TABLES

Table D1.1 Estimated Economic Benefits

US dollars based on shadow exchange rate of 50 SL per dollar
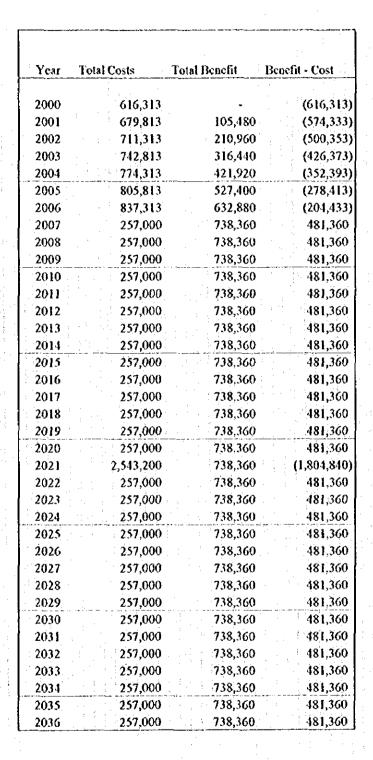
	DMA				Informal Areas				
Year	Net Incremental Water (000's m³)	Unit value	Gross benefits ($)	Year	Incremental Water (000's m³)	Unit Value	Water Sales ($)	Health Benefits ($)	Total Benefits ($)
		0.04				0.10			
2000	-	0.04	-	2000	-	0.10	-	-	
2001	2,637	0.04	105,480	2001	-	0.10	-	-	
2002	5,274	0.04	210,960	2002	3,760	0.10	376,000	123,000	499,000
2003	7,911	0.04	316,440	2003	3,760	0.10	376,000	123,000	499,000
2004	10,548	0.04	421,920	2004	3,760	0.10	376,000	123,000	499,000
2005	13,185	0.04	527,400	2005	3,760	0.10	376,000	123,000	499,000
2006	15,822	0.04	632,880	2006	3,760	0.10	376,000	123,000	499,000
2007	18,459	0.04	738,360	2007	3,760	0.10	376,000	123,000	499,000
2008	18,459	0.04	738,360	2008	3,760	0.10	376,000	123,000	499,000
2009	18,459	0.04	738,360	2009	3,760	0.10	376,000	123,000	499,000
2010	18,459	0.04	738,360	2010	3,760	0.10	376,000	123,000	499,000
2011	18,459	0.04	738,360	2011	3,760	0.10	376,000	123,000	499,000
2012	18,459	0.04	738,360	2012	3,760	0.10	376,000	123,000	499,000
2013	18,459	0.04	738,360	2013	3,760	0.10	376,000	123,000	499,000
2014	18,459	0.04	738,360	2014	3,760	0.10	376,000	123,000	499,000
2015	18,459	0.04	738,360	2015	3,760	0.10	376,000	123,000	499,000
2016	18,459	0.04	738,360	2016	3,760	0.10	376,000	123,000	499,000
2017	18,459	0.04	738,360	2017	3,760	0.10	376,000	123,000	499,000
2018	18,459	0.04	738,360	2018	3,760	0.10	376,000	123,000	499,000
2019	18,459	0.04	738,360	2019	3,760	0.10	376,000	123,000	499,000
2020	18,459	0.04	738,360	2020	3,760	0.10	376,000	123,000	499,000
2021	18,459	0.04	738,360	2021	3,760	0.10	376,000	123,000	499,000
2022	18,459	0.04	738,360	2022	3,760	0.10	376,000	123,000	499,000
2023	18,459	0.04	738,360	2023	3,760	0.10	376,000	123,000	499,000
2024	18,459	0.04	738,360	2024	3,760	0.10	376,000	123,000	499,000
2025	18,459	0.04	738,360	2025	3,760	0.10	376,000	123,000	499,000
2026	18,459	0.04	738,360	2026	3,760	0.10	376,000	123,000	499,000
2027	18,459	0.04	738,360	2027	3,760	0.10	376,000	123,000	499,000
2028	18,459	0.04	738,360	2028	3,760	0.10	376,000	123,000	499,000
2029	18,459	0.04	738,360	2029	3,760	0.10	376,000	123,000	499,000
2030	18,459	0.04	738,360	2030	3,760	0.10	376,000	123,000	499,000
2031	18,459	0.04	738,360	2031	3,760	0.10	376,000	123,000	499,000
2032	18,459	0.04	738,360	2032	3,760	0.10	376,000	123,000	499,000
2033	18,459	0.04	738,360						
2034	18,459	0.04	738,360						
2035	18,459	0.04	738,360						
2036	18,459	0.04	738,360						
Total	609,147		24,365,880	Total	116,560		11,656,000	3,813,000	15,469,000

Table D1.2 Estimated Economic Costs

US dollars based on shadow exchange rate of 50 SL per dollar

Year	DMA Capital Costs ($)	DMA O&M Costs ($)	DMA Total ($)	Year	Informal Areas Capital Costs ($)	Informal Areas O&M Costs ($)	Informal Areas Total ($)
2000	616,313	-	616,313	2000	2,611,400		2,611,400
2001	616,313	63,500	679,813	2001	2,611,400		2,611,400
2002	616,313	95,000	711,313	2002	-	-	-
2003	616,313	126,500	742,813	2003	-	-	-
2004	616,313	158,000	774,313	2004	-	-	-
2005	616,313	189,500	805,813	2005	-	-	-
2006	616,313	221,000	837,313	2006	-	-	-
2007	-	257,000	257,000	2007	-	-	-
2008	-	257,000	257,000	2008	-	-	-
2009		257,000	257,000	2009	-	-	-
2010	-	257,000	257,000	2010	-	-	-
2011	-	257,000	257,000	2011	-	-	-
2012	-	257,000	257,000	2012	-	-	-
2013	-	257,000	257,000	2013	-	-	-
2014	-	257,000	257,000	2014	-	-	-
2015	-	257,000	257,000	2015	-	-	-
2016	-	257,000	257,000	2016	-	-	-
2017	-	257,000	257,000	2017	-	-	-
2018	-	257,000	257,000	2018	-	-	-
2019	-	257,000	257,000	2019	-	-	-
2020	-	257,000	257,000	2020	-	-	-
2021	2,286,200	257,000	2,543,200	2021	-	-	-
2022	-	257,000	257,000	2022	-	-	-
2023	-	257,000	257,000	2023	-	-	-
2024	-	257,000	257,000	2024	-	-	-
2025	-	257,000	257,000	2025	-	-	-
2026	-	257,000	257,000	2026	-	-	-
2027	-	257,000	257,000	2027	-	-	-
2028	-	257,000	257,000	2028	-	-	-
2029	-	257,000	257,000	2029	-	-	-
2030	-	257,000	257,000	2030	-	-	-
2031	-	257,000	257,000	2031	-	-	-
2032	-	257,000	257,000	2032	-	-	-
2033	-	257,000	257,000				-
2034	-	257,000	257,000				-
2035	-	257,000	257,000				-
2036	-	257,000	257,000				-
Total	6,600,391	8,563,500	15,163,891	Total	5,222,800	-	5,222,800

Table D1.3   Economic Internal Rate of Return -DMA

Year	Total Costs	Total Benefit	Benefit - Cost
2000	616,313	-	(616,313)
2001	679,813	105,480	(574,333)
2002	711,313	210,960	(500,353)
2003	742,813	316,440	(426,373)
2004	774,313	421,920	(352,393)
2005	805,813	527,400	(278,413)
2006	837,313	632,880	(204,433)
2007	257,000	738,360	481,360
2008	257,000	738,360	481,360
2009	257,000	738,360	481,360
2010	257,000	738,360	481,360
2011	257,000	738,360	481,360
2012	257,000	738,360	481,360
2013	257,000	738,360	481,360
2014	257,000	738,360	481,360
2015	257,000	738,360	481,360
2016	257,000	738,360	481,360
2017	257,000	738,360	481,360
2018	257,000	738,360	481,360
2019	257,000	738,360	481,360
2020	257,000	738,360	481,360
2021	2,543,200	738,360	(1,804,840)
2022	257,000	738,360	481,360
2023	257,000	738,360	481,360
2024	257,000	738,360	481,360
2025	257,000	738,360	481,360
2026	257,000	738,360	481,360
2027	257,000	738,360	481,360
2028	257,000	738,360	481,360
2029	257,000	738,360	481,360
2030	257,000	738,360	481,360
2031	257,000	738,360	481,360
2032	257,000	738,360	481,360
2033	257,000	738,360	481,360
2034	257,000	738,360	481,360
2035	257,000	738,360	481,360
2036	257,000	738,360	481,360

Internal Rate of Return	%
1. Base Case	9%
2. Costs + 15%	7%
3. Benefits - 10%	7%
4. 2 and 3	5%

Table D1.4 Economic Internal Rate of Return -Informal Areas

Year	Total Costs	Total Benefit	Benefit - Cost		Internal Rate of Return	%
2000	2,611,400	-	(2,611,400)		1. Base Case	8%
2001	2,611,400	-	(2,611,400)			
2002	-	499,000	499,000		2. Costs + 15%	7%
2003	-	499,000	499,000			
2004	-	499,000	499,000		3. Benefits - 10%	7%
2005	-	499,000	499,000			
2006	-	499,000	499,000		4. 2 and 3	6%
2007	-	499,000	499,000			
2008	-	499,000	499,000			
2009	-	499,000	499,000			
2010	-	499,000	499,000			
2011	-	499,000	499,000			
2012	-	499,000	499,000			
2013	-	499,000	499,000			
2014	-	499,000	499,000			
2015	-	499,000	499,000			
2016	-	499,000	499,000			
2017	-	499,000	499,000			
2018	-	499,000	499,000			
2019	-	499,000	499,000			
2020	-	499,000	499,000			
2021	-	499,000	499,000			
2022	-	499,000	499,000			
2023	-	499,000	499,000			
2024	-	499,000	499,000			
2025	-	499,000	499,000			
2026	-	499,000	499,000			
2027	-	499,000	499,000			
2028	-	499,000	499,000			
2029	-	499,000	499,000			
2030	-	499,000	499,000			
2031	-	499,000	499,000			
2032	-	499,000	499,000			

Table D1.5 Unit Operating Cost for Figeh & Barada Spring Sources

Type of facility		Figeh Sources [2]		
		Pumped (dry season)	Not pumped (wet season)	Barada [1]
Station name				
Quantity Produced (MCM)	MCM	142.5	34.9	6.8
Well Pumps	Operation(hr)	117,435		15,133
	Number	29		6
Booster Pumps	Operation(hr)			
	Number			
Electrical Consumption	(x 103 Kw.hr)	9,148		2,647
	Kw.hr per pump hour	78.26		211
Diesel Generator	Operation(hr)	541		2,600
	Equivalent electrical consumption (x 103 Kw.hr)	42		549
Total Electrical Requirement	(x 103 Kw.hr)	9,190		3,196
Unit Pumping Cost (a)	(S.L./m3)	0.19		1.41
Hypochlorite Consumption	(kg)	49,257	12,063	2,351
Unit Treatment Cost (b)	(S.L./m3)	0.01	0.01	0.01
Unit Operating Cost (a+b)	(S.L./m3)	0.20	0.01	1.42

Source: 1995 data obtained from DAWSSA, presented in master Plan JICA 1997

Cost of electricity	(S.L./Kw.hr)	1.50	1.50	1.50
Inflation multiplier		2.00	2.00	2.00
Cost of chlorine	(S.L./kg)	21.00	21.00	21.00

Notes:
1) Barada Spring operated from Sept. 1995. The contribution in a normal year would be 22.6 MCM.
2) 1995 production for Figeh Spring sources includes: Ain Haroush, Deir Moukaren, Figeh Side, Figeh Main

Calculation of Unit Operating Costs

Sources	Unit Operating Cost (S.L./m3)	Average Annual Supply (MCM)	Weighting Factor	Totals
Figeh Spring Sources - Pumped (dry season)	0.20	142.5	0.7	0.14
Figeh Spring Sources - Natural Flow (wet season)	0.01	34.9	0.2	0.00
Barada Springs	1.42	22.6	0.1	0.16
Totals		200.0		0.30

Table D1.6 Unit Operating Costs for Production Well Centers

Type of facility		Production Well Center								
Station name		Mazraa	Ibn Assaker	Kaboon	Kadam Store	Kadam Store	Oumawiyin	Jobar	University	Kadam Railway
Quantity Produced [1]	MCM	6.55	5.64	0.86	[3]	2.20 [4]	3.31	5.80	2.53	5.25
Well Pumps	Operation(hr)	109.248	76.945	16.849	11.966		65.236	57.422	22.430	37.758
	Number	24	19	5	3	100 (m^3/hr) [6]	14	14	8	10
Booster Pumps	Operation(hr)	30.241	27.914	12.041	-		12.315	17.251	16.488	10.486
	Number	10	6	2	-		7	5	5	5
Electrical Consumption [2]	(x 103 Kw.hr)	3.773	2.343	1.476	162	13.5 kw [5]	1.726	2.531	1.406	1.500
Unit Pumping Cost (a)	(S.L./m3)	1.73	1.25	5.15		0.41	1.56	1.31	1.67	0.86
Hypochlorite Consumption	(kg)	48.200	34.700	4.900	-	11.190 [6]	27.700	34.700	15.600	26.700
Unit Treatment Cost (b)	(S.L./m3)	0.15	0.13	0.12	0.11	0.11	0.18	0.13	0.13	0.11
Unit Operating Cost (a+b)	(S.L./m3)	1.88	1.38	5.27		0.51	1.74	1.43	1.80	0.96

Source: 1995 data obtained from DAWSSA, presented in master Plan JICA 1997

Cost of electricity	(S.L./Kw.hr)	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Inflation multiplier		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
Cost of chlorine	(S.L./kg)	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00	21.00

Notes:

1) Based on 1995 records. Pumped from wells and boosted into distribution system
2) Total for production well and booster station
3) No production in 1995, only installation and testing
4) Annual production quantity for 1997 based on recommended production plan (JICA Master Plan)
5) for each pump
6) Estimate based on per unit consumption of Kadam Rail production well

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Table D1.7 Unit Operating Costs for Pumping Stations at Reservoirs

Pumping Station Name	Boost to	Quantity	P(kw)	Q (m3/h)	Per Unit Pumping Cost(1) (S.L./m3)	Weighting factor	Weighted per Unit Pumping Cost (S.L./m3)
Eastern S.R. (ILE)	Reservoir B.1v - Bzze Village	3	132	250	1.58	0.75	1.19
		1	75	150	1.50	0.25	0.38
		4				Total Unit Operating Cost =	1.56
	Reservoir B.2	2	110	160	2.06	0.40	0.83
		3	110	150	2.20	0.60	1.32
		1	132	180	2.20	0.20	0.44
		5				Total Unit Operating Cost =	2.59
	Reservoir B.1b	4	132	315	1.26	0.80	1.01
		1	110	300	1.10	0.20	0.22
		5				Total Unit Operating Cost =	1.23
Wali Old & Wali New (1.A & 1.S)	Reservoir K.1	2	80	288	0.83	0.40	0.33
		3	85	432	0.59	0.60	0.35
		5				Total Unit Operating Cost =	0.69
	Reservoir K.3	1	200	325	1.85	0.14	0.26
		1	160	325	1.48	0.14	0.21
		1	90	180	1.50	0.14	0.21
		1	50	72	2.08	0.14	0.30
		3	85	90	2.83	0.43	1.21
		7				Total Unit Operating Cost =	2.20
Kassioun High (k.3)	Reservoir K.7	3	40	50	2.40	0.50	1.20
		2	55	50	3.30	0.33	1.10
		1	45	75	1.80	0.17	0.30
		6				Total Unit Operating Cost =	2.60
Mezze (m.1)	Reservoir M.2	2	75	300	0.75	0.22	0.17
		3	55	250	0.66	0.33	0.22
		1	90	375	0.72	0.11	0.08
		3	80	350	0.69	0.33	0.23
		9				Total Unit Operating Cost =	0.70

Source: 1995 data obtained from DAWSSA, presented in master Plan JICA 1997

Notes:

1) Per unit pumping cost = P (kw) x electrical cost / Q (m3/hr)

Cost of electricity (S.L./Kw.hr)   1.50

Inflation multiplier   2.00

Table D1.8 Source of Supply Weighting Factors for Large Blocks

DMA Large Block	Consumption[1] Requirement (a) (m3/day)	Production Well Sources (b) Average Capacity[2] (m3/day)		Weighting Factor	Required from Figeh/Barada (a-b) (m3/day)	Weighting Factor
E01	1,670	-		-	1,670	1.00
E02	4,200	-		-	4,200	1.00
B01	2,410	-		-	2,410	1.00
B02	7,300	-		-	7,300	1.00
B03	11,710	-		-	11,710	1.00
B04	5,500	-		-	5,500	1.00
M03	9,280	-		-	9,280	1.00
M04	1,580	-		-	1,580	1.00
D01	6,220	-		-	6,220	1.00
D02	11,240	-		-	11,240	1.00
D03	14,180	-		-	14,180	1.00
D04	35,530	-		-	35,530	1.00
D11	21,670	-		-	21,670	1.00
D05+M01+M02	49,100	17,300	University	0.35	31,800	0.65
D06	69,820	15,000	Oumawiyin	0.21	54,820	0.79
D07	17,290	17,132	Mazraa	0.99	158	0.01
D08	24,480	-		-	24,480	1.00
D09	48,820	35,820			13,000	0.27
		5,620	Kaboon	0.12		
		30,200	Jobar	0.62		
D10	254,220	76,948			177,272	0.70
		29,800	Ibn Assaker	0.12		
		26,500	Kadam Rail	0.10		
		8,980	Kadam Store (3)	0.04		
		11,668	Mazraa	0.07		
Totals	596,220	162,200			434,020	

Notes:
1) Based on 1997 estimated demand (Source - JICA Master Plan)
2) Average capacity is based upon operating the source at achievable rate (Source - JICA Master Plan)
3) based on 2.2 MCM seasonal average operating 245 days per year (Source - JICA Master Plan)

Table D1.9 Unit Capital Cost (10% discount factor)

Year		Cost of Capital Works (US$ 000's) Actual/Modified																	Total Modified Cost (US$ 000's)	Discount Factor (10%)	Discounted Capital Cost (US$ 000's)
		Water Mains	Pumping Stations	Kaboon I	Kaboon II	Takadom	Fisheen & Kiwan	Fisheen & Kiwan	Fisheen & Kiwan	Dumma	Jaramana	Barada	Barada	Kfar al Ashayer	Shobry al Qouvathy	Ibn Assaker	Fringe Wells	Kanawal Gardens	Kadam Railway			
1997	Actual	1,000	450	250		350	329	-	-	-	-	-	-	-	-	-	-	-	-			
	Modified	250	113	250	-	350	329	-	-	-	-	-	-	-	-	-	-	-	-	1,292	1.00	1,292
1998	Actual		450		150			189	-	500	2,435	250	-	-	-	-	-	-	-			
	Modified		113	-	150	-	-	189	-	500	2,435	250	-	-	-	-	-	-	-	3,048	0.91	2,773
1999	Actual												250	4,232	-	-	-	-	-			
	Modified												250	4,232	-	-	-	-	-	4,821	0.83	4,001
2000	Actual												300	-	1,740	-	-	-	-			
	Modified												300	-	1,740	-	-	-	-	2,040	0.75	1,530
2001	Actual								834							1,243	1,068	-	-			
	Modified							-	834							1,243	1,068	-	-	3,145	0.68	2,139
2002	Actual																	1,491	1,230			
	Modified																	1,491	1,230	1,491	0.62	924
Demand Multiplier		0.25	0.25	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00			12,659

Source: DAWSSA investment plan
Shadow exchange rate: 50 SL per US dollar

rate of return	10%
annual change in demand m3/day	13.699
Unit Capital Cost (S.L./m3) = (TDCC x r) / ((1+r) x 365 x d)	1.15

Table D1.10 (1/2) Unit Cost of Leakage per District Meter Area

DMA Large Block	Source	Boosted to	Unit Operating Cost (S.L./m3)	Weighting Factor	Weighted Unit Operating Cost (S.L./m3)	Unit Capital Cost for r=10% (S.L./m3)	Unit Cost of Leakage (S.L./m3)
Block M01 - Mezze High I & II	Figeh/Barada		0.30	0.65	0.20		
	University		1.80	0.35	0.63		
				Total	0.83	1.15	1.98
Block M02 - Mezze Medium	Figeh/Barada		0.30	0.65	0.20		
	University		1.80	0.35	0.63		
	Reservoir M.1	Reservoir M.2	0.70	1.00	0.70		
				Total	1.53	1.15	2.68
Block M03 - Mezze High	Figeh/Barada		0.30	0.65	0.20		
	Reservoir M.1	Reservoir M.2	0.70	1.00	0.70		
				Total	0.89	1.15	2.04
Block M04 - Mezze Medium	Figeh/Barada		0.30	0.65	0.20		
				Total	0.20	1.15	1.35
Block E01 - Eastern Berze High	Figeh/Barada		0.30	1.00	0.30		
	Kaboon Booster Station	Reservoir C.k	5.27	1.00	5.27		
				Total	5.57	1.15	6.72
Block E02 - Eastern Berze High	Figeh/Barada		0.30	1.00	0.30		
	Eastern Reservoir II.E	Reservoir B.1v	1.56	1.00	1.56		
				Total	1.87	1.15	3.02
Block B01 - Berze High II	Figeh/Barada		0.30	1.00	0.30		
	Eastern Reservoir II.E	Reservoir B.2	2.59	1.00	2.59		
				Total	2.89	1.15	4.04
Block B02 - Berze High I	Figeh/Barada		0.30	1.00	0.30		
	Eastern Reservoir II.E	Reservoir B.1b	1.23	1.00	1.23		
				Total	1.53	1.15	2.68
Block B03 - Berze Medium	Figeh/Barada		0.30	1.00	0.30		
				Total	0.30	1.15	1.46
Block B04 - Berze Medium	Figeh/Barada		0.30	1.00	0.30		
	Kaboon Booster Station	Reservoir C.k	5.27	1.00	5.27		
				Total	5.57	1.15	6.72

Table D1.10 (2/2) Unit Cost of Leakage per District Meter Area

DMA Large Block	Source	Boosted to	Cost (S.L./m3)	Weighting Factor	Weighted Unit Operating Cost (S.L./m3)	Unit Capital Cost for r=10% (S.L./m3)	Unit Cost of Leakage (S.L./m3)
Block D01 - Damas Center Superior High	Figeh/Barada		0.30	1.00	0.30		
	Wali Reservoir I.A & I.S	Reservoir K.3	2.20	1.00	2.20		
	Reservoir K.3	Reservoir K.7	2.60	1.00	2.60		
			Total		5.11	1.15	6.26
Block D02 - Damas Center High II	Figeh/Barada		0.30	1.00	0.30		
	Wali Reservoir I.A & I.S	Reservoir K.3	2.20	1.00	2.20		
				Total	2.51	1.15	3.66
Block D03 - Damas Center High I	Figeh/Barada		0.30	1.00	0.30		
	Wali Reservoir I.A & I.S	Reservoir K.1	0.69	1.00	0.69		
				Total	0.99	1.15	2.14
Block D04 - Damas Center Medium	Figeh/Barada		0.30	1.00	0.30	1.15	1.46
Block D05 - Damas Center Medium	Figeh/Barada		0.30	0.65	0.20		
	University PWC		1.80	0.35	0.63		
				Total	0.83	1.15	1.98
Block D06 - Damas Center Low	Figeh/Barada		0.30	0.79	0.24		
	Oumawiyn		1.74	0.21	0.37		
				Total	0.61	1.15	1.76
Block D07 - Damas Center Low	Mazraa	Reservoir N.1	0.30	1.00	0.30	1.15	1.46
Block D08 - Damas Center Low	Figeh/Barada		0.30	1.00	0.30	1.15	1.46
Block D09 - Damas Center Low	Figeh/Barada		0.30	0.27	0.08		
	Kaboon		5.27	0.12	0.61		
	Jobar		1.43	0.62	0.89		
				Total	1.88	1.15	3.03
Block D10 - Damas Center Low	Figeh/Barada		0.30	0.70	0.21		
	Kadam Store		0.51	0.04	0.02		
	Kadam Rail		0.96	0.10	0.10		
	Mazraa		1.88	0.07	0.12		
	Ibn Assaker		1.38	0.12	0.16		
				Total	0.62	1.15	1.77
Block D11 - Damas Center Medium	Figeh/Barada		0.30	1.00	0.30	1.15	1.46

Table D1.11 Average Unit Cost of Leakage

DMA Large Block	Consumption (m3/day)	Weighting Factor	Unit Operating Cost (S.L./m3)	Weighted Unit Operating Cost (S.L./m3)
E01	1,670	0.003	5.573	0.02
E02	4,200	0.007	1.867	0.01
B01	2,410	0.004	2.889	0.01
B02	7,300	0.012	1.530	0.02
B03	11,710	0.019	0.304	0.01
B04	5,500	0.009	5.573	0.05
D01	6,220	0.010	5.105	0.05
D02	11,240	0.018	2.505	0.05
D03	14,180	0.023	0.992	0.02
D04	35,530	0.058	0.304	0.02
D05	15,280	0.025	0.830	0.02
D06	69,820	0.114	0.613	0.07
D07	17,290	0.028	0.304	0.01
D08	39,850	0.065	0.304	0.02
D09	48,820	0.080	1.880	0.15
D10	254,220	0.416	0.616	0.26
D11	21,670	0.035	0.304	0.01
M01	22,510	0.037	0.830	0.03
M02	11,310	0.018	1.525	0.03
M03	9,280	0.015	0.892	0.01
M04	1,580	0.003	0.197	0.00
	611,590			0.85

Unit Capital Cost for r=10% (S.L./m3)	1.15
Weighted Average Unit Cost of Leakage (S.L./m3)	2.00

Notes:
1) Based on 1997 estimated demand (Source - JICA Master Plan)
2) Average capacity based on operating the source at achievable rate (Source - JICA Master Plan)
3) based on 2.2 MCM seasonal average operating 245 days per year (Source - JICA Master Plan)

Table D2.1   Estimated Financial Benefits

US dollars based on official exchange rate of 45 SL per dollar

	DMA				Informal Areas		
Year	Incremental Water (000's m³)	Unit value	Gross benefits ($)	Year	Incremental Water (000's m³)	Unit value	Gross benefits ($)
		0.11				0.11	
2000	-	0.11	-	2000	-	0.11	-
2001	2,637	0.11	290,070	2001	-	0.11	-
2002	5,274	0.11	580,140	2002	3,760	0.11	413,600
2003	7,911	0.11	870,210	2003	3,760	0.11	413,600
2004	10,548	0.11	1,160,280	2004	3,760	0.11	413,600
2005	13,185	0.11	1,450,350	2005	3,760	0.11	413,600
2006	15,822	0.11	1,740,420	2006	3,760	0.11	413,600
2007	18,459	0.11	2,030,490	2007	3,760	0.11	413,600
2008	18,459	0.11	2,030,490	2008	3,760	0.11	413,600
2009	18,459	0.11	2,030,490	2009	3,760	0.11	413,600
2010	18,459	0.11	2,030,490	2010	3,760	0.11	413,600
2011	18,459	0.11	2,030,490	2011	3,760	0.11	413,600
2012	18,459	0.11	2,030,490	2012	3,760	0.11	413,600
2013	18,459	0.11	2,030,490	2013	3,760	0.11	413,600
2014	18,459	0.11	2,030,490	2014	3,760	0.11	413,600
2015	18,459	0.11	2,030,490	2015	3,760	0.11	413,600
2016	18,459	0.11	2,030,490	2016	3,760	0.11	413,600
2017	18,459	0.11	2,030,490	2017	3,760	0.11	413,600
2018	18,459	0.11	2,030,490	2018	3,760	0.11	413,600
2019	18,459	0.11	2,030,490	2019	3,760	0.11	413,600
2020	18,459	0.11	2,030,490	2020	3,760	0.11	413,600
2021	18,459	0.11	2,030,490	2021	3,760	0.11	413,600
2022	18,459	0.11	2,030,490	2022	3,760	0.11	413,600
2023	18,459	0.11	2,030,490	2023	3,760	0.11	413,600
2024	18,459	0.11	2,030,490	2024	3,760	0.11	413,600
2025	18,459	0.11	2,030,490	2025	3,760	0.11	413,600
2026	18,459	0.11	2,030,490	2026	3,760	0.11	413,600
2027	18,459	0.11	2,030,490	2027	3,760	0.11	413,600
2028	18,459	0.11	2,030,490	2028	3,760	0.11	413,600
2029	18,459	0.11	2,030,490	2029	3,760	0.11	413,600
2030	18,459	0.11	2,030,490	2030	3,760	0.11	413,600
2031	18,459	0.11	2,030,490	2031	3,760	0.11	413,600
2032	18,459	0.11	2,030,490	2032	3,760	0.11	413,600
2033	18,459	0.11	2,030,490				
2034	18,459	0.11	2,030,490				
2035	18,459	0.11	2,030,490				
2036	18,459	0.11	2,030,490				
Total	609,147		67,006,170	Total	116,560		12,821,600

Table D2.2 Estimated Financial Costs

US dollars based on official exchange rate of 45 SL per dollar

	DMA				Informal Areas		
Year	Capital Costs ($)	O&M Costs ($)	Total ($)	Year	Capital Costs ($)	O&M Costs ($)	Total ($)
2000	664,715	-	664,715	2000	3,141,500		3,141,500
2001	664,715	70,555	735,270	2001	3,141,500		3,141,500
2002	664,715	105,555	770,270	2002	-	-	-
2003	664,715	140,555	805,270	2003	-	-	-
2004	664,715	175,555	840,270	2004	-	-	-
2005	664,715	210,555	875,270	2005	-	-	-
2006	664,715	245,555	910,270	2006	-	-	-
2007	-	285,555	285,555	2007	-	-	-
2008	-	285,555	285,555	2008	-	-	-
2009		285,555	285,555	2009	-	-	-
2010	-	285,555	285,555	2010	-	-	-
2011	-	285,555	285,555	2011	-	-	-
2012	-	285,555	285,555	2012	-	-	-
2013	-	285,555	285,555	2013	-	-	-
2014	-	285,555	285,555	2014	-	-	-
2015	-	285,555	285,555	2015	-	-	-
2016	-	285,555	285,555	2016	-	-	-
2017	-	285,555	285,555	2017	-	-	-
2018	-	285,555	285,555	2018	-	-	-
2019	-	285,555	285,555	2019	-	-	-
2020	-	285,555	285,555	2020	-	-	-
2021	3,013,700	285,555	3,299,255	2021	-	-	-
2022	-	285,555	285,555	2022	-	-	-
2023	-	285,555	285,555	2023	-	-	-
2024	-	285,555	285,555	2024	-	-	-
2025	-	285,555	285,555	2025	-	-	-
2026	-	285,555	285,555	2026	-	-	-
2027		285,555	285,555	2027	-	-	-
2028		285,555	285,555	2028	-	-	-
2029		285,555	285,555	2029	-	-	-
2030		285,555	285,555	2030	-	-	-
2031		285,555	285,555	2031	-	-	-
2032		285,555	285,555	2032	-	-	-
2033		285,555	285,555				-
2034		285,555	285,555				-
2035		285,555	285,555				-
2036		285,555	285,555				-
Total	7,666,705	9,514,980	17,181,685	Total	6,283,000	-	6,283,000

Table D2.3 Financial Internal Rate of Return

1 US$ = 45 SL

Year	Total Costs	Total Benefit	Benefit - Cost
2000	3,806,215	-	(3,806,215)
2001	3,876,770	290,070	(3,586,700)
2002	770,270	993,740	223,470
2003	805,270	1,283,810	478,540
2004	840,270	1,573,880	733,610
2005	875,270	1,863,950	988,680
2006	910,270	2,154,020	1,243,750
2007	285,555	2,444,090	2,158,535
2008	285,555	2,444,090	2,158,535
2009	285,555	2,444,090	2,158,535
2010	285,555	2,444,090	2,158,535
2011	285,555	2,444,090	2,158,535
2012	285,555	2,444,090	2,158,535
2013	285,555	2,444,090	2,158,535
2014	285,555	2,444,090	2,158,535
2015	285,555	2,444,090	2,158,535
2016	285,555	2,444,090	2,158,535
2017	285,555	2,444,090	2,158,535
2018	285,555	2,444,090	2,158,535
2019	285,555	2,444,090	2,158,535
2020	285,555	2,444,090	2,158,535
2021	3,299,255	2,444,090	(855,165)
2022	285,555	2,444,090	2,158,535
2023	285,555	2,444,090	2,158,535
2024	285,555	2,444,090	2,158,535
2025	285,555	2,444,090	2,158,535
2026	285,555	2,444,090	2,158,535
2027	285,555	2,444,090	2,158,535
2028	285,555	2,444,090	2,158,535
2029	285,555	2,444,090	2,158,535
2030	285,555	2,444,090	2,158,535
2031	285,555	2,444,090	2,158,535
2032	285,555	2,444,090	2,158,535
2033	285,555	2,444,090	2,158,535
2034	285,555	2,444,090	2,158,535
2035	285,555	2,444,090	2,158,535
2036	285,555	2,444,090	2,158,535

Internal Rate of Return	%
1. Base Case	16%
2. Costs + 15%	11%
3. Benefits - 10%	15%
4. 2 and 3	13%

Table D2.4 (1/3) Projected Cash Flow

in US$

I. Income Statement	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1.1 Revenue											
(1) Incremental Water Sales (000 m3)	-	2.637	9.034	11.671	14.308	16.945	19.582	22.219	22.219	22.219	22.219
(2) Average Water Tariff	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
(3) Total Revenue	-	290.070	993.740	1.283.810	1.573.880	1.863.950	2.154.020	2.444.090	2.444.090	2.444.090	2.444.090
1.2 Expenditure											
(1) Salary	-	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462
(2) Electricity	-	175	175	175	175	175	175	175	175	175	175
(3) Depreciation	-	.	138.700	138.700	138.700	138.700	138.700	138.700	339.633	339.633	339.633
(4) Repair & Others	-	57.918	92.918	127.918	162.918	197.918	232.918	272.918	272.918	272.918	272.918
(5) Foreign Loan Interest							539.243	560.987	545.978	529.920	512.737
(6) Total Expenditures	-	70.555	244.255	279.255	314.255	349.255	923.498	985.242	1.171.166	1.155.108	1.137.925
1.3 Revenue - Expenditure	-	219.515	749.485	1.004.555	1.259.625	1.514.695	1.230.522	1.458.848	1.272.924	1.288.982	1.306.165
1.4 Profit Taxes	-	131.709	449.691	602.733	755.775	908.817	738.313	875.309	763.754	773.389	783.699
1.5 Net Revenue (after interest and taxes)	-	87.806	299.794	401.822	503.850	605.878	492.209	583.539	509.169	515.593	522.466
1.6 Accumulated Net Revenue (Deficit)	-	87.806	387.600	789.422	1.293.272	1.899.150	2.391.359	2.974.898	3.484.068	3.999.661	4.522.127
II. Cash Flow											
2.1 Cash Inflow											
(1) Cash Flow from Operations 1.5 + 1.2(3)	-	87.806	438.494	540.522	642.550	744.578	630.909	722.239	848.802	855.226	862.099
(2) Foreign Loan	2.854.661	2.854.661	498.536	498.536	498.536	498.536	498.536				
(3) Foreign Loan Accumulated	2.854.661	5.709.323	6.207.859	6.706.395	7.204.931	7.703.468	8.202.004				
(4) Government Contribution	951.554	951.554	166.179	166.179	166.179	166.179	166.179				
(5) Government Contribution Accumul	951.554	1.903.108	2.069.286	2.235.465	2.401.644	2.567.823	2.734.001				
(6) Total Cash Inflow	3.806.215	3.894.021	1.103.209	1.205.237	1.307.265	1.409.293	1.295.624	722.239	848.802	855.226	862.099
2.2 Cash Outflow											
(1) Investment	3.806.215	3.806.215	664.715	664.715	664.715	664.715	664.715				
(2) Foreign Loan Repayment							187.910	214.401	229.409	245.468	262.651
(3) Total Outflow	3.806.215	3.806.215	664.715	664.715	664.715	664.715	852.625	214.401	229.409	245.468	262.651
2.3 Net Cash Flow											
2.1(6) - 2.2(4)	-	87.806	438.494	540.522	642.550	744.578	442.999	507.838	619.393	609.758	599.448
2.4 Accumulated Net Cash Flow	-	87.806	526.300	1.066.822	1.709.372	2.453.950	2.896.949	3.404.787	4.024.180	4.633.938	5.233.386

Table D2.4 (2/3) Projected Cash Flow

in US $

I. Income Statement	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
1.1 Revenue											
(1) Incremental Water Sales (000 m3)	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219
(2) Average Water Tariff[1]	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
(3) Total Revenue	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090
1.2 Expenditure											
(1) Salary	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462
(2) Electricity	175	175	175	175	175	175	175	175	175	175	175
(3) Depreciation	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633
(4) Repair & Others	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918
(5) Foreign Loan Interest	494.352	474.679	453.629	431.106	407.007	381.220	353.628	324.105	292.515	258.714	222.547
(6) Total Expenditures	1,119.540	1,099.867	1,078.817	1,056.294	1,032.195	1,006.408	978.816	949.293	917.703	883.902	847.735
1.3 Revenue - Expenditure	1,324.550	1,344.223	1,365.273	1,387.796	1,411.895	1,437.682	1,465.274	1,494.797	1,526.387	1,560.188	1,596.355
1.4 Profit Taxes	794.730	806.534	819.164	832.677	847.137	862.609	879.164	896.878	915.832	936.113	957.813
1.5 Net Revenue (after interest and taxes)	529.820	537.689	546.109	555.118	564.758	575.073	586.110	597.919	610.555	624.075	638.542
1.6 Accumulated Net Revenue(Deficit)	5,051.947	5,589.636	6,135.745	6,690.863	7,255.621	7,830.694	8,416.804	9,014.723	9,625.277	10,249.352	10,887.894
II. Cash Flow											
2.1 Cash Inflow											
(1) Cash Flow from Operations 1.5 + 1.2(3)	869.453	877.322	885.742	894.751	904.391	914.706	925.743	937.552	950.188	963.708	978.175
(2) Foreign Loan											
(3) Foreign Loan Accumulated											
(4) Government Contribution											
(5) Government Contribution Accumul.											
(6) Total Cash Inflow	869.453	877.322	885.742	894.751	904.391	914.706	925.743	937.552	950.188	963.708	978.175
2.2 Cash Outflow											
(1) Investment											3,013.700
(2) Foreign Loan Repayment	281.036	300.709	321.758	344.281	368.381	394.168	421.760	451.283	482.873	516.674	552.841
(3) Total Outflow	281.036	300.709	321.758	344.281	368.381	394.168	421.760	451.283	482.873	516.674	3,566.541
2.3 Net Cash Flow											
2.1(6) - 2.2(4)	588.417	576.613	563.984	550.470	536.010	520.538	503.983	486.269	467.315	447.035	(2,588.366)
2.4 Accumulated Net Cash Flow	5,821.803	6,398.417	6,962.401	7,512.871	8,048.881	8,569.419	9,073.402	9,559.671	10,026.986	10,474.020	7,885.655

Table D2.4 (3/3) Projected Cash Flow

in US $

I. Income Statement	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
1.1 Revenue											
(1) Incremental Water Sales (000 m3)	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219	22.219
(2) Average Water Tariff	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
(3) Total Revenue	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090	2,444.090
1.2 Expenditure											
(1) Salary	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462	12.462
(2) Electricity	175	175	175	175	175	175	175	175	175	175	175
(3) Depreciation	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633	339.633
(4) Repair & Others	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918	272.918
(5) Foreign Loan Interest	183.848	142.440	98.134	50.726							
(6) Total Expenditures	809.036	767.628	723.322	675.914	625.188	625.188	625.188	625.188	625.188	625.188	625.188
1.3 Revenue - Expenditure	1,635.054	1,676.462	1,720.768	1,768.176	1,818.902	1,818.902	1,818.902	1,818.902	1,818.902	1,818.902	1,818.902
1.4 Profit Taxes	981.032	1,005.877	1,032.461	1,060.905	1,091.341	1,091.341	1,091.341	1,091.341	1,091.341	1,091.341	1,091.341
1.5 Net Revenue (after interest and taxes)	654.022	670.585	688.307	707.270	727.561	727.561	727.561	727.561	727.561	727.561	727.561
1.6 Accumulated Net Revenue(Deficit)	11,541.916	12,212.501	12,900.808	13,608.078	14,335.639	15,063.200	15,790.760	16,518.321	17,245.882	17,973.443	18,701.004
II. Cash Flow											
2.1 Cash Inflow											
(1) Cash Flow from Operations 1.5 + 1.2(3)	993.655	1,010.218	1,027.940	1,046.903	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194
(2) Foreign Loan											
(3) Foreign Loan Accumulated											
(4) Government Contribution											
(5) Government Contribution Accumul.											
(6) Total Cash Inflow	993.655	1,010.218	1,027.940	1,046.903	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194
2.2 Cash Outflow											
(1) Investment											
(2) Foreign Loan Repayment	591.540	632.947	677.254	724.661							
(3) Total Outflow	591.540	632.947	677.254	724.661	-	-	-	-	-	-	-
2.3 Net Cash Flow											
2.1(6) - 2.2(4)	402.115	377.270	350.687	322.242	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194	1,067.194
2.4 Accumulated Net Cash Flow	8,287.770	8,665.040	9,015.726	9,337.968	10,405.162	11,472.356	12,539.550	13,606.744	14,673.937	15,741.131	16,808.325

APPENDIX E

INSTITUTIONAL AND FINANCIAL ASPECTS

APPENDIX E
INSTITUTIONAL AND FINANCIAL ASPECTS

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1.   PRESENT ORGANIZATION

1.1   Background

Rapid urban growth has increased the demand for services and created new pressures on the existing organization. Although many new engineering projects have been initiated to deal with the demand for water supply, little has been done to improve the business side of the organization. The organizational structure and the administrative procedures have remained unchanged since the last major re-organization took place in 1976.

The master planning study completed in 1997 (JICA) identified a capital spending program for developing water resources and the water supply system. The improvement of financial management was selected from the master plan as a priority project for the present feasibility study recognizing the need for DAWSSA to become more business oriented in order to meet the fiscal requirements for developing, owning and operating on ever growing system.

1.2   Past and Present Financial Performance -Overview

A summary statement of revenues and expenditures for the period of 1990 to 1995 is shown in Table E-1.1. The figures indicate that in terms of revenue growth, DAWSSA's financial performance has apparently improved considerably from a pre-tax net income of SL 5.5 million in 1990 to SL 74.8 million in 1995. Water sales in 1995 provided SL 278 million, representing 80% of total revenues. The improvements are somewhat misleading because while the volume of water production has increased substantially over the same period, the percentage of water that is actually sold has decreased steadily from 34% in 1990 to 29% in 1995. The revenue increases are only due to frequent and large increases in tariffs over the same period.

The operating ratio, defined as the total annual operating costs (including depreciation) divided by the total annual revenue, is a financial indicator used to assess the extent to which the existing revenue covers all of the costs of supplying water to the customers. In general the

operating ratio should be below 0.5 in order for a utility to fully cover the costs of operation and maintenance costs, debt servicing charges, as well as build a reserve for financing future investment projects. Although DAWSSA's operating ratio has improved considerably over the last five years, it remains high mainly because only one third of the water produced is actually sold.

A summary statement of source and use of funds is presented in Table E-1.2. Operating income before taxes accounted for only 5.5% of all funding available to DAWSSA while the balance was provided by Government and foreign aid loans, and increases in payable. Approximately 58% of the operating income is taxed by the Government. The relatively high tax rate and the large proportion of investment funding provided from government loans indicate that DAWSSA has very little financial management autonomy.

As discussed in the Master Plan (JICA-1997) DAWSSA must focus more of it's efforts on increasing revenues from the sale of water. There are three components to the revenue equation that must be addressed in a coordinated effort to improve financial performance: (a) high levels of unaccounted for water; (b) low tariffs; and (c) inefficient customer billing resulting in poor cash flow.

(a)   Unaccounted for water was reviewed as part of the Master Plan (JICA-1997) and priority projects for rehabilitation, leakage detection and informal use are addressed under the scope of this feasibility study.

(b)   Tariffs are set uniformly by the Central Government for the whole country. Although these tariffs do not reflect it's own unique operating costs and investment needs, DAWSSA has little control on tariff policy and must continue to rely on government subsidy to make up any short fall in funding.

(c)   The most critical financial management issue that remains to be resolved is the long delay in producing bills and collecting payments. The delay in collecting revenue is on average 12.5 months and seriously hampers financial performance as well as financial management processes throughout the organization. Although the billing process was

partly computerized in 1982, the administrative procedures remain manual, labor intensive and do not permit the analysis of data for operational needs. It takes an average of 10.5 months, internal to DAWSSA's administration, to issue a bill after reading the customer's meter. The inability to control expenditures and identify the component costs of producing water and providing support services. This lack of information makes it impossible for management to plan budgets based on the true needs of the organization. The inability to breakdown the operating costs for each part of the organization also makes it impossible to identify potential operating problems and control spending for various activities.

1.3   Present Organization

In order to fully understand how the various processes of financial management actually work and what the impact of a proposed change will be, it is necessary to first understand the organizational structure and how it functions. The overall organization structure is presented in Figure E-1.1 as taken from the Master Plan (JICA - 1997).

The use of terminology to describe the different levels of the organizational structure was found to vary throughout DAWSSA. It is therefore proposed to standardize the terminology for this report as described on the generic organizational chart shown in Figure E-1.2. There are three Directorates involved in financial management: finance, consumer affairs and accounting. The organization charts for each Directorate are shown in Figure E-1.3. In addition, the Planing Directorate plays an important role in preparing the investment budget and approving spending commitments for investment projects.

The process of generating revenue starts in the Customer Affairs Directorate. This Directorate is responsible for four critical functions:
- subscriber services (new connections, customers accounts, complaints)
- making service connections and metering, including meter repairs
- meter reading
- billing and payment collection

The main task of managing budgets and the daily financial transactions within the organization are the responsibility of the Finance Directorate. There are five functions:

- budgeting
- spending control
- procurement: contracts/purchasing
- treasury & cash collection
- materials management/store keeping

The Accounting Directorate is responsible for four critical functions:

- providing computer services for accounting, inventory control, salary, and billing
- financial accounting for all revenue and expenditures
- materials accounting and costing of inventory
- auditing and reconciliation of cashiers, contract payments, banking transactions, movements in stores materials

Several opportunities for improvement have been identified:

(a)   The Customer Affairs Directorate has a very broad scope of work and is twice as large, in terms of staff (276), as the next largest Directorate - Administration. It would be desirable to reduce the work load in this Directorate and focus it's rather broad mandate to deal more with customer service and less with the operation of cash collection centers.

(b)   All managerial and financial decisions are made by the Directors and the Director General with little or no approval authority delegated to other levels in the chain of command. As a result, these senior management positions must deal with many micro management issues causing decision making delays. Senior management has little time to provide the kind of strategic planning required to deal with the real management issues facing their Directorates. This situation will likely get worse as the number of customers continues to grow.

(c)   The Finance Directorate has very broad mandate that includes many non-financial functions such as store keeping, procurement and some expenditure control functions that should be controlled by accounting. Revenue generation & collection operations are fragmented between three directorates resulting in a lack of direction for making changes to correct administrative inefficiencies such as delayed billing and payment collection.

1.4   Customer Information Management

The information required for customer service and billing is referred to frequently by different parts of the organization and in different administrative processes related to the financial management function. Customer information management is therefore considered the cornerstone supporting the systems that generate and manage revenue. The following tasks are included under the heading of customer information management:

- new subscriptions, initiation of service
- transactions or changes in accounts
- canceling services
- high bill complaints
- interruption in services

Currently DAWSSA undertakes what is essentially a supply contract with each consumer. As a result of these contracts, a great deal of information about customers and connections accumulates (e.g. building permit, municipal address, photo identification, water right agreements, ownership, rate classification, consumption, location of service line, etc.) Because the information is so large and changes constantly and because it accumulates randomly over time and from different places throughout the organization, it is difficult to manage effectively given the existing manual filing system.

The Customer Affairs Directorate processes approximately 2,000 requests for new connections, 20,000 information changes and 5,500 complaints per year. Although these numbers are relatively low compared to the size of the customer base, the ability to service clients quickly and efficiently is poor because information about customer accounts is not

readily available to customer service representatives. The process of subscribing new customers and providing a metered connection is one of the first steps required for generating revenue. It is during this initial stage that customer account data required for the billing system is collected. The work flow involved in processing a new subscriber is presented in Figure E-1.4. Several opportunities for improvement have been identified:

(a)   Although the existing process of adding a new customer to the system works well for DAWSSA it generally provides poor customer service because it is slow and information is not readily available when customers make inquiries. This results in frequent visits by the customer to schedule appointments, pay for the fees, or inquire about the status of an account.

(b)   Technical information to determine the feasibility of making a connection is not readily available when the customer makes a request. This results in unnecessary administrative work and time delays.

(c)   Filing and archiving facilities for customer files and documents is inadequate. It is difficult to find files and easy to misplace documents. Approximately 250,000 customer files, many dating back to the early 1930's, are kept in open storage, in a very dusty and damp basement room. The records contain the original and only copy of important legal documents such as previously paid for water rights. These water rights are perpetual and the loss of these records due to fire or unsuitable environmental conditions would be problematic from a legal perspective.

1.5   Customer Metering, Billing and Collection

The meter is DAWSSA's cash register and the systems that read it and generate revenues based on consumption are critical to DAWSSA's ability to invest in projects for the continued operation, maintenance, and expansion of the water supply system. Therefore, DAWSSA needs to charge for it's services in a business like manner, rendering timely and accurate bills.

It is DAWSSA's legal mandate to bill customers quarterly based on metered consumption readings. However, actual meter reading cycles have slipped to 5 months and billing is carried out every 6 months with two equal bills issued at the same time (one for each quarter within the six month period). Once bills are printed and verified for accuracy, they are sent to one of 20 remote cash collection offices corresponding to the metering district where the connection is made. When the bills have been issued, customers are requested by newspaper and television advertisement to pay their bills in person at their designated collection office.

In 1982, DAWSSA took the important step of implementing a computerized billing system. Unfortunately, the billing system is rather limited and can only be used to produce billing statements from manually entered meter readings. The efficient issuing of bills is considered to be one of the most urgent matters to be resolved and this process is investigated in detail. Other procedures for collecting payments and adjusting billings are also reviewed as they form part of the billing process.

(1)   Meter reading and billing procedure

The work flow for metering and billing is described in detail in the Figure E-1.5 and the time frames for each activity are documented in Table E-1.3. Together with the work flow diagram, the analysis of the billing schedule helps to locate critical time delays and administrative bottle necks. From this information, the following opportunities for improvement are identified:

(a)   Time Delays

The analysis, carried out for each of the 26 metering/billing districts, is based on billing cycle 269 for the last quarter of 1996, considered typical by the Consumer Affairs Directorate. The total time lapse from the time a meter is read to the time a bill is issued to the cashiers at remote payment collection centers varies from 138 to 296 days. The time depends to some extent on the size of the district and averages around 197 days (6.5 months) per district. The

analysis indicates that the most significant delays are occurring at three junctures in the process:

(i)   after meter readings are completed there is an average 67 day (2 month) delay before sending or entering the data into the computer. Reasons for this considerable delay could not be explained by staff.

(ii)   after the data is entered, there is an average 28 day (1 month) delay before printing the bills. This delay appears to be due in part to the process of checking for data entry errors.

(iii)   after the bills have been verified a second time by the Consumer Affairs Directorate, and corrections made, there is an average 43 day (1.5 month) delay before the bills are actually issued to the collection center. This delay is apparently deliberate and intended to limit the number of billing cycles given to each cashier to no more than four (one year of receipts). When accounts have been delinquent for more than one year, the cashier returns all the bills to the late payment section of the Customer Services Department.

(b)   Meter reading

Time taken to read meters in each district varies considerably from 10 to 27 days depending on the size and complexity of the districts. However, in terms of the overall delays being experienced throughout the billing process, meter reading is only a very small part of the problem. Meter readers are given a quota of 125 meters per work day. Some days they read more, some days less depending on the difficulties encountered in reading the meters. The analysis presented in Table E-1.4 shows that the actual production rate is probably closer to 90 meters per reader per day. It takes a meter reader approximately three hours to cover the daily round. Productivity is low since there are 6 hours in a working day. However this time frame does not appear too unreasonable given the unfavorable work environment. The work is physically demanding, very hot in the summer and cold in the winter. The workers must spend on average about 1 hour per day traveling to and from DAWSSA HQ to each site. Meter

readers cover their rounds on foot which in some mountainous and rural areas can be very time consuming and difficult.

Customers are difficult to locate due to the absence of an addressing system in many areas. Gaining access to customer meters is difficult because people are often not home during the day or in many cases women (especially of the Muslim faith) do not want to open the door to the meter reader . Meters are difficult to read because they are often installed incorrectly or located in dark places. A review of five typical districts shown in Table E-1.5 indicates that approximately 10% of meters are skipped until the next billing cycle because meters could not be accessed. This has a negative impact on cash flow because bills must be issued on the basis of a small minimum monthly charge. It can also create problems for customers who may be faced with a large bill when the meter is finally read one or two cycles later.

(c)   Data entry

Time for data entry also varies considerably from 1 to 25 days depending on the size of the district. Productivity appears reasonable given that as in most parts of the organization there is apparently no motivation to work at an accelerated pace.

(d)   Error detection and correction

Error detection and correction takes place in the Computer Department of the Accounting Directorate and takes on average 28 days (1 month). It involves checking for unusually high readings to avoid embarrassing billings and comparing each data entry to the values entered in the meter reading books. Error checks are carried out again in the Consumer Affairs Directorate and takes an average 21 days. This second verification process involves comparing the consumption values entered into the computer with the values recorded in the meter reading books. Table E-1.6 indicates that the percentage of errors found during the second verification stage is a very low 0.5%. There is entirely too much time spent on error checking activities and the duplication is unnecessary given the relatively high accuracy at the data entry stage .

(c)   Coordination between billing and meter reading

As shown in Figure E-1.6 the schedules for meter reading and billing generally are not synchronized i.e. billing for each district is in a different sequence than that of the meter reading schedule. This leads to complications in coordinating activities between different parts of the organization with resulting time delays.

(f)   Issuing the billing statements

It takes 173 days (almost 6 months) within the Customer Affairs Directorate to complete the cycle of issuing bills for all districts. This is 42 days longer than it takes to complete the meter reading cycle and indicates that the process of issuing the bills to the cashiers is lagging the meter reading and bill production cycles i.e. a bottle neck. As of June 9, 1997, some 52,307 bills for the last quarter of 1996 were still not issued even though they were ready.

(2)   Collection of payments & billing adjustments

Work flow charts for the billing tasks of payment collection are presented in Figure E-1.7 and billing complaints in Figure E-1.8. From the work flow charts opportunities for improving the effectiveness of the collection and payment process are identified:

(a)   Time delays

In general the time given to customers for paying bills is extremely generous. The first (and only notice) is delivered sometime after 45 days has elapsed. About 65% of customers pay within the first 45 days. Another 20 % of customers pay within 30 days of receiving the late payment notice. Approximately 15% do not pay their bills until they are threatened with service disconnection one year after receiving their bill. Only a small percentage of customers don't pay even after services are disconnected. A review of the billings for 1994 and 1995 is shown in Table E-1.7. As of May 31 1997, 32,329 bills issued in 1994 (3.4% of the total)

remain unpaid. These are worth 15,873,901 SL. The situation for bills issued in 1995 is worse with 65,992 (7%) unpaid bills worth 25,621,764 SL.

Reporting of delinquent accounts is non-existent. Action is at the discretion and control of the cashiers and usually only occurs once the payments have slipped past four quarters (one year)!!!! The process is passive and generally occurs so late after the bill is issued that it is ineffective. This passive approach results in a backlog of delinquent accounts that becomes the source of many administrative headaches throughout the organization.

1.6   Financial Management

Financial management tasks handled by the Finance Directorate consists of: (a) preparing the ordinary budget; (b) expenditure control by monitoring spending against the budget; (c) managing cash needs (treasury) to optimize cash flow against expenditures. The Finance Directorate is also involved in other activities such as procurement of materials and services, and stores management (stock keeping). These activities are not strictly related to financial management and are not discussed here. Materials management should be the focus of future study since the establishment appears to have a substantial amount of assets in stores and inadequate tools to properly control materials management and deal with the issues of optimum re-order points, minimum re-order quantities and materials pricing.

The main focus of this study is to strengthen the financial management of the organization. Accordingly, there are three important aspects of financial management that are be examined: budgeting, expenditure control, and cash management.

(1)   Budgeting

Preparing the ordinary budget is a relatively unsophisticated process. The Finance Directorate coordinates budget preparation for the whole establishment. The budget is based on the list of the previous year's expenses and payments kept by the ordinary budget section. The Accounting Directorate assists forecasting revenues. In general, the line items (accounts) in the previous budget are adjusted up or down by a small percentage. Preparing the

investment budget is more difficult because it is linked to the five year investment plan set by the State Planning Commission. The Planning Directorate prepares the investment budget with input from the various directorates on project needs. The Planning Directorate, prepares project estimates, staffing requirements, and presents the investment budget to the Ministry of Planning for approval. Both budgets, once prepared, are reviewed by the Director General, then transmitted to the Ministry of Finance to receive funding. The following opportunities for improvement have been identified:

(a)   the process for preparing the ordinary budget does not require the users to forecast their operating needs for the coming year. The ordinary budget therefore is not based on planning by those who will incur the expenses - the users.

(b)   the ordinary budget structure does not lend itself to financial analysis. There is no breakdown of the budget (for expenditure) along the functional lines of the organization and a limited breakdown on an operational basis. As a result it is impossible to identify the budget requirements for different activities such as production and distribution, or differentiate between the maintenance budget for the distribution system vs. building and grounds maintenance.

(c)   preparation of the ordinary budget is a passive system limited to observing the variances between budgeted amounts and actual spending after the fact. The budget should be based on a true forecast of future needs and used as a tool to allow users to control and manage their expenditures

(d)   cost control on the investment budget is almost non-existent. Budgets can easily be overspent by 25% and there is no procedure in place to document and formalize changes to the contract. This makes review of contractor progress billings difficult and control of project budgets impossible.

(2)   Expenditure control

The work flow for the process of approving and monitoring expenditures is described in Figure E-1.9. The overall expenditure management system has a number of conceptual and organizational weaknesses:

(a)   the payment processing system is completely manual, involving the functions of account control and verification, transaction recording and payment

(b)   data aggregation is manual and involves substantial "double handling" of data.

(c)   there is no real spending "control" only monitoring of expenditures. The lack of a budget breakdown along functional lines means that operating expenditures are lumped together and spending approval is allocated on a first come first serve basis as long as there is still money in the budget.

(3)   Cash management

The term "cash management" is used to describe the activities required to control the movement of funds and establish financial equilibrium of DAWSSA's cash reserves (treasury). These activities are required to optimize the yield of DAWSSA's financial resources (7% bank interest). In most water utilities these activities include:
-   controlling the use of funds allocated to the various Directorates
-   forecasting the treasury needs for the organization on an annual basis to produce a balanced financial plan for the coming twelve months. This requires taking into account all disbursements that might influence the use of financial resources such as investment projects, loans, costs for production and payroll.
-   verifying the payments of the organization and following the balance of bank accounts. The treasury section must know at all times the amount of funds available.
-   forecasting the daily treasury needs

Unfortunately the treasury control function at DAWSSA is virtually non-existent. The following opportunities for improvement have been identified:

(a) A lack of current information on bank balance and outstanding payments results in little or no financial planning. This is evidenced by the need to have a separate bank account for monthly payroll expenses. Each month, revenues are directed to the payroll account at the Central bank until sufficient funds are accumulated to cover the monthly payroll. Any additional revenue is then deposited to the checking account at the Commercial bank for paying other expenses. Due to the lack of control there is often a lack of funds to pay for expenditures. This is mainly caused by inadequate cash flow in revenues to cover the payments issued to material suppliers and contractors. The Finance Director does not have the means to forecast his treasury needs in advance. The only options for dealing with non sufficient funds are to accelerate the collection of payments from customer billings, or delay payment until funds are available.

(b) There is a great deal of difficulty in reconciling the bank balance against checks already issued and having the information required to know how much money is available to meet daily and future expenditures. The reason for this is not clear and perhaps lies in the fact that the system is manual and it is difficult to track long outstanding checks.

(7) Accounting

As in most water utilities, the accounting system is the tool that provides management with the information required to analyze expenditures, control costs and plan for future budgetary needs. The accounting process consists of the following tasks:

- making journal entries for all actual revenue and payments
- producing a trial balance every month
- producing a balance sheet and a statement of profit and losses.

DAWSSA uses the general accounting structure specified by the Ministry of Finance. It is the same Unified Accounting System (UAS) that all government institutions must use in

order to integrate their budgets within the Central Government's overall budget. The system is called allows the organization to produce a balance sheet for it's accounts and a profit and loss statement. The existing UAS accounting structure is presented in Table E-1.8. The accounting information is recorded manually in journals and posted to the computerized accounting system on a monthly basis to produce a trial balance. Ledgers are printed for all accounts that have seen some movement during the period.

The Accounting Directorate is solely responsible for accounting of all revenue and expenditures and is at the receiving end of the billing, cash collection and expenditure processes discussed in previous sections of the report. The focus of the accounting systems is to keep an accurate account of expenditures and revenues, income and losses, and to provide timely and accurate financial information for management to make better informed decisions. It is not the work procedures themselves that are of particular interest in this case but rather, the accounting structure and how it can be used to provide the information needed to improve cost control and budget preparation. In general the information received by accounting is processed quickly and efficiently. Unfortunately the existing computerized accounting system is not geared towards producing financial reports that can be used by management. The following opportunities for improvement have been identified:

(a)   In general, staff are very competent, the accounting procedures are well organized, and performed efficiently but they are time consuming because they are completely manual.

(b)   There is a certain duplication by the Finance Directorate in auditing cashiers and the functions of account control, transaction recording and payment.

(c)   The system for data aggregation is manual involving substantial double handling of data and is primarily aimed at producing accounting reports in the form of ledgers rather than towards producing documents suitable for management information and decision making i.e. account spending .vs. budgeted amount, variances.

(d)   The existing computer equipment has been in service for some time and the staff are well trained in it's use. Unfortunately the system is not integrated with the processing

of payments, and expenditures. Journal entries are processed in batch mode at the end of each month whereas it would be desirable to make journal entries directly into the computer on a daily basis. In the absence of a fully automated accounting system, a cumbersome and often duplicate system of checks and balances has been built-up and a disproportionate amount of manual resources is used on attempting to ensure that prescribed financial controls are applied to all transactions. The hardware and software is considered outdated and would require considerable enhancements to provide the functional integration required between the accounting and financial management processes.

(c)   There is no suitable reporting of financial management information to provide senior management with realistic measures of operational and financial performance. The existing accounting structure does not identify the costs for various production and maintenance activities making it impossible to rationalize the cost services and provide the information required for planning the budget and controlling expenditures. Although the unified accounting system has provisions for cost accounting, the details on how to do it are very general and DAWSSA has not been able to implement the cost accounting procedures required by the Ministry of Finance.

1.7   Information Technology

(1)   Computer use at DAWSSA

Like many utilities, DAWSSA has joined the computer revolution in an effort to keep up with the growing complexity of the information it must manage and the increasing volume of data it must collect and process as the number of customers increases.

DAWSSA has a wide array of computer systems supporting several applications, a list of which is presented in Table E-1.9. The main applications are: billing, accounting, stores inventory, and payroll. These applications were implemented in the early 80's and have essentially remained unchanged. The application programs are written in COBOL and are supported by a UNIX based Bull DPX 2000 file server with limited 8 Mb of processing

memory and 450 Mb storage capacity. Approximately 14 remote terminals are linked through an Ethernet LAN to the main CPU. A second DPX 2000 machine with 12 remote terminals supports engineering applications such as well and spring discharge data, water quality data, network data. Many of the more recently implemented engineering applications are PC based and DAWSSA has experienced difficulties operating these from the UNIX file server. Consequently, many of the applications have been moved to stand alone PC's and DAWSSA is currently implementing a new Novell network to link the PC's throughout the organization.

Organizational responsibility for these systems is not clearly delineated. The Computer Department within the Accounting Directorate is responsible for software applications related to billing, inventory, accounting, and payroll. Responsibility for hardware and systems support remains undefined. The New Works and Studies Directorate, which is one of the most advanced groups in terms of computer use, has shown great vision by creating a special section dedicated to computer applications and the development of information technology. By default, this section has seen it's role expand to support the growing computer needs of the whole organization.

The existing information systems and applications have evolved at different rates and have been implemented at different times without an overall plan or strategy. As the result of this development there are now several small "islands of automation" throughout the organization. Under this kind of development regime, inefficiencies have arisen. As a result of the lack of planning and standards, integration between systems is either non existent or now impossible. There is a significant duplication of effort in collecting and processing data and often the data does not match from one system to the next. In the absence of defined priorities, machines have been allocated in a very even handed way in order to satisfy as many requests as possible. Unfortunately, fiscal resources have not been focused to meet the most urgent requirements.

(2)   Application needs

DAWSSA has a wide range of existing and future computer needs all of which are very information sensitive. A list of applications and the status of their development to date is shown in Table E-1.10.

The implementation of a SCADA system is currently under way. The system will provide an opportunity to build a database of flows and pressures etc. and provides the foundation for analyzing and understanding system operations. This is the first major computerization initiative to be undertaken in the last 15 years and it should provide DAWSSA with the momentum it needs to continue the development of computer systems throughout the organization.

2.   CHANGE STRATEGY

2.1   The Need for Change

An overview of the existing organization and administrative procedures related to financial management is presented in section 1. The profile that emerges is one of an organization whose administrative and management processes have not kept pace with a rapidly growing population and the increasing complexity of the systems and information it must manage. The management team recognizes the many challenges it must now face in order to continue providing the quantity and quality of water required for future generations. The Government has made substantial investments in water supply infrastructure over the last five years. However the focus of these investments has been largely on the development of new water resources and the extension of the distribution system into informal areas.

While DAWSSA is a "Public" utility and should be a commercially viable operation, it is recognized that it operates at a loss, generating sufficient funds to meet day to day operating expenses but not enough to cover the growing capital contributions required to finance new works. DAWSSA is accustomed to operating as a highly subsidized Government institution and it's financial management philosophy has been deeply ingrained along these lines

2.2   Goals and Guiding Principles

Creating an organization that is financially self supporting, cost-effective and responsive to the needs of it's users is clearly the long term goal. The present feasibility study is aimed at developing a change strategy that will:

(a) Improve financial management processes

(b) Increase revenues.

(c) Improve management's ability to budget and control costs

Before reviewing what options are available to DAWSSA for achieving the stated goals, it is important to define some of the principles that will guide the development of the overall change strategy:

Guiding Principle#1 - Participation of those affected by change

The organizational structure is currently the subject of formal discussion between DAWSSA and the Ministry of Housing and Utilities (MHU) and it is highly unlikely that any major organizational changes can be implemented in the near future. Nevertheless, options are presented to stimulate discussions amongst DAWSSA's management team with the expectation that new ideas will be put forward. Directors, and a number of staff were consulted throughout the study. Thanks to their excellent participation, a number on opportunities for improvement were identified and many of their suggestions are incorporated herein. In most organizations it is not unusual to find some initial reluctance and even resistance to change. The best way to overcome this trepidation is to have the full participation of those affected by the changes as well as the support and leadership of the whole management team.

Guiding Principle#2 - Using information technology to improve productivity

DAWSSA's traditional response to inefficient administrative systems and low staff productivity has been to increase staffing levels to cope with increases in work load. Unfortunately this is a short sighted solution that does not address the root of the problem. Managers are being asked to improve service levels and achieve greater results with the same limited financial resources. Therefore DAWSSA will need to find more creative ways of stretching it's existing resources to provide better, faster and cheaper services. The computer is widely recognized as a great productivity tool and must therefore play a central role in DAWSSA's change strategy.

Guiding Principle#3 - Promoting greater integration of management and information systems

The historical pattern of developing separate information and management systems in water utilities is no longer adequate. As the number of customers increases and the water supply network continues to expand, the information required to effectively manage the system becomes more complex e.g. new SCADA system at DAWSSA. The growing

complexity of this information suggests that an integrated approach to the management processes that create and use the information is essential. The change strategy must therefore emphasize integration.

2.3   Overall Organization

This section considers the type of organizational changes that are needed to improve management's ability to implement changes. The overall objectives are to: (a) streamline decision making; (b) clarify roles and responsibilities; and (c) consolidate the organizational structure along functional lines. The possible range of options are presented in Figure E-2.1 and discussed in the following paragraphs. The feasibility of implementing the various options depends on receiving the approval from the Ministry of Housing and Utilities.

Option 1a - Create new Assistant Director positions within each Directorate

As discussed in section 1, Directors are spending most of their time micro-managing the daily activities of their directorates. They are burdened by having to approve every financial transaction no matter how small. As a result they have little time to deal with strategic planning and the broader management issues facing their directorates. Assistant directors would be responsible for dealing with most of the ordinary day to day operational issues and would be given delegated authority to make policy and financial decisions within pre-defined limits on behalf of the Director. This position would free the Directors to spend more time on the programs and policy issues facing their Directorates.

Option 1b -Move payment collection functions from Consumer Affairs to Finance Directorate

This option is proposed to alleviate the work load on the Customer Affairs Directorate, giving it a stronger customer service focus. This option also consolidates all cash collection activities within the Finance Directorate resulting in improved efficiency. There are no staffing changes required and no budget implications. This option requires only the transfer of responsibility and staff to the Finance Directorate. Staff would remain in the same work locations but report to a different Director.

Option 1c - Move all store keeping functions to the New Works & Studies Directorate

This option provides two significant advantages: (a) the New Works Directorate is the largest user and specifier of materials and it would be advantageous for it to mange it's own needs; and (b) this move strengthens the Finance Directorate by providing it with a clear focus on financial management. There are no staffing changes required and no budget implications. This option requires only the transfer of responsibility and staff to the New Works and Studies Directorate.

Option 1d - Create an Information Technology Directorate

The role of the existing Computer Department will change considerably with the implementation of new systems. The focus of this group will change from the current accounting and billing functions to supporting a wide variety of client/server applications and multi-user networks. The need for planning and integrated development of new systems will also require a central focus. It is recommended that a new Information Technology Directorate be created to regroup all activities related to planning, implementing and supporting computer systems including SCADA. Some of the existing staff from the existing Computer Department would be transferred to provide technical support in the new Directorate. Existing staff have limited experience with client/server environment, database management systems, network management and data communications. Although they can be trained, new staff with specialized technical skills will be required. Table E-2.1 shows the number of new staff required and their intended functions. The Information Technology Directorate would provide technical support to all Directorates involved in using the new systems for billing and information management.

2.4 Customer Information Management

As discussed in section 1, a well organized customer information system is the foundation needed to support the billing functions that generate revenue. The objectives for customer information management are to: (a) improve access to account information; (b)

improve accuracy and speed of customer service transactions; and (c) improve retrieval and archiving of customer information. The possible range of options are as follows:

Option 2a - Provide a computerized document management system

The important documents in each of the existing 250,000 customer files would be scanned and stored in digital format as images. This would involve scanning roughly 1,000,000 documents (3 per customer). A document management system would be implemented to allow proper filing and retrieval of records based on customer reference numbers, name or meter number. All new customer files would be dealt with in the same way. Although this option would safeguard important documents and make them more readily available for viewing it does not fulfill the need for an information management system that can be used to record transactions or changes to the basic information in the customers' file. This option would only be practical if it were combined with a database management system.

Option 2b - Computerized customer information system

All customer information would be entered into a database management system. Important file documents would be scanned and digitized for storage in a document management system, as proposed in Option 2a, interfaced to the database management system. The database would be maintained by the Customer Service Department now responsible for maintaining all customer information. All remote payment collection centers would be connected to the database to have access to current account information and be able to respond to customer inquires on demand. Requests for new connections, entered into the system by customer service representatives, would automatically issue work orders to the Service Connection Department.

A customer information system is an essential component of the billing and customer accounting systems proposed further on in this report. Since the new billing system will result in substantial economic benefits this option is considered desirable. It has the added benefits of improving customer service by meeting all three of the stated objectives and solves the problem of loosing important legal documents.

Option 2c - Improve filing facilities

This option involves establishing a new filing system to and modifying the existing storage space to create a suitable environment for archiving paper files. This option improves storage conditions but does not provide the remote payment collection centers with access to account information that they need. It is physically impossible to meet the needs of the remote customer services centers using the current paper based filing system therefore this option is not considered.

2.5   Customer Metering, Billing & Collection

This section considers the changes required to increase annual revenues. The overall objectives are: (a) reduce time delays and duration of billing activities; (b) reduce billing errors; and (c) accelerate the collection of late payments.

Option 3a - Implement meter installation standards

This option is aimed at improving meter reading productivity. The work of reading meters can be greatly improved by installing meters so they are always accessible and in a position that is easy to read. During a tour with the meter readers, a high number of incorrectly installed meters were noted e.g. meters installed in very dark locations, counter facing a wall or up too high to be reached. There is no excuse for such poor installation practices and an installation standard would greatly improve this deplorable situation. The standard could be developed by the New Works & Studies Directorate with input from the staff of the Connection Department and the Meter Reading Department.

Option 3b - implement new technology to automate and/or facilitate meter reading

The ultimate solution to many of the various problems associated with meter reading is a completely automatic system of reading meters and processing the results by computer.

Modern metering systems are characterized by a widely varying degree of automation

and technological options. Consumption data can be captured from the meter in a number of ways:

- manual entry into meter books (this method used at DAWSSA)
- manual entry into portable hand-held data entry terminals
- readings for the above two options can be taken either directly at the meter (DAWSSA) or from remote digital or analogue registers mounted outside the customer's premises
- direct electronic entry from meter registers (usually via remote receptacles mounted outside the customer's premises) either into portable data terminals
- telemetry link such as radio or telephone line automatic meter reading (AMR).

Although adopted by some utilities, automatic meter reading is not widely used because of the high cost, lack of standards, and technological difficulties for implementation. The most commonly used method consists of using remote register meters and hand-held data entry terminals (HDET) for on-site data processing. In DAWSSA's case the use of remote mounted meter registers would be the ideal way to improve productivity because this simple device could eliminate the need to access customer premises. HDETs are simple to use and can be downloaded with all of the customer information required by the meter reader, including maps, and previous consumption data to flag out of limit readings (the meter reader may make a mistake or consumption is unexpectedly high or low). The use of HDET's has the added benefit of reducing data entry errors as well as data processing time. The HDET units is a portable, self-contained programmable microprocessor. It has an interface port so that necessary meter route information (e.g. address, presence of dog, meter location, last meter reading) can be downloaded to the unit from a host computer and the meter readings themselves uploaded. The meter reader follows the route instruction indicated on the HDET. If the meter can be read, the meter reading is keyed in. Programming in some HDETs can determine whether a meter reading is out of limits and request the meter reader to verify and re-key the information. At the end of the route, the meter reader usually returns the HDET to the office where the data is uploaded from it to the host computer, it's batteries recharged, and the next day's meter reading route is downloaded to it. The procedure is shown in Figure E-2.2.

The existing meters are Syrian made by the Industrial Establishment for Defense (IED) a Government run establishment. All 1/2" water meters used by DAWSSA for residential metering must be supplied by the IED. There are many problems with the existing meters: the design is over 30 years old, the manufacturing process is outdated and relies on manual assembly lines, the quality of the materials used is poor and quality control is minimal. IED would like to improve it's product line and manufacturing process however investment funding is not available and the MHU is not able to pay more for better meters. Based on discussions with IED officials during a tour of the plant it is currently not feasible to expect any new technological improvements in the near future.

For the time being the only technology feasibly available for improving productivity in meter reading is the use of HDETs to record meter readings. In order minimize data entry errors, all meters should be bar coded with a unique serial number. The bar code would be read by a small pen scanner connected to the HDET to identify the and automatically store the meter reading with the correct customer account. Although this device would not speed up the work of reading the meters it's ability to minimize errors by eliminating the need to re-enter consumption data and flagging out of limit readings are sufficiently important to justify using the technology.

Option 3c - Improve the efficiency of the billing process

The existing billing schedule presented in Table E-1.3 identifies three opportunities for improving the efficiency of the billing process:

- reduce the time delay between the meter reading and data entry steps to 14 calendar days (based on the need to provide a buffer for scheduling problems caused for example by bad weather)
- reduce the time delay between producing bills and sending them on to the customer affairs Directorate for verification and correction to 2 calendar days (allowing for one day off on the assumption that the task is completed at the end of a work week)
- issue the bills directly to the cashiers allowing 7 calendar days for delivery, receipt and set-up before starting the payment collection process.

The impact of all three measures proposed in this alternative on the schedule is shown in Table E-2.2. Assuming the duration of each activity remains the same as it is now, the average time per district is reduced from 197 to 103 days.

Option 3d - consolidate error detection and correction

There is a lengthy time delay in the error verification process related to manual data entry. Error verification is currently carried out by two different groups. The first verification and correction process takes place in the Computer Department. A second verification by the Consumer Affairs Directorate indicates a very small percentage of billing errors. This option proposes eliminating error verification in the Consumer Affairs Directorate and consolidating all verification functions in the Computer Department. It is assumed that once the bills have been thoroughly checked and printed they would be issued directly to the payment collection centers. The benefit of this option on the overall billing schedule is shown in Table E-2.3 Assuming this option is combined with the improvements identified in option 3c the average billing time per district would be reduced from 197 to 80 days.

Option 3e - Implement a computer system for customer accounting and billing

As discussed in section 1 the existing billing system has a number of severe limitations: data entry is done manually as a batch process, the system is not integrated with accounting and customer service functions, and it does not provide management with the features needed to process payments, follow accounts receivable, provide consumption and billing history for planning and forecasting, and analytical tools to assess the impact of rate changes. The existing system is based on 20 year old technology and cannot be modified or integrated to provide the desired application features. Option 3e proposes a new customer accounting and billing system, fully integrated with the customer information system described in option 2b and complete with automatic data validation features to eliminate the need for manual error verification. This option includes the use of HDET for entering meter readings in order to completely eliminate the need for manual data entry and minimize data entry errors.

Assuming that the administrative efficiencies outlined in option 3c and 3d have been implemented the average time to complete the billing cycle for one district, as shown in Table E-2.4 is reduced from 197 to 32 days. However, it is important to note that the cycle time for billing production is 116 days (3.8 months) which means that even with all the improvements discussed so far, it is still not possible to meet a truly quarterly billing schedule. It is also important to note that the meter reading is lagging the billing production process by two weeks indicating that it could become a bottle neck in the billing process. The improved schedule will result in more billings over the same period of time and this has a positive impact on cash flow. However the increase in billings will require more staff to deal with collection of payments. The impact of the improved schedule on both cash flow and staffing is discussed in option 3f.

Option 3f - optimize meter reading cycle

The billing schedule indicates that meter reading currently takes 131 days (4.4 months) to complete one cycle of all metering districts. It is DAWSSA's intention to reduce this to quarterly (90 days) readings in accordance with Ministry of Housing and Utility directives. The analysis presented in Table E-1.4 indicates that with the current staffing and productivity levels it is not possible to meet this target unless staffing numbers or productivity is increased. It would take 36 meter readers (11 new positions) at existing productivity levels, to read meters on a quarterly basis. Alternatively it would require a 46% increase in productivity using the existing staffing complement of 26 meter readers. Based on management's previous attempts to increase the daily quota of meter readings, it is unrealistic to expect that existing staff can be motivated to higher productivity levels especially given the relatively low rate of pay. Increasing staff is a possible solution but it is a short sighted one that does not address the real problems of low productivity and poor working conditions. In addition, the billing production process that occurs after the meter readings are taken has an average duration of 128 days, exceeding the 90 day meter reading cycle. Bill production will become the next bottleneck and cannot be improved without the implementation of automated data entry and error verification. Therefore, it is highly unlikely that the desired 90 day billing cycle can be achieved by simply increasing staff.

In the absence of a reasonable short term solution for obtaining quarterly meter readings, and rather than forcing the issue, option 3f examines the feasibility of improving cash flow by adjusting meter reading and billing to a four month cycle. The current meter reading cycle takes four and a half months and it should be possible with the existing staff, once some of the new recruits are fully trained, to bring this down to four months. Figure E-2.3 shows the meter reading and billing schedule assuming that the administrative efficiencies outlined in option 3c, 3d and the computer system in option 3e have been implemented.

A comparison of existing cash flows to those achievable from an improved four month cycle is shown in Table E-2.5. It indicates that this combination of options (3c,3d,3e,3f) greatly improves DAWSSA's revenue situation providing a net increase of 57.5 million SL (US$ 1.15 million) in billings over a six month period. This option will require some very minor changes to the existing billing program to provide 3 billing issues per year. For example, the practice of dividing 6 month meter readings into two equal quarterly bills will need to be modified. These modifications can easily be made by DAWSSA staff.

The suggested changes will increases the frequency at which bills are issued with a resulting increase in work load at payment collection centers. In the absence of detailed information on how many customers are served each day, the impact on collection centers is assessed roughly by making the following general assumptions:

- 65% of customers will pay within the first 6 weeks (week 1 to 6)
- 20% of customers will pay in the next two weeks (week 7 & 8)
- 10% of customers will pay in the next 44 weeks (week 9 to 52)

The schedule and number of bills issued to each payment collection center is shown in Table E-2.6. Based on this schedule the peak number of transaction per day is derived in Table E-2.7. Assuming the existing transaction processing time is 2 minutes for manually processing the payment, the assessment indicates that the existing staffing levels are adequate to deal with a four month billing cycle.

Automating the billing and payment collection process (option 3e) will double the transaction time to an estimated 4 minutes. As shown in Table E-2.7 this will have the effect

of increasing the number of cashiers required to deal with peak days. To keep the transaction processing time within the reasonable range of 4 minutes, the cashiers will require quick access to the data in customer accounts and the capability of efficiently processing payments. Added to the transaction time issue is DAWSSA's desire to have cashiers print the bills on demand at the remote payment collection centers. This system has been successfully implemented at the STE and although it adds to the cashiers' work load it offers several important advantages:

- bills can be issued showing up-to-date account information
- cashier transactions can be more easily audited and controlled
- customers can pay their bills at any payment center
- it eliminates the need for batch processing centrally which is time consuming and involves the cumbersome process of sorting the bills by district and controlling the issue of bills to the cashiers
- it reduces the amount of paper and manual labor

To compensate for the additional time it would take for printing bills a number of software features can be provided to minimize transaction times. The cashiers can be given a user identification number which can be attached to each transaction. This feature would make it possible to rotate staff from one collection center to another to cover off peaks in work load at one center when other centers are less busy. In addition, the implementation of bar code recognition can also help reduce transaction times. Bills could be printed with unique bar codes to identify customers and the amount owed. The bar codes could then be scanned by the cashiers to automatically access a customer's account and even to process the payment transaction without having to key in any data if the amount paid is the same as the amount billed.

Option 3g - Issue late payments notices monthly.

The current 45 day waiting period for collecting payments exceeds the 30 day norm adopted by most utilities and the process of collecting late payments is entirely too passive to be effective. This option involves changing the payment period to 30 days and pursuing the collection of delinquent accounts on a monthly basis. Customers would be given late payment

notices at regular monthly intervals after the initial 30 day period and a final notice with warning of impending disconnection would be issued after no more than 6 months. This option will improve cash flow and eliminate the backlog of unpaid bills kept at each collection center. This option may initially increase the work load for service disconnection however as customers begin to understand that DAWSSA is serious about collecting it's revenues, the number of delinquent accounts is expected to decrease. In the interim period, a temporary increase in administrative and maintenance staff may be required to clear the backlog of delinquent accounts.

This will require the implementation of a new customer accounting and billing system suggested in option 3e to facilitate the preparation of monthly reports. In the interim period until a new system is implemented it is suggested that the role of the Late Payment Section be expanded to include this new reporting function. Staff, declared redundant under option 3d could be shifted from the Billing Control and Error Verification Sections of the Metering Department to carry out this task. The Late Payment Section would work closely with each payment collection center to follow the status of customer accounts and coordinate with the computer section to print late payment notices. With the implementation of a new customer accounting and billing system, reporting of delinquent accounts will be automated and the number of staff required to follow-up with cashiers and customers can then be reduced. This option is considered feasible and well within DAWSSA's existing mandate.

2.6   Financial Management and Cost Accounting

This section considers options for improving management's ability to optimize the use of it's limited financial resources. The existing systems and processes that are supposed to support financial management do not provide the information required to control costs, analyze trends and plan for budget needs. The overall objectives are to: (a) provide accurate and timely financial information; (b) provide the cost information required to control expenditures; and (c) provide the information required to improve budget preparation. The options considered are outlined in the following paragraphs.

Option 4a - Implement cost accounting

Cost accounting will provide the basic data required to identify where and how DAWSSA spends it's money. Typically cost accounting involves tracking costs separately for each organizational unit or process in the organization. The existing Unified Accounting System (UAS) has provisions for cost accounting by using a series of cost center codes attached to the front of the existing accounting code structure. An example of how the existing UAS could be used at DAWSSA is shown in Table E-2.8. The implementation of a cost accounting structure will require a great deal of discussion between all Directorates in order to define the account structure in sufficient detail to achieve the desired results.

The difficulty of allocating personnel and asset costs to each organizational unit has been cited as one of the reasons why cost accounting has not already been implemented. A breakdown of staff costs by Directorate is readily available from the payroll system and can be used to overcome the problem. In a some cases staff may work for different parts of the organization at different times of the year or even during a given work day. The procedures required for time keeping and reporting in order to recover costs between Directorates would require such rigid control that it would be impractical. In any case, the sharing of human resources is not a common occurrence and would have a negligible impact on the resulting benefits of cost accounting. In order to simplify the cost accounting process it is proposed that staff costs be assigned to the Directorate they most frequently report to.

The work of assigning fixed assets to each directorate is a little more involved because there is a large number of assets that need to be allocated, and in many cases "ownership" is not clearly delineated. In the case where more than one Directorate shares an asset, these could be assigned to the Directorate which uses the asset the most. In other cases, for example buildings and office furniture required to support head office, assets could be placed under the finance and administration cost center.

Implementation of cost accounting is the essential first step required to support the information systems that management will need to have realistic and timely measures of DAWSSA's financial performance, and control expenditures. Preparations for implementing

cost accounting can proceed as soon as possible using the existing computer system. Preparing the information for cost accounting will require a temporary increase in accounting staff to gather the required information and coordinate the work of entering data into the computer. Once implemented, there should be no substantial increase in work load since the amount of information processed (spending and payment orders) will be the same as it is now. The work of making journal entries for expenditures will proceed as before except with the use of a new and expanded structure of accounting codes.

Option 4b - Provide a new financial management information system

This option proposes a new financial management information system information consisting of cost accounting, budget preparation, cash management and reporting modules. The system would be fully integrated with the customer accounting and billing system to provide meaningful and timely reports on the financial performance of the establishment. The heart of the system would be the accounting module which would be used by Finance and Accounting Directorates to record and control expenditure transactions. The program could be used by the Finance Directorate to produce financial management reports circulated to each Directorate. The reports would highlight budget expenditures to date, amounts remaining, budget variances (over/under spending) and other user defined financial performance criteria such as operating ratios, debt ratios etc. The Accounting Directorate would use the accounting program to produce ledgers, keep journal entries, and provide an audit trail for all changes in transactions. The accounting program would be integrated to customer billing and accounting systems to track the status of accounts receivable and provide timely reports such as trial balance, income/expenditure statements, assets and liabilities.

Option 4c - Divide the overall budget into smaller budgets for each Directorate

This option is closely linked to cost accounting and involves the same breakdown of the accounting structure into smaller units. The existing account structure would be used to allow all budgets to be consolidated into the overall budget for the establishment, and presented to the Ministry of Finance in the format that is required. Initially this option is difficult to implement because it requires an analysis of the estimated costs associated for each

Directorate in order to allocate an appropriate budget amount. This allocation could be carried out on the basis of estimates for the first year and then adjusted with budget transfers to reflect actual conditions however this option would be much easier to implement after cost accounting has been in use for a one year period.

The benefits include creating a mechanism for identifying costs for each organizational unit. This option would necessitate a computer tool for budget preparation to be used by the Planning and Finance Directorate for providing each Directorate with an analysis of previous spending variances, and a method of consolidating (rolling up) the separate budget submissions into the larger overall budget, line item by line item.

Option 4d - Delegating budget preparation to each Directorate

This option involves giving more responsibility the end users for determining their operating budget needs. The benefit is that end users would have a stake in controlling their expenditures within their allocated budgets. As part of this option, financial responsibility for approving expenditures should be delegated to each Director in order to enhance budget discipline. This option requires the implementation of some simplified form of cost accounting as discussed in option 4a to separate and monitor expenditures for each organizational unit. It is not considered feasible at this time to provide delegated authority to the other Directors without MHU approval. However there is no reason why each Directorate cannot participate in the budget preparation process.

Option 4e - Change the existing accounting structure

This option is not feasible since the accounting structure is determined by the Ministry of Finance because of the need to have a unified system for preparing the national budget. This option is therefore not examined.

Option 4f - Enhance the existing accounting program

It has been suggested that the existing computer system might be enhanced to make it more functional. Reprogramming to provide some minor improvements is feasible but the existing program cannot easily be modified to produce the desired financial management reports. In addition, the program cannot be integrated with new computer systems. This option is therefore not examined

3. COMPUTER SYSTEMS

In this section, the concepts and desirable features for the CIS and FMIS systems are formulated. A preferred system configuration is proposed in order to establish the feasibility of implementing it and to develop generic system specifications for the purpose of establishing budget estimates. Details of the system may change during the final design stage given that computer technology changes rapidly potentially providing more powerful, and more cost effective solutions.

3.1 Configuration

Although the CIS and FMIS systems serve different needs, they share common data and must be fully integrated with each other. As a basic underlying principle, the systems should be structured along functional rather than organizational lines. This approach has the advantage that it will enable the creation of integrated systems and data bases in which the timely provision of a particular sub-set of data will reside with the organizational unit responsible for that function. With this approach all the data in the system would be available to those users requiring access subject to appropriate security controls.

In general information systems can be configured in one of three ways: 1) centralized configuration: where data storage, retrieval and processing is done in one central location; 2) distributed configuration: where the processing and data functions are moved as close as practical to the source; 3) a combination of the preceding two configurations. Whichever configuration is used, it is recommended that data be entered only once as close to it's source as possible. Therefore each segment of the database will need a caretaker or responsible work Section (Directorate). Generally, only personnel in the responsible work Section will be allowed to write to the database; all other users will be able to "read" the data but not modify it. In this way each work Section can add the data for which it is responsible to a record as it is passed through different parts of the organization.

In DAWSSA's case, a combination between central and distributed systems is preferred. Since there is no unusually large processing requirements (mainframe) it is

recommended that the new CIS and FMIS be configured on central file servers located in the existing computer room at DAWSSA headquarters. In order to reduce the risks associated with data security, all data will be kept centrally at headquarters and backed up on a regular basis. One of the key concerns is the need to provide reliable communication links between the users in remote locations and the application programs. It is essential that remote payment collection and customer service centers continue to operate even if communications fail. On-line access is not reliable therefore the 20 remote payment collection centers should have their own separate systems for stand alone operations. The master database will reside centrally at DAWSSA headquarters and be distributed to remote sites where it will be used, updated and returned to the central database.

The process of entering meter readings, and calculating bills will be carried out centrally at DAWSSA headquarters. The process of printing bills, collecting payments and recording customer account transactions will be carried out at the remote payment collection locations on a demand basis (i.e. when the customer presents him/her self). Complete customer account information will be available at each payment collection location to answer customer inquiries. New subscriber functions will initially be provided at the four existing service centers with capability to expand to more locations as the need arises.

3.2   Network Access

The new systems will require a means of connecting the many users in different parts of the organization to the centralized database at the computer center. Within DAWSSA headquarters, on-line access for real time processing of data can be achieved by extending the recently installed Local Area Network (LAN) and providing a new network controller. Remote payment collection and customer service locations must be linked with each other and the computer center at DAWSSA headquarters. There are three possible options for establishing this communications link: (1) use the public X.25 network; (2) dedicate existing DAWSSA owned telephone lines for data communications; or (3) use existing telephone lines and telephone switching equipment owned by DAWSSA for data over voice communications. The Syrian Telephone Exchange (STE) provides a public X.25 packet switching network (SYRIAPACK X.25). This system is relatively inexpensive and provides reliable network

communications that can meet all of DAWSSA's requirements. The system is used successfully by STE to connect their own remote customer billing sites with their central billing office. This option is the simplest and most cost effective solution for DAWSSA: (1) it requires no specialized and costly equipment; (2) there is no need for specialized data communication staff; and (3) it avoids the many problems associated with providing and maintaining reliable telephone line connections. Nevertheless, because computer and data communication technologies tend to change rapidly, these options should be re-assessed at the detailed design stage. An overview of the recommended system configuration is presented in Figure E-3.1.

3.3   System Software Requirements

(1)   Operating system

The most critical software decision involves selecting an operating system that is widely used, well supported by vendors, and compatible with recently implemented applications and hardware. UNIX is often used in customized utility billing for large client/server applications Recent improvements in PC technology has seen the development of several desktop applications that can satisfy DAWSSA's needs. It would be desirable for compatibility and ease of support that new systems be Windows based and compatible for use with the recently installed equipment.

Database management should use a modern relational database system RDBMS with query language capabilities. Oracle SQL is assumed for cost estimating purposes. The final selection of a DBMS should consider compatibility with Autocad products currently used by DAWSSA's engineering group to develop distribution system drawings and mapping. Autocad has provisions for attaching data attributes to drawings (e.g. service location, pipe design data, and customer address) and it may be desirable in the near future to integrate this data with the new CIS.

(2)   Data integrity and security

Each system will create or operate on a set of data and therefore, manage a system data base. While some data is system specific and likely will not be used by any other sub-system, most of the data will form part of a common data base. Standards must be developed and applied to all common data to ensure data integrity. Standards should include a description of the data structure and data dictionaries defining the terms, abbreviations, units, codes, etc. that will be used. There should only be one set of data in the common database for any one function and there should be no duplicate sets of data. Access to the database will be controlled by the network management software which will provide the following security functions:

- user ID and password assigned to each user,
- multiple, user defined security levels, for user groups or individuals
- each user will be given a security profile granting read only or read/write access to all or only certain segments of the database as specified by the system administrator.

(3)   Customized versus Packaged Applications

There are various alternatives for application software - either packages can be purchased and modified for use, or customized applications can be developed from scratch. Customization however should be minimized if at all possible in favor of commercially available packages to reduce long term costs. Packages offer many advantages because they have many users: 1) software is continuously being enhanced, 2) software maintenance costs are reduced in the long term through the availability of upgrades, 3) there is generally better user support and documentation 4) software changes keep up with technological advancements in hardware. The final decision can be made at the design stage. For the purposes of estimating budget costs it is assumed that the applications will be custom developed since this option will likely be the most expensive.

3.4   Customer Information System

(1)   Overview

There are two reasons for recommending a CIS. The main objective is to improve financial management by improving the efficiency of billing and revenue collection. The second objective, is to integrate the utility's critical customer information, utility billing, and management reporting information for water consumption and in the near future, sewer services. Integration through the use of a computer system will result in improved accountability, improved control, improved planning and improved customer service functions. The customer information system will consist of four integrated modules:

(a)   the customer accounting module will maintain the database of relevant information about customers, such as consumption and billing history, meter and service information, address, account status, accounts receivable and transaction summaries.

(b)   the billing module will take data from the customer's meters, the customer accounting system and customer service system and produce bills, process payments, track accounts receivable and direct the collection process.

(c)   the customer service module will take information from customers regarding special needs, e.g. high billing complaints, inquiries, interruption of service, transactions or changes in accounts, initiation of services, water rights. The module will be interfaced to a document management system capable of providing digital images of the relevant customer application documents kept on file.

(d)   the management information module will provide management with trend reports, financial reports related to billings issued, unpaid, accounts receivable, and engineering/service reports regarding distribution network management such as number of service connections, and type.

(2)   Process configuration

The central headquarters billing center will receive consumption data from meter readings entered into HDET's. The Consumer Affairs Directorate will upload the data to the billing system at the end of each working day. The software will validate data, checking for errors. A list of errors will be automatically produced and sent to the consumer affairs directorate for corrective action. The bills will be automatically calculated according to the tariff information included in the customer account data base. Incorrect or zero readings will be charged at the minimum monthly rate. Calculated bills will be posted to the customers account and transferred to the remote payment collection centers who will print the bills, and collect payments. Information regarding payment of accounts and complaints will be communicated from the remote payment collection centers to the central data base to automatically update account information and advise the appropriate Section if action is required.

The billing process will remain under the direction of the Accounting Directorate, and will be technically supported by the Information Technology Directorate. The Customer Service Department will manage customer complaints, subscriber information and connection/disconnection work orders. The Late Payment Section of the Finance Directorate will produce tables of debtors and issue requests to the Consumer Affairs Directorate for follow up action.

(3)   Customer service module features

The customer service module will be used by customer service representatives at remote payment collection centers and by the Customer Service Department located at DAWSSA headquarters.

The customer service module will support four main tasks:

a) Customer subscription - required to processes requests from customers for a new connection

b) Installation processing - required to issue work orders, monitor the schedule and execute the installation of new service connections

c) Customer information management - required to manage account status, change of address, change of ownership, change in service details.

d) Customer inquiries - required to deal with requests for meter repairs, account status and billing adjustments

For the Customer Subscription task the customer service module will provide the following features:

- entering new application forms and recording data on the customer
- issuing automatically a service request to the Connection Department
- recording receipt of inspection and connection fees
- issuing a bill of materials estimate prepared by the Connection Department
- recording receipt of connection fee
- updating data concerning the application forms when status is changed
- issuing a receipt to the customer for receipt of payment

For the Installation Processing task the customer service module will provide the following features:

- issuing the service order for installation of connection/disconnection
- printing a notice of installation/disconnection to be sent to the applicant indicating the date of installation
- recording when the installation/disconnection is completed, sending confirmation to the Customer Accounts Department and updating the customer information file with service connection details.

For the Customer Information Management task the module will provide the following features:

- updating the database for, changing the meter or type of service, changing the address or ownership, cutting and resuming services
- reporting statistics on number of connections/disconnection's installed per month or per day, the number of applications per type, the number of applications per month,

the number of applications per area, and printing waiting lists according to request priority and type of service

For the Customer Inquiries task the customer service module will provide the following features:

- answering inquiries by name of applicant, date, type of service request, location
- access to data in responding to customer inquiries provided for account number, meter number, billing history, financial details
- initiating customer service work orders for broken meters, or other repairs etc.
- registering complaints in the database indicating date and type e.g. incorrect billing complaint, water quality complaint, and directing them to the appropriate section for follow-up

(4)   Billing module features

The billing module calculates and produces bills. It provides the necessary functions for processing meter reading data, validating data, calculating bills, formatting and printing bills complete with bar codes. It also dispatches the billing data to the cashiers at the remote payment collection sites via the X25 WAN. The billing module will support the following main tasks:

a) Data entry

b) Data validation

c) Formatting and printing of bills

d) interface to customer accounting

e) transfer of billing and account information to and from remote payment collection centers

For the Data Entry task meter readings will be uploaded from HDET's into the central database at the billing center via workstations located in the meter reading section and connected to the headquarters LAN.

For the Data Validation task the billing module will check and validate the data by:

- applying user defined "reasonableness" parameters to consumption and balance due and flagging accounts which exceed parameters by certain percentages

- producing high/low checking reports for accounts which exceed user-defined limits for consumption or dollar value

- proving a user defined, "maximum bill amount" parameter to prevent embarrassing customer bills

- automatically flagging and reporting zero accounts

- the system will generate exception reports listing all possible errors and unusual billings; these will be sent to the meter reading section for investigation and follow-up. Customers with unusual readings will automatically be billed using the minimum monthly consumption charge of 20 m3.

For the Formatting and Printing of Bills task, the bills will be calculated centrally at the headquarters billing center and dispatched to the remote payment collection centers where they will be printed. Late payment notices will be automatically calculated, and issued separately at monthly intervals.

For the Interface to Customer Accounting the billing module will have a direct interface with the customer accounting module and the FMIS for accounts receivable. Billing results will be automatically reflected in customer accounts.

For the Transfer of Bills the customer account and billing information will be transferred electronically to the database at remote payment collection sites via the X.25 WAN. The customers account information will be available to the cashiers for printing bills and recording payment transactions.

The following list identifies some of the desirable software features for the customer service module but is by no means intended to exclude other features that may be identified by DAWSSA during the detail design stage:

- user definable rate tables for flat rate and variable step rates, default inspection fee and connection charges, quarterly/monthly minimum charge, surcharges, etc.

- equalized billing options or budget billings for payment by installments
- automatic estimated credit adjustment for accounts with consumption overestimated or overbold in prior periods
- new account charges and service charges can be added by the user
- automatic estimated credit adjustment generated for accounts with consumption overestimated at prior period(s)
- cancel and re-bill function to automatically adjust financial and consumption history and re-bill customers at the next billing.

(5)   Customer accounting module features

The Customer Accounting Module is used by the Accounting Directorate to record accounts receivable, by cashiers to record payment transactions, and by the Finance Directorate to make adjustments to billings and issue lists of delinquent accounts on a monthly basis. The system will reside centrally and also at each collection center. This module will provide the following functions:

- automatically retrieving the customer account files by scanning the bar code on the bill
- collecting the payment and recording the amount paid
- automatically stamping the bill
- printing the daily transaction journal
- issuing a list of unpaid bills at the end of each month

Customer account files and data on paid/unpaid bills will be automatically transferred electronically to the central computer center on a daily basis via the X.25 WAN from the database on the file server at each cash collection site. Data will be processed at the headquarters billing center. Delinquent account reports will be automatically produced at the end of each month. These reports will be followed up by the late payment section in the Finance Directorate. The system will have the flexibility to allow users to automatically print late payment notices after 30 days and every month thereafter. All bill payment, settlements, objections and adjustments will be recorded on customer account files. These files will be kept on-line for a period of up to one year before being archived. All debits and unpaid bills will

remain on-line. The system will automatically issue warnings for service disconnection as a result of non-payment. It will also issue service orders to the Service Connection Department with dates for action.

The following list identifies some of the desirable software features for the customer services module but is by no means intended to exclude other features that may be identified by DAWSSA during the design stage:

- bar code recognition of customer account number and billed amount. Payment screen permits fully automated entry or overrides for partial payments
- automatically validating payment stubs
- automatically generating daily cash payment record
- informing cashier of correct change due
- cashier ID is part of the payment record for security and auditing purposes
- keeping track of cash entries and cash balances for easy checking
- automatically producing past due and final notices for delinquent accounts based on user defined parameters such as number of days since the bill was issued
- generating listings of debtors automatically
- automatically generating service orders for accounts to be cut off for non payment
- automatically producing listing of services "scheduled for cut off"
- provisions for making special payment arrangements with customers

(6) Management reporting module features

Data concerning management information will be stored in the central data base at the headquarters billing center. The management reporting module will gather customer information and billing information from the central database and automatically generate user defined reports for management purposes at regular intervals (monthly). The module will also provide managers with the facility to search and query the database for specific records and produce their own customized reports for trend analysis such as:

- summary billing and consumption history for all accounts, by tariff class or band, by service type and size

- detailed financial transactions and billing history maintained at the individual account level with the amount of history limited only by disk storage space
- service order and meter reading history for each account

Financial reporting capabilities:
- daily reporting of financial transaction for each cashier
- daily aged receivable report for balancing of the system, user definable aging categories e.g. 0-30, 31-60, 60-91, 90-120 days.
- daily balancing report showing prior day's ending Accounts Receivable (A/R) balance
- current days change in A/R resulting from various financial transactions, and current day's ending A/R balance, both computed and reported, and the difference if any
- revenue reports with various breakdowns and formats such as by customer class, tariff band, metering district
- on demand reports provide information on delinquent and terminated accounts,

Engineering and service reporting:
- unread meters and meter replacements
- inactive services,
- consumption reports by meter district, cycle, service class, meter size,

(7) Existing Application Programs

The existing computer application for payroll cannot be integrated with the new FMIS system. Therefore it should be replaced by a new automated payroll system, fully integrated with the accounting module to cover salary and related payments to civil servants. Similarly the existing inventory management system cannot be integrated into the new system. It should also be replaced by a new automated materials management system, fully integrated with the accounting module to cover materials inventory costs and accounting. Although payroll management and materials management is beyond the scope of this feasibility study, it has been noted that the existing computer systems have limited management and reporting

features. Modernization of these systems should be the subject of more detailed study in the future.

3.5 Financial Management Information System

(1) Overview

It is proposed to implement a new fully integrated Financial Management Information System (FMIS) capable of meeting DAWSSA's wide ranging financial management needs, from budget preparation to processing of a payment/spending orders against a particular budget line item. The FMIS will be implemented with two main objectives: a) to control the budget, assets and liabilities and b) to provide comprehensive, reliable and timely information on the financial position of DAWSSA to facilitate it's financial management.

The FMIS will consist of three fully integrated modules that will be linked with the Customer Information System: 1) financial accounting; 2) budget preparation and 3) reporting. The financial accounting module includes payroll and materials management. The FMIS system will be integrated to the Customer Information System to receive input data on accounts receivable, current account status and amounts owed.

(2) Financial accounting module features

The accounting module will be custom designed in accordance with the State Unified Accounting System and MOF policies and procedures. It will be a fully automated accounting system closely resembling the existing accounting system. It will be based on the existing chart of accounts with the introduction of an appropriate chart of cost codes. It will enable expenditures and revenues to be recorded at a detail level and related to specific programs, projects and activity centers throughout the organization. Data will be captured only once, as an accounting transaction progresses through the system. The introduction of the system will ensure completeness of data capture (i.e. no transactions will be processed outside the system) and rigorous application of all relevant financial controls to all transactions processed within the system.

<u>Capabilities:</u>

The software will provide the following general features:

- accounting functions including accounts payable, accounts receivable, general ledger options, report generation, recording of revenue collections, appropriations, commitments, verifications and fund allocations leading to payment.

- recording and reporting the distribution of the budget as approved by the Ministries of Finance and Planning to the various Directors, keeping records of initial budget, and budget adjustments.

- recording authorization for spending by Directorates (spending units) and recording commitments against the approved budget limits.

- recording and reporting at all relevant stages of the payments and receipts processes and enabling reports to be made on key variables such as, commitments, funds available, bills outstanding, payments and receipts (both cash and accrual basis)

- incorporating controls on any specified variable, providing the facility to check availability of funds, commitment authorization and funds allocation prior to approval of spending or payment.

- recording and reporting revenue and other receipts against appropriate accounts

- printing checks when payment or spending orders are approved

- generating standard monthly reports and providing query facilities to determine the budgetary position of each Directorate.

- maintaining data according to budget classification and cost accounting codes for as many years as required to allow useful trend analysis to management.

- facilitating reconciliation between accounts payable and banking information by generating a chronological list of transactions

- having provisions to restrict access to authorized staff

(3)   Budget preparation module features

This module will support the process of preparing budget estimates and monitoring both investment and operating (ordinary) budgets. The module will receive from the various Directorates (spending units) the details of their programs and projects, consolidate them and

produce from them a budget document for review and discussion with the ministries of approval. The module will facilitate the iterative process of budget submission, consolidation, review/negotiation and documentation until the budget is finalized and approved. The system will thus provide the facility for tracking the budget preparation process from preliminary budget to final draft stage and produce a master copy in a form suitable for presentation to MOF, MOP and MHU. After approval, the system will produce the approved budget estimates in a format suitable for budget implementation and accounting purposes.

The budget preparation module should be able to capture and maintain budgetary proposals and revenue estimates from the various Directorates and to capture any subsequent changes during the budget development and approval processes. The system should be able to assist in the evaluation of the budget proposals enabling an analysis of the manpower costs, the maintenance and other operating expenses and capital costs by accessing baseline data from previous periods for comparison. The system will use the database established by the accounting system to provide accurate historical data on previous years spending. It will identify all budget variances (overspending/underspending) on a line item basis and facilitate analysis for identifying the cause of the variances.

The systems for preparing the current budget will be managed by the Finance Directorate and the Planning Directorate with input from the accounting module and the Accounting Directorate. Both modules will require extensive integration between the Finance Planning and Accounting Directorates with regular data input from the Accounting Section, Budget Control Sections and Treasury Control Sections.

(4)   Reporting module features

The system will be designed to produce the financial and management reports required by the various users. This will include, monthly financial reports on revenue and expenditure accounts, budget reports showing amounts remaining until fiscal year end and accounts were expenditures will potentially exceed the budgeted amount. The reporting function will address all matters that affect the efficiency of the accounting function. The system will have

capabilities for search and query to facilitate interaction for easy retrieval, analysis and reporting of data by the users.

3.6 Hardware and Equipment Requirements

The following sections identify generic hardware and equipment specifications for the new CIS and FMIS systems. It is important to recognize that technology is expected to change rapidly and that by the time DAWSSA is ready to proceed to the detail design stage many of these specifications will likely be out of date. The specifications are therefore intended as a guide to obtain a reasonable budget estimate of the costs.

(1)   Remote payment collection & customer service sites

Based on the assessment of required staffing levels (section 2) the number of workstations required for each remote location is identified in Table E-3.1 and a list of hardware and equipment requirements is presented in Table E-3.2. All machines should be should be suitable for operation in harsh environments Workstations should be PC desk tops with mid to high end processing power and high clock speeds to minimize the time spent for each customer transaction. The main file server should be a high end PC machine with sufficient hard disk storage to keep customer account information for a least one year. Data back-up is not required as this function will be carried out automatically by the central server at headquarters, polling each remote site at the end of each working day. Each file server and workstation should be connected to a dedicated uninterruptable power supply system (UPS) to isolate computer equipment from electrical transients, surges, and line voltage drops as well as provide power for at least 15 minutes to allow an orderly shutdown of computer systems during power outages. Emergency diesel generators are not required at remote sites since continued operations during power outages is not essential.

Existing remote sites generally have sufficient space to since the new computer equipment will occupy existing desktop space. In cases where the number of cashiers is increased, there must be sufficient space available for at least one desk per cashier. Some sites

may require minor modifications to make the environment more suitable e.g. wiring for UPS system and computer connections. Air conditioning systems will not be required.

(2)   Bar code payment system

Bar coding will simplify payment processing, improve speed of customer transactions and reduce the chance of errors. All bills will be encoded with the account number. When the customer returns payment they usually bring with them the previous bill for identification. Cashiers will be able to scan the bar code on the previous bill to access the correct account, print the current bill and record payment.

(3)   Computer center at DAWSSA headquarters

The CIS system will be designed to initially serve 300,000 customers with the ability to expand to 400,000 customers by the year 2015. The systems and the data will reside on the file server at the central billing center located in the existing computer room. The CIS and FMIS will each have their own file server and a second identical machine will be provided in a redundant "off-line" configuration to ensure that the systems are available at all times in case the main file has a catastrophic failure. Main storage for each file server must be sufficient to hold the CIS and FMIS application programs. Each file server will have two hard disks to improve processing efficiency.

The size of disk storage for CIS data will depend on the number of customers billed and the number of years of historical information maintained on-line. Storage requirements for systems with three utility services such as water, sewer and refuse average 10,000 bytes per customer account. The total storage required for 10,000 customers with 5 years of history would be approximately 100 MB while a customer base of 100,000 would require 10 times this amount. In DAWSSA's case there is only one utility, however provision should be made for adding sewerage charges to customer accounts when DAWSSA takes over this responsibility in the near future. Initially it would be desirable to have up to 10 years of storage on-line for 300,000 customers to allow for proper trend analysis. On-line disk storage for the CIS would be provided by optical disk because of the large volume of data. On-line

disk storage for the FMIS data can be provided by two hard disks, one hard disk dedicated to accounting data and the other to remaining financial information. For the purposes of backing up and recovering files if necessary, from a hardware or software failure, a tape drive is recommended.

There is ample space available within the existing computer center for the new equipment. The cooling requirements for the new computer systems are quite small and the existing computer room already has a dedicated air conditioning system with adequate capacity to support the addition of the new file servers. Power from the existing emergency diesel generator is available but a new UPS with sufficient capacity for 1/2 hour will be required to ensure enough time is available to execute an orderly shutdown of computer systems should the emergency diesel generator fail.

(4)   DAWSSA headquarters LAN

Within headquarters a new PC based Novell network is currently being implemented. This network should be extended to include the new CIS and FMIS file servers and connect the users of these new financial systems. A list of the required hardware and software for users at DAWSSA headquarters is shown in Table E-3.3. All workstations should be PC desk top machines with sufficient processing power to run typical office applications (word processing, spreadsheet, presentation tools, e-mail) and linked to the CIS and FMIS file servers located in the computer center in a multi-user client/server environment.

(5)   Document management system

A scanner is required to produce digital copies of important documents submitted by new subscribers. These documents will be filed by customer account number and name by an computerized document management system linked with the CIS. The document management system will require on-line storage for 300,000 customer files containing approximately 1,000,000 documents. This will require optical disk storage with a capacity of approximately 16 GB. The document management system will be interfaced to the customer service and

customer accounting modules to allow on screen access by customer service representatives to archived data.

(6)   Hand held data entry terminals for meter reading

HDET's will be used by the meter readers to capture meter readings. The HDETs will consist of a programmable microprocessor, a pen based data entry system with a bar code recognition, a display unit and a battery power supply all contained in a weather proof and shock resistant housing. An interface port will permit information to be transferred between the unit and the host computer. The programming in the HDET will read the bar code on the meter, automatically present the meter reader with the correct account for entering the reading. The program will determine if the reading is out of limits and request the reader to re-enter the data to minimize key errors. The program should have a calendar-clock to time stamp the reading.

4. IMPLEMENTATION PLAN

4.1 Priorities

A summary of the recommendations to management that form the change strategy is presented in Figure E4.1. The figure illustrates the relative priority of each recommendation and the extent to which improvements are dependent on the development of computer applications.

(1) First and Immediate Priority: Improve Billing And Payment Collection Process

It is recognized that DAWSSA does not currently have the financial resources to embark on an extensive "automation" program. It will likely be a few years (2 to 5 years) before funding can be obtained and the necessary information systems required to make significant improvements are implemented. Nevertheless, administrative processes that are currently inefficient should be optimized in the short term to yield some preliminary financial benefits and set the stage for further productivity improvements when computers are finally implemented. Even though some of the changes may appear to be minor they will be an important first step in building a corporate culture that is comfortable with the idea of change. These small changes will help build the organizational momentum required to cope with the more difficult changes required to bridge the huge 20 year technology gap. DAWSSA's first efforts should therefore consist of implementing the following improvements:

- implement meter installation standards to increase meter reading productivity (Option 3a)
- improve efficiency of the billing process by: 1) entering meter reading data as soon as meter readings for one district are complete; 2) carry out error verification only once before printing the bills; 3) issue the bills directly to the cashiers once the bills are
- adopt a four (4) month meter reading and billing cycle to improve cash flow (Option 3f)

- implement a new payment policy to speed up collection of revenue. Change the payment period to 30 days, and implement active follow-up of delinquent accounts on a monthly basis, disconnecting delinquent accounts after six (6) months (Option 3g).

(2)   Second Priority: Plan for Information Technology

The remaining elements of the change strategy is dependent on the implementation of two modernization projects to implement computer and information technology: 1) a new customer information system (CIS) including meter reading, billing, and customer accounting functions; and 2) a new financial management information system (FMIS) including budget preparation, cost accounting, and reporting. There are also likely to be many other information technology projects in DAWSSA's future. It is therefore essential for DAWSSA to prepare itself for the computer revolution has already started. The complexity of DAWSSA's information needs suggests that an integrated approach to information infrastructure is essential. DAWSSA's directors, many of them engineers, are familiar with planning for water supply infrastructure (e.g. preparing multi-year plans for investment budgets) and generally they have a good understanding of the alternatives and their implications. Unfortunately this is not the case for information technology which may seem foreign to almost everyone except a few staff with specialized training. Nevertheless, directors must determine how best to use information technology because like it or not computers are the future. More than any other measure, computers can provide the largest and fastest improvements in staff productivity. Implementing new technology is not without risk since the technology changes rapidly and the investment of time and money in creating databases is substantial. The risks of introducing information technology can be reduced by creating an information technology plan (ITP). Planning is a smart investment that provides many benefits: 1) systems can be designed to easily communicate information with each other and 2) support multiple applications; 3) systems can be designed in a modular way to allow systems to be implemented in smaller parts over a longer period of time to reduce the burden on financial resources.

Although information technology involves many issues and challenges, proper planning can deal with these issues sequentially to ensure that the organization's priorities and goals are

met. Therefore, before any more computer systems are purchased, DAWSSA should carry out a detailed planning study to assess computer needs across the organization, and develop a strategy for implementing integrated information systems. The result will be beneficial to the organization and customers will benefit because the long term costs of providing information technology will be reduced.

(3)   Third Priority: Create an Information Technology Directorate

The role of the existing Computer Department will change considerably with the implementation of new computer systems. The focus of this group will change from the current accounting and billing functions to supporting a wide variety of client/server applications and multi-user networks, especially as the number of computer applications is likely to grow at an exponential rate over the next few years. The need for planning and integrated development of new systems will also require a central focus. Therefore before implementing new client server applications DAWSSA will need to create a new Information Technology Directorate to regroup all activities related to planning, implementing and supporting computer systems and all other information technology based systems such as SCADA, data communications, and radio communication. The new directorate should also be responsible for developing hardware and software standards for the organization.

Staff of the existing Computer Department have limited experience with the recommended client/server environment, database management systems, network management and data communications. Although they have a technical background and can be retrained, new staff with specialized technical skills will also be required to manage the network, the database and provide support to the growing number of computer users. Specially trained SCADA technicians will be required for instrumentation and control installation and maintenance. In addition systems engineers and computer technicians will be required to support users, provide hardware and software maintenance, and develop applications.

4.2   Implementation Strategy

The completion of the first three priority projects will set the stage for implementing the computer systems that are required to complete the change strategy for improved financial management. The Customer Information System (CIS) is considered the most urgent because it directly affects the collection of revenue. After implementation of the CIS is underway, and cash flow begins to improve, management can turn it's focus to developing the financial management information system. With the implementation of a new FMIS, DAWSSA will need to turn it's focus towards controlling expenditures and improving fiscal control.

These changes will be much more difficult than business as usual and DAWSSA will need to devote sufficient resources to make the changes happen. Management has suggested that steering committees be tasked with overseeing the implementation of these changes - this approach is highly recommended but will require significant personal time and cooperation from the senior management team. Communications to the stakeholders affected by change will be essential in order to obtain their necessary support. Management will need to identify staff who are "strong and willing" and give them the mandate to champion the different tasks required to implement the changes.

4.3   Project Organization

An implementation team will be required to plan, design, coordinate and execute the work. It is proposed that DAWSSA form working groups under the direction of a nominated chief counterpart (e.g. Director of New Works and Studies). The working groups should begin by implementing the changes identified as first priorities. Afterwards, they will assist the consultant(s) and participate directly in the development of new procedures and systems. This approach will facilitate the gathering of information and the exchange of technology and is a good way to ensure that all systems will meet the requirements of the end users who have participated in their development. Five working groups are proposed with responsibilities as follows:

(a)   Budget Preparation & Control. This working group will:

- propose the budget breakdown structure by Directorate

- design budget presentation and related preparation procedures

- coordinate with the working group for systems design

(b)   Expenditure Control & Cost Accounting. This working group will:

- study the expenditure control processes

- propose the cost accounting structure

- propose cash management and banking arrangements

- coordinate with the working group for systems design

(c)   Billing and Customer Accounting. This working group will:

- study the billing and customer accounting processes

- propose cash collection procedures

- propose customer billing and accounting procedures

- propose optimized meter reading and billing schedules

- coordinate with the working group for systems design

(d)   Customer Services. This working group will:

- study customer information management processes

- review procedures for complaints, service requests, and billing adjustments

- coordinate with the working group for systems design

(e)   Information systems. This working group will:

- design, develop and implement computer systems related to the FMIS and CIS

- propose hardware and software standards

- coordinate the on-going implementation activities

- provide training and support

Design development and implementation of computer systems will require specialized expertise not currently available within DAWSSA. To overcome the shortage of technical staff it is recommended that detailed design and implementation be carried out by specialized

consultants. Two consultancies are envisaged: Consultancy 1- project manager & short term experts; and Consultancy 2 - design, development and implementation of integrated CIS and FMIS system.

(1)   Consultancy 1- project manager & short term experts:

The services of a project manager and short term consultancies from specialized experts will be required to assist the Project Director with implementation of reforms that will be defined by the working groups. A number of specialized short term experts will be required to complete the detailed design and implementation of the new procedures and work practices. The following assignments are identified: (a) Budget formulation; (b) Budget implementation; (c) Chart of cost accounts; (d) Review payment/spending process; (e) Customer billing and accounting; (f) Procurement. The project manager will be required for an estimated period of 18 months over the three year implementation period from 2000 to 2002. The short term consultants will provide an estimated 20 man-months of work.

(2)   Consultancy 2 - design, development and implementation of integrated systems

A consultant with extensive experience in the design, development and implementation of information systems in water utilities will be required. It is considered that most of the services can be satisfactorily carried out by a local firm. International consulting companies should be encouraged to enter into partnerships with a local firm to deliver services for parts of the project where local expertise is available.

The scope of work under this Consultancy will consist of the following tasks: (a) prepare a detailed functional design and systems specifications for each module of the integrated CIS and FMIS and develop related procedures and manuals; (b) design of the system architecture required for the information systems; (c) investigate alternatives for application software; (d) prepare tender documents for hardware (and "off the shelf" software); (e) Develop training program and provide training of DAWSSA staff; and (f) implement system. It is estimated that this Consultancy will require about 100 man months assuming the customized development of the CIS and FMIS software.

4.4 Training

Modernization will not only involve new systems and procedures but also the integration of automation into the work place. It will have an immediate and significant impact on human resources management and training within the organization. Retraining will be required to support new systems and procedures resulting from simplification and computerization. In addition training will be required to support entirely new procedures such as cost accounting, cost analysis, budget formulation and control.

(1) Systems operation training

The Computer Section has limited experience with client/server environments and database management systems. The implementation of new CIS and FMIS computer systems will require that new & existing computer section staff receive generic training in subjects of modern computing:

- introduction to computer systems hardware
- introduction to relational database management systems (DBMS)
- Windows Operating system
- introduction to Client/Server computing
- telecommunications, local (LAN) and wide area networking (WAN)
- introduction to network management (Novell Netware) and data security.

Staff who will be participating in the working groups should also take the same training to become familiar with computer system concepts. In addition it is recommended that new staff with the required technical skills be hired prior to the beginning of the project in order to have them involved directly in the working groups. The generic training should proceed before the implementation of the new systems in order to prepare staff to participate fully during the implementation program.

(2) Computers use - general training

Some of the existing office staff are familiar with windows applications programs for word processing and spreadsheets but most have very little practical skills. They will need to upgrade their technical skills in order to be productive in the new system environment. In addition to specific training on FMIS and CIS use, a training program will be required in the areas of:

- using windows
- how computers work
- using word processing applications
- using spreadsheet applications
- organizing files and data

(3)   Financial management training

The implementation of a new CIS and FMIS will also create a need for training in the areas of financial management. This training program will be aimed at the senior management team and selected section heads who will be involved in using the new systems. Topics will include

- budget formulation & planning
- cost accounting principles
- cost analysis and control
- formulation and evaluation of projects
- design and application of tariff structures

4.5   Schedule

The detailed schedule of activities for the implementation of CIS and FMIS systems is shown in Figure E-4.1. The implementation of changes to the billing procedures will take place first and should take about one year (1998). The implementation of the information technology planning study should also proceed as soon as possible (start 1998) and should take approximately one year to complete. It is recommended that both the revisions to billing procedures and the planning study be completed before starting the implementation of the new systems.

The schedule for implementing CIS and FMIS assumes customized development of application software. The process of implementing FMIS will take longer because it requires many new work procedures that do not already exist. The work of designing both systems should proceed in parallel in order to ensure full integration between both applications. The implementation of the CIS is expected to take about 2 years to complete (years 2000 to 2001). The process of implementing a FMIS will take about 3 years to complete (years 2000 to 2002).

4.6   Costs

Project costs are calculated based on the estimated quantity of hardware, equipment and man-month estimates for the consultancies identified. Total software and consultant costs are estimated at US$1.9 million as shown in Table E-4.1. Total hardware & equipment costs are estimated at US$1.6 million as shown in Table E-4.2. Hardware installation costs are assumed to be 5% of the total hardware costs. Computer equipment costs are based on budget estimates obtained from local suppliers in Damascus. Software costs assume the customized development of CIS and FMIS software by a local consultant. Software costs are expected to vary widely in an open international competitive bid depending on the final selection of packaged vs. completely customized development. In a recent computerization project at the Syrian Telephone Exchange (STE) local consultants developed all of the customized software and training at very competitive rates (one tenth the cost of international) Building modification if costs are excluded since none are anticipated at this time

Costs for the consultancies are based on man-month estimates assuming local consultants. Consultancy 1 will require a project manager for an estimated 18 man months at a cost of US$ 270,000 and short term experts who will provide an estimated 20 man-months at a cost of US$ 240,000. Consultancy 2 will require an effort of approximately 100 man-months at a cost of US$ 800,000. Total project costs are estimates at US$ 3.5 million over a 3 year period.