

**United Nations Development for Economic and Social Affairs (UNDESA)
In Collaboration with
Economic and Social Commission for Asia and the Pacific (UNESCAP)**

**Capacity Building Workshop on Partnerships for Improving the Performance
of Water Utilities in the Asia and the Pacific Region**

**Outline of utility Case studies
Status of
*Water & Sanitation Services in Chittagong Water
Supply and Sewerage Authority, Bangladesh.***

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1. INTRODUCTION

Bangladesh is a low-lying country with a total area of 147570 Sq. km's. It stretches latitudinally between 20°34' and 26°38' north and longitudinally between 88°01' and 92°41' east. It is mostly surrounded by Indian Territory except for a small strip in the southeast by Myanmar. Bay of Bengal lies on the south. Most of its area is relatively flat lying in the deltaic plain of the Ganges-Brahmaputra-Meghna river system. Bangladesh became an independent country on 16th December, 1971 with Dhaka as its capital. Chittagong is the second largest city and commercial capital of Bangladesh. The growth of this city is mainly contributed to the port. After independence Chittagong city has grown at a tremendous pace. Many large medium and small-scale industries have been set up here. The first Export Processing Zone (EPZ) of the country was established in the city. There was unprecedented growth of Garments industries in the last few decades. This city is also witness major population growth over the last three decades, mainly due to migration from the villages and other part of the country. The population of the city was 0.5 million in 1971, which has grown to more than 3.6 million in 2004. The city area has also expanded considerably. The service area of CWASA has increases from 77 Sq. km (yr 1974) to 270 Sq. km (yr 2004).

This growth presents tremendous challenge to the Chittagong Water Supply and Sewerage Authority (CWASA) in providing services to the city dwellers. Presently CWASA is supplying potable water in the city. There is no sewerage facility in the city. Due to limitation in resources, many development initiatives are being restricted.

2. History of Water Demand and Supply

CWASA came into existence in November 1963. When the water demand of the city was nearly 30 MLD. After 40 years the demand has increased to about 536 MLD. With consumption rate of 155 liter per capita per day. The growth of demand and supply of water by CWASA is shown below Table-1 and Figure-1.

Year	Demand (MLD)	Supply of Water (MLD)			% Demand
		Underground Water	Surface Water	Total	
1963	30	20.5	-	20.5	68%
1970	60	25	-	25.0	42%
1980	140	30	-	30.0	22%
1990	270	45	89.5	134.5	50%
1996	366	55.3	89.3	144.6	40%
1997	382	58.4	89.7	148.0	39%
1998	400	73.5	89.8	163.3	41%
1999	418	78.0	90.1	168.1	40%
2000	450	73.0	90.7	163.7	36%
2001	470	70.0	90.5	160.5	34%
2002	491	72.0	90.4	162.4	33%

2003	513	77.0	91.6	168.6	33%
2004	536	83.7	91.3	175.0	33%
2005	560	84	91.0	175	31%
2006	585	84	91.0	175	30%

Table 1: Historical Water Supply and Demand Scenario

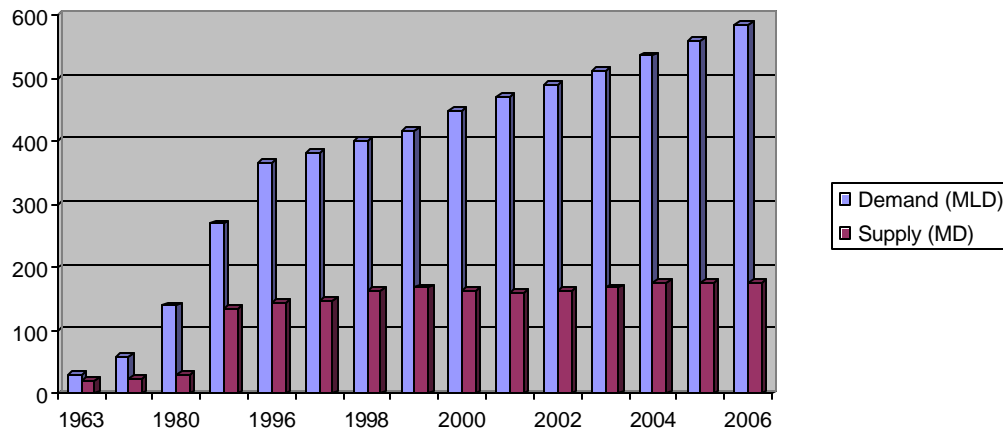


Figure 1: Historical Water Supply and Demand Scenario

2.1. Sources of Water supply

Chittagong WASA can supply only 175 MLD of water. CWASA has water supply pipeline of 570 km. Production from surface water is 91 MLD from only one treatment plant in Mohara. There are 52 DTW in the entire CWASA jurisdiction. The production from ground water is 84 MLD. Present shortfall of water supply is about 325 MLD (Table 1). With available supply, demand of about 33% of the city population can be met. The ratio of surface water and ground water is 52:48 (Figure-2).

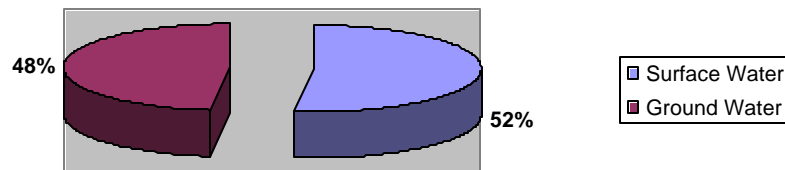


Figure-2. water supply source of CWASA

Ground water in Chittagong city contains high iron concentration (2~8 mg/l). That is why the wells strainer and the gravel pack become clogged with iron bacteria causing decline in water production within few years of installation. Again ground water of southwest area of the city contains Chloride and recently some well water found to contain Manganese and Nitrate concentration exceeding the limit of Bangladesh Standard (As per JICA feasibility study report 2000, Manganese 0.17~0.28, Nitrate 1.2~13). Also, it is

found that the ground water level in the city center has been declining. As CWASA is not able to meet the demand of water in the city, many household and industries have constructed their own deep tube wells. It is expected that due to abstraction of water by CWASA and private tube wells, the ground water development in aquifer within Chittagong city area is in near limitation. As a result, the ground water would no longer be a sustainable source of raw water for CWASA.

2.2 Sewerage System

At present Chittagong city has no sewerage system. Some high-income houses have septic tanks; the reminders have no such facilities. Domestic and industrial wastewater is being discharged in the open drain. The Parsons Overseas Company prepared plans for a sewerage system and treatment plant in 1962. Also another Feasibility Study and Development Plan for Sewerage and Sanitation System for Chittagong Metropolitan Area was prepared by Bongaerts, Kuyper and Huiswaard B.V. (BKH) in 1983. Recently CWASA has appointed individual consultants to prepare TOR for sewerage and storm water systems.

2.3 Storm-water Drainage

Though as per ordinance it is the responsibilities of CWASA to construct operate and maintain drainage facilities to carry rain, flood and surface water. This has not yet been transferred to CWASA. Chittagong City Corporation (CCC) is now looking after the drainage system. CCC are constructing and maintaining drains and canals in the city. Also, CCC has constructed one storm water box type under drain under IDA credit in Agrabad commercial area.

2.4 Financial Position of CWASA

Financial Year	Total Income (Water & Other Revenue) (Tk)	Operating Expenses (Operation, Collection, General & Admin) (Tk)	Operating Gain / (Loss) (Tk)	Total Expenditure (Including Interest on long term loan & payment of exchequer) (Tk)	Gain / (Loss) (Before prior year's adjustment) (Tk)	Prior Year's adjustment (Tk)	Net Gain / (Loss) (Tk)
1	2	3	4 = (2-3)	5	6 = (2-5)	7	8 = (6+7)
1998-1999	244,205,721	242,417,429	178,829,2	304,055,863	(598,501,42)	(214,722)	(600,648,64)
1999-2000	246,085,443	255,321,881	(923,643,8)	316,766,133	(706,806,90)	541,771	(701,389,19)
2000-2001	254,207,019	254,676,189	(469,170)	314,168,932	(599,619,13)	711,208	(592,507,05)
2001-2002	277,637,665	254,193,126	234,445,39	313,383,057	(357,453,92)	157,488,56	(199,965,36)
2002-2003	319,300,883	270,472,745	488,281,38	328,728,092	(942,720,9)	900,782	(852,642,7)
2003-2004	331,577,706	278,681,515	52,896,191	330,632,341	(945,365)	12,162,092	(11,216,727)
2004-2005 (Provisional)	323,884,322	277,900,868	45,983,454	315,070,771	(8,813,551)	3,541,974	(12,355,523)

Table-2: Income & Expenditure of CWASA

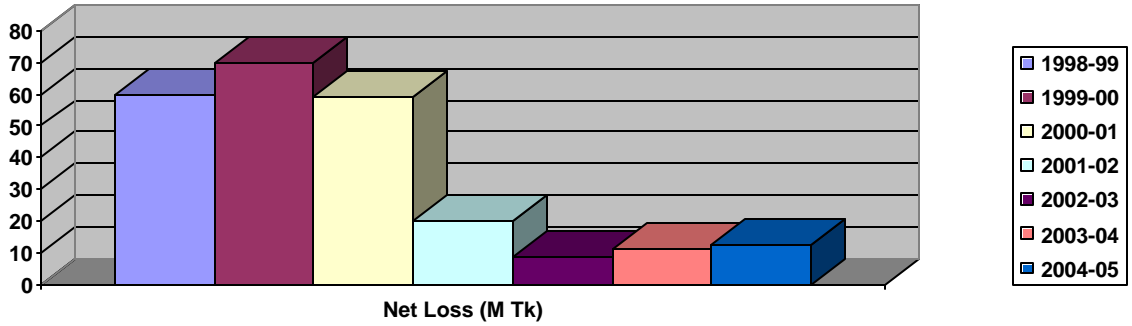


Figure-3: Net Loss position of CWASA

From the above Table-2, it is seen that CWASA is in gaining position in respect to operating expenditure (Column 4) but it is in the net loss position after payment of interest on long term loan and payment of exchequer. Any way the net loss is in decreasing trend.

2.5 Number of Water Connections:

All the water connections under CWASA are metered. Present status of category wise water connections are shown in the Table-3 and Figure-3 (April, 2006)

Total No. of connections	Domestic	Non-domestic
39,235	34,242	4,993
41,114	35,844	5270

Table-3: Category wise water connections

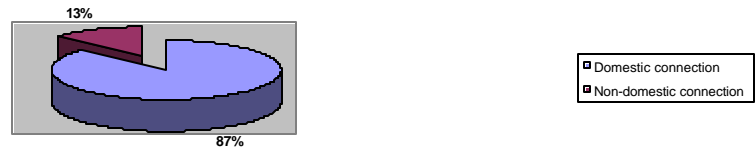


Figure-4: Water Connections

2.6 Domestic and Non-domestic Water use:

About 80% of the supplied water in quantity is used by domestic consumers rest 20% used by the Non-domestic consumers as shown in Figure-5

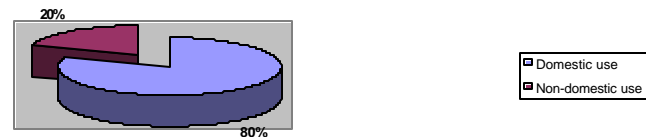


Figure-5: Quantity of water use

2.7 Amount Receivable in Taka:

	30 th June, 99	30 th June, 00	30 th June, 01	30 th June, 02	30 th June, 03	30 th June, 04	30 th June, 05	30 th April, 06
Govt.	165,415,465	179,145,999	198,303,016	213,939,540	182,725,483	84,041,057	84,146,492	79,897,311
Private	116,885,001	126,944,718	137,397,072	162,101,070	180,804,941	196,109,567	202,730,781	196,284,281
Total	282,300,466	306,090,717	335,700,088	376,040,610	363,530,424	280,150,624	286,877,273	276,181,592
Ratio	58:42	58:42	59:41	56:44	50:50	30:70	29:71	29:71

Table-4: Amount Receivable

2.8 Un-accounted for water (in million gallon):

Year	Volume Produced	Volume used for Treatment	Volume available for Distribution	Volume Billed	Volume used in CWASA	Total Accounted Tor	% of Un-accounted water after distribution
1999-00	13768	400	13368	8322	12	8334	38%
2000-01	13475	369	13106	8459	12	8471	35%
2001-02	13310	485	12825	8986	12	8998	30%
2002-03	13899	454	13445	9806	12	9818	27%
2003-04	14062	482	13580	9549	12	9561	30%
2004-05	13633	556	13067	9406	12	9418	28%

Table-5: Un-accounted for water

2.9 Percent of collection against billed amount:

Month	Billed Amount	Collection Amount	% Collection
Jun'2003	22,264,169.74	79,681,145.13	357.89%
Jul'2003	22,304,268.17	18,927,923.70	84.86%
Aug'2003	22,450,442.90	19,586,189.50	87.24%
Sep'2003	26,983,908.87	19,642,095.50	72.79%
Oct'2003	24,927,987.21	24,147,758.88	96.87%
Nov'2003	24,257,888.80	25,398,059.71	104.70%
Dec'2003	23,017,142.99	21,696,604.03	94.26%
Jan'2004	23,812,763.96	20,199,044.32	84.82%
Feb'2004	23,901,187.92	16,366,638.06	68.48%
Mar'2004	23,042,074.61	21,952,184.87	95.27%
Apr'2004	24,101,288.65	17,440,032.63	72.36%
May'2004	24,842,899.86	21,732,769.11	87.48%
June'2004	25,400,692.01	34,209,278.36	134.68%
Jul'2004	23,901,590.57	22,590,211.68	94.51%
Aug'2004	24,202,256.48	19,020,001.74	78.59%
Sept'2004	24,449,483.34	22,381,556.91	91.54%
Oct'2004	23,077,819.37	19,482,627.11	84.42%

Nov'2004	23,529,767.29	16,573,319.76	70.44%
Dec'2004	23,786,972.78	23,939,975.10	100.64%
Jan'2005	22,968,570.48	20,503,031.86	89.26%
Feb'2005	23,710,049.81	27,458,838.28	115.81%
Mar'2005	22,421,918.78	23,416,746.53	104.43%
Apr'2005	23,425,303.95	19,773,303.28	84.41%
May'2005	22,866,196.00	28,055,250.00	122.69%
June'2005	23,918,940.00	81,955,514.00	342.64%
July'2005	22,633,542.00	22,131,953.00	99.78%
Aug'2005	23,724,000.00	18,166,224.00	76.57%
Sept'2005	23,636,148.00	23,179,144.00	98.07%
Oct'2005	23,255,687.00	21,718,563.00	93.39%
Nov'2005	23,765,482.00	20,052,415.00	84.38%
Dec'2005	25,350,923.00	20,763,913.00	81.91%
Jan'2006	24,380,346.00	21,633,388.00	88.73%
Feb'2006	24,212,976.00	22,706,307.00	93.78%
Mar'2006	23,967,717.00	61,994,773.00	258.66%
Apr'2006	25,223,868.00	19,910,758.00	78.94%
May'2006	24,015,366.00	21,478,842.00	89.43%
Average	23,825,878.87	26,107,399.44	109.57%

Table-6: Collection and billed amount

2.10 Billed and Un-billed connections:

Month	Total No. of Connection in Operation	Billed Connections	Un-billed Connections	% Billed
Oct'2003	33,197	32,767	430	98.70%
Nov'2003	33,274	32,807	467	98.60%
Dec'2003	33,504	33,033	471	98.59%
Jan'2004	33,751	33,219	532	98.42%
Feb'2004	33,808	33,363	445	98.68%
Mar'2004	33,944	33,492	452	98.67%
Apr'2004	34,098	33,726	372	98.91%
May,2004	34,104	33,767	337	99.01%
Jun'2004	34,221	33,827	394	98.85%
Jul'2004	34,442	33,957	485	98.59%
Aug'2004	34,732	34,231	501	98.56%
Sept'2004	34,936	34,355	581	98.34%
Oct'2004	35,136	34,467	669	98.10%
Nov'2004	35,152	34,543	609	98.27%
Dec'2004	35,465	34,944	521	98.53%
Jan'2005	35,600	35,083	517	98.54%
Feb'2005	35,698	35,020	978	98.10%
Mar'2005	35,864	35,300	564	98.42%

Apr'2005	35,900	35,285	615	98.28%
May'2005	36,021	35,429	592	98.35%
June'2005	40,396	36,063	524	89.27%
July'2005	35,921	35,416	505	98.59%
Aug'2005	35,944	35,641	303	99.15%
Sept'2005	35,991	35,673	318	99.11%
Oct'2005	35,997	35,745	252	99.29%
Nov'2005	36,081	35,785	296	99.17%
Dec'2005	36,162	35,884	278	99.23%
Jan'2006	36,182	35,881	301	99.16%
Feb'2006	36,268	35,898	370	98.97%
Mar'2006	36,382	35,933	389	98.76%
Apr'2006	36,487	36,142	345	99.05%
May'2006	36,568	36,222	346	99.05%
Average	35,350	34,778	461	98.38 %

Table-7: Billed and Un-billed connection

2.11 History of Water Rates:

Year	Rate in Taka Per 1000 Gallons (% increase shown in the bracket)			
	Domestic	Industrial	Commercial	Non-metered / Remarks
1964	2.00	3.00	4.00	4% of Valuation in Municipal area 5% of Valuation in Outside Municipal area 5% of Valuation for all areas w.e.f. 16.11.1966
July 1975	3.00 (50%)	4.00 (33%)	6.00 (50%)	7.5% of Valuation
July 1976	4.50 (50%)	6.75 (69%)	9.00 (50%)	7.5% of Valuation
January 1978	Not increased	9.00 (33%)	18.00 (100%)	Same as previous
September 1979	6.00 (33%)	13.00 (44%)	Same as previous	All connections metered
October 1980	7.00 (17%)	20.00 (11%)		Industrial and Commercial rate has been merged as Non-domestic
July 1982	10.00 (2.00 per m ³) (43%)	28.00 (6.16 per m ³) (40%)		
July 1986	12.50 (2.75 per m ³) (25%)	35.00 (7.70 per m ³) (25%)		
November 1987	13.75 (3.03 per m ³) (10%)	38.50 (8.47 per m ³) (10%)		Adjusted for increased Power Cost only
October 1990	15.12 (3.33 per m ³) (10%)	42.35 (9.31 per m ³) (10%)		Adjusted for increased Power Cost only
September 1992	17.39 (3.83 per m ³) (15%)	48.70 (10.71 per m ³) (15%)		Adjusted for increased Power Cost only
July 1997	18.43 (4.06 per m ³) (6%)	51.52 (11.35 per m ³) (6%)		Adjusted for increased Power Cost only

February 2001	20.27 (4.46 per m ³) (10%)	56.78 (12.48 per m ³) (10%)	Adjusted for increased Power Cost only
August 2003	22.29 (4.90 per m ³) (10%)	62.45 (13.72 per m ³) (10%)	Adjusted for increased Power Cost only

Table-8: History of Water Rates

3. Population and Demand for Water Supply, Sewerage & Drainage

3.1 Water supply

Population of Chittagong Metropolitan city, water demand and CWASA supply capacity are shown in Table-10 and Figure-6.

Year	Population in million	Water Demand in MLD			Water Supply Capacity in MLD	Shortfall in MLD	% of Shortfall
		Right Bank of Karnafuli	Left Bank of Karnafuli	Total			
1990	1.86	279	-	279	137	142	50.1
1995	2.34	351	-	351	145	206	58.7
2000	2.96	450	-	450	163	287	63.8
2005	3.68	549	-	549	175	354	64.5
2007	4.02	660	45	705	371	334	47.4

Project to be undertaken:

2010	4.59	770	70	840	486	152	18.1
2015	5.72	1091	140	1231	1110	121	9.8
2020	7.13	1423	200	1623	1480	143	8.8

Table9: Projected population with water demand and supply

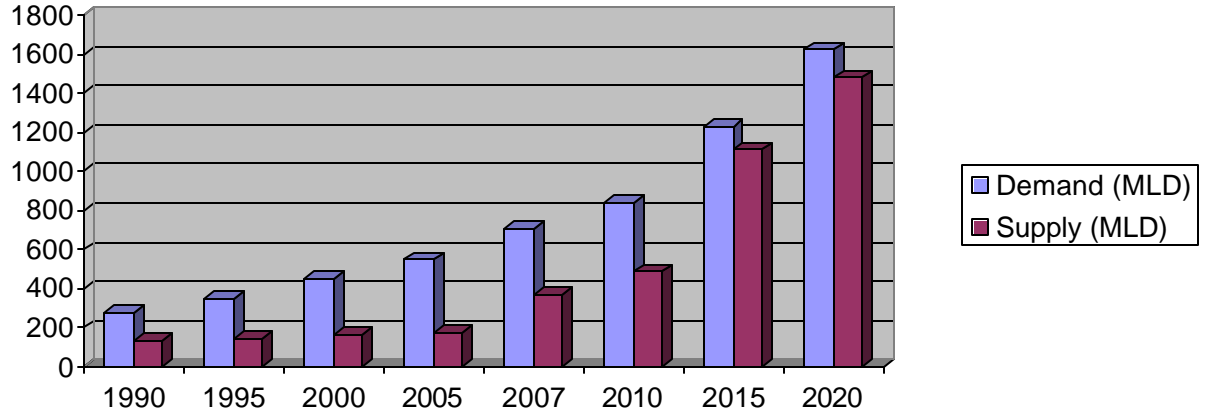


Figure-6: Projected Water Demand and Supply

Considering the rapid expansion of the city concomitant with the high rate of population growth and other physical and infrastructure developments, there would be huge demand for piped water, sanitation and storm water drainage in the near future. As mentioned ground water development in aquifer is in near limitation so, surface water as a source is the only option for development of water supply in the Metropolitan city of Chittagong

A water supply master plan for the Chittagong city was prepared by Persons Overseas Company in 1979 aiming at year 2000. Again in 2000 JICA has prepared a master plan aiming at year 2010 considering the city development along the right bank of the river Karnafuli. A feasibility study/Preparation of Master plan for the Metropolitan city of Chittagong situated on both bank of the river Karnafuli aiming at 2025 is urgently required to be taken up. CWASA is working with the World Bank aiming at this purpose.

3.2 Sewerage

A feasibility study/Preparation of Master plan for sewerage system of the Metropolitan city of Chittagong aiming at 2025 is urgently required to be taken up. CWASA has prepared a TAPP for this purpose. Presently CWASA has appointed individual consultant for preparation of TOR, Being funded by World Bank, The consultant has submitted his report.

3.3 Drainage

A feasibility study/Preparation of Master plan for drainage facility of the Metropolitan city of Chittagong aiming at 2025 is urgently required to be taken up. CWASA has appointed consultant for preparing TOR. Consultant is at present working. This is also being funded by World Bank.

3.4 Increase Revenue Earning

- Steps for reducing system loss-
 - Identification of non-metered domestic and commercial connections
 - Identification of all non-domestic water use customers
 - Identification of illegal connections

- Pipeline leak detection
- Replace poor quality connections
- Replace defective meters of the consumer connections
- Optimizing pressure to reduce pipeline damage
- Metering of main and sub-mains to reconcile with consumer billing
- Improved Metering system
- Computerization billing, accounting and reconciliation
- Outsourcing of consumer meter reading and billing – yet to be done.

4. On-going Projects of CWASA:

Sl. #	Name of Project	Status	Period	Capacity	Estimated Cost in M. Taka	Remarks
1.	3 rd Interim Water Supply Project (Ground water)	Approved by ECNEC in 2001	2001-2007	90 MLD	548.83	Revised PP under process of approval
2.	Modunaghat Water Supply Project (Phase-I)	Approved by ECNEC in 1999	2004-2007	45 MLD	1350.25	Revised PP under process of approval
3.	Mohara Water Supply Project	Approved by ECNEC in 2003	2004-2007	90 MLD	1976.90	
4.	Karnafuli Water Supply Project (Phase-I)	JBIC is actively considering for financing of the Project	2006-2008	136 MLD	6000	EOI under process.
Total				361 MLD	9875.98	

5. Proposed Future Action Plan of CWASA

5.1 Water Supply

Sl. #	Name of Project	Status	Period	Capacity	Estimated Cost in M. Taka	Remarks
1.	Feasibility Study on 3 rd Chittagong Water Supply Project	Under process of approval			87.026	Preparation of Master Plan aiming at 2025 for Chittagong Metropolitan city area situated on both left and right bank of Karnafuli

2.	Modunaghat Water Supply Project (Phase-II)	Project Concept Paper to be prepared	2007-2010	45 MLD	1200	
3.	Karnafuli Water Supply Project (Phase-II)	Project to be formulated	2008-2010	136 MLD	3600	
4.	Karnafuli Water Supply Project (Phase-III)	Project to be formulated	2010-2015	272 MLD	9600	
5.	Muhuri Water Supply Project (Phase-I)	Project to be formulated	2012-2015	150 MLD	7500	
6.	Muhuri Water Supply Project (Phase-II)	Project to be formulated	2015-2020	120 MLD	4000	
7.	Kumira-Sitakunda Hill Water Reservoir Project	Project to be formulated	2015-2020	90 MLD	2000	
8.	Rehabilitation of old Pipelines	Project to be formulated	2007-2010	100 km	200	
9.	Upgrading & Rationalization of Trunk, sub-main of water supply system	Project to be formulated	2007-2010	30 km	500	
10.	Up-gradation of Computer billing and GIS (TA)	Project to be formulated	2005-2007	-	100	
11.	Assessment & monitoring of quantity and quality of ground and surface water through mathematical modeling	Project to be formulated	2005-2007	-	50	
12.	Network analysis for evaluation and management of water supply system (TA)	Project to be formulated	2005-2007	-	80	
13.	Improvement of consumer metering for reduction of system loss	Project to be formulated	2005-2007	25,000 nos.	40	
14.	Rehabilitation of existing Mohara plant, Kalurghat IRP and construction of Kulshi Hill reservoir	-	2007-2009	-	600	DPP approved.
15.	Develop & install inter-communication system within CWASA installations	Project to be formulated	2007-2008	-	20	

5.2 Sewerage System

Sl. #	Name of Project	Status	Period	Capacity	Estimated Cost in M. Taka	Remarks
1.	Feasibility study of sewerage project	Individual consultant for preparing TOR for consultancy team has submitted report.	2005-2006	-	87.02	

2.	Chittagong sewerage project (Phase-I)	Project to be formulated	2007-2010	137 MLD	4000	
3.	Chittagong sewerage project (Phase-II)	Project to be formulated	2010-2015	137 MLD	5000	
4.	Chittagong sewerage project (Phase-III)	Project to be formulated	2015-2020	274 MLD	9000	

5.3 Drainage Facility

Sl. #	Name of Project	Status	Period	Capacity	Estimated Cost in M. Taka	Remarks
1.	Feasibility study of storm water drainage	Individual consultant is working for preparation of TOR for the consultancy team.	2005-2006	-	100	
2.	Drainage Project (Phase-I)	Project to be formulated	2010-2015	-	2000	
3.	Drainage Project (Phase-II)	Project to be formulated	2015-2020	-	4000	

6. Priority Requirement

In order to meet the present huge shortage of water in the city of Chittagong; the following steps are to be taken on priority basis-

- i) Implement Mohara Water Supply Project by 2007.
- ii) Implement Modunaghat Water Supply Project (Phase-I) by 2007.
- iii) Implement 3rd Interim Water Supply Project by 2007.
- iv) Implement Karnafuli Water Supply Project (Phase-I) by 2010.
- v) Implement Water Supply Project for left bank of the river Karnafuli by 2012.
- vi) Prepare Master Plan for Water Supply aiming at 2025.
- vii) Prepare Master Plan for Sewerage system aiming at 2025.
- viii) Prepare Master Plan for Drainage facility aiming at 2025.