 working days/month)					
Total income loss of inpatient per annum:				8,145		(Kyats/working person per annum)					
Total income loss of outpatient per annum:				2,424		(Kyats/working person per annum)					
Share rate of working persons per HH*(%):				32.29%							
Sources: * Result of Consumer Survey made by JICA Study Team, July 2001.											

Appendix T.3 Annual Disbursement of Construction Cost and Estimation of Its Economic Cost

(Note)
FC = Foreign currency portion
LC = Local currency portion
(US\$1,000)

Cost item	Annual disbursement (Phase-1)																												Total																
	2001			2002			2003			2004			2005			2006			2007			2008			2009			2010																	
	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC	LC	Sub-total	FC		LC	Sub-total														
Construction works																																													
Direct cost	0	0	0	0	0	0	0	0	22,334	1,712	24,046	23,262	2,122	25,384	85,697	9,683	95,380	59,467	5,783	65,250	103,613	22,278	125,891	80,492	16,402	96,894	103,293	18,807	122,100	478,158	76,787	554,945													
Indirect cost	0	0	0	0	0	0	0	0	5,137	394	5,531	5,350	488	5,838	19,710	2,227	21,937	13,677	1,330	15,008	23,831	5,124	28,955	18,513	3,772	22,286	23,757	4,326	28,083	109,976	17,661	127,637													
Sub-total	0	0	0	0	0	0	0	0	27,471	2,106	29,577	28,612	2,610	31,222	105,407	11,910	117,317	73,144	7,113	80,258	127,444	27,402	154,846	99,005	20,174	119,180	127,050	23,133	150,183	588,134	94,448	682,582													
Engineering cost	0	0	0	0	0	0	0	0	2,662	0	2,662	2,810	0	2,810	10,559	0	10,559	7,223	0	7,223	13,936	0	13,936	10,726	0	10,726	13,516	0	13,516	61,432	0	61,432													
Compensation cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0													
Sub total	0	0	0	0	0	0	0	0	30,133	2,106	32,239	31,422	2,610	34,032	115,966	11,910	127,876	80,368	7,113	87,481	141,380	27,402	168,782	109,731	20,174	129,906	140,567	23,133	163,699	649,567	94,448	744,015													
Administration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	0	1	1	0	4	4													
Sub total	0	0	0	0	0	0	0	0	30,133	2,106	32,239	31,422	2,610	34,032	115,966	11,910	127,876	80,368	7,114	87,481	141,380	27,403	168,783	109,731	20,175	129,906	140,567	23,133	163,700	649,567	94,452	744,019													
Physical contingency	0	0	0	0	0	0	0	0	1,507	105	1,612	1,571	131	1,702	5,798	596	6,394	4,018	356	4,374	7,069	1,370	8,439	5,487	1,009	6,495	7,028	1,157	8,185	32,478	4,723	37,201													
Financial cost	0	0	0	0	0	0	0	0	31,639	2,211	33,851	32,993	2,741	35,734	121,764	12,506	134,270	84,386	7,469	91,855	148,449	28,773	177,222	115,218	21,184	136,402	147,595	24,290	171,885	682,045	99,174	781,220													
Economic cost	0	0	0	0	0	0	0	0	26,475	1,108	29,583	29,694	1,373	31,067	109,588	8,263	115,851	75,947	3,741	79,688	133,604	14,409	148,013	105,696	10,609	114,305	132,836	12,164	145,000	613,841	49,666	663,507													
Remarks:																																													
1. Price share rates:	FC	LC	6. Operation & maintenance cost:																								(US\$1,000)	7. Price :		As of November 2001.															
- Labour	0.0%	80.0%	OM work items																								2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	8. Exchange rate:	US\$ 1.00 = 500 Kyats = Japanese Yen 120.00.
- Equipment and Material	100.0%	20.0%	Personal cost	5	5	5	5	6	6	6	6	7	7	7	7	7	7	7	7	7	7	7	9	9	9. Physical contingens	5.00%	(of total of the above)																		
2. Tax for construction and engineering services			Electricity cost	10	10	199	337	415	415	487	625	556	686	686	686	744	778	778	778	778	834	10. Indirect cost:	23%	(of direct cost)																					
			Chemical cost	192	192	600	600	928	928	8,666	8,666	8,666	8,666	8,666	8,677	8,677	8,677	8,677	8,677	8,677	8,677	16,324	11. (Equivalent to million Kyats) (in financial cost)																						
3. Contractor's overhead & profit	10%		Inspection/repairing cost				791			345	1,076			989	401	1,076			989	7,301	14,289	12. Engineering cost:		(of direct and indirect cost)																					
4. Standard conversion factor:	0.95195		Financial total	207	207	804	943	2,140	1,349	9,159	9,642	10,304	9,359	10,347	9,771	10,504	9,462	10,450	16,764	31,455																									
5. Shadow wage rate (economic wage rate):	50%		Economic cost	104	104	403	472	1,072	676	4,587	4,829	5,161	4,687	5,182	4,893	5,260	4,738	5,234	8,396	15,753																									
			Remarks:																																										
			Cyubyu:	167	Phygyi:	400	Terminal-Kokin	7,042	Terminal CBW	8,217	Ngamoyeik:	6,900	CBDT East:	4,708																															
			East Block S:	983	Terminal to CB	6,517	Hlaing WTP:	5,342	Transmission:	7,042	West Block N:	875	East Block N:	558																															
			West Block S:	225	East Block C:	900	West Block C:	217																																					

Appendix T.4 Calculation of Economic Internal Rate of Return in Stage-1

(Note) Sunk cost is assumed at 0.5 % of replacement cost until the end of works.
(US\$1,000)

Year in order	Year	Economic cost				Economic benefit				Cash balance	
		Construction cost		OM cost	Replace ment cost	Total	Potable water supply	Saving of medical expenditure	Saving of income loss		Total
		F/C portion	L/C portion								
-1	2001	0	0	0	0	0	0	0	0	0	
0	2002	0	0	0	0	0	0	0	0	0	
1	2003	0	0	0	0	0	0	0	0	0	
2	2004	28,475	1,108	104	0	29,687	8,705	3	4	8,712	-20,975
3	2005	29,694	1,373	104	0	31,171	11,631	4	6	11,641	-19,530
4	2006	109,588	6,263	403	0	116,253	24,635	8	12	24,655	-91,598
5	2007	0	0	403	0	403	24,635	8	12	24,655	24,252
6	2008	0	0	403	0	403	24,635	8	12	24,655	24,252
7	2009	0	0	403	0	403	24,635	8	12	24,655	24,252
8	2010	0	0	403	0	403	24,635	8	12	24,655	24,252
9	2011	0	0	403	0	403	24,635	8	12	24,655	24,252
10	2012	0	0	403	0	403	24,635	8	12	24,655	24,252
11	2013	0	0	403	0	403	24,635	8	12	24,655	24,252
12	2014	0	0	403	0	403	24,635	8	12	24,655	24,252
13	2015	0	0	403	0	403	24,635	8	12	24,655	24,252
14	2016	0	0	403	0	403	24,635	8	12	24,655	24,252
15	2017	0	0	403	0	403	24,635	8	12	24,655	24,252
16	2018	0	0	403	0	403	24,635	8	12	24,655	24,252
17	2019	0	0	403	0	403	24,635	8	12	24,655	24,252
18	2020	0	0	403	0	403	24,635	8	12	24,655	24,252
19	2021	0	0	403	0	403	24,635	8	12	24,655	24,252
20	2022	0	0	403	0	403	24,635	8	12	24,655	24,252
21	2023	0	0	403	0	403	24,635	8	12	24,655	24,252
22	2024	0	0	403	0	403	24,635	8	12	24,655	24,252
23	2025	0	0	403	0	403	24,635	8	12	24,655	24,252
24	2026	0	0	403	61,775	62,178	24,635	8	12	24,655	-37,523
25	2027	0	0	403	0	403	24,635	8	12	24,655	24,252
26	2028			403	0	403	24,635	8	12	24,655	24,252
27	2029			403	0	403	24,635	8	12	24,655	24,252
28	2030			403	0	403	24,635	8	12	24,655	24,252
29	2031			403	0	403	24,635	8	12	24,655	24,252
30	2032			403	0	403	24,635	8	12	24,655	24,252
31	2033			403	0	403	24,635	8	12	24,655	24,252
32	2034			403	0	403	24,635	8	12	24,655	24,252
33	2035			403	0	403	24,635	8	12	24,655	24,252
34	2036			403	0	403	24,635	8	12	24,655	24,252
35	2037			403	0	403	24,635	8	12	24,655	24,252
36	2038			403	0	403	24,635	8	12	24,655	24,252
37	2039			403	0	403	24,635	8	12	24,655	24,252
38	2040			403	0	403	24,635	8	12	24,655	24,252
39	2041			403	0	403	24,635	8	12	24,655	24,252
40	2042			403	0	403	24,635	8	12	24,655	24,252
41	2043			403	0	403	24,635	8	12	24,655	24,252
42	2044			403	0	403	24,635	8	12	24,655	24,252
43	2045			403	0	403	24,635	8	12	24,655	24,252
44	2046			403	61,775	62,178	24,635	8	12	24,655	-37,523
45	2047			403	0	403	24,635	8	12	24,655	24,252
46	2048			403	0	403	24,635	8	12	24,655	24,252
47	2049			403	0	403	24,635	8	12	24,655	24,252
48	2050			403	0	403	24,635	8	12	24,655	24,252
49	2051			403	0	403	24,635	8	12	24,655	24,252
50	2052			403	0	403	24,635	8	12	24,655	24,252
51	2053			403	0	403	24,635	8	12	24,655	24,252
52	2054			403	0	403	24,635	8	12	24,655	24,252
53	2055			403	0	403	24,635	8	12	24,655	24,252
54	2056			403	0	403	24,635	8	12	24,655	24,252
Total		167,757	8,743	20,752	123,550	320,803	1,276,706	413	639	1,277,758	956,955

In the condition of discount rate at 10%:

Present value: 113,461 165,081 51,620

Internal rate of return (EIRR): 16.62%

B/C: 1.45

Appendix T.5 Calculation of Economic Internal Rate of Return in Stage-2

(Note) Sunk cost is assumed at 0.5 % of replacement cost until the end of works.
(US\$1,000)

Year in order	Year	Economic cost					Economic benefit				Cash balance
		Construction cost		OM cost	Replace- ment cost	Total	Potable water supply	Saving of medical expenditure	Saving of income loss	Total	
		F/C portion	L/C portion								
-1	2001	0	0	0	0	0	0	0	0	0	0
0	2002	0	0	0	0	0	0	0	0	0	0
1	2003	0	0	0	0	0	0	0	0	0	0
2	2004	0	0	0	0	0	0	0	0	0	0
3	2005	0	0	0	0	0	0	0	0	0	0
4	2006	0	0	0	0	0	0	0	0	0	0
5	2007	75,947	3,741	472	0	80,160	1,013	0	0	1,014	-79,147
6	2008	133,604	14,409	1,072	0	149,085	2,026	1	1	2,027	-147,058
7	2009	103,696	10,609	676	0	114,980	3,043	1	1	3,045	-111,935
8	2010	132,836	12,164	4,587	0	149,586	18,684	5	7	18,696	-130,890
9	2011	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
10	2012	0	0	5,161	0	5,161	18,684	5	7	18,696	13,535
11	2013	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
12	2014	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
13	2015	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
14	2016	0	0	5,161	0	5,161	18,684	5	7	18,696	13,535
15	2017	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
16	2018	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
17	2019	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
18	2020	0	0	5,161	0	5,161	18,684	5	7	18,696	13,535
19	2021	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
20	2022	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
21	2023	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
22	2024	0	0	5,161	0	5,161	18,684	5	7	18,696	13,535
23	2025	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
24	2026	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
25	2027	0	0	4,587	0	4,587	18,684	5	7	18,696	14,109
26	2028			5,161	0	5,161	18,684	5	7	18,696	13,535
27	2029			4,587	0	4,587	18,684	5	7	18,696	14,109
28	2030			4,587	170,452	175,039	18,684	5	7	18,696	-156,343
29	2031			4,587	0	4,587	18,684	5	7	18,696	14,109
30	2032			5,161	0	5,161	18,684	5	7	18,696	13,535
31	2033			4,587	0	4,587	18,684	5	7	18,696	14,109
32	2034			4,587	0	4,587	18,684	5	7	18,696	14,109
33	2035			4,587	0	4,587	18,684	5	7	18,696	14,109
34	2036			5,161	0	5,161	18,684	5	7	18,696	13,535
35	2037			4,587	0	4,587	18,684	5	7	18,696	14,109
36	2038			4,587	0	4,587	18,684	5	7	18,696	14,109
37	2039			4,587	0	4,587	18,684	5	7	18,696	14,109
38	2040			5,161	0	5,161	18,684	5	7	18,696	13,535
39	2041			4,587	0	4,587	18,684	5	7	18,696	14,109
40	2042			4,587	0	4,587	18,684	5	7	18,696	14,109
41	2043			4,587	0	4,587	18,684	5	7	18,696	14,109
42	2044			5,161	0	5,161	18,684	5	7	18,696	13,535
43	2045			4,587	0	4,587	18,684	5	7	18,696	14,109
44	2046			4,587	0	4,587	18,684	5	7	18,696	14,109
45	2047			4,587	0	4,587	18,684	5	7	18,696	14,109
46	2048			5,161	0	5,161	18,684	5	7	18,696	13,535
47	2049			4,587	0	4,587	18,684	5	7	18,696	14,109
48	2050			4,587	170,452	175,039	18,684	5	7	18,696	-156,343
49	2051			4,587	0	4,587	18,684	5	7	18,696	14,109
50	2052			5,161	0	5,161	18,684	5	7	18,696	13,535
51	2053			4,587	0	4,587	18,684	5	7	18,696	14,109
52	2054			4,587	0	4,587	18,684	5	7	18,696	14,109
53	2055			4,587	0	4,587	18,684	5	7	18,696	14,109
54	2056			5,161	0	5,161	18,684	5	7	18,696	13,535
55	2057			4,587	0	4,587	18,684	5	7	18,696	14,109
56	2058			4,587	0	4,587	18,684	5	7	18,696	14,109
57	2059			4,587	0	4,587	18,684	5	7	18,696	14,109
58	2060			5,161	0	5,161	18,684	5	7	18,696	13,535
Total		446,083	40,922	224,679	340,904	1,052,589	884,213	229	354	884,797	-167,792

In the condition of discount rate at 10%:

Present value:	246,373	81,148	-165,226
Internal rate of return (EIRR):			-2.25%
B/C:			0.33

Appendix T.6 Calculation of Economic Internal Rate of Return in All Phase-1

(Note) Sunk cost is assumed at 0.5 % of replacement cost until the end of works.
(US\$1,000)

Year in order	Year	Economic cost					Economic benefit				Cash balance
		Construction cost		OM cost	Replace ment cost	Total	Potable water supply	Saving of medical expenditure	Saving of income loss	Total	
		F/C portion	L/C portion								
-1	2001	0	0	0	0	0	0	0	0	0	0
0	2002	0	0	0	0	0	0	0	0	0	0
1	2003	0	0	0	0	0	0	0	0	0	0
2	2004	28,475	1,108	104	0	29,687	8,705	3	4	8,711	-20,976
3	2005	29,694	1,373	104	0	31,171	11,631	3	5	11,640	-19,531
4	2006	109,588	6,263	403	0	116,253	24,635	7	11	24,653	-91,600
5	2007	75,947	3,741	472	0	80,160	25,648	8	12	25,667	-54,493
6	2008	133,604	14,409	1,072	0	149,085	26,660	8	12	26,680	-122,405
7	2009	103,696	10,609	676	0	114,980	27,678	8	13	27,699	-87,281
8	2010	132,836	12,164	4,587	0	149,586	43,318	13	20	43,351	-106,235
9	2011	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
10	2012	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
11	2013	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
12	2014	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
13	2015	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
14	2016	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
15	2017	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
16	2018	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
17	2019	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
18	2020	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
19	2021	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
20	2022	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
21	2023	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
22	2024	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
23	2025	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
24	2026	0	0	4,587	61,775	66,362	43,318	13	20	43,351	-23,011
25	2027	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
26	2028	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
27	2029	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
28	2030	0	0	4,587	170,452	175,039	43,318	13	20	43,351	-131,688
29	2031	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
30	2032	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
31	2033	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
32	2034	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
33	2035	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
34	2036	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
35	2037	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
36	2038	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
37	2039	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
38	2040	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
39	2041	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
40	2042	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
41	2043	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
42	2044	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
43	2045	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
44	2046	0	0	4,587	61,775	66,362	43,318	13	20	43,351	-23,011
45	2047	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
46	2048	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
47	2049	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
48	2050	0	0	4,587	170,452	175,039	43,318	13	20	43,351	-131,688
49	2051	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
50	2052	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
51	2053	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
52	2054	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
53	2055	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
54	2056	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
55	2057	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
56	2058	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
57	2059	0	0	4,587	0	4,587	43,318	13	20	43,351	38,764
58	2060	0	0	5,125	0	5,125	43,318	13	20	43,351	38,226
Total		613,841	49,666	243,754	464,454	1,371,714	2,334,193	691	1,068	2,335,951	964,237

In the condition of discount rate at 10%:

Present value: 357,617 246,885 -110,732

Internal rate of return (EIRR): 5.03%

B/C: 0.69

**Appendix T.7 Calculation of Financial Internal Rate of Return in
for Stage-1 of Phase-1**

Water price to be applied (US\$/l)

Sector	2005	2010	2015	2020	Share rate
Domestic sector	8.47	12.65	15.62	17.92	70%
Public sector	5.65	8.43	10.41	11.95	10%
Industrial/commercial sector	38.11	56.93	70.29	80.65	20%

(1,000 US\$)

Year in order	Year	Financial cost				Annual water volume to be supplied (m ³ /annum)	Financial benefit			Cash balance		
		Construction cost		OM cost	Replace- ment cost		Total	Domestic sector	Public sector		Industrial/ commerca l sector	
		F/C portion	L/C portion									
-1	2001	0	0	0	0	0	0	0	0	0		
0	2002	0	0	0	0	0	0	0	0	0		
1	2003	0	0	0	0	0	0	0	0	0		
2	2004	31,639	2,211	207	0	34,058	59,620,938	551	52	708	1,312	-32,747
3	2005	32,993	2,741	207	0	35,942	79,666,047	4,723	450	6,073	11,246	-24,696
4	2006	121,764	12,506	804	0	135,075	168,730,851	10,004	953	12,862	23,818	-111,257
5	2007	0	0	804	0	804	168,730,851	10,004	953	12,862	23,818	23,014
6	2008	0	0	804	0	804	168,730,851	10,004	953	12,862	23,818	23,014
7	2009	0	0	804	0	804	168,730,851	10,004	953	12,862	23,818	23,014
8	2010	0	0	804	0	804	168,730,851	14,943	1,423	19,213	35,580	34,775
9	2011	0	0	804	0	804	168,730,851	14,943	1,423	19,213	35,580	34,775
10	2012	0	0	804	0	804	168,730,851	14,943	1,423	19,213	35,580	34,775
11	2013	0	0	804	0	804	168,730,851	14,943	1,423	19,213	35,580	34,775
12	2014			804	0	804	168,730,851	14,943	1,423	19,213	35,580	34,775
13	2015			804	0	804	168,730,851	18,448	1,757	23,719	43,924	43,120
14	2016			804	0	804	168,730,851	18,448	1,757	23,719	43,924	43,120
15	2017			804	0	804	168,730,851	18,448	1,757	23,719	43,924	43,120
16	2018			804	0	804	168,730,851	18,448	1,757	23,719	43,924	43,120
17	2019			804	0	804	168,730,851	18,448	1,757	23,719	43,924	43,120
18	2020			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
19	2021			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
20	2022			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
21	2023			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
22	2024			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
23	2025			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
24	2026			804	71,349	72,154	168,730,851	21,167	2,016	27,215	50,397	-21,756
25	2027			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
26	2028			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
27	2029			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
28	2030			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
29	2031			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
30	2032			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
31	2033			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
32	2034			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
33	2035			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
34	2036			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
35	2037			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
36	2038			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
37	2039			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
38	2040			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
39	2041			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
40	2042			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
41	2043			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
42	2044			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
43	2045			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
44	2046			804	71,349	72,154	168,730,851	21,167	2,016	27,215	50,397	-21,756
45	2047			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
46	2048			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
47	2049			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
48	2050			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
49	2051			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
50	2052			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
51	2053			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
52	2054			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
53	2055			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
54	2056			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
55	2057			804	0	804	168,730,851	21,167	2,016	27,215	50,397	49,593
Total		186,397	17,458	42,242	142,699	388,796		1,016,591	96,818	1,307,043	2,420,452	2,031,656

In the condition of discount rate at 10%:

Present value: 133,207 99,123 9,440 127,443 236,006 102,798

Internal rate of return (FIRR): 17.65%

B/C: 1.77

**Appendix T.8 Calculation of Financial Internal Rate of Return in
for Stage-2 of Phase-1**

Water price to be applied (US\$/m ³):	2005	2010	2015	2020	Share rate
Domestic sector	8.47	12.65	15.62	17.92	70%
Public sector	5.65	8.43	10.41	11.95	10%
Industrial/commercial sector	38.11	56.93	70.29	80.65	20%

(1,000 US\$)

Year in order	Year	Financial cost				Annual water volume to be supplied (m ³ /annum)	Financial benefit			Cash balance		
		Construction cost		OM cost	Replace- ment cost		Total	Domestic sector	Public sector		Industrial/ commercial sector	
		F/C portion	L/C portion									
-1	2001	0	0	0	0	0	0	0	0	0		
0	2002	0	0	0	0	0	0	0	0	0		
1	2003	0	0	0	0	0	0	0	0	0		
2	2004	0	0	0	0	0	0	0	0	0		
3	2005	0	0	0	0	0	0	0	0	0		
4	2006	0	0	0	0	0	0	0	0	0		
5	2007	84,386	7,469	943	0	92,798	6,938,000	411	39	529	979	-91,819
6	2008	148,449	28,773	2,140	0	179,362	13,874,199	823	78	1,058	1,958	-177,404
7	2009	115,218	21,184	1,349	0	137,751	20,845,098	1,236	118	1,589	2,942	-134,808
8	2010	147,595	24,290	9,159	0	181,044	127,970,199	11,334	1,079	14,572	26,985	-154,059
9	2011	0	0	9,159	0	9,159	127,970,199	11,334	1,079	14,572	26,985	17,826
10	2012	0	0	10,234	0	10,234	127,970,199	11,334	1,079	14,572	26,985	16,750
11	2013	0	0	9,159	0	9,159	127,970,199	11,334	1,079	14,572	26,985	17,826
12	2014	0	0	9,159	0	9,159	127,970,199	11,334	1,079	14,572	26,985	17,826
13	2015	0	0	9,159	0	9,159	127,970,199	13,992	1,333	17,989	33,314	24,155
14	2016	0	0	10,234	0	10,234	127,970,199	13,992	1,333	17,989	33,314	23,079
15	2017	0	0	9,159	0	9,159	127,970,199	13,992	1,333	17,989	33,314	24,155
16	2018	0	0	9,159	0	9,159	127,970,199	13,992	1,333	17,989	33,314	24,155
17	2019	0	0	9,159	0	9,159	127,970,199	13,992	1,333	17,989	33,314	24,155
18	2020	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
19	2021	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
20	2022	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
21	2023	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
22	2024	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
23	2025	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
24	2026	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
25	2027	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
26	2028	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
27	2029	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
28	2030	0	0	9,159	202,077	211,236	127,970,199	16,054	1,529	20,640	38,223	-173,013
29	2031	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
30	2032	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
31	2033	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
32	2034	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
33	2035	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
34	2036	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
35	2037	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
36	2038	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
37	2039	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
38	2040	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
39	2041	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
40	2042	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
41	2043	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
42	2044	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
43	2045	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
44	2046	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
45	2047	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
46	2048	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
47	2049	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
48	2050	0	0	9,159	202,077	211,236	127,970,199	16,054	1,529	20,640	38,223	-173,013
49	2051	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
50	2052	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
51	2053	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
52	2054	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
53	2055	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
54	2056	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
55	2057	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
56	2058	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
57	2059	0	0	9,159	0	9,159	127,970,199	16,054	1,529	20,640	38,223	29,064
58	2060	0	0	10,234	0	10,234	127,970,199	16,054	1,529	20,640	38,223	27,988
Total		495,648	81,716	485,501		1,467,020		787,293	74,980	1,012,233	1,874,507	407,487

In the condition of discount rate at 10%:

Present value: 308,899 59,028 5,622 75,893 140,543 -168,356

Internal rate of return (FIRR): 2.31%

B/C: 0.45

**Appendix T.9 Calculation of Financial Internal Rate of Return in
for Overall Works of Phase-1**

Water price to be applied (US\$/m ³):	2005	2010	2015	2020	Share rate
Domestic sector	8.47	12.65	15.62	17.92	70%
Public sector	5.65	8.43	10.41	11.95	10%
Industrial/commercial sector	38.11	56.93	70.29	80.65	20%

(1,000 US\$)

Year in order	Year	Financial cost				Annual water volume to be supplied (m ³ /annum)	Financial benefit			Cash balance		
		Construction cost		OM cost	Replace- ment cost		Total	Domestic sector	Public sector		Industrial/ commercia l sector	
		F/C portion	L/C portion									
-1	2001	0	0	0	0	0	0	0	0	0		
0	2002	0	0	0	0	0	0	0	0	0		
1	2003	0	0	0	0	0	0	0	0	0		
2	2004	31,639	2,211	207	0	34,058	59,620,938	551	52	708	1,312	-32,747
3	2005	32,993	2,741	207	0	35,942	79,666,047	4,723	450	6,073	11,246	-24,696
4	2006	121,764	12,506	804	0	135,075	168,730,851	10,004	953	12,862	23,818	-111,257
5	2007	84,386	7,469	943	0	92,798	175,668,851	10,415	992	13,391	24,797	-68,001
6	2008	148,449	28,773	2,140	0	179,362	182,605,050	10,826	1,031	13,919	25,777	-153,585
7	2009	115,218	21,184	1,349	0	137,751	189,575,950	11,239	1,070	14,451	26,761	-110,990
8	2010	147,595	24,290	9,159	0	181,044	296,701,051	26,277	2,503	33,785	62,564	-118,480
9	2011	0	0	9,159	0	9,159	296,701,051	26,277	2,503	33,785	62,564	53,406
10	2012	0	0	10,234	0	10,234	296,701,051	26,277	2,503	33,785	62,564	52,330
11	2013	0	0	9,159	0	9,159	296,701,051	26,277	2,503	33,785	62,564	53,406
12	2014			9,159	0	9,159	296,701,051	26,277	2,503	33,785	62,564	53,406
13	2015			9,159	0	9,159	296,701,051	32,440	3,090	41,708	77,238	68,080
14	2016			10,234	0	10,234	296,701,051	32,440	3,090	41,708	77,238	67,004
15	2017			9,159	0	9,159	296,701,051	32,440	3,090	41,708	77,238	68,080
16	2018			9,159	0	9,159	296,701,051	32,440	3,090	41,708	77,238	68,080
17	2019			9,159	0	9,159	296,701,051	32,440	3,090	41,708	77,238	68,080
18	2020			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
19	2021			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
20	2022			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
21	2023			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
22	2024			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
23	2025			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
24	2026			9,159	71,349	80,508	296,701,051	37,221	3,545	47,855	88,620	8,112
25	2027			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
26	2028			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
27	2029			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
28	2030			9,159	202,077	211,236	296,701,051	37,221	3,545	47,855	88,620	-122,616
29	2031			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
30	2032			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
31	2033			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
32	2034			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
33	2035			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
34	2036			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
35	2037			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
36	2038			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
37	2039			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
38	2040			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
39	2041			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
40	2042			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
41	2043			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
42	2044			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
43	2045			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
44	2046			9,159	71,349	80,508	296,701,051	37,221	3,545	47,855	88,620	8,112
45	2047			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
46	2048			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
47	2049			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
48	2050			9,159	202,077	211,236	296,701,051	37,221	3,545	47,855	88,620	-122,616
49	2051			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
50	2052			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
51	2053			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
52	2054			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
53	2055			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
54	2056			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
55	2057			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
56	2058			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
57	2059			9,159	0	9,159	296,701,051	37,221	3,545	47,855	88,620	79,462
58	2060			10,234	0	10,234	296,701,051	37,221	3,545	47,855	88,620	78,386
Total		682,045	99,174	486,721		1,814,794		1,867,385	177,846	2,400,921	4,446,151	2,631,358

In the condition of discount rate at 10%:

Present value: 437,601 158,381 15,084 203,632 377,096 -60,504

Internal rate of return (FIRR): 8.27%

B/C: 0.86

Appendix T.10 Repayment Ability of Loan for Phase 1 Works

Year in order	Year	Outflow						In flow				Subsidy to the Project from YCDC or Central Government of Myanmar
		Construction cost		Foreign borrow		OM cost	Total	Foreign borrow	Revenu e in total	In flow in total	Cash balance	
		Loan portion	Local portion	Interest	Principal							
-1	2001	0	0	0	0	0	0	0	0	0	0	0
0	2002	0	0	0	0	0	0	0	0	0	0	0
1	2003	0	0	0	0	0	0	0	0	0	0	0
2	2004	31,875	2,361	0	0	207	34,444	31,875	1,312	33,186	-1,257	1,257
3	2005	33,380	2,908	414	0	207	36,910	33,380	11,246	44,626	7,716	
4	2006	121,799	13,105	848	0	804	136,556	121,799	23,818	145,617	9,061	
5	2007	94,693	7,943	2,432	0	943	106,010	94,693	24,797	119,490	13,480	
6	2008	168,339	29,994	3,663	0	2,140	204,136	168,339	25,777	194,115	-10,020	10,020
7	2009	132,470	22,193	5,851	0	1,349	161,863	132,470	26,761	159,230	-2,633	2,633
8	2010	171,576	25,656	7,573	0	9,159	213,964	171,576	62,564	234,140	20,176	
9	2011			9,804	0	9,159	18,962		62,564	62,564	43,602	
10	2012			9,804	0	10,234	20,038		62,564	62,564	42,526	
11	2013			9,804	33,260	9,159	52,222		62,564	62,564	10,342	
12	2014			9,371	33,692	9,159	52,222		62,564	62,564	10,342	
13	2015			8,933	34,130	9,159	52,222		77,238	77,238	25,016	
14	2016			8,490	34,574	10,234	53,298		77,238	77,238	23,940	
15	2017			8,040	35,024	9,159	52,222		77,238	77,238	25,016	
16	2018			7,585	35,479	9,159	52,222		77,238	77,238	25,016	
17	2019			7,124	35,940	9,159	52,222		77,238	77,238	25,016	
18	2020			6,656	36,407	10,234	53,298		88,620	88,620	35,322	
19	2021			6,183	36,881	9,159	52,222		88,620	88,620	36,398	
20	2022			5,704	37,360	9,159	52,222		88,620	88,620	36,398	
21	2023			5,218	37,846	9,159	52,222		88,620	88,620	36,398	
22	2024			4,726	38,338	10,234	53,298		88,620	88,620	35,322	
23	2025			4,228	38,836	9,159	52,222		88,620	88,620	36,398	
24	2026			3,723	39,341	9,159	52,222		88,620	88,620	36,398	
25	2027			3,211	39,852	9,159	52,222		88,620	88,620	36,398	
26	2028			2,693	40,371	10,234	53,298		88,620	88,620	35,322	
27	2029			2,168	40,895	9,159	52,222		88,620	88,620	36,398	
28	2030			1,637	41,427	9,159	52,222		88,620	88,620	36,398	
29	2031			1,098	41,966	9,159	52,222		88,620	88,620	36,398	
30	2032			553	42,511	10,234	53,298		88,620	88,620	35,322	
31	2033					9,159	9,159		88,620	88,620	79,462	
32	2034					9,159	9,159		88,620	88,620	79,462	
33	2035					9,159	9,159		88,620	88,620	79,462	
34	2036					10,234	10,234		88,620	88,620	78,386	
35	2037					9,159	9,159		88,620	88,620	79,462	
36	2038					9,159	9,159		88,620	88,620	79,462	
37	2039					9,159	9,159		88,620	88,620	79,462	
38	2040					10,234	10,234		88,620	88,620	78,386	
39	2041					9,159	9,159		88,620	88,620	79,462	
40	2042					9,159	9,159		88,620	88,620	79,462	
41	2043					9,159	9,159		88,620	88,620	79,462	
42	2044					10,234	10,234		88,620	88,620	78,386	
43	2045					9,159	9,159		88,620	88,620	79,462	
44	2046					9,159	9,159		88,620	88,620	79,462	
45	2047					9,159	9,159		88,620	88,620	79,462	
46	2048					10,234	10,234		88,620	88,620	78,386	
47	2049					9,159	9,159		88,620	88,620	79,462	
48	2050					9,159	9,159		88,620	88,620	79,462	
49	2051					9,159	9,159		88,620	88,620	79,462	
50	2052					10,234	10,234		88,620	88,620	78,386	
51	2053					9,159	9,159		88,620	88,620	79,462	
52	2054					9,159	9,159		88,620	88,620	79,462	
53	2055					9,159	9,159		88,620	88,620	79,462	
54	2056					10,234	10,234		88,620	88,620	78,386	
55	2057					9,159	9,159		88,620	88,620	79,462	
56	2058					9,159	9,159		88,620	88,620	79,462	
57	2059					9,159	9,159		88,620	88,620	79,462	
58	2060					10,234	10,234		88,620	88,620	78,386	
Total		754,131						754,131				

(Note)

- (1) Interest rate of foreign loan: 1.30%
- (2) Equal annual repayment amount of capital for foreign loan (US\$1,000): 43,064

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