CHAPTER 10

ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

CHAPTER 10 ENVIRONMENTAL AND SOCIAL CONSIDERATIONS

10.1.1 Standard for Inland Surface Water

Best Practice based classification	pH	BOD (mg/l)	DO (mg/l)	Total Coliform Number/100
a. Source of drinking water for supply only after disinfecting	6.5-8.5	2 or less	6 or above	50 or less
b. Water usable for recreational activity	6.5–8.5	3 or less	5 of more	200 or less
c. Source of drinking water for supply after conventional treatment	6.5–8.5	6 of less	6 or more	5000 or less
d. Water usable by fisheries	6.5–8.5	6 of less	5 or more	
e. Water usable by various process and cooling industries	6.5–8.5	10 or less	5 or more	5000 or less
f. Water usable for irrigation	6.5–8.5	10 or less	5 or more	1000 or less

Note:

1) In water used for fish culture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.
2) Electrical conductivity for irrigation water – 2250 μ mho ms/cm (at a temperature of 25°C); Sodium less than 26%; boron less than 0.2%.

Source: Schedule -3 (A) of Environmental Conservation Rules, 1997

10.1.2 Standard for Drinking Water

Parameter	Unit	Standards	Parameter	Unit	Standards
1. Aluminum	mg/L	0.2	26. Hardness (as $CaCO_3$)	mg/L	200 – 500
2. Ammonia (NH3)	mg/L	0.5	27. Iron	mg/L	0.3 – 1.0
3. Arsenic	mg/L	0.05	28. Kjeldhl Nitrogen (total)	mg/L	1
4. Balium	mg/L	0.01	29. Lead	mg/L	0.05
5. Benzene	mg/L	0.01	30. Magnesium	mg/L	30 – 35
6. BOD_5 20°C	mg/L	0.2	31. Manganese	mg/L	0.1
7. Boron	mg/L	1.0	32. Mercury	mg/L	0.001
8. Cadmium	mg/L	0.005	31. Manganese	mg/L	0.1
9. Calcium	mg/L	75	32. Mercury	mg/L	0.001
10. Chloride	mg/L	150-600*	33. Nickel	mg/L	0.1
11. Chlorinated alkanes			34. Nitrate	mg/L	10
carbontetrachloride	mg/L	0.01	35. Nitrite	mg/L	<1
1.1 dichloroethylene	mg/L	0.001	36. Odor	mg/L	Odorless
1.2 dichloroethylene	mg/L	0.03	37. Oil and grease	mg/L	0.01
tetrachloroethylene		0.03	38. pH	-	6.5-8.5
trichloroethylene		0.09	39. Phenolic compounds	mg/L	0.002
12. Chlorinated phenols			40. Phosphate	mg/L	6
pentachlorophenol	mg/L	0.03	41. Phosphorus	mg/L	0
2.4.6 trichlorophenol	mg/L	0.03	42. Potassium	mg/L	12
13. Chlorine (residual)	mg/L	0.2	43. Radioactive materials (gross alpha activity)	Bq/L	0.01
14. Chloroform	mg/L	0.09	44. Radioactive materials (gross beta activity)	Bq/L	0.1
15.Chromium (hexavalent)	mg/L	0.05	45. Selenium	mg/L	0.01
16. Chromium (total)	mg/L	0.05	46. Silver	mg/L	0.02
17. COD	mg/L	,, 4	47. Sodium	mg/L	200
18. Coliform (fecal)	n/100ml	0	48. Suspended particulate matters	mg/L	10
19. Coliform (total)	n/100 ml	0	49. Sufide	mg/L	0
20. Color	Hazen unit	15	50. Sulfate	mg/L	400
21. Copper	mg/L	1	51. Total dissolved solids	mg/L	1000
22. Cyanide	Mg/L	0.1	52. Temperature	°C	20-30
23. Detergents	mg/L	0.2	53. Tin	mg/L	2
24. DO	mg/L	6	54. Turbidity	JTU	10
25. Fluoride	mg/L	1	55. Zinc	mg/L	5

*In coastal area 1000. Reference: Bangladesh Gazette, Addendum, August 28, 1997
Source: Schedule -3 (B) of Environmental Conservation Rules, 1997

10.1.3 Standards for Ambient Air Quality

Unit: Microgram/m^3

Sl. No.	Area	Suspended Particulate Matters (SPM)	Sulfur Dioxide (SO_2)	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)
a.	Industrial and mixed	500	120	5000	100
b.	Commercial and mixed	400	100	5000	100
c.	Residential and rural	200	80	2000	80
d.	Sensitive	100	30	1000	30

Notes:

1) At national level, sensitive area includes monuments, health center, hospital, archaeological site, educational institution, and government designated areas (if any).
2) Industrial units located in areas not designated as industrial areas shall not discharge pollutants which may contribute to exceeding the standard for air surrounding the areas specified at Sl. nos. c and d above.
3) Suspended Particulate Matter means airborne particles of a diameter of 10 micron or less.
4) Source: Schedule – 2 of Environmental Conservation Rules, 1997

10.1.4 Standards for Sound (Noise)

SI. No.	Area Category	Standards Values (all values in dBA)	
		Day	Night
a.	Silent zone	45	35
b.	Residential area	50	40
c.	Mixed area (mainly residential area, and also simultaneously used for commercial and industrial purposes)	60	50
d.	Commercial area	70	60
e.	Industrial area	75	70

Note:

1) Daytime is reckoned as the time between 6 a.m. to 9 p.m.
2) Night time is reckoned as the time between 9 p.m. to 6 a.m.
3) Area up to a radius of 100 meters around hospitals or educational institutions or special institutions/ establishments identified/to be identified by the Government is designated as Silent Zones where use of horns of vehicles or other audio signals, and loudspeakers are prohibited

Source: Schedule – 4 of Environmental Conservation Rules, 1997

10.1.5 Standards for Odor

Parameters	Unit	Values
Acetaldehyde	ppm	0.5-5
Ammonia	ppm	1-5
Hydrogen Sulfide	ppm	0.02-0.2
Methyl Disulfide	ppm	0.009-0.1
Methyl Sulfide	ppm	0.01-0.2
Styrene	ppm	0.4-2.0
Trimethylamine	ppm	0.005-0.07

Note:

1) Regulatory standards at emission/discharge outlets (apply to those outlets which are higher than 5 meters): $Q = 0.108 \times He^2$ cm, Where Q – gas emission rate (Nm^3/hour), He – effective height of the outlet (m), Cm – above mentioned standard (ppm)
2) Where there is a range given for a parameter, the lower value will be used for warning and the higher value for initiation of legal procedure or punitive measures.

Source: Schedule – 8 of Environmental Conservation Rules, 1997

10.1.6 Standards for Sewage Discharge

Parameters	Unit	Values
BOD	mg/l	40
Nitrate	mg/l	250
Phosphate	mg/l	35
Suspended Solids (SS)	mg/l	100
Temperature	^{o}C	30
Coliforms	number/100ml	1000

Note:

1) This limit shall be applicable to discharges into surface and inland waters bodies.
2) Chlorination is to be done before final discharge

Source: Schedule - 9 of Environmental Conservation Rules, 1997

10.1.7 Standards for Industrial and Project Effluent

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public sewerage system connected to treatment at second stage	Irrigated Land
1	Ammonical nitrogen (as elementary N)	mg/l	50	75	75
2	Ammonia (as free ammonia)	mg/l	5	5	15
3	Arsenic (as As)	mg/l	0.2	0.05	0.2
4	BOD_5 at 20^{o}C	mg/l	50	250	100
5	Boron	mg/l	2	2	2
6	Cadmium (as Cd)	mg/l	0.05	0.5	0.5
7	Chloride	mg/l	600	600	600
8	Chromium (as total Cr)	mg/l	0.5	1.0	1.0
9	COD	mg/l	200	400	400
10	Chromium (as hexavalent Cr)	mg/l	0.1	1.0	1.0
11	Copper (as Cu)	mg/l	0.5	3.0	3.0
12	Dissolved oxygen (DO)	mg/l	4.5-8	4.5-8	4.5-8
13	Electro-conductivity (EC)	µsiemens /cm	1200	1200	1200
14	Total dissolved solids	mg/l	2100	2100	2100
15	Fluoride (as F)	mg/l	2	15	10
16	Sulfide (as S)	mg/l	1	2	2
17	Iron (as Fe)	mg/l	2	2	2
18	Total Kjeldahl nitrogen (as N)	mg/l	100	100	100
19	Lead (as Pb)	mg/l	0.1	1	0.1
20	Manganese (as Mn)	mg/l	5	5	5
21	Mercury (as Hg)	mg/l	0.01	0.01	0.01
22	Nickel (as Ni)	mg/l	1.0	2.0	1.0
23	Nitrate (as elementary N)	mg/l	10.0	Not yet set	10

Sl. No.	Parameters	Unit	Discharge To		
			Inland Surface Water	Public sewerage system connected to treatment at second stage	Irrigated Land
24	Oil and grease	mg/l	10	20	10
25	Phenolic compounds (as C_6H_5OH)	mg/l	1.0	5	1
26	Dissolved phosphorus (as P)	mg/l	8	8	15
27	Radioactive substance	(to be specified by Bangladesh Atomic Energy Commission)			
28	PH		6-9	6-9	6-9
29	Selenium (as Se)	mg/l	0.05	0.05	0.05
30	Zinc (as Zn)	mg/l	5	10	10
31	Total dissolved solids	mg/l	2100	2100	2100
32	Temperature	^oC (summer) ^oC (winter)	40 45	40 45	40 45
33	Suspended solids	mg/l	150	500	200
34	Cyanide	mg/l	0.1	2.0	0.2

Note:

1) These standards shall be applicable to all industries or projects other than those specified under the heading "Standards for sector-wise industrial effluent or emission."
2) Compliance with these standards shall be ensured from the moment an industrial unit starts trial production, and in other cases, from the moment a project starts operation.
3) These standards shall be inviolable even in case of any sample collected instantly at any point of time. These standards may be enforced in a more stringent manner if considered necessary in view of the environmental conditions of a particular situation.
4) Inland Surface Water means drains/ponds/tanks/water bodies/ ditches, canals, rivers, springs and estuaries.
5) Public sewerage system means treatment facilities of the first and second stage and also the combined and complete treatment facilities.
6) Irrigable land means such land area which is sufficiently irrigated by waste water taking into consideration the quantity and quality of such water for cultivation of selected crops on that land.
7) Inland Surface Water Standards shall apply to any discharge to a public sewerage system or to land if the discharge does not meet the requirements of the definitions in notes 5 and 6 above.
8) Source: Schedule - 10 of Environmental Conservation Rules, 1997

10.1.8 Standards for Gaseous Emission from Industries or Projects

Sn. No.	Parameters	Values (in mg/Nm^3)
1	Particulates (a) Power station of capacity of 200 MW or more (b) Power station of capacity of less than 200 MW	 150 350
2	Chlorine	150
3	Hydrochloric acid vapor and mist	350
4	Total fluoride (as F)	25

Sn. No.	Parameters	Values (in mg/Nm^3)
5	Sulfuric acid mist	50
6	Lead particulates	50
7	Mercury particulates	10
8	Sulfur dioxide (a) Sulfuric acid production (DCDA* process) (b) Sulfuric acid production (SCSA* process) (* DCDA : Double conversion, double absorption, SCSA : Single conversion single absorption) Lowest height of stack for sulfur dioxide dispersion : (a) Coal based power plant (1) 500 MW or more (2) 200 MW – 500 MW (3) Less than 200 MW (b) Boiler (1) Steam per hour – up to 15 tons (2) Steam per hour – more than 15 tons ($Q = SO_2$ emission in kg/hour)	kg/ton acid 4 100 275 m 220m $14(Q)^{0.3}$ 11m $14(Q)^{0.3}$
9	Oxides of nitrogen (a) Nitric acid production (b) Gas based power stations 500 MW or more 200 – 500 MW Less than 200 MW (c) Metallurgical oven	 3 kg/ton acid 50 ppm 50 ppm 40 ppm 30 ppm 200 ppm
10	Kiln soot and dust (a) Blast furnace (b) Brick kiln (c) Coke oven (d) Lime kiln	Mg/Nm^3 500 1000 500 250

Source: Schedule - 11 of Environmental Conservation Rules, 1997

10.1.9 Standards for Sound originating from Motor Vehicles or Mechanized Vessels

Category of Vehicles	Unit	Standards	Remarks
Motor Vehicles* (all types)	dBA	85	As measured at a distance of 7.5 meters from exhaust pipe.
		100	As measured at a distance of 0.5 meter from exhaust pipe.
Mechanized Vessels	dBA	85	As measured at a distance of 7.5 meters from the vessel which is not in motion, not loaded and is at two thirds of its maximum rotating speed.
		100	As measured at a distance of 0.5 meter from the vessel which is in the same condition as above.

Note: *At the time of taking measurement, the motor vehicle shall not be in motion and its engine conditions shall be as follows:

1) Diesel engine – maximum rotating speed.

2) Gasoline engine –at two thirds of its maximum rotating speed and without any load.
3) Motorcycle – If maximum rotating speed is above 5000 rpm; two-thirds of the speed, and if maximum rotating speed is less than 5000 rpm, three-fourth of the speed.

Source: Schedule - 5 of Environmental Conservation Rules, 1997

10.1.10 Standards of Emission from Motor Vehicles

Parameter	Unit	Standard Limit
Black Smoke	Hartridge Smoke Unit (HSU)	65
Carbon Monoxide	gm/k.m.	24
	percent area	4
Hydrocarbon	gm/k.m.	2
	Ppm	180
Oxides of Nitrogen	gm/k.m.	2
	Ppm	600

Note: As measured at two-thirds of maximum rotating speed.
Source: Schedule - 6 of Environmental Conservation Rules, 1997

10.2.1 Environmental Clearance

Environmental Site Certificate (rewritten from copy of original letter from DOE to CWASA. Note that in rewritten version (i) abbreviations have been used in some cases and (ii) text in italics added for clarity in terms of content of IEE report that was submitted as part of the Application.)

Government of the People's Republic of Bangladesh
Department of Environment www.doe-bd.org
Head Office, Paribesh Bhaban, E-16 Agargaon, Dhaka-1207

Memo No: DoE/Clearance/2225/2005/75
Date: 9-01-2006
Subject: Environment Site Clearance for Karnaphulli Water Supply Project.
Ref: Your Application dated 04/12/2005

With reference to the above, the Department of Environment (DOE) is pleased to award the Environmental Site Clearance in favor of Karnaphuli Water Supply Project subject to fulfilling the following terms and conditions.

1. This clearance shall only be applicable for the infrastructure of the said project.
2. Chittagong Water Supply and Sewerage Authority (CWASA) shall submit a comprehensive Environmental Impact Assessment (EIA) report considering the overall activity of the said Project in accordance with the TOR and time schedule submitted to the Department of Environment (DOE).
3. The EIA shall incorporate the following components/items in addition to the issues mentioned in the proposed TOR for EIA.
   a) In section 4.0 *(Chapter 4 Description of Existing Environment in IEE Report)* detail description of the land cover/land use with all the existing resource classes along with area coverage shall be shown in the respective maps derives from updated image of proper spatial and spectral resolution including name of satellite, date and time of acquisition with atmospheric condition, etc.
   b) Refer to section4.1; Physical Environment-Data pertaining to ambient water quality (surface as well as ground), ambient air quality and soil quality of the project area shall be included as updated and in detail. (*No data regarding ambient quality of air, water and noise were included.)*
   c) Refer to Section-7; Identification of potential impacts should be replaced with Identification and Analysis of Potential impacts; The Analysis part shall include the analysis of relevant spatial and non-special data. The outcome of the analysis shall be presented with scenarios, models, maps, graphics etc. for the cases of anticipated impacts on baseline environment as specified in section 4.1 through 4.3. Description of the project on air, water, land, vegetation-man made or natural, wildlife, socio-economic aspect shall be incorporated in detail for the project.
   d) There shall be new section on "Analysis and Description of the Mitigation measures" to be arranged in accordance with the adverse impacts for the interventions as identified in previous section.
   e) Specific formats for environmental monitoring shall be included under proposed chapter 8.0.
4. Without approval of EIA report by the Department of Environment, Chittagong Water Supply and Sewerage Authority (CWASA) shall not be able to open L/C in favor of importable machineries.
5. Without obtaining Environmental Clearance, CWASA shall not be to start the physical activity of the project.
6. Rehabilitation or compensation for any sort of activity that will incur damage or loss of public or private property shall be addressed as per Government of Bangladesh rules and regulation.
7. No activity of cutting/razing/dressing of hill or hilly land is endorsed without permission/clearance of the concerned authority of the government.
8. Appropriate permission would be required to obtain from the forest department in favor of cutting/felling of any plant/sapling forested by individual or government before doing such type of activity.
9. CWASA shall submit the EIA to the divisional office of DOE in Chittagong along with a filled-in ap-

plication for Environmental Clearance in prescribed form, the feasibility report. The No Objection Certificates (NOCs) from the local authorities. NOC from forest department (if is required in case of cutting any forested plant/trees-private or public) and NOC in favor of cutting Dressing (if it is required) of Hill/Hillock from the concerned authority.

10. A soft copy of the image data as well as the maps to be generated from the image shall be submitted to DOE Head Office along with the EIA.
11. This clearance is valid for one year from the date of issuance and CWASA shall apply for renewed to the Chittagong Divisional Office of DOE at Chittagong with a copy to Head Office at least 30 days ahead of expiry.

(Sign) **Syed Nazmul Ahsam**
Research Officer and Member Secretary, Environmental Clearance Committee

Mr. Maksumul Hakim Chaudhury
Chairman, Chittagong WASA,
WASA Office Building, Dampara, Chittagong

Copy Forwarded to:

1) The Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka
2) Director, Department of Environment, Chittagong Division, Chittagong
3) Staff Officer to the Director General, Department of Environment, Head Office, Dhaka

10.2.2 Approval of Environmental Impact Assessment (EIA) Report on Karnaphuli Water Supply Project (rewritten from copy of original letter from DOE to CWASA)

Government of the People's Republic of Bangladesh
Department of Environment
Head Office, E-16 Agargaon
Dhaka-1207

Memo No:DOE/Clearance/2225/2005/2416 Date:13/09/2007

Subject: Approval of Environmental Impact Assessment (EIA) Report on Karnaphulli Water Supply Project

Ref: 1) Your application on 14/03/2006

With reference to the above, the Department of Environment (DOE) hereby approves Environmental Impact Assessment Report on **Karnaphulli Water Supply Project**, Chittagong. This approval authorizes and regulates the following activities:

1. Project Proponent may undertake activities for land development and infrastructural development of the project subject to conditions laid out in the Site Clearance issued from the Department of Environment on 09 January 2006 as well as the following:

1.1 During site preparation, top soil shall be kept aside and be restored after completion of the said activities.

1.2 The open areas that are grasslands can be used for construction but with appropriate safeguards to maintain materials and dump sites from contaminating haor/river waters.

1.3 Soil erosion caused by removal of vegetation cover and excavated loose soil shall be checked through repopulation with local vegetation as soon as possible; loose soil shall be covered and stored away from the edge of the haor/river.

1.4 Proper construction practices shall be followed that minimize loss of habitats and fish breeding, feeding & nursery sites.

1.5 Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period.

1.6 In order to control noise pollution, vehicles & equipment shall be maintained regularly; working during sensitive hours and locating machinery close to sensitive receptors shall be avoided.

1.7 No solid waste can be burnt in the project area. An environment friendly solid waste management should be in place during whole the period of the project in the field.

1.8 Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.

1.9 All the required mitigation measures suggested in the IEE and EIA reports along with the emergency response plan are to be strictly implemented and kept operative/ functioning on a continuous basis.

1.10 To control dust vehicles and equipment to be used for this project shall be maintained properly, water trucks shall be used, stockpiles to be located away from sensitive receptors and vehicle speed limits shall be enforced.

1.11 Resettlement plan should be properly implemented and people should be adequately compensated, where necessary.

1.12 Construction material should be properly disposed off after the construction work is over.

1.13 The Environmental management Plan included in the IEE and EIA reports shall strictly be implemented and kept functioning on a continuous basis.

2. **Limit Condition for Discharges to Air and Water**: The Site Clearance Certificate must comply with schedule 2 and 10, rule 12 of the Environment Conservation Rules, 1997.
3. **Noise Limit**: The Site Clearance Certificate must comply with schedule 4, rule 5(2) of the Noise Pollution (Control) Rules, 2006.
4. **Monitoring and Recording conditions**:

M1.1 The results of any monitoring required to be conducted by this Clearance Certificate must be recorded.

M1.2 The following records must be kept in respect of any samples required to be collected for the purpose of

this Clearance certificate:

(a) The date(s) on which the sample was taken;
(b) The time(s) at which the sample was collected;
(c) The point at which the sample was taken; and
(d) The name of the person who collected the sample.

M2. Requirement to monitor concentration of pollutants discharged

M2.1 For each monitoring, the Clearance Certificate holder must monitor (by sampling and obtaining results by analysis) the following parameter; water flow, water quality, air quality (SPM), the surrounding areas for spread of invasive species, the changes in aquatic habitats before, during and after construction, fish catching during and after construction.

5. Reporting Conditions: Environmental Monitoring Reports shall be made available simultaneously to Head Quarters and respective Divisional offices of the Department of Environment on a quarterly basis during the whole period of the project.
6. Notification of Environmental Harm: The Clearance Certificate holder or its employees must notify the Department of Environment of incidents causing or threatening material harm to the environment as soon as practicable after the person becomes aware of the incident.
7. Project Proponent may open L/C (Letter of Credit) for importing machineries for the project which shall also include machineries relating to pollution devices;
8. Before finalizing of the design of Karnaphulli Water Treatment Plant following water quality data should be updated:
   Spatial variability of water quality along the rivers Karnaphulli and Halda. Variables to be chosen for water quality analysis should include: temperature, TSS, TDS, turbidity, conductivity, pH, DO, hardness, nutrients (NH_4-N, NO_3-N), Phosphorus), organic matter (COD, BOD), major ions (Sodium, Potassium, Calcium, Manganese, Chloride, Sulphate, other inorganic variables (Fluoride, Boron, Cyanide), trace elements, heavy metals, Arsenic, Organic contaminants (oil and petroleum products, pesticides), faecal coliform and total coliform.
   Hydrodynamic and water quality models should be used by constructing different scenarios for production and quantification of the potential impacts on water quality.
9. Based on up-to-date water quality data, model out-put as well as other scientific study WTP should be designed, installed and operated.
10. Project Proponent shall, after installation of the plant as well as other pollution control facilities and equipment apply for Environmental Clearance Certificate without which, proponent shall not start operation of the project.

(Sign) Masud Iqbal Md. Shameem
Deputy Director (Technical, Current Charge) and Member Secretary
Environmental Clearance Committee

Md. Maksumul Hakim Chaudhury
Chairman, Chittagong WASA, WASA Office Building, Dampara, Chittagong

Copy Forwarded to:

1. PS to Secretary, Ministry of Environment and Forests, Bangladesh Secretariat, Dhaka
2. Staff Officer, Director General, Department of Environment, Dhaka

10.2.3 Correspondence between CWASA and DOE Chittagong (Environmental Site Clearance)

(1) Letter from CWASA to DOE Chittagong
(2) Responding letter from DOE Chittagong

চট্টগ্রাম পানি সরবরাহ ও পয়:নিষ্কাশন কর্তৃপক্ষ
Chittagong Water Supply & Sewerage Authority
WASA Office Building, Dampara, Chittagong, Bangladesh
ফোন: ৮৮০ ৩১ ২৮৫১৮০৬ ফেক্স: ০৩১ ৬১০৪৬৫ ইমেইল: cwasa@globalctg.net

Memo no. CWSIP/PD/01/12/01 Date: 05.07.2012

পরিবেশ অধিদপ্তর, চট্টগ্রাম বিভাগ
চিঠি গৃহীত
নংঃ.....
তারিখঃ 05/07/2012
স্বাক্ষরঃ.....
গণপ্রজাতন্ত্রী বাংলাদেশ সরকার

Director
Department of Environment
Government of the People's Republic of Bangladesh
Chittagong Division, Chittagong.

Sub: **Environmental Site Clearance for Karnaphuli Water Supply Project of Chittagong WASA**

Ref: 1. DoE/Clearance/2225/2005/75 dt. 17.01.2005
2. DoE/Clearance/2225/2005/2416 dt. 13.09.2007

Dear Sir,

Thank you very much for issuance of Environmental Site Clearance and approval of Environmental Impact Assessment (EIA) report in time on Karnaphuli Water Supply Project as referenced above.

It is my pleasure to inform you that the work of Karnaphuli Water Supply Project, Phase-1 financed by JICA and GoB are progressing fast. In the mean time, JICA started processing to finance Phase-2 project. A preparatory survey team appointed by JICA for Phase-2 is now working to formulate the project. It is to be mentioned that Karnaphuli Water Supply Project Phase-1 and Phase-2 both are included in the approved Environmental Impact Assessment (EIA) report.

It is to be mentioned that inadvertently Environmental Site Clearance is not renewed in due course as per condition laid in it.

Now, we would like to regularize the Environmental Site Clearance along with other steps pending related to environmental issues.

Please let us know how we can proceed to regularize the renewal of Environmental Site Clearance along with other pending issues related to environment.

Photocopy of the Environmental Site Clearance and approval of Environmental Impact Assessment (EIA) report on Karnaphuli Water Supply Project are enclosed herewith for your ready reference.

Your kind coopcration in this regard will be highly appreciated.

Thanking you.

Yours truly,

(Jane Alam Bhuiyan)
Project Director (CWSIP)
Chittagong WASA

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
পরিবেশ অধিদপ্তর, চট্টগ্রাম বিভাগীয় কার্যালয়
পরিবেশ ভবন
[illegible], চট্টগ্রাম-৪১০০।
www.doe-bd.org

স্মারক নম্বর: [illegible]
তারিখ: ২৬ [illegible] বঙ্গাব্দ
[illegible]/২০১২ খ্রিঃ

বিষয় : পরিবেশগত ছাড়পত্র নবায়নের বিষয়ে প্রয়োজনীয় কাগজপত্র দাখিল।

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চট্টগ্রাম

To
Chairman
CNSP
Chittagong WASA.

Sub: ~~Necessary~~ Submission of documents for Renewal of Environmental site clearance

According to Environmental conservation Act. 1995 and 1997 you are hereby requested to Submit the following documents.

1. Renual fee 5,75,000 ৳

After receiving the above ~~the amount for renewal~~ necessary action will be taken for Environmental clearance.

Deputy Director.
DOE/Chittagong

[illegible]

10.2.4 Renewal of Environmental Site Clearance Certificate for Karnaphuli Water Supply Project of Chittagong WASA

Government of the People's Republic of Bangladesh
Department of Environment
Chittagong Division
Zakir Hossain Road
Khulshi, Chittagong
www.doe-bd.org

Memo No: DoE/CD/Clearance-18343/2012/730 Date: 31/07/2012.

Subject : Renewal of Environmental Site Clearance Certificate for karnaphuli Water Supply Project of Chittagong WASA.

Reference: Application of karnaphuli Water Supply Project of Chittagong WASA. Date: 05/07/2012,

Reference to your above mentioned application on Environmental Site Clearance Certificate issued against the karnaphuli Water Supply Project, Chittagong WASA. hereby is renewed subject to fulfilling the following terms and conditions:

1. Renewal of the site clearance certificate will be valid for a period of 1(one) year with effect from 17th January 2012 to 16th January 2013.
2. No activity of cutting/razing/dressing of hill, helloes are favored with this renewal.
3. Must submit Environmental monitoring reports as mentioned in the article 5 of the approved EIA.
4. Application along with renewal fees must be submitted to this office prior to 30 days of the expiry of the certificate.

Beside this you will also abide by the terms and conditions mentioned in the original Site Clearance Certificate and approved EIA. Violation of any of the above mentioned terms and conditions shall render this renewal void.

(Md. Zafar Alam)
Director
Phone: 659379

Project Director (CWSIP)
karnaphuli Water Supply Project of
Chittagong WASA. Chittagong.

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10.2.5 Application of Environmental Site Clearance for Phase 2 Project

চট্টগ্রাম পানি সরবরাহ ও পয়:নিষ্কাশন কর্তৃপক্ষ
Chittagong Water Supply & Sewerage Authority
WASA Office Building, Dampara, Chittagong, Bangladesh
ফোন: ৮৮০ ৩১ ২৮৫১৮০৬ ফেক্স: ০৩১ ৬১০৪৬৫ ইমেইল: cwasa@globalctg.net

Memo no. CWSIP/PD/01/12/12 Date: 20.09.2012

Director
Department of Environment
Government of the People's Republic of Bangladesh
Chittagong Division, Chittagong.
Phone: 2566696

Sub: **Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II of Ctg. WASA**

Ref: 1. DoE/Clearance/2225/2005/75 dt. 17.01.2005
2. পঅ/চবি/ছাড়পত্র-১৮৪৩/২০১২/৬৭৫ তাং ১২.০৭.২০১২
3. DoE/CD/Clearance-18343/2012/730 dt. 31.07.2012

Dear Sir,

Thank you for giving us time today in your office to discuss the issue of Environmental Site Clearance for Karnaphuli Water Supply Project- Phase II of Chittagong WASA and also for issuing the renewal of Environmental Site Clearance as per above ref. 3. We sincerely appreciate your support to this important water supply projects of Karnaphuli WSP-Phase I & II.

It is my pleasure to inform you that the work of Karnaphuli Water Supply Project, Phase-I financed by JICA and GoB are progressing fast. In the mean time, JICA started processing to finance Phase-2 project. A preparatory survey team appointed by JICA for Phase-II is now working to formulate the project and a high power fact finding mission is coming on September 24, 2012. It is to be mentioned that Karnaphuli Water Supply Project Phase-I and Phase-II both are mentioned in the approved Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA) report as we have shown to you and the copy of which are enclosed herewith.

As per discussion we are preparing to submit necessary prescribed forms collected from your office to get Environmental Site Clearance for Karnaphuli WSP- Phase II including amount of fee for the clearance. But in the meantime it will be highly appreciated if you can provide us a response stating that this issue is in right track and that you have no objection to go ahead with the project. This will help us to convince the JICA fact finding mission to proceed further for the project funding requirements.

Your kind cooperation in this regard will be highly appreciated.

Thanking you.

Yours truly,

(Engr. A K M Fazlullah)
Managing Director
Chittagong WASA

10.2.6 Environmental Site Certification for Phase 2 Project

Government of the People's Republic of Bangladesh
Department of Environment
Chittagong Division
Zakir Hossain Road
Khulshi, Chittagong
www.doe-bd.org

Memo no. DoE/CD/Clearance-18343/12/872 Date: 20.09.2012

Sub: **Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II of Ctg. WASA**

Ref: 1. CWSIP/PD/01/12/12 dt. 20.09.2012
2. DoE/CD/Clearance-18343/2012/730 dt. 31.07.2012

Reference to above-1 we have reviewed the issue and found that Karnaphuli Water Supply Project (KWSP) has got the Site Clearance Certificate (SCC) from Department of Environment on 17.01.2006 and that has been renewed and remain valid till 16.January 2013. During issuance of SCC the committee reviewed the Initial Environment Examination (IEE) and Environmental Impact Assessment (EIA) report of the said project. We have examined the IEE and EIA again and found that both documents were prepared covering the Phase-1 and Phase-2 of KWSP. Since the location of the both phases are same and situated side by side and covered by the IEE and EIA an extension of the site clearance certificate is required under Environment Conservation Act 1995 and Environment Conservation Rules 1997.

To expedite the SCC extension issue you are requested to furnish information in the prescribed formalong with requisite fees.

After getting the application we will be very prompt to issue the SCC.

Best regards.

20/9/2012

(Md. Zafar Alam)
Director
Phne: 659379

Managing Director
Chittagong WASA
WASA office Building
Dampara, Chittagong

10.2.7 Correspondence between CWASA and DOE Chittagong (Extension of Environmental Site Clearance)

(1) Letter from CWASA to DOE Chittagong

চট্টগ্রাম পানি সরবরাহ ও পয়ঃনিষ্কাশন কর্তৃপক্ষ
Chittagong Water Supply & Sewerage Authority
WASA Office Building, Dampara, Chittagong, Bangladesh
ফোন: ৮৮০ ৩১ ২৮৫১৮০৬ ফেক্স: ০৩১ ৬১০৪৬৫ ইমেইল: cwasa@globalctg.net

Memo no. CWSIP/PD/01/12/13 Date: 26.09.2012

Director
Department of Environment
Government of the People's Republic of Bangladesh
Chittagong Division, Chittagong.
Phone: 659379

Sub: **Extension of Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II**

Ref: 1. DoE/CD/Clearance-18343/2012/872 dt. 20.09.2012
2. DoE/Clearance/2225/2005/75 dt. 17.01.2006
3. DoE/Clearance/2225/2005/2416 dt. 13.09.2007

Dear Sir,

Thank you for your letter under reference-1, in which you clearly pointed out the status of the Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II. Currently visiting JICA fact find mission also appreciated your prompt action in response to our letter on the subject matter. In the light of your letter we are submitting herewith Form-3 duly filled in with necessary enclosures including fees (in the form of treasury chalan) for extension of the Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II.

As scheduled, the JICA fact finding mission is with us since 24th instant to formulate the Karnaphuli Water Supply Project-Phase II. They will remain with us until 30th instant and expecting to get extension of Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II.

It will be highly appreciated if you can issue the extension of Environmental Site Clearance for Karnaphuli Water Supply Project-Phase II during their presence in Chittagong WASA.

Thanking you.

Yours truly,

(Engr. A K M Fazlullah)
Managing Director

Enclo : 1. Treasury Chalan 4117/01 dt. 20.09.2012 Tk. 1,00,000/-
2. Approved EIA and IEE reports- 2 sets
3. Letter of issuance of approval for IEE and EIA report as mentioned in ref. 2 & 3- 2 nos.

(2) Letter from DOE Chittagong to CWASA

Government of the People's Republic of Bangladesh
Department of Environment ,Chittagong Division
Zakir Hossain Road, Khulshi, Chittagong
www.doe-bd.org

Memo No: DoE/CD/Clearance-18343/2012/ 4265 Date: 13 /11/2012.

Subject : Renewal of Site Clearance Certificate for Karnaphuli Water Supply Project (Phase I &II) of Chittagong WASA till January 2014.
Reference: CWSIP/PD/01/12/13, Date: 26/09/2012,

In Reference to your letter for the renewal of Site Clearance Certificate(SCC) issued against the Karnaphuli Water Supply Project(KWSP), Chittagong WASA, we have examined the Environment Impact Assessment (EIA) of the project submitted earlier. During the inception of the project EIA was carried out for the both phases of KWSP and the national Environmental Clearance Committee vide its memo no. DoE/Clearance/2225/2005/2416, dated: 13.09.2007 approved the said EIA. Considering the EIA the renewal of site clearance Site Clearance Certificate is also applicable for the second phase. The existing Site Clearance Certificate will expire on 16.01.2013 and as per EIA the clearance is meant for the both phase of the project. Hence for the convenience of the Project activities of the second phase the Site Clearance Certificate of KWSP, phase I&II is hereby renewed subject to fulfilling the following terms and conditions:

1. All the terms and conditions of the original Site Clearance Certificate issued on 17/01/2006, Memo No. DoE/Clearance/2225/2005/75 will remain unchanged and will be applicable for both phases of the KWSP.
2. Renewal of the site clearance certificate will be valid for a period of 1(one) year with effect from 17th January 2013 to 16th January 2014.
3. No activity of cutting/razing/dressing of hill or hilly land is endorsed without permission/ clearance of the concerned authority of the government. If any cutting/razing/dressing of hill is required a fresh permission/clearance will be required from DoE as per section 6(B) of Bangladesh Environment Conservation Act, 1995 (Amendment 2010).
4. Must submit Environmental monitoring reports as mentioned in the article 5 of the approved EIA.
5. Application along with renewal fees must be submitted to this office prior to 30 days of the expiry of the certificate.

Beside this all the terms and conditions mentioned in the original Site Clearance Certificate and approved EIA will be applicable mutatis mutandis. Violation of any of the above mentioned terms and conditions shall render this renewal void.

Project Director (CWSIP)
karnaphuli Water Supply Project
Chittagong WASA (Phase I&II).
Chittagong.

(Md. Zafar Alam)
Director
Phone: 659379

Memo No. DoE/CD/Clearance-18343/2012/ 4265 Date: 13 /11/2012.
Copy Forwarded to:
1. Director General, Department of Environment, Dhaka.
2. Office Copy.

(Md. Zafar Alam)
Director

10.3 Specific Environmental and Social Aspects in the Project site

10.3.1 Result and analysis of Socio-Economic Survey

(1) Report of Socio-Economic Survey

1. Background of the study

Chittagong is a commercial and industrial hub and a port city in southeastern Bangladesh. Built on the bank of the Karnaphuli River the city is home to Bangladesh's busiest sea port and has a population of 2.7 million in the administrative area of about 200 square kilometer. Today, Chittagong is one of the fastest growing cities in the world, in terms of population and economy. Such expansion is pressing pressure on utility services such as water, electricity, gas. Water supply service is thoroughly taken care of by Chittagong Water Supply and Sewerage Authority (CWASA), but its capacity is limited to only 48% (168,000 m^3/day) of water demand in the existing service area and an immediate action to cater for this water gap is deemed urgent task of CWASA.

CWASA has availed of the Japan's ODA Loan to expand supply capacity of construction of Karnaphuli Water Treatment Plan. In this regard the Preparatory Survey on Chittagong Water Supply Improvement Project (herein after referred to as PSCWSIP) is intended to augment production capacity of Karnaphuli Water Treatment Plant and to rehabilitate/expand the distribution network in Karnaphuli Service Area proposed in the PSCWSISP. Social survey including water service condition and willingness to pay for water tariff etc. is needed for judging the actual present condition of water supply, decision of service area of PSCWSIP, Economic and Financial analysis etc.

PSCWSIP has therefore decided engage services of local consultants to conduct the Social Survey at the expected Karnaphuli Service Block.

So as a response of it a social survey has been conducted in the defined area and outcome and findings of the survey have been demonstrated in the existing report.

2. Study Area

The proposed Area of the Social Survey is shown in following figure.

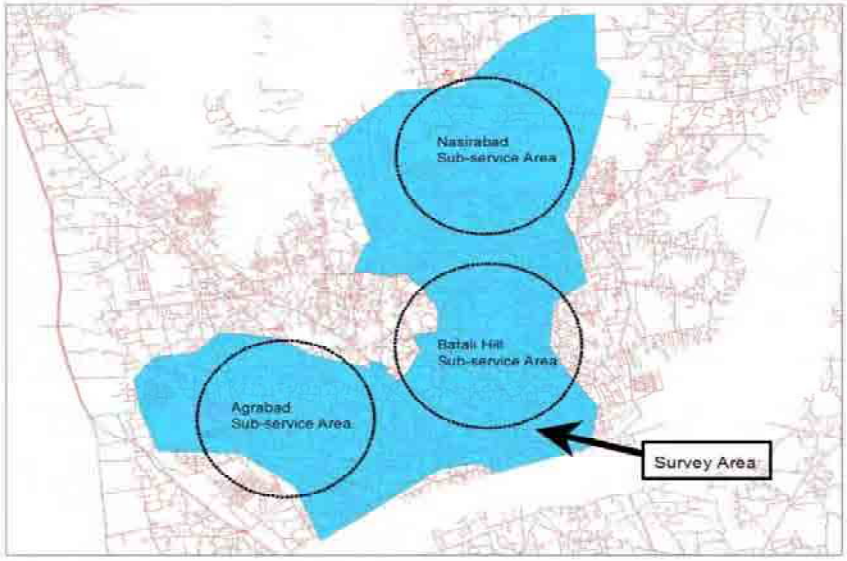


Figure 01: Study Area

3. Scope of Work

Numbers of Social Survey are described below

Land Use	Structure Type/Use Category	No. of Sample
Residential	Pucca	385
	Semi Pucca	312
	Kutcha/Slum	242
Industrial	Factory	9
Commercial	Office	23
	Hotel	11
	Restaurant	7
	Shop	11
Educational	High School	4
	Elementary School	9
	College / University	10
Community Service	Community	23
Total		1046

Table 01: Sample distribution

4. Methodology

Figure 02: Methodology

Step 01:

In this step some preliminary work regarding social survey has done by PSCWSIP. Demarcations of study area which are illustrated in the study area are determined by the clients along with questionnaire which are given in ***Annex-01***.

Step 02:

This step is carried on by local consultants. In the following the different stages of step 02 are discussed.

Formulation of survey team: Survey teams have been formed including one female supervisor and 8 surveyors among them one was female. They were well trained and having previous experience of questionnaire survey

Data Collection: Data collection method was direct interview to the household head or any members of the household. Questionnaires were filled by the surveyors according to the response of interviewee. Some photos taken during data collection process are given in ***Annex-02.***

Data Encoding: Data encoding has done in using 'Microsoft Access'. A survey form has been created in access where data from a questionnaire are being documented. A picture of survey form in attached in ***Annex-03.*** With entry of each questionnaire in the survey form they get arranged in a table format in 'Microsoft Access'. After entry of all the data we get a total table where all the information's are arranged. A final table including all the data is given in ***Annex-04.***

Data Analysis: A final table then has analyzed using 'SPSS' a statistical software. Several tables has been created describing different aspects regarding income structure, water supply quality, availability of water supply, consumers' willingness to pay, drainage facility etc.

Preparing Report: A report has been prepared describing all the analysis using different chart, table using table created from 'SPSS' and detailing all the process regarding social survey activity.

5. Survey Findings:

According to the data collected from the survey there are several findings which are discussed under the following 7 categories.

1. Structure use
2. Economic Condition
3. Water supply condition
4. Consumer's expectation and willingness to pay
5. Sanitation and waste water disposal
6. Drainage Facility
7. Water Related Hygiene Conditions

5.1. Structure Use

Table 02 show the number of different category of structure use and their respective percentages which are surveyed.

From the table it can be easily seen that residential use is the dominant and it is almost 89.8% of the total surveyed household. Then community as same as office use is 2.2%, hotel and shop is 1.1% each, college is 1%, factory and elementary school are similar 0.9%. High school is lowest 0.4%.

Structure Use		
Type	**Number**	**Percent**
Residential	939	89.8
Hotel	11	1.1
High School	4	0.4
Shop	11	1.1
Factory	9	0.9
Community	23	2.2
Office	23	2.2
Restaurant	7	0.7
Elementary School	9	0.9
College / University	10	1.0
Total	**1046**	**100**

Table 02: Number of different structure use

Among the residential use there are there types of structure. In the following pie chart structure types are shown.

In the pie chart it shows that about 41% houses are pucca structure where semi pucca and kutcha houses are 33% and 26% respectively.

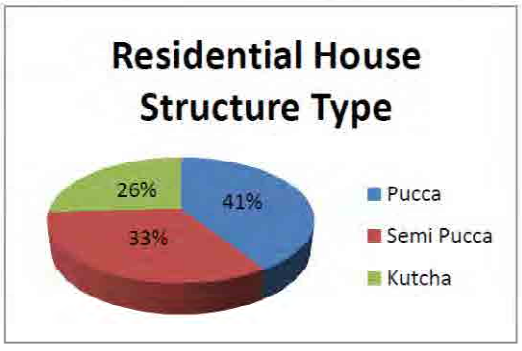


Chart 01: Residential House Built Type

5.2. Economic Condition

Source of income are mainly independent Business and Private Job. Almost 90% of the people in the study area are doing either independent business or private job. Very few amounts of people only 5% are engaged in Government job. Being a port city and for other infrastructure facility Chittagong city emerged as a commercial capital of the country. And this also affected the professional behavior of the inhabitants. Lots of factory and privatized industry, company play a vital for the economic stability of this reason.

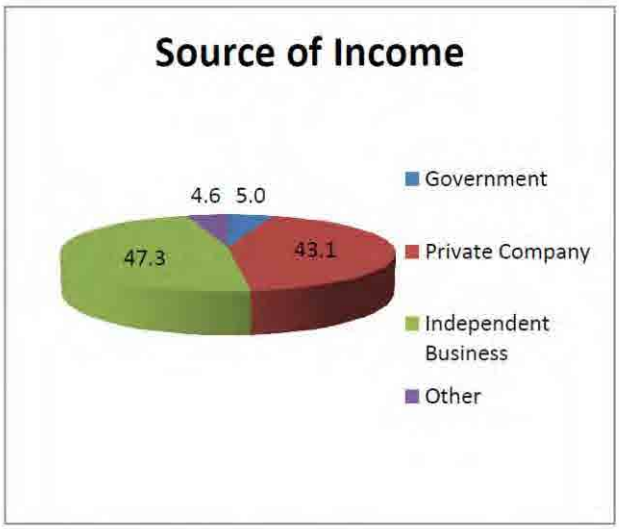


Chart 02: Source of Income

In the following monthly income chart is given to show the income distribution of the study area.

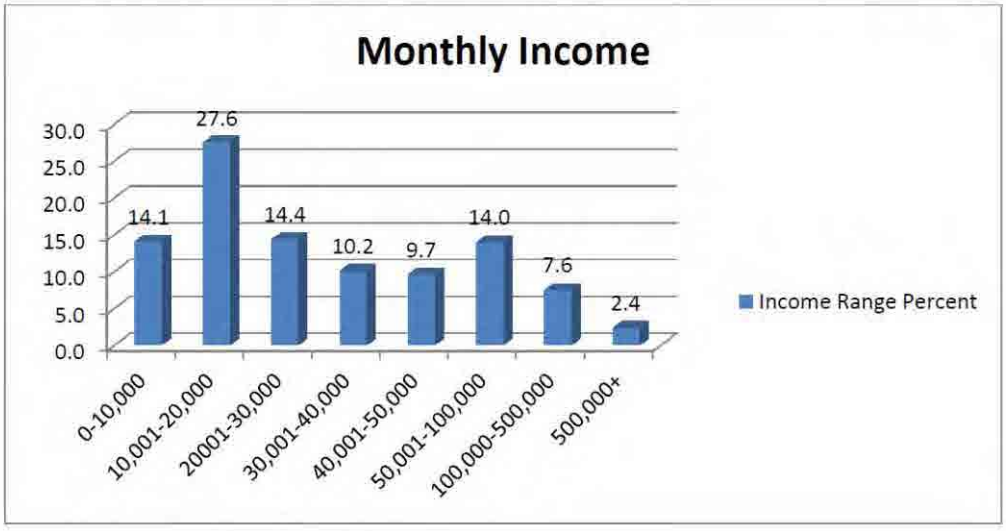


Chart 03: Monthly Income distribution

Almost 27.6% of the people's monthly income is between 10000-2000. Where 14% people's monthly income are in the 40,000-50,000 range. Low income people are 14.1%

So we can say that on the basis of monthly income economic condition is quite good compared to others parts of the country.

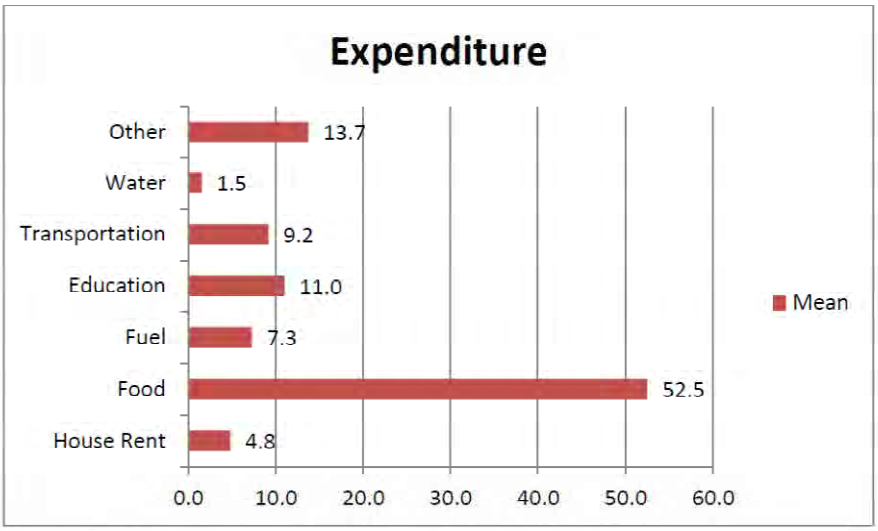


Chart 04: Monthly expenditure pattern in different sector

From the above bar chart it is seen that the spending in food is very high (52.5%) where expense in education and transportation are 11.0% and 9.2% respectively.

Expense in water is only 1.5% which is not very significant. Cheap tariff of CWASA and existence of alternative water sources such as tube well, pond is possibly the main reason behind it.

5.3. Water Supply Condition

Water supply conditions are illustrated in the table.

According to it almost 74.6% household has CWASA connections while others having alternative water sources such as private shallow tube well and deep tube well. Most of the CWASA connections are very recent.

In the following pie chart water meter installation period are revealed.

Source of Water Supply					
Source		**Frequency**		**Percent**	
CWASA	**House Connection**	**789**	**755**	**74.6**	**96.9**
	Hydrant Connection		**24**		**3.1**
Other	**Private STW**	**265**	**218**	**25.4**	**82.3**
	Other (DTW)		**47**		**17.7**
Total		**1045**		**100**	

Table 03: Number of different structure use

From the pie chart we can assume that substantial amount of meter (40.9%) installed after 2000 on the other hand 27.8% and 23% meter installed in 1991-2000 and 1981-1990 period correspondingly. Only 8.3% meter installed in before 1980. So we can see that number of meter installation in increasing by time to time which indicates the growing dependency to CWASA water supply.

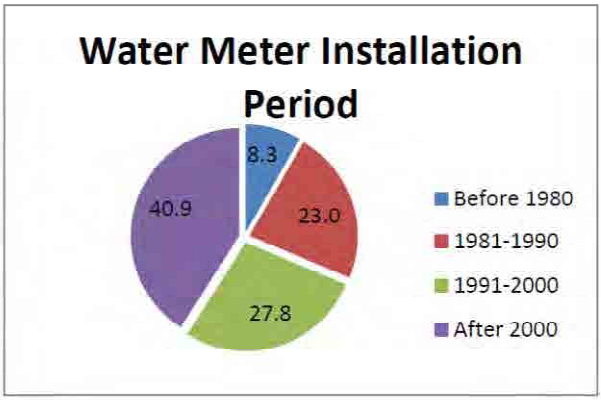


Chart 05: Water Meter Installation Period

Water supply per week and water supply per day illustrates the supply availability of CWASA. Almost 30.7% household get water every days of the week where 18.8%, 17.4% and 18.6% household get once, twice and thrice in a week respectively.

In the following per day water supply chart we find that almost 30% house hold get 2 hour supply in a day where 22% and 15.8% households get 1 hour and 3 hour supply respectively. There are 47% household which get more than 12 hour supply in a day.

Water Supply per Week	
Day	***Percent***
0	*0.4*
1	*18.8*
2	*17.4*
3	*18.6*
4	*7.6*
5	*5.8*
6	*0.6*
7	*30.7*
Total	***100***

Table 04: Water supply day per week

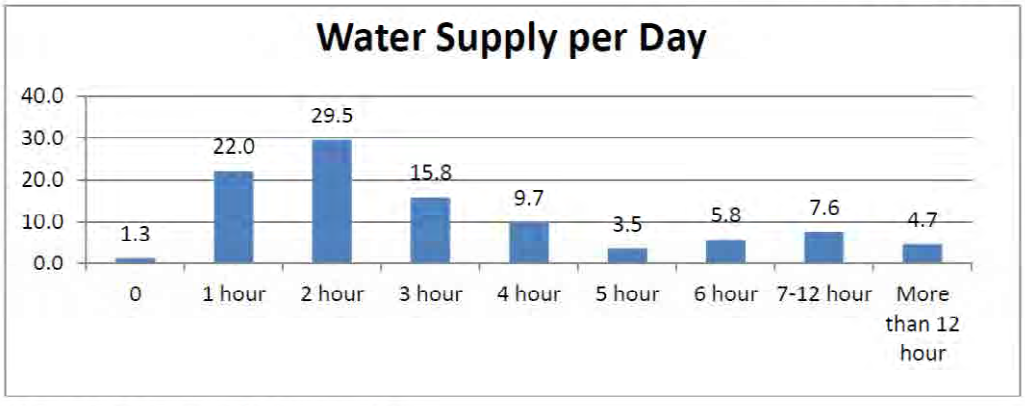


Chart 06: Water Supply hour per day

CWASA water supply condition varies from place to place. But overall in planned residential area water supply condition seems to be good.

5.4. Consumer's expectation and willingness to pay

The following column chart is showing the expectation of the people in the study area regarding CWASA water supply.

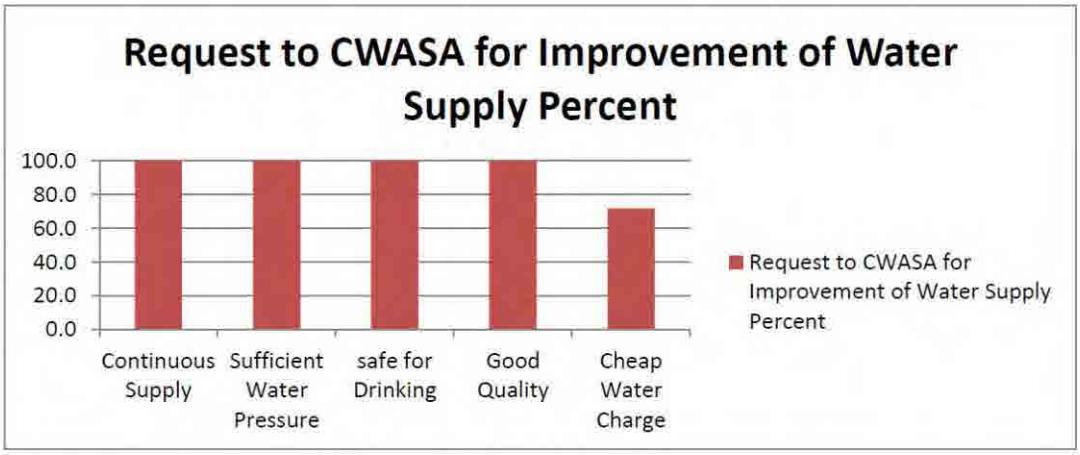


Chart 07: Consumer's different request to CWASA regarding supply quality and rate

Almost 100% respondents want continuous, safe and good quality water supply along with sufficient water pressure. 65% of the people want cheap water price.

To improve the water supply quality it will require the improvement of service in CWASA thus extra cost in water production and maintenance resulting increase in water charge.

In the study we find that almost 54.7% respondents willing to pay up to 1.5 times of present where 20.5% up to 2.0 times. 24.65% people want to stay in present rate. This is the indication that there is a scope for CWASA to increase its revenue if it can improve its water supply condition.

Willingness to Pay after Improvement		
Willingness	***Frequency***	***Percent***
Only Present Charge	*186*	*24.6*
Up to 1.5 times	*413*	*54.7*
Up to 2.0 times	*155*	*20.5*
Up to 2.5 times	*1*	*0.1*
Total	***755***	***100.0***

Table 05: Willingness to pay after improvement

In the previous part we illustrated the economic condition of the studied area which is quite good regarding other parts of the country. And we also found that expenditure in water is not very significant. So it can be implied that people can spend more than present rate for better quality water supply which become evident in the previous table.

5.5. Sanitation and waste water disposal

Almost 100% household has sanitary latrine. 37% households have pour flash latrine while 30.9% have latrine flushed by tape water and 30.9% have pit latrine.

Type of Toilet		
Type	**Frequency**	**Percent**
Flushing by tape water	336	32.1
Pour flash	387	37.0
Pit latrine	323	30.9
Total	**1046**	**100**

Table 06: Type of Toilet

Most of the household (94.2%) use septic tank for waste water disposal from toilet while 4.5% household disposed waste water from toilet directly to drain. In the following the disposal place of waste water from toilet are shown in bar chart.

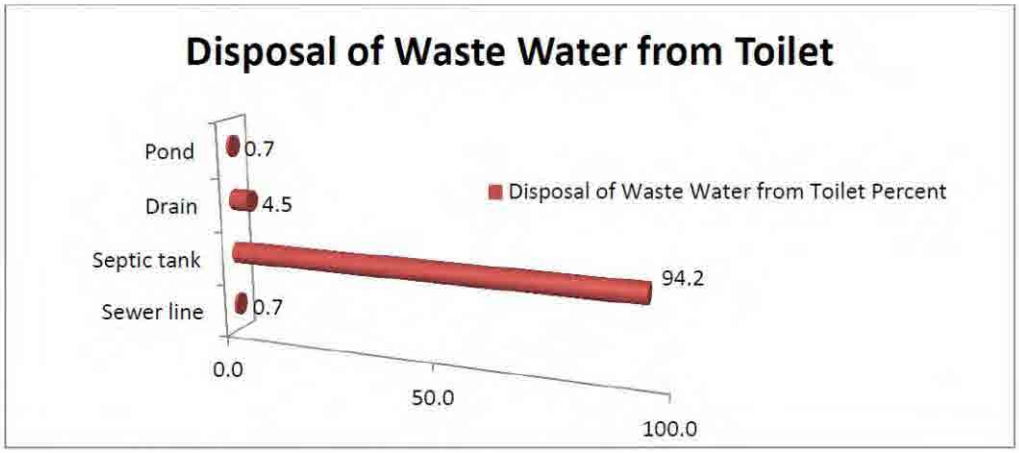


Chart 08: Disposal of water from toilet

On the other hand 97.4% household use drains for the disposal of waste water from kitchen.

So we find that for waste water disposal drain is playing a vital role though CWASA is not the concerned authority for management of the drainage facility.

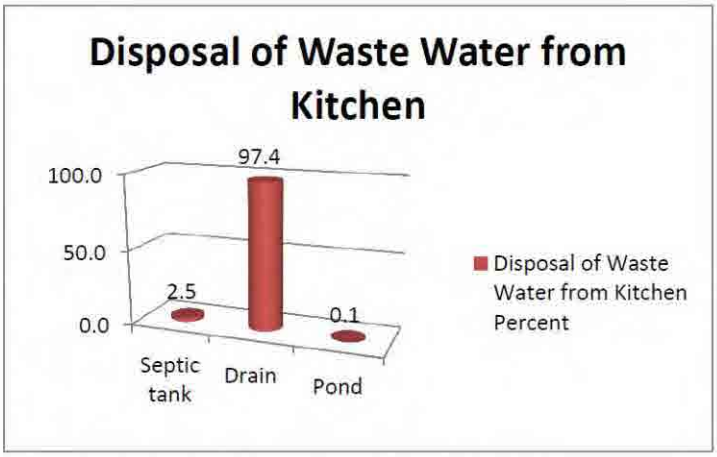


Chart 09: Disposal of waste water from kitchen

5.7. Water Related Hygiene Condition

Water related hygiene condition in the study area is very good. Approximately 95.45% of the household's experiencing no sickness due to water quality.

Because of improve hygiene sanitation system and medical facility. Using of ground water in the form of private STW (shallow tube well), DTW (deep tube well) make it happen.

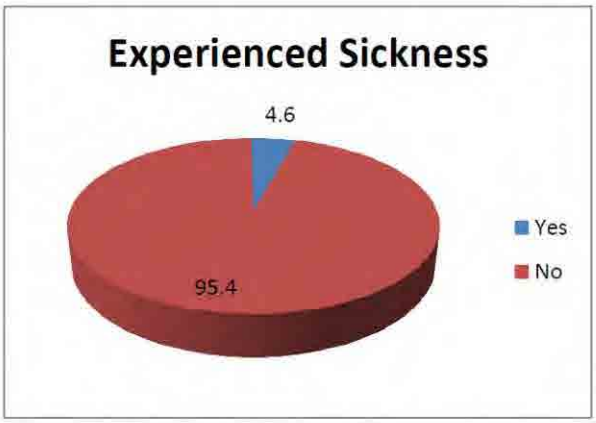


Chart 09: Experienced Sickness due to water

But we should keep in mind that the study area is the core Chittagong city area, where economic condition of the people is good though all of them are not getting good quality water supply but they are using alternative sources. But situation is deteriorating with increasing number of population there is now high demand of water where CWASA is failed to meet this demand. Dependency on ground water is increasing environmental vulnerability. Several studies show that ground water level depletion is very alarming. So it is the right time to take immediate otherwise situation will get worse day by day.

6. Conclusion

From the social survey we can conclude that despite the progressive socio-economic condition and growing demand of water, CWASA is not yet updated as required which hindering the expected growth of the area though people are willing to pay if they get better service. On the other hand drainage system being a vital for waste water disposal is not yet treated in systematic approach or managed by any authority causing overflow and water stagnation in some parts of the city after heavy rain. Situation may get even worse after 10 years if current state continuous.

In the CWASA jurisdiction area almost 25.4% of areas are out of CWASA water supply where as an alternative people use STW (Shallow Tube Well) which are prone to arsenic contamination and in some case DTW (Deep Tube Well). Dependency on ground water is environmentally hazardous causing depletion in water level. Concentration should be given on surface water treatment CWASA should also be increased because city area is expanding and several housing projects are ongoing.

In such a case immediate steps should be taken to improve the water supply condition which will not only contribute in the economy of the region but can make CWASA a profitable organization.

(Annex of Socio-Economic Survey)

Preparatory Survey on Chittagong Water Supply Improvement Project

Questionnaire form

To the People of Chittagong

This Social Survey is intended to obtain information on awareness, willingness and affordability, as well as actual conditions of Chittagong people for improvement of existing water supply conditions in the City of Chittagong being undertaken by the joint effort of the Japan International Cooperation Agency (JICA) and Chittagong Water Supply and Sewerage Authority (CWASA)

Any answer to this questionnaire survey will not used other than the above-mentioned purpose

Thank you,
JICA Study Team and CWASA

1. Location of Residence

   Name of Street, Ward and Thana

   Street ,_____Ward No._____, Thana No,_____

2. Housing

   2.1 Housing Type; ☐ Pucca, ☐ Semi-Pucca, ☐ Kutcha,
   ☐ Hotel, ☐ School, ☐ Shop, ☐ factory, ☐ Community(Mosque etc)

   2.2 Construction Year

   ☐ Built before 1980, ☐ Built between 1981 to 1990. ☐ Built between 1991 to 2000
   ☐ Built after 2001

3. Family

   3.1 General/Income

   (1) Number of inhabitant; _____persons
   (2) Number of family; _____families
   (3) Number of income earners; _____persons
   (4) Sum of income; _____TK/Year, _____TK/month
   (5) Main income source;
   ☐ Government, ☐ Private Company, ☐ Independent business,
   ☐ Other; Specify _____

   3.2 Expenditure

   Total Expenditure; _____TK/month (100%)

1)	Housing	_____TK (%)	5)	Transportation/Communication	_____TK (%)
2)	Food	_____TK (%)	6)	Water	_____TK (%)
3)	Fuel and Electricity	_____TK (%)	7)	Sewerage	_____TK (%)
4)	Education	_____TK (%)	8)	Others	_____TK (%)

4. Water Supply Condition

4.1 Source of Drinking Water; Are you supplied the tapped water from CWASA?

☐ Yes,

☐ a) By house connection; How many people use the house connection? _____ persons

☐ b) By hydrant; How many people use the hydrant? _____ pesons

☐ No, if No.

1) Where is the source for your drinking water?

☐ Private shallow well, ☐ Other; Specify_____

2) Where is the source for your washing clothes?

☐ Private shallow well, ☐ Stream water/pond water, ☐ Other; Specify_____

4.2 Metering (in case you have water supply service by CWASA)

(1) Do you have a water meter at your resident? ☐ Yes, ☐ No

If yes, is it functioning? ☐ Good, ☐ Not Correct

(2) When was it installed? ☐ Before 1980, ☐ 1981-1990, ☐ 1991- 2000, ☐ 2001-

4.3 Awareness/Willingness/Affordability (in case you have water supply service by CWASA)

(1) Are you interrupted in water supply? ☐ Yes, ☐ No.

If Yes, how many hours a day can you get the tap water?

_____ Hours a day at; ☐ day-time or ☐ evening/night time

(2) Do you have request to CWASA for the improvement/provision of Water Supply Conditions?

(more than one answer is available)

☐ Continuous supply (no interruption when you want)

☐ Sufficient water pressure

☐ Safe for drinking

☐ Good quality for water supply

(Have you experienced iron content or offensive smell/taste? ☐ Yes, ☐ No)

☐ Cheap water charge

☐ Other; Specify _____

(3) Upon improvement/provision of Water Supply conditions, are you willing to pay water charge which may be required for CWASA's investment program, as you consume water based on the water meter reading?

☐ No, present water charge is maximum to pay. How much is it now? _____TK

☐ Up to 1.5 times of present (up to _____TK/month)

☐ Up to 2.0 times of present (up to _____TK/month)

☐ Up to 2.5 times of present (up to _____TK/month)

☐ Up to3.0 times of present (up to _____TK/month)

☐ More than 3.0 times of present (more than _____TK/month)

5. Sanitary Condition

5.1 Toilet Facility; Type of toilet

☐ Flushing by tap water, ☐ Pour flush, ☐ Pit latrine, ☐ No toilet

5.2 Disposal

(1) Disposal of wastewater from toilet

☐ to Sewer line, ☐ to Septic tank, ☐ to Drainage, ☐ to road/pond

(2) Disposal of wastewater from kitchen and bath room

☐ to Sewer line, ☐ to Septic tank, ☐ to Drainage, ☐ to road/pond

(3) Have you experienced overflowing or flooding from sewer pipeline or drainage facility nearby your house?

☐ Yes, ☐ No

If yes, how often and how long does it happen?

_____Time/s a year, and _____days for every flooding

6. Water Related Hygiene Conditions

(1) Have your family member experienced sickness (e.g. diarrhea, dysentery, skin disease) by the usage of tap water? ☐ Yes, ☐ No

(2) Do you know the occurrence of health hazard being caused by unsanitary water source (e.g. shallow well nearby septic tank) or by polluted tap water? ☐ Yes, ☐ No

(2) Analysis of Willingness to pay of Household

Table (1): Situation of Household and Connection to Water Supply Services

Type of House	N. of Respodent Household		Average of N. of Families in a House	Average of N. of Family Members	Average of Monthly Income (Tk)	Monthly Income The Lowest (Tk)	Monthy Income The Highest (Tk)	N. of Household Connected to Water Supply by CWASA	% of Connected Household	N. of Household regarding Water Meter Possession	% of Water Meter Possession in Connected Household	N. of Household that Water Meter is working accurately	% of Accurate Water Mater Working
Kutcha	242	26%	1.00	5.90	14,716	5,000	100,000	57	24%	36	63%	35	97%
Pucca	385	41%	1.02	5.98	63,182	10,000	550,000	376	98%	373	99%	371	99%
Semi-Pucca	312	33%	1.03	5.51	25,186	5,000	100,000	263	84%	258	98%	255	99%
Total	939	100%	1.01	5.80	38,051			696	74%	667	96%	661	99%

Table (2): Willingness to pay

Type of House	Whether Water Tarriff can be paid higher or not							Amount of Willigness to Pay				% of Average of Willingness to pay in Average of Monthly Income
	N. of Respndent	Only Present Charge	More than Present Charge	% of "More than Present Charge"	Detail of "More than Present Charge"			N. of Respondent	Average (Tk)	The Lowest (Tk)	The Highest (Tk)	
					Up to 1.5 times	Up to 2 times	Up to 2.5 times					
Kutcha	37	21	16	43%	16	0	0	35	198	86	867	1.35%
Pucca	376	66	310	82%	218	91	1	376	442	72	4,000	0.70%
Semi-Pucca	259	73	186	72%	135	51	0	259	246	65	2,000	0.98%
Total	672	160	512	76%	369	142	1	670	353			0.93%

Table (3): Duration of Water Supply

Type of House	N. of Respodent	Average of Supply Hours	Range of Water Supply Hours				
			No Supply (0 hour)	1-3hours	4 hours	5-23hours	24hours
Kutcha	37	4.27	3	21	7	4	2
Pucca	370	3.78	4	255	31	67	13
Semi-Pucca	213	3.86	1	151	23	29	9
Total	620	3.84	8	427	61	100	24

10.6.1 Bangladesh Environmental Checklist of Karnaphuli Water Supply Project Phase 2

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
Ⅰ Pre-Construction (Planning) Stage						
1. Secure land for Intake, Water Treatment Plant (WTP) and Distribution Reservoir; Right of way for transmission and distribution pipelines.	Land acquisition and resettlement	×				Any involuntary resettlement is not expected because of following reasons: a) All the necessary land and space for the project related facilities have been secured by land acquisition and relocation of people during Phase 1, b) new ly constructed Halishahar Elevated Tank is within property of CWASA, c) The right of way for pipeline construction will be ensured with concerned authorities (Roads and Highways Department (RHD), Ministry of Communication).
II Construction Stage						
II-1 Social Environment						
1. Temporary occupancy of space for construction related facilities (office, worker's camp, material storage, waste disposal)	may cause nuisance to the community and people.		x			Plan to avoid or minimize nuisance to residents and local communities and disturbance of road transport.
2. Construction works, especially laying pipelines along existing roads and Halda river bridge	Traffic congestion, disturbance of navigation and nuisance to business activities and living conditions.			x		1) In case of pipe laying work along roads and Halda river bridge, permission from concerned authorities should be obtained before start of construction works (and in the case of construction along Kaptai Road in the planning stage), by submission of drawings of pipe laying works in the roads, schedules, safety traffic control plan, etc. 2) To avoid or minimize traffic congestion and navigation disturbance and nuisance to local people and communities, consideration should be given to pipe laying in one lane of a two way road (to allow vehicular access to be maintained), as well as providing construction signs and post with color taping, temporary fences and using watchmen.3) In addi-

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
						tion, at night time, the Contractor shall provide electric lighting/signal equipment indicating the location of the construction site to ensure safe traffic control and management.
3. Construction work as a whole	health conditions of residents and workers			x		Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period. Measures to minimize dust, noise and traffic congestion shall be taken, as mentioned in other items.
4. Construction workers and construction vehicle drivers are in some cases considered as having a high potential for the spread of sexually transmitted diseases (STDs) and HIV/AIDS virus due to their mobility.	Infection of HIV/AIDS and other diseases			x		1) Education of and campaign of prevention and cure of HIV/AIDS to residents and construction workers. 2) Monitoring of cases of HIV/AIDS before, during and after the construction stage. 3) Migration of workers should be minimized by giving local people preferences as construction workers.
5. Construction work as a whole	Worker's health			x		1) Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed project period. 2) Medical check for workers, as required.
6. Migration and staying construction workers	Risk of security and crime			x		(1) Consult with police and local government, and establish vigilantes composed of CBOs and residents, if necessary. 2) Education of workers to keep manners and obey community rules. 3) Monitoring of cases and causes of hazard risks.
7. Traffic congestion and disturbance by the work laying pipelines along roads and the Halda river bridge.	An increase in number of traffic accidents			x		1) Suitable planning and management of construction work to prevent the number and minimize the consequences of accidents. 2) Monitoring cases and causes of accidents.
II-2 Natural Environ-						

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
ment						
1. Topography and Geology	Deterioration of topographic/geological features	x				No large scale alteration of ground, which may give rise to a change in topography and geology, is expected.
2. Excavation, cutting and filling of earthmoving work and removal of vegetation cover	Soil erosion		x			1) Soil erosion caused by removal of vegetation cover and excavated loose soil shall be checked and replantation with local vegetation carried out as soon as possible, as necessary. 2) Loose soil shall be covered and stored away from the edge of the hoar/river.
3. Groundwater will be used for some construction work subject to permission being received from the concerned authorities.	groundwater pollution		x			Measures to prevent infiltration of polluted water to the ground and groundwater shall be implemented.
4. Tree cutting Removal and/or transplantation of road side trees and greens are expected due to earthmoving and construction works.	Loss of trees and vegetation		x			1) To get permit of cutting from concerned authorities in advance. 2) proper plantation and/or forestation to replace cut trees under the instruction of the authorities.
5. Construction work as a whole	Global warming/Climate change	x				The amount of greenhouse gases such as CO_2, which are generated due to construction vehicles and machines, is expected to be negligible.
II-3 Environmental Pollution						
1. Emission of air pollutants (dust, NOx, etc.) from vehicles and equipment during construction works is expected.	Air pollution due to dust, NOx, etc.			x		1) Vehicles, machines and plant shall be properly and regularly maintained. 2) Water trucks shall be used and material stockpiles shall be located away from sensitive receptors. 3) Vehicle speed limits shall be enforced.
2. Discharge of wastewater from construction work and worker's camps is expected.	Water pollution			x		1) Wastewaters should be collected in reservoir tank and discharged to water bodies after treatment by sedimentation and/or flocculation process to comply with wastewater quality standards. 2) Sludge and/or sediment including clay and silt etc. should be reused or disposed to waste storage site.
3. Toxic materials such as lubricant oil and asphalt	Soil contamination by toxic materials			x		In order to prevent spillover or leakage of toxic materials such

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
emulsifiers for construction works may give rise to soil contamination.						as lubricant oil and asphalt emulsifiers into soil, following measures should be implemented: (i) To keep clean storage sites of construction equipment, (ii) To install storage tank for preventing spill and leakage of lubricating oil and grease, etc., (iii) Training of workers for proper handling of toxic materials.
4. Generation of construction waste and garbage from worker's camp.	Solid waste		x			1) Consider ways to minimize waste generation in the construction work plan. 2) Proper treatment and disposal of waste generated from construction work. 3) The open areas that are grasslands can be used for construction but with appropriate safeguards to maintain materials and dump sites from contaminating watercourses/river waters.
5. Asbestos cement pipes are used for existing distribution pipes in some parts of the project area.	Exposure to hazardous fine asbestos fibers			x		1) If asbestos cement pipes are found, they should be abandoned and replaced by pipes made of other materials, which are safe enough. 2) At present in Bangladesh there is no clear provision regarding regulation of asbestos waste. Therefore, at first to consult measures for safe treatment and disposal asbestos cement water pipes and asbestos debris with DOE and other responsible organizations. In this regards Japanese laws and manuals such as Waste Management and Public Cleansing Law, Industrial Safety and Health Law, and “Manual for asbestos treatment and disposal of asbestos containing wastes” (Ministry of Environment, 2007.3. In Japanese) will be useful. 3) To confirm the existence of asbestos cement water pipes for water pipes replacement lines. 4) The replacement work of old asbestos cement pipes should be treated carefully taking in to

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
						consideration possible health effect to workers by inhaling and adhering scattered fine fibers. Thus, the workers should be equipped with helmets, masks, shoes and wears to prevent inhalation and adhesion of asbestos fibers. All the equipped materials should be separately stored and safely disposed after replacement work. 5) While loading, unloading and transport, dug out asbestos cement water pipes should be covered with plastic sheets and/or packed with closed containers or bags marking a sign of hazardous asbestos. 6) Collected asbestos pipes should be solidified with cement and/or transferred to secured final disposal site.
6. Generation of noise and vibration from construction vehicles, machines and plant.	Ambient noise and vibration			x		1) Vehicles, machines and plant shall be properly and regularly maintained. 2) Working during sensitive hours and locating machinery close to sensitive receptors shall be avoided. 3) Use equipment with low-noise and vibration. 4) Installation of soundproof walls/acoustic enclosures and provision of buffer zones.
III Post Construction Phase (Operation and Maintenance) Stage						
III-1 Social Environment						
1. Existing social infrastructure and services -1 Water supply	water supply improvement in both quality and quantity	x				The project may contribute to easier access of safe drinking water and improvement in sanitary conditions, as well as a decrease in the number of cases of water-borne diseases.
III-2 Natural Environment						
1. Spatial occupancy of water supply related facilities	Deterioration of natural landscape	x				No negative impact on the landscape is expected in view of the location, scale and design of water supply facilities.
2. Operation activities as a whole	Change of local climate	x				No major infrastructure development and reclamation, which may give rise to a change in the micro-climate is expected.
3. Operation activities as a whole	Global warming/climate change	x				The amount of greenhouse gas emissions from diesel genera-

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
						tors used for water supply facilities is expected to be negligible.
III-3 Environmental Pollution						
1. Emission of air pollutants from diesel generators at the water treatment plant and other facilities	Dust and NOx pollution	x				1) Emission of air pollutants from diesel generators at the water treatment plant and other facilities is expected to be negligible.
2. Chlorine gas emission from leakage of chlorination facility	Hazardous chlorine gas exposure		x			1)In ordinary handling, chlorine gas emission is hardly expected from stored utilities and automatic injec-tion equipment of chlorination. 2) However, following measures should be considered: a) Handing personnel should be properly trained and cautioned, b) Use of good quality nozzles for injection, c) Installation of warning signs.
3. The increase in the quantity of water supply	Increase in the quantity of wastewater and sludge.		x			1) Sludge generated from water treatment plant should be dried and reused. 2) Supernatant water separated from sludge will be sent back to water treatment process and and some portion of will be overflown to Karnaphuli river through drain. Water quality of the supernatant water complies with Bangladesh wastewater standards (such as SS 150 mg/l and BOD 50 mg/l) by flocculation, sedimentation and sand filtration process.
4. Generation of sludge from water treatment plants.	Sludge waste problem		x			Sludge generated from water treatment plants will be dried and utilized.
5. Generation of noise and vibration from water supply facilities (pumps, diesel generator, etc.)	Ambient noise and vibration		x			1) Vehicles, machines and plant shall be properly and regularly maintained. 2) Working during sensitive hours and locating machinery close to sensitive receptors shall be avoided. 3) Use equipment with low noise and vibration. 4) Installation of soundproof walls/acoustic en-closures and provision of buffer zones.
6. Leakage of chlorine gas	Offensive odor		x			1) Strict management for use of chlorine. 2) Monitoring of leakage of chlorine. 3) Good maintenance/ storage and injec-

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
						tion facilities.
IV General (Mostly Overall Stages)						
IV-1 Social Environment						
1. Water supply project activities as a whole	Local economy	x				Beneficial impacts are expected on the local economy, such as creation of employment opportunity for public works during construction and easier access to drinking water will contribute to the reduction of the burden on women and children to collect water and improvement, thus improving living conditions.
2. Water supply project activities as a whole	Making urban socio-economic conditions worse	x				1) The influence of migration may be minimal as increase in workers is limited to the construction period. 2) Migration of workers should be minimized by giving local people preferences as construction workers.
3. Water supply project activities as a whole	Anxieties and complaints may spread amongst the people and communities.			x		Information disclosure and public participation should be fully considered for all the stake-holders from early stage of planning in order to obtain a thorough understanding of the project and consensus of the people and communities.
4. Water supply project activities as a whole	Misdistribution of benefit and damage			x		Consultation with stakeholders, including residents and community organizations should be planned from an early stage to obtain understanding and consent amongst the stakeholders in order to share equally benefits and damage.
5. Water supply project activities as a whole	Local conflict of interests			x		Consultation with stakeholders, including residents and community organizations, should be planned from early stage to obtain understanding and consent amongst the stakeholders in order to avoid or minimize local conflict of interests.
IV-2 Natural Environment						
1. Water supply project activities as a whole	Salt intrusion and change of river regime	x				1) Karnaphuli River discharges into the Bay of Bengal. It is a tidal river and the tidal flow was observed to take place up to about 10 km upstream of the confluence with the Halda River

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures
						However, the rising tide cannot come up to the intake point and no salinity problem was reported due to salt intrusion from the rising tide. 2) The impact on the river regime is expected to be negligible considering the size of the rivers and the flow discharge.
2. Water supply project activities as a whole	Coastal erosion	x				River mouth of Karnaphuli river is located in coastal zone of the Bay of Bengal. However, the project sites including the water intake are more than about 40 km upstream from the river mouth. Therefore, effects related to coastal erosion and sedimentation of sand are not expected.
3. Water supply project activities as a whole	Deterioration of flora, fauna and ecosystem		x			No rare, endangered or endemic terrestrial plant or animal species are expected in the project area. However, planted trees along the road contribute to the greenery and visual amenity providing relaxation and recreation area to local residents.
4. Water supply project activities as a whole	Loss of fishery resources	x				The project area being estuarine is rich in fish resources as both marine and freshwater fish roam the area. There are 76 species and 35 families of fishes. Out of the 76 species 49 species are either endangered or threatened. Both Karnaphuli and Halda rivers are rich in fish and good location for hatcheries. River fishing is active in both rivers. However, the project would not involve any direct interference with water bodies and water resources. Thus, effect on fishery resources activity is not expected.
5. Water supply project activities as a whole	Protected zone	x				There are no sites of protected areas such as National Parks, Wildlife Sanctuaries and Game reserves in the project area.

Activities	Impact	Confirmation of Environmental Considerations*				
		None	Minor	Moderate	Major	Reasons/Mitigation Measures

Note: * (1) In general, both positive and negative impacts are expected by the project activities. However, negative impacts only is considered. (2) Ratings of "Major, Moderate, Minor and None" are almost similar to those of "Significant or serious impact (A), Not significant but some impact (B), Little impact or extent of impact is unknown/not clear (C) and Negligible or no impact (D)" in JICA Guidelines, respectively

10.6.2 JICA Environmental Checklist - Preparatory Survey on Chittagong Water Supply Improvement Project

<table>
<tr><th>Category</th><th>Environmental Item</th><th>Main Check Items</th><th>Yes: Y
No: N</th><th>Confirmation of Environmental Considerations
(Reasons, Mitigation Countermeasures)</th></tr>
<tr><td rowspan="2">1 Permits and Explanation</td><td>(1) EIA and Environmental Permits</td><td>(a) Have EIA reports been already prepared in official process?
(b) Have EIA reports been approved by authorities of the host country's government?
(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?
(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</td><td>(a) Y
(b) Y
(c) N
(d) N</td><td>(a) IEE report (December 2005) and EIA reports (June 2007), the descriptions of which cover Phase 1 and 2 of the Karnaphuli Water Supply Project were prepared and submitted to DOE to obtain necessary approvals.
(b) CWASA received approvals with conditions from DOE as follows:
(1) Environmental Site Clearance issued on January 9, 2006 (Memo No. DoE/Clearance/2225/2005/75). ESC for Phase 2
(2) Approval of Environmental Impact Assessment (EIA) Report issued on September 13, 2007 (Memo No. DoE/Clearance/2225/2005/2416)
Renewal of the ESC for Phase 1 was issued by DOE Chittagong on July 31, 2012, and will be issued by the end of November 2012 for Phase 2.
(c) Approval of the EIA included conditions relating to proper mitigation countermeasures and monitoring for site preparation, construction and operation stages and resettlement plan. It is also pointed out that CWASA shall apply for Environmental Clearance Certificate (ECC) after installation of the plant as well as other pollution control facilities and equipment.
(d) No need of permits</td></tr>
<tr><td>(2) Explanation to the Local Stakeholders</td><td>(a) Have contents of the project and the potential impacts been adequately explained to the local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the local stakeholders?
(b) Have the comments from the stakeholders (such as local residents) been reflected in the contents of the project?</td><td>(a) Y
(b) Y</td><td>(a). Information disclosure was carried out for the public occasionally from the early stage of the project implementation for Phase 1 in accordance with appropriate procedures.
Public consultation was conducted at four places as shown in the table below. Participants of public consultation were local leaders, women groups, representatives of professional groups like farmers, businessman, teachers, local representatives, etc.
<table>
<tr><th></th><th>Date</th><th>Place</th><th>No. of Participants</th></tr>
<tr><td>1</td><td>12-08-2005</td><td>Shantir Hat of Rangunia</td><td>20</td></tr>
<tr><td>2</td><td>12-09-2005</td><td>Godown of Rangunia</td><td>24</td></tr>
<tr><td>3</td><td>13-09-2005</td><td>Ward No.14 of Double Mooring Thana</td><td>18</td></tr>
<tr><td>4</td><td>13-09-2005</td><td>Ward No.8 of Khulsi Thana</td><td>20</td></tr>
</table>
The participants in general welcomed the project. Concerns expressed by the people were as follows:
(i) Agricultural products including vegetation may be affected during</td></tr>
</table>

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
				movement of transport and equipment, (ii) Assembly of people during project activities may damage crops and other trees, (iii) Noise pollution from vehicles and equipment may cause socio-economic and ecological disruption, (iv) Environmental pollution through sanitation and waste materials as well as other social nuisance should be controlled, (v) Local personnel should be employed in different activities of the project on a priority basis, (vi) Compensation payment in any form, should be properly distributed so that the actual people get his full share, (vii) Affected property should be assessed properly. (b) The comments of the local residents have been reflected in the contents of and design of the project.
	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a) Y	(a) Alternative plans were studied for the alignment of major facilities including right of way for pipeline installation and the location of distribution reservoirs/elevated tank.
2 Pollution Control	(1) Air Quality	(a) Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Are any mitigating countermeasures taken? (b) Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	(a) N (b) Y	(a) Chlorine from chlorine storage facilities and chlorine injection facilities will not cause air pollution. Mitigation measures such as use of automatic injection equipment, safe operation and maintenance practices and provision of training to O&M personnel will be incorporated in the design of the facilities (as for Phase 1) and lessons learned from Phase 1 will be included in Phase 2. In addition, the existing Mohara water treatment which includes chlorination has been operated safely since commencement of operation. (b) Thus, the automatic injection system will comply with the country's occupational health and safety standards. However, to make ready against leakage accidents of chlorine gas by any possibility, Emergency Responsible Plan (10.5.3) including training of workers and preparation of safety protection masks and manuals will be prepared.
	(2) Water Quality	(a) Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	(a) Y	(a) 1) By the water treatment plant operation river water is purified for use of water supply. 2) Supernatant separated from sludge will be sent back to water treatment process, some portion of which will be overflown to Karnaphuli river through nearby canal. Water quality of the supernatant complies with Bangladesh wastewater standards (such as SS 150

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
				mg/l and BOD 50 mg/l) by flocculation, sedimentation and sand filtration process.
	(3) Wastes	(a) Are wastes, such as sludge generated by the facility operations properly treated and disposed of in accordance with the country's regulations?	(a) Y	(a) 1) Sludge generated by water treatment plant operation will be separated by sedimentation and filtration process and dried for reuse as manure and land reclamation. 2) There is a possibility that hazardous asbestos cement pipes are used in some portion. (1) If asbestos cement pipes are found, they should be abandoned and replaced by pipes made of other materials, which are safe enough. (2) At present in Bangladesh there is no clear provision regarding regulation of asbestos waste. Therefore, at first to consult measures for safe treatment and disposal of asbestos cement pipes and asbestos debris with DOE and other responsible organizations. (3) To confirm the existence of asbestos cement pipes. (4) The replacement work of old asbestos cement pipes should be treated carefully taking into consideration possible health effect to workers by inhaling and adhering scattered fine fibers. Thus, the workers should be equipped with helmets, masks, shoes and wears to prevent inhalation and adhesion of asbestos fibers. All the equipped materials should be separately stored and safely disposed of after replacement work. (5) While loading, unloading and transport, dug out asbestos cement pipes should be covered with plastic sheets and/or packed with closed containers or bags marking a sign of hazardous asbestos. (6) Collected asbestos pipes should be solidified with cement and/or transferred to secured final disposal site.
	(4) Noise and Vibration	(a) Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	(a) Y	(a) 1) Vehicles, machines and plant shall be properly and regularly maintained. 2) Working during sensitive hours and locating machinery close to sensitive receptors shall be avoided. 3) Use equipment with low noise and vibration. 4) Installation of soundproof walls/acoustic enclosures and provision of buffer zones.
	(5) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	(a) N	(a) The water source is a river, so no subsidence will be caused by the extraction of groundwater.

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
3 Natural Envi-ronment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a) N	(a) There is no protected area located in and in the vicinity of the project sites.
3 Natural Envi-ronment	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, and ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection countermeasures taken to reduce the impacts on the ecosystem? (d) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate countermeasures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	(a) N (b) N (c) N (d) N	(a) The project site does not encompass primeval forests, tropical rain forests, and ecologically valuable habitats. (b) The project site does not encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions. (c) No significant ecological impacts are anticipated; however adequate countermeasures will be taken to reduce the impacts on the ecosystem in case such impacts are identified during the later stages of the project, including detailed design. (d) The water used by the project does not adversely affect aquatic environments. The amount used for water supply is not large in comparison with the total river flow.
	(3) Hydrology	(a) Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect surface water and groundwater flows?	(a) N	(a) The water used by the project does not adversely affect aquatic environments. The amount used for water supply is not large in comparison with the total river flow. In addition drinking water has top priority among all the purposes of water uses.
4 Social Envi-ronment	(1) Resettle-ment	(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? (b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement? (c) Is the resettlement plan, including compen-	(a) N (b) N/A (c) N/A (d) N/A (e) N/A (f) N/A (g) N/A (h) N/A	(a) Necessary land for the facilities for Karnaphuli Water Supply Project was already secured by CWASA for the two phases. (b) to (j) Any involuntary resettlement is not expected. Therefore, items from (b) to (j) will be not applicable.

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
		sation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? (d) Is the compensations going to be paid prior to the resettlement? (e) Is the compensation policies prepared in document? (f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous people? (g) Are agreements with the affected people obtained prior to resettlement? (h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? (i) Is a plan developed to monitor the impacts of resettlement? (j) Is the grievance redress mechanism established?	(i) N/A (j) N/A	
4 Social Environment	(2) Living and Livelihood	(a) Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate countermeasures considered to reduce the impacts, if necessary? (b) Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect the existing water uses and water area uses?	(a) N (b) N	(a) There is no possibility that the project will adversely affect the living conditions of inhabitants. However, adequate countermeasures will be considered to reduce the impacts, if necessary. (b) There is no possibility that the project will adversely affect any other existing water uses and users.

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate countermeasures considered to protect these sites in accordance with the country's laws?	(a) N	(a) There are no local archaeological, historical, cultural, and religious heritage sites to be affected by the project.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary countermeasures taken?	(a) N	(a) The project will not adversely affect the local landscape.
	(5) Ethnic Minorities and Indigenous People	(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous people? (b) Are all of the rights of ethnic minorities and indigenous people in relation to land and resources respected?	(a) N (b) N	(a) The project does not violate any of the country's laws for rights of ethnic minorities and indigenous peoples. (b) There are no impacts on culture and lifestyle of ethnic minorities and indigenous people by the project.
	(6) Working Conditions	(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country, which the project proponent should observe in the project? (b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents from labor accidents, and management of toxic substances? (c) Are tangible safety education for labors and the formulation of safety sanitary practices (in-	(a) Y (b) Y (c) Y (d) Y	(a) Project will be carried out in compliance with prevailing legislation, including Labour Act 2006, Factories Act 1965. (b) Project will be designed considering the needs for safety equipment and measures for the safe management of toxic substances. In addition, Emergency Response System including emergency situation, emergency response system and procedure, alarm systems and training, etc. will be established. (c) Tangible safety education for labors and the formulation of safety sanitary practices will be planned and implemented for concerned persons in the project. (d) Appropriate countermeasures will be taken to ensure that security guards involved in the project do not violate the safety of local residents

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
		cluding traffic control and public health) to concerned persons in the project planned and conducted? (d) Are proper countermeasures taken not so as to threaten the safety of the local residents and concerned persons in the project by security guards employed by the project?		and concerned persons in the project.
5 Others	(1) Impacts during Con-struction	(a) Are adequate mitigation countermeasures considered to reduce adverse impacts during construction (e.g., noise, vibrations, turbid wa-ter, dust, exhaust gases, and wastes)? (b) If construction activities adversely affect the natural environment (ecosystem), are adequate mitigation countermeasures considered to re-duce impacts? (c) If construction activities adversely affect the social environment, are adequate mitigation countermeasures considered to reduce impacts? (d) If the construction activities might cause traffic congestion, are adequate countermeasures considered to reduce such impacts?	(a) Y (b) N (c) N (d) Y	(a) Adequate countermeasures to reduce adverse impacts (noise, turbidity of effluent, waste disposal, etc) during construction will be included in the design and Contract Documents. (b) Construction activities will not adversely affect the natural environ-ment. (c) Construction activities will not adversely affect the social environ-ment. (d) Adequate countermeasures to reduce traffic congestion will be in-cluded in the design and Contract Documents. These will include specific requirements for maintaining traffic flow on Kaptai Road along the route of the conveyance and transmission pipelines, as well as within Chit-tagong City.
5 Others	(2) Monitoring	(a) Does the proponent develop and implement a monitoring program for the environmental items that are considered to have potential impacts? (b) How are the items, methods and frequencies of the monitoring program planned? (c) Does the proponent establish an adequate monitoring system (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? (d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	(a) Y (b) Y (c) Y (d) Y	(a) The proponent will develop and implement a monitoring program for the environmental items that are considered to have potential impacts. (b) The items, methods and frequencies included in the monitoring pro-gram will be carefully planned and take full account of the conditions of the approval of the EIA. (c) The proponent will establish an adequate monitoring system (organi-zation, personnel, equipment, and adequate budget to sustain the moni-toring framework). This will be based upon and take account of the monitoring that is undertaken at existing WTPs and for Phase 1 of the project. (d) The monitoring will comply with regulatory requirements, such as the format and frequency of reports, pertaining to the monitoring report sys-tem to the regulatory authorities in due course of time.

Category	Environ-mental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Countermeasures)
6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in other sectors such as in the Dam and River Projects checklist should also be referred to.	(a) N/A	(a) Not applicable.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to trans-boundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as trans-boundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a) N	(a) The nature and scale of the project are such that there will be no impacts to trans-boundary or no global issues.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made. In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which the project is locate

CHAPTER 11

IMPLEMENTATION PLAN AND CONSTRUCTION COST ESTIMATES

CHAPTER 11 IMPLEMENTATION PLAN AND CONSTRUCTION COST ESTIMATES

11.6 Terms of Reference (TOR) for Consulting Services under Karnaphuli Water Supply Project - Phase 2 (KWSP2

Chapter 1 Background

1.1 Background

The Chittagong Water Supply and Sewerage Authority (CWASA) is in the implementation of a project constructing a 143,000 m^3/day water treatment plant including water intake facility, two water reservoirs and water transmission and distribution main pipelines (named "Karnaphuli Water Supply Project; abbreviated as KWSP") with Japanese ODA Loan provided by the Japan International Cooperation Agency (JICA) and the development funds of the Government of Bangladesh (GOB).

In order to further improve the water supply service in Chittagong, CWASA plans to undertake Karnaphuli Water Supply Project -Phase 2 (KWSP2) (hereinafter referred to as "KWSP2" or "the Project").for expanding the water treatment and supply facilities with an additional 143,000m^3/day capacity.
GOB has received a Japanese ODA Loan to finance the KWSP2. GOB intends to use part of the proceeds of the Japanese ODA Loan for eligible payments for consulting services for which this TOR is issued

1.2 Components of the Project

The Project consists of the following components:

(a) Construction of a complete package unit of Water Intake Facility having additional 150,000 m^3/day pumping capacity *1) adjacent to the Water Intake Facility being constructed under KWSP.
(b) Construction of complete package unit of WTP having a capacity of 143,000 m^3/day *2) at the site of the WTP being constructed under KWSP.
(c) Construction of an additional reservoir having a capacity of 24,800 m^3 and installation of additional pumps and electrical equipment *3) at the site of Nashirabad Water Reservoir being constructed under KWSP.
(d) Construction of a new 2,400 m^3 elevated tank at Halishahar (called "Halishahar Elevated Tank").
(e) Construction of water conveyance pipeline from Water Intake Facility to WTP in a length of approximately 3.6km.
(f) Transmission pipeline from WTP to Nashirabad Reservoir and further to Halishahar Elevated Tank in a total length of approximately 34.4km.
(g) Construction of primary distribution mains from Nashirabad Reservoir, Battali Hill Reservoir and Halishahar Elevated Tank to the respective service areas in a total length of approximately 20km, including the installation of water distribution control system.
(h) Construction of additional optical fiber cable line to extend the planned cable in KWSP1, in a length of approximately 20km.
(i) Construction of secondary/tertiary distribution network through individual service connection points in the service areas covering approximately 3,063 ha, including the laying of pipes in a total length of approximately 475km, the installation of meters at the individual service connection points and supply low income communities
(j) Procurement Package and Procedure of:
    a. Water meters to be installed for Service connections from distribution pipe, and

b. mobile ultrasonic flow meters, vehicle-mounted electromagnetic-type flow meters, pick-up cars, and backhoes to be used for O&M of networks in DMA (district metered area) and WTP.

(Remarks)

*1), *2) and *3): All construction works include the procurement and installation of mechanical and electrical equipment required.

1.3 Procurement Package and Procedure

(1) Procurement Package

The construction works will be divided into three contract packages as follows:

Package 1: Construction of Water Intake Facility and WTP including the expansion of Nashirabad Reservoir and the construction of Halishahar Elevated Tank as listed in (a) to (d) above.

Package 2: construction of conveyance and transmission pipeline, including the construction of Optical Fibre from Nashirabad Reservoir to Halishahar Elevated Tank.

Package 3: Constriction of primary/secondary/tertiary distribution network, service connections and supply low income communities as listed in (g) and (i) above.

Package 4: Procurements of equipment, vehicles and materials as listed (j) above.

The contractors' works for Package 1 and Package 2 will include O&M supervision and training services to be provided during the Defect Liability Period in respect of (i) WTP including Intake Facility and (ii) Water Distribution Control System.

(2) Procurement procedure

Package 1, 2 and 3 will be procured respectively through International Competitive Bidding (ICB) based on Single-Stage Two-Envelope Bidding Procedure with Pre-qualification in accordance with the JICA's Procurement Guideline (Section 2.03, Part II),

While Package 4 will be procured for each item of products through ICB or Local Competitive Bids (LCB) in accordance with the biddings set forth in the JICA Sample Bidding Documents under Japanese ODA Loans for Procurement of Goods version 1.0 issued in August 2010.

(3) Service connection with water meter including supply low income communities

For the construction of service connections, the following work shall be undertaken by different parties.

(a) Collection of information on customers including mapping on the location of water meter to be installed

CWASA staff trained by PANI will undertake the required work in the field as early as possible after loan agreement.

(b) Procurement of equipment

The selected contractor will procure the required equipment for the service connection

(c) Preparation of installation plan for service connections

The contractor to be selected for the construction of distribution pipelines will prepare plan using information collected by CWASA staff.

(d) Connection work from CWASA pipeline to each customer connection pipe

The customers will make contract with private company for the connection of pipes between CWASA pipe and private pipe.

1.4 Funding Source

GOB has received a Japanese ODA Loan to finance the KWSP2. GOB intends to use part of the proceeds of the Japanese ODA Loan for eligible payments for consulting services for which this TOR is issued.

1.5 Completion of the Project

The Project is expected to be completed by the 31th day of March 2021.

1.6 Location of the Project

The Water Intake Facility and WTP are located at the outskirt of Chittagong City, approximately 25 km far to the north-east from the city center and along the Karnaphuli River. Nashirabad Reservoir and Battali Hill Reservoir and Halishahar Elevated Tank are located in the Chittagong City. The location of the Project is shown in a location map enclosed as Attachment 1.

1.7 Executing Agency

The Execution Agency of the KWSP2 is CWASA.

1.8 Technical information

The final report on the "Preparatory Survey on Chittagong Water Supply Improvement Project[1]" as well as the results of topographic and geological surveys at the facility sites and pipeline routes conducted for the Project are available at CWASA.

Chapter 2 Objectives of Consulting Services

The consulting services shall be provided by an international consulting firm (hereinafter referred to as "the Consultant") in association with national consultants in compliance with Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012). The objective of the consulting services is to achieve the efficient and proper preparation and implementation of the Project through the following works:

(a) Detailed design
(b) Tender Assistance
(c) Construction supervision
(d) Facilitation of implementation of Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP)
(e) Capacity Development for CWASA
(f) Guidance for Public Awareness Campaign

Chapter 3 Terms of Reference for Consulting Services

3.1 Detailed Design

The Consultant shall carry out the following works:

(a) review and verify all available primary and secondary data;
(b) carry out all the required engineering surveys and investigations such as topographical survey, hydrological survey, geotechnical survey, material availability survey and other related engineering works required for preparing basic and detailed designs, as applicable to the concerned project components;
(c) prepare detailed work plan, progress reports and implementation schedule for the Project to ensure effective monitoring and timely project outputs, and regularly update the same;
(d) prepare the detailed design of all the Project components in sufficient detail to ensure clarity and

[1] In the course of the survey, the name of the project was changed to "Karnaphuli Water Supply Project (Phase2)".

understanding by CWASA, contractors and other relevant stakeholders; All the design must be in conformity with the Bangladesh Standards (if available) or with the appropriate international standards. The detailed design shall, as a minimum, include (i) drawings and plot plants for all facilities (ii) detailed cost estimates, and (iii) necessary calculations to determine and justify the engineering details for the Project. The detailed design shall be prepared in close consultation with, and to meet the requirements of CWASA, and shall be incorporated into the detailed design report to be submitted for approval of CWASA;

(e) prepare Detailed Specifications, Bill of Quantities (BOQ) and Tender Drawings to be incorporated into Bidding Documents. Such Detailed Specifications shall contain those in relation to i) quality control of plant, materials and workmanship, ii) safety and iii) protection of the environment.

3.2 Tender Assistance

(1) Assistance in Pre-Qualification (PQ) of Bidders undertaking Construction Works

The Consultant shall:

(a) define PQ criteria: technical and financial requirements, capacity and/or experience taking into consideration technical feature of the Project;
(b) prepare PQ documents in accordance with the latest version of Standard Prequalification Documents under Japanese ODA Loans;
(c) assist CWASA in PQ announcement, addendum/corrigendum, and clarifications to the applicants' queries;
(d) evaluate PQ applications in accordance with the criteria set forth; and
(e) prepare a PQ evaluation report for approval of the PQ evaluation committee.

(2) Assistance in the Bidding for Award of Contractor(s) undertaking Construction Works

The Consultant shall

(a) prepare bidding documents in accordance with the latest version of Standard Bidding Documents under Japanese ODA Loans for Procurement of Works together with all relevant specifications, drawings and other documents;
(b) assist CWASA in issuing bid invitation, conducting pre-bid conferences, issuing addendum/corrigendum, and clarifications to bidders' queries.
(c) evaluate bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical proposal including, but not limited to, site organization, mobilization schedule, method statement, construction schedule, safety plan, have been prepared in harmony each other and will meet such requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;
(d) prepare a bid evaluation report for approval of the bid evaluation committee;
(e) assist CWASA in contract negotiation by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meeting; and
(f) prepare a draft and final contract agreement.

(3) Assistance in the Bidding for Procurement of Equipment and Materials for Service Connections and Equipment and Vehicles for O&M

The Consultant shall

(a) prepare bidding documents in accordance with the latest version of Standard Bidding Documents under Japanese ODA Loans for Procurement of Goods together with all relevant specifications, drawings and other documents in respect of individual items as listed in 1.2 (j);
(b) carry out the bidding assistance works as stipulated in (b) to (f) of Paragraph (2) above.

3.3 Construction Supervision

The Consultant shall perform his duties during the construction period in accordance with the contracts to

be executed between CWASA and the contractors. It should be noted, however, House connection from meter to house etc. is out of the Consultant's scope of the works. FIDIC MDB Harmonized Edition (2010) complemented with the Specific Provisions as included in the Standard Bidding Documents under Japanese ODA Loans for Procurement of Works will be applied to the civil works of the Project. In this context, the Consultant shall:

(a) act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority delegated by CWASA ;
(b) provide assistance to the Employer concerning variations and claims which are to be ordered/issued at the initiative of CWASA;
(c) issue the commencement order to the Contractors;
(d) provide recommendation to CWASA for acceptance of the Contractor Performance security, advance payment security and required insurances.
(e) review and approve the proposals submitted by the contractors which include work program, method statements, material sources, manpower and equipment deployment. In light of **Section 3.03** of Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012), the Consultant shall pay attention, in particular, to whether such proposals will meet the safety requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract;
(f) explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions;
(g) review, verify and further detail the design of the works, approve the Contractors' working drawings and, if necessary, issue further drawings and/or give instructions to the Contractor;
(h) liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated.
(i) carry out field inspections on the contractor's setting out to ensure that the works are carried out in accordance with drawings and other design details.
(j) regularly monitor physical and financial progress against the milestones as per the contract so as to ensure completion of contract in time;
(k) supervise the works so that all the contractual requirements will be met by the contractors, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. In light of **Section 3.03** of Guidelines for the Employment of Consultants under Japanese ODA Loans (April 2012), the Consultant shall confirm that an accident prevention officer proposed by contractor is duly assigned at the project site and that construction works are carried out according to the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract ;
(l) supervise field tests, sampling and laboratory test to be carried out by the contractors;
(m) inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;
(n) survey and measure the work output performed by the contractors and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;
(o) coordinate the works among different contractors employed for the Project;
(p) modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);
(q) carry out timely reporting to CWASA for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;
(r) inspect, verify and determine claims issued by CWASA in accordance with the civil works contract;
(s) perform the inspection of the works and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the civil works contract, ;
(t) supervise testing and commissioning;

(u) provide periodic and/or continuous inspection services during defects liability period (Defect Notification Period defined in FIDIC Conditions of Contract) and if any defects are noted, instruct the contractor to rectify;
(v) check and certify as-built drawings submitted by the contractors; and prepare and submit reports to CWASA, which are detailed in **Chapter 6** in relation to the implementation of the Project.

(Note)

The Consultant's supervision duties as set out above shall include those for the procurement of meters, saddles, pipes, etc. to be used for house connections and also for the procurement of equipment to be used for O&M of DMA distribution networks as required.

3.4 Safety Measures

The Consultant shall:

(a) When preparing or reviewing bidding documents for procurement of work and those for procurement of supply and installation of plant, make sure to meet the requirements for safety measures.
(b) Review the safety plans submitted by the bidders from the point of view of securing the safety during the construction. (Refer to *Paragraph (2), Section 4.02 Scope of the Project and of the Consulting Services of the Guidelines for the Employment of Consultants under Japanese ODA Loans, April 2012*).
(c) Review the Programme (the programme stipulated in the relevant clause of *the Standard Bidding Documents under Japanese ODA Loans (Procurement of Works) 2012*) submitted by the contractors from the point of view of securing the safety during the construction and require them to submit further details, if necessary.
(d) During the supervision of the construction work, confirm that an accident prevention officer proposed by the contractor is duly assigned at the project site and that the construction work is carried out according to the safety plan as well as the safety measures prescribed in the Programme. If consultants recognize any questions regarding the safety measures in general including the ones mentioned above, the consultants shall require the contractors to make appropriate improvements.

3.5 Facilitation of implementation of Environmental Management Plan (EMP), and Environmental Monitoring Plan (EMoP)

The Consultant shall:

(a) update and review EMP submitted by the contractor, as appropriate; incorporate necessary technical specifications with design and contract documentation;
(b) during the preparation of bidding documents, clearly identify environmental responsibilities as explained in the environmental impact assessment/initial environmental examination report and EMP;
(c) prepare EMoP for monitoring implementation of EMP;
(d) supervise EMP implementation and undertake regular compliance monitoring according to EMoP to ensure that the civil works are implemented in accordance with the EMP; and
(e) assist CWASA in the capacity building of CWASA staff on environmental management through on-the-job training on environmental assessment techniques, mitigation measure planning, supervision and monitoring, and reporting.

3.6 Capacity Development for CWASA

(a) The Consultant shall transfer the technology in design and supervision works through OJT. The Consultant shall provide the opportunity to CWASA officers and staffs to be involved in the working team of the Consultant during the design, contract administration and supervision works for their capacity building wherever possible.
(b) The Consultant shall develop the capacity of the CWASA's staff to enhance the expertise and skills of key staff, as well as identified group(s) of personnel with the competencies required to

manage, operate and maintain the new facilities/system thereby transforming organizational and individual potentials into actuality.

The contractors will be required to provide O&M supervision and/or training services for one year during the Defect Notification Period in respect of WTP including Water Intake Facility and Distribution Control System.

In this context, the Consultant shall:

1) prepare manuals for overall O&M of the following facilities constructed under the Project for the contractor's activities.:
   i) Intake Facility and WTP
   ii) Conveyance/ Transmission Pipelines
   iii) Primary, Secondary and Tertiary Distribution Networks

2) In particular, prepare specific operation manual in respect of:
   i) WTP sludge treatment
   ii) Overall distribution control based on SCADA system
   iii) Distribution system, including:
      - Water pressure monitoring and control as sector inlet chambers
      - Leakage investigation and repairs at DMA in let chambers

3) provide specific training for the aspects stated in Paragraph 3.6 (b) 2) ii) above (SCADA system), supplement to the training provided by the contractor.

4) monitor and evaluate the contractors' performance of O&M supervision and training services, and instruct the contractors to improve their services if necessary.

5) submit to CWASA "Evaluation Report of Contractors' Training Services" stating the evaluation of the training services provided by the contractors after completion of the contractors' training services.

3.7 Guidance for Public Awareness Campaign

The purpose of public awareness campaign is to inform and educate the general public of the present situation of health damage in the project area caused by the use of groundwater, the objectives of the proposed project, the importance of connection to a proposed water supply system under the project and payment of water tariff for sustainable operation and management of water supply facilities. These activities are essential for expediting the works for secondary/tertiary distribution network, since it is needed to increase a large numbers of house connections and also promote applications for the house connections in advance so that the meter installation locations can be fixed. These activities should primarily be carried out by CWASA.

The Consultant shall:

(a) design and formulate the campaign program to be carried out by CWASA;
(b) guide and assist CWASA on the implementation of the campaign program; and
(c) coordinate with the "Project for Advancing NRW Reduction Initiative (PANI) of CWASA" (hereinafter referred to as the "PANI") for the CWASA's performance of the campaign program.

*(Note) JICA's technical cooperation project to CWASA being carried out for technology transfer and CWASA staff capability build-up with regard to measures for identifying leakage and reducing non-revenue water.

Chapter 4 Expected Time Schedule

The total duration of consulting services will be 106 months including 12 months of Defect Notification Period. The implementation schedule expected is as shown in **Table 1**.

Table 1 Implementation Schedule Expected

Key Activities	Date	Duration in Months
Commencement of Consulting Services	1 December 2013	13
Completion of detail design, preparation of drawings and tender documents	31 December 2014	
Tender process including prequalification	1 October 2014 to 31 January 2016	16
Commencement of Works	1 February 2016	62
End of Works	31 March 2021	
Defect Notification Period	1 April 2021 to 31 March 2022	12
Final Contract Administration	1 April 2022 to 30 June 2022	3
Completion of Consulting Services	30 June 2022	-

Chapter 5 Staffing (Expertise Required)

17 of Professional (A) consultants (Foreign Persons) and 23 of Professional (B) consultants (Local Persons) will be engaged, over 102 months duration of consulting services, for a total of 505 man-months for Professional consultants (A) and 856 man-months for Professional consultants (B). Total consulting input is estimated to 1,361 man-months. A detailed schedule of consulting services and a distribution of man-months are shown in **Attachment 2**.

5.1 Consulting Input for the Respective Phase

The Consultant Team for the design, tender assistance, construction supervision and other miscellaneous consulting services consist of following key personnel together with supporting staff.
The allocation of person-month for the respective phases of consulting services, excluding local supporting staff, is as shown in **Table 2**.

Table 2 Allocation of Person-Month for the Respective Phases

Designation	No.	Phase wise input in months			Total Input in Months
		Design phase	Construction Phase	Post Construction Phase	
		December .2013- December 2014	February 2016- March 2021	April 2021 March 2022	
Professional (A): International Specialist					
Team Leader	1	24	57	6	87
Water Treatment Expert	1	6	3	0	9
Intake & WTP Engineer (Civil)	1	12	37	0	49
Senior Pipeline Engineer	1	16	57	0	73
Pipeline Engineer(1)	1	12	57	0	69
Pipeline Engineer(2)/Hydrologist	1	12	57	0	69
Pipeline Engineer(3)	1	12	0	0	12
Pipeline Engineer(4)	1	12	0	0	12
Structure Engineer	1	6	3	0	9
Mechanical Engineer	1	12	14	0	26
Electrical Engineer	1	12	14	0	26
O&M Specialist (WTP)	1	0	2	6	8

Designation	No.	Phase wise input in months			Total Input in Months
		Design phase	Construction Phase	Post Construction Phase	
		December .2013- December 2014	February 2016- March 2021	April 2021 March 2022	
O&M Specialist (Distribution Control)	1	0	8	4	12
Specification Specialist	1	3	0	0	3
Environment/Social campaign Specialist	1	2	10	0	12
Costing Engineer	1	5	0	0	5
Contract Specialist	1	8	113	3	24
Total	17	154	332	19	505
Professional (B): National Specialist					
Deputy Team Leader	1	26	62	12	100
Senior Engineer (Intake and WTP)	1	14	40	0	54
Senior Engineer (Pipeline-1)	1	17	62	0	79
Senior Engineer (Pipeline-2)	1	13	62	0	75
Senior Engineer (Pipeline-3)	1	13	62	0	75
Senior Engineer (Pipeline-4)	1	13	62	0	75
Senior Engineer (Pipeline-5)	1	13	62	0	75
Senior Engineer (Pipeline-6)	1	13	0	0	13
Senior Engineer (Pipeline-7)	1	13	0	0	13
Senior Engineer (Pipeline-8)	1	13	0	0	13
Senior Engineer (Pipeline-9)	1	13	0	0	13
Senior Engineer (Pipeline-10)	1	13	0	0	13
Senior Engineer (Structure)	1	5	5	0	10
Senior Engineer (Mechanical)	1	9	37	0	46
Senior Engineer (Electrical)	1	9	37	0	46
Senior Engineer (Architect)	1	7	5	0	12
Senior Engineer (Build. Services)	1	7	5	0	12
Engineer (Topographic Specialist)	1	5	0	0	5
Engineer (Geotechnical Specialist)	1	3	0	0	3
Environment/Social Campaign Specialist	1	2	10	0	12
Engineer (Specification Specialist)	1	3	0	0	3
Quantity Surveyors	2	6	97	6	109
	18	230	608	18	856

5.2 Qualification of Key Team Members

The qualification of Key Team Members of Professional (A) is shown in **Table 3**.

Table 3 Qualification of Key Team Members

Designation	Qualification
Professional (A) International Specialist	
Team Leader	Should have at least 15 years' experience in urban water supply and water related projects. Should have handled at least one urban comprehensive water supply project involving planning, process design, detail design, detailed engineering, construction supervision, monitoring and commissioning. Should have handled at least one Japanese ODA Loan project.
Water Treatment Expert	Should have at least 10 years' experience in urban water supply and water related projects. Should have handled at least one urban water supply project involving progress design, detailed engineering, construction supervision, monitoring and commissioning.
Civil Engineer (Intake Facility & Water Treatment Plant)	Should have at least 7 years' experience in urban water supply and water related projects. Should have handled at least one urban water supply project involving process design, detailed engineering, construction supervision, monitoring and Commissioning.
Senior Pipeline Engineer	Should have at least 7 years' experience in detailed engineering in water conveyance system and distribution network analysis for a minimum length of 50 km and minimum diameter 100 mm. Should have handled at least one urban water supply project.
Mechanical Engineer	Should have at least 10 years' experience in design/detailed engineering of mechanical works and piping in water/waste water treatment plant, pump system and water hammer analysis. Should have handled at least one urban water supply project.
Electrical Engineer	Should have at least 10 years' experience in detailed Engineering of HT/LT installations and pumping machineries in water supply and water related projects with instrumentation with SCADA system. Should have handled at least one urban water supply project.
Professional (B) National Specialist	
Deputy Team Leader	Qualification: • Licensed or Registered Civil Engineer and Graduate (B.Sc.) in Civil Engineering/ construction management and/or related field Experience: • More than 15 years in water supply projects in similar area

Consultant may propose other experts and supporting staff required to accomplish the tasks outlined in the TOR. It is the Consultant's responsibility to select the optimum team and to propose the professionals which he believes best meets the needs of CWASA.

5.3 Scope of Works for the Respective Personnel

Detailed information on the major tasks and duties to be performed by the members of the detailed engineering design team and the construction supervision team is shown in **Table 4**.

Table 4 Major Tasks and Duties of Team Members

Designation	Major Tasks and Duties
Professional (A) (International Specialist)	
Team Leader	Pre-Construction Stage: • General coordination • Supervises the Consultant's services • Assumes direct responsibility for day-to-day consulting services • Represents the Consultant's Team in all matters relating to the performance of services Construction Stage: • General coordination • Supervises the Consultant's services • Assumes direct responsibility for day-to-day consulting services • Represents the Consultant's Team in all matters relating to the performance of services
Water Treatment Expert	Pre-Construction Stage • Review existing designs and specifications • Prepare the basic design and detailed design of the water treatment plant including water intake facilities and other related facilities • Direct the foreign and local engineers attending the detailed designs of the water treatment plant including water intake facilities
Civil Engineer (Intake Facility & Water Treatment Plant)	Pre-Construction Stage • Review structural designs • Assist the water supply expert in preparing the basic design and detailed design of the water treatment plant including water intake facilities • Direct the local engineers attending the detailed designs of the water treatment plant including water intake facilities • Prepare Technical Specifications • Prepare Bills of Quantities Construction Stage • Coordinate and supervise contractors' works for civil engineering of Intake Facility and WTP • Review and approve Shop Drawings/ Construction Drawings for these works submitted by the contractors. • Review and approve test reports for materials submitted by the contractors • Inspect the contractors' works
Senior Pipeline Engineer	Pre-construction stage • Review structural designs • Prepare the basic design and detailed design of water transmission and distribution pipelines and facilities and secondary/tertiary distribution network • Direct the foreign and local engineers attending the detailed designs of water transmission and distribution pipelines and facilities and secondary/tertiary distribution network • Prepare Technical Specifications • Prepare Bills of Quantities ・Direct the local pipeline engineers Construction stage ・Coordinate and supervise the contractor's works ・Review and approve shop drawings submitted by the contractors ・Inspect the contractor's works
Pipeline Engineer (1)	Pre-construction stage • Assist Senior Pipeline Engineer in preparing detailed design, specifications and drawings for conveyance and transmission pipelines and primary distribution mains. Construction stage • Assist Senior Pipeline Engineer in reviewing shop drawings for the above works. • Supervise day-to-day contractors' work performance for the above works.

Designation	Major Tasks and Duties
Pipeline Engineer (2) to (4)	Pre-construction stage • Assist Senior Pipeline Engineer in preparing detailed design, specifications and drawings for secondary/tertiary distribution networks. Construction stage • Assist Senior Pipeline Engineer in reviewing shop drawings for the above works. • Supervise day-to-day contractors' work performance for the above works.
Structure Engineer	Pre-construction stage • Assist Senior Pipeline Engineer in preparing detailed design, specifications and drawings for civil structures. Construction stage • Assist Senior Pipeline Engineer in reviewing shop drawings for the above works.
Mechanical Engineer	Pre-construction stage • Review existing designs • Prepare the basic design of mechanical equipment for the water treatment plant including water intake facilities / water transmission and distribution facilities • Direct the local mechanical engineers attending the detailed designs of mechanical works for the water treatment plant including water intake facilities / water transmission and distribution facilities • Prepare Specifications for mechanical works • Prepare Bill of Quantities for mechanical works Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of mechanical equipment • Attend the factory inspection together with CWASA's engineer, if requested • Attend the trial operation of mechanical equipment
Electrical Engineer	Pre-construction stage • Review existing designs • Prepare the basic design of electrical equipment for the water treatment plant including water intake facilities / water transmission and distribution facilities • Direct the local electrical engineers attending the detailed designs of the water treatment plant including water intake facilities / water transmission and distribution facilities • Prepare Specifications for electrical works • Prepare Bill of Quantities for electrical works Construction stage • Check the shop drawings submitted by the contractors • Assess the substitution of products proposed by the contractors • Supervise the installation work of electrical equipment • Attend the factory inspection together with CWASA's engineer, if requested • Attend the trial operation of mechanical equipment
O&M Specialist (Water Treatment Plant)	Construction stage • Review and contractors' proposed O&M supervision work program and training programs for WTP including Intake Facility and Reservoirs • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training for WTP, Intake Facility and Reservoirs, including SCADA system • Monitor and assess the effect of training and instruct any improvement of training services if necessary • Prepare O&M manuals on WTP sludge treatment and SCADA system management • Provide training on the above and any other particular aspects supplement to the contractors' training services
O&M Specialist	Construction stage

Designation	Major Tasks and Duties
(Distribution Control System)	• Review and contractors' proposed O&M supervision work program and training programs for Distribution Control System • Coordinate the contractor's commissioning works • Coordinate the contractor's O&M supervision and training for Distribution Control System • Monitor and assess the effect of training and instruct any improvement of training services if necessary • Prepare O&M manuals on water pressure monitoring and control at Sector inlet chambers and leakage investigation and repairs at DMA inlet chambers • Provide training on the above and any other particular aspects, supplement to the contractors' training services
Specification Specialist	Pre-construction stage • Review and formalize all specification documents to be incorporated in the Bidding Documents
Environment/Social campaign Specialist	Pre-construction stage/ construction stage • Prepare environmental monitoring program to be carried out by CWASA • Assist CWASA in initial set-up of environmental monitoring program • Prepare the CWASA's campaign program and action program for public education and awareness of public water supply and beneficiaries' obligations and promotion of applications for house connections to be carried out by CWASA • Guide and assist CWASA 's in initial set-up of these action programs • Assist CWASA in carrying out these actions. • Monitor the effect of these campaign programs and improve programs if necessary.
Costing Engineer	Pre-construction stage • Prepare the Engineer's Cost Estimates for the Project • Assist the Civil Engineer and Senior Pipeline Engineer in finalizing Bill of Quantities
Contract Specialist	Pre-construction stage • Prepare Bidding Documents and Evaluation Criteria • Assist CWASA in conducting bidding process • Coordinate consultant's bid evaluation and prepare bid evaluation reports • Assist Team Leader in presentation to and discussion with CWASA as well as liaison with JICA on the bid evaluation Construction stage • Assist CWASA in contract administration • Assist Team Leader in presentation to and discussion with CWASA as well as liaison with JICA on contractual matters
Professional (B) (National Specialist)	
Deputy Team Leader	• Assist Team Leader in carrying out all tasks and duties of Team Leader • Represent the Consultant's team during absence of the Team Leader • Perform specific issues/aspects delegated by Team Leader
Senior Engineer (Intake and WTP)	Pre-construction stage • Assist Professional (A) Civil Engineer (Intake Facility & Water Treatment Plant) in carrying out site survey/investigation and collecting local data and information related to civil works for Intake Facility, WTP and Reservoirs • Assist Professional (A) Civil Engineer (Intake Facility & Water Treatment Plant) in carrying out detailed design of civil structure and buildings • Prepare drawings for these facilities Construction stage • Assist Professional (A) Civil Engineer (Intake Facility & Water Treatment Plant) in carrying out day-to-day supervision of the contractors' works for Intake Facility, WTP and Reservoir/Elevated Tank construction
Senior Engineer (Pipeline – 1 & 2)	Pre-construction stage • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out the pipeline route survey/investigation and collecting local data and information related to Conveyance and Transmission Pipelines and Primary Distribution Mains • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out detailed design of Conveyance and Transmission Pipelines and Primary Distribution

Designation	Major Tasks and Duties
	Mains • Prepare drawings for these pipelines <u>Construction stage</u> • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out day-to-day supervision of the contractors' works for these Pipelines
Senior Engineer (Pipeline – 3, 4 & 5)	<u>Pre-construction stage</u> • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out the pipeline route survey/investigation, trial digging and collecting local data and information related to Secondary/Tertiary Distribution Networks • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out detailed design of Secondary/Tertiary Distribution Networks • Prepare drawings for these pipelines <u>Construction stage</u> • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out day-to-day supervision of the contractors' works for these pipelines and relevant facilities
Senior Engineer (Pipeline – 6 & 7)	<u>Pre-construction stage</u> • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out the pipeline route survey/investigation and collecting local data and information related to Conveyance and Transmission Pipelines and Primary Distribution Mains • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out detailed design of Conveyance and Transmission Pipelines and Primary Distribution Mains • Prepare drawings for these pipelines
Senior Engineer (Pipeline – 8, 9 & 10)	<u>Pre-construction stage</u> • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out the pipeline route survey/investigation, trial digging and collecting local data and information related to Secondary/Tertiary Distribution Networks • Assist Professional (A) Senior Pipeline Engineer and Pipeline Engineers in carrying out detailed design of Secondary/Tertiary Distribution Networks • Prepare drawings for these pipelines
Senior Engineer (Structure)	<u>Pre-construction stage</u> • Assist Professional (A) Structure Engineer in detailed design of civil structures <u>Construction stage</u> • Assist Professional (A) Structure Engineer in carrying out day-to-day supervision of the contractors' civil structure works
Senior Engineer (Mechanical)	<u>Pre-construction stage</u> • Assist Professional (A) Mechanical Engineer in detailed design of mechanical works <u>Construction stage</u> • Assist Professional (A) Mechanical Engineer in carrying out day-to-day supervision of the contractors' mechanical works
Senior Engineer (Electrical)	<u>Pre-construction stage</u> • Assist Professional (A) Electrical Engineer in detailed design of electrical works <u>Construction stage</u> • Assist Professional (A) Electrical Engineer in carrying out day-to-day supervision of the contractors' electrical works
Senior Engineer (Architect)	<u>Pre-construction stage</u> • Assist Professional (A) Civil Engineer in architectural design of buildings • Prepare drawings for buildings <u>Construction stage</u> • Assist Professional (A) Civil Engineer in reviewing shop drawings for buildings • Assist Professional (A) Civil Engineer in carrying out day-to-day supervision of the contractors' building works
Senior Engineer (Build. Services)	<u>Pre-construction stage</u> • Assist Professional (A) Mechanical Engineer and Electrical Engineer in detailed design of building services <u>Construction stage</u>

Designation	Major Tasks and Duties
	• Assist Professional (A) Mechanical Engineer and Electrical Engineer in reviewing shop drawings for building services • Assist Professional (A) Mechanical Engineer and Electrical Engineer in carrying out day-to-day supervision of the contractors' works for building services • Assist Professional (A) Mechanical Engineer and Electrical Engineer in carrying out on-site inspection and installation inspection of the delivered building service equipment • Assist Professional (A) Mechanical Engineer and Electrical Engineer in carrying out on-site inspection, installation inspection and tests of the delivered building service equipment
Engineer (Topographic Specialist)	Pre-construction stage • Supervise topographic surveyors to be carried out by Topographic Surveyors • Assist Professional (A) Civil Engineer in reviewing Topographic Survey Reports submitted by the Topographic Surveys and determining topographic conditions for detailed design
Engineer (Geotechnical Specialist)	Pre-construction stage • Supervise geotechnical surveyor and investigations to be carried out by Geotechnical Surveyors • Assist Professional (A) Civil Engineer in reviewing Geotechnical Survey Reports submitted by the Geotechnical Surveys and determining geotechnical conditions for detailed design
Environment/Social Campaign Specialist	• Assist the duties and works to be carried out by Professional (A) Environment/Social Campaign Specialist
Engineer (Specification Specialist)	• Assist the duties and works to be carried out by Professional (A) Specification Specialist, in particular inputting local regulations and practices and other particular conditions in Bangladesh
Quantity Surveyors	Pre-construction stage • Assist Professional (A) Costing Specialist in collecting local cost data and information and estimating local components of works Construction stage • Assist Professional (A) Engineers and Contract Specialist in measuring quantities of contractors' works claimed for monthly payments and also assist Professional (A) Team Leader and Contract Specialist in certifying contractors' monthly bills • Assist Professional (A) Contract Specialist in contract administration, in particular variation orders and so on • Assist Professional (A) Team Leader and Contract Specialist in reviewing and certifying final measurements and accounts submitted by the contractors • Assist Professional (A) Team Leader in monitoring financial progress of works and estimating payment/disbursement amount for the coming few months • Assist Professional (A) Team Leader in preparing financial monitoring reports to be submitted to CWASA and JICA

Chapter 6 Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to Project Director/ Project Manager in charge in CWASA as shown in **Table 5**. The Consultant shall provide electronic copy of each of these reports.

Table 5 Summary of Reports to Be Submitted

Category	Type of Report	Timing	No. of Copies
Consultancy Services	Inception Report	Within 1 month after commencement of the services	10
	Monthly Progress Report	Every month	10

Category	Type of Report	Timing	No. of Copies
	Quarterly Progress Report	Every quarter	10
	Project Completion Report (for submission to JICA)	At the end of the services	10
Detailed Design	Project Definition Report	Within 3 months after commencement of the services	10
	Draft Design Report	Within 8 months after commencement of the services	10
	Cost Estimate Report	As per the Project Schedule for each Package	10
	Final Design Report	As per the Project Schedule for each Package	10
Tender Assistance	Pre-qualification Document	As per the Project Schedule for each Package	10
	Bidding Document	As per the Project Schedule for each Package	10
	Pre-qualification Evaluation Report	At appropriate timing	10
	Technical Evaluation Report	At appropriate timing	10
	Price and Commercial Evaluation Report	At appropriate timing	10
Assistance in Environment Monitoring	Environmental Monitoring Report	Every quarter after commencement of the services	10
Construction Supervision	Construction Completion Report	Within 3 months after completion of construction	10
Technology Transfer	O&M Manual	At appropriate timing in accordance with the Inception Report	10
	Evaluation Report of Contractors' Training Services	Within 1 month after completion of training	10
Other Report	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

(1) For Inception Report
   (a) **Inception Report**: presents the methodologies, schedule, organization, etc.

(2) For Monthly and Quarterly Progress Report
   (a) **Monthly Progress Report**: describes briefly and concisely all activities and progress for the previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for correction. Also indicates the work to be performed during the coming month.
   (b) **Quarterly Progress Report**: presents the progress status of the Project.

(3) For Detailed Design
   (a) **Project Definition Report**: presents the design criteria and standards.
   (b) **Draft Design Report**: presents detailed engineering design.
   (c) **Cost Estimate Report**: presents detailed cost estimate.
   (d) **Final Design Report**: presents final documents of detailed design and cost estimate and bid plan through the incorporation of comments on the Draft Design Report provided by the Consultant.

(4) For Tender Assistance
   (a) **Pre-qualification Document**: presents the pre-qualification documents and its evaluation criteria.

(b) **Bidding Document**: presents the bidding documents and bid evaluation criteria.
(c) **Pre-qualification Evaluation Report**: presents the results of the evaluation with recommendation on the selection of the qualified applicants.
(d) **Technical Evaluation Report**: presents the results of technical evaluation with recommendation on technically responsive bidders.
(e) **Price and Commercial Evaluation Report**: presents the results of the tenders with recommendation on the successful bidder for award of contract.

(5) For Assistance in Environment Monitoring
(a) **Environmental Monitoring Report**: presents the environmental impacts and implementation of environmental mitigation measures during and after the construction stage. Environmental monitoring forms attached as **Appendix 1** shall be filled and attached to the Report.

(6) For Construction Supervision
(a) **Construction Completion Report**: comprises outline of all facilities completed and construction records from the commencement through completion, together with key data and records.

(7) For Technology Transfer
(a) **O&M Manuals**: comprises the contents mentioned in 3.6 (b) (i) & (ii)
(b) **Evaluation Report of Contractors' Training Services**: presents the evaluation of contractors training services

Chapter 7 Obligations of the Executing Agency

A certain range of arrangements and services will be provided by CWASA to the Consultant for smooth implementation of the Consulting Services. In this context, CWASA will:

(1) Reports and data
Make available to the Consultant existing reports and data related to the Project as required.

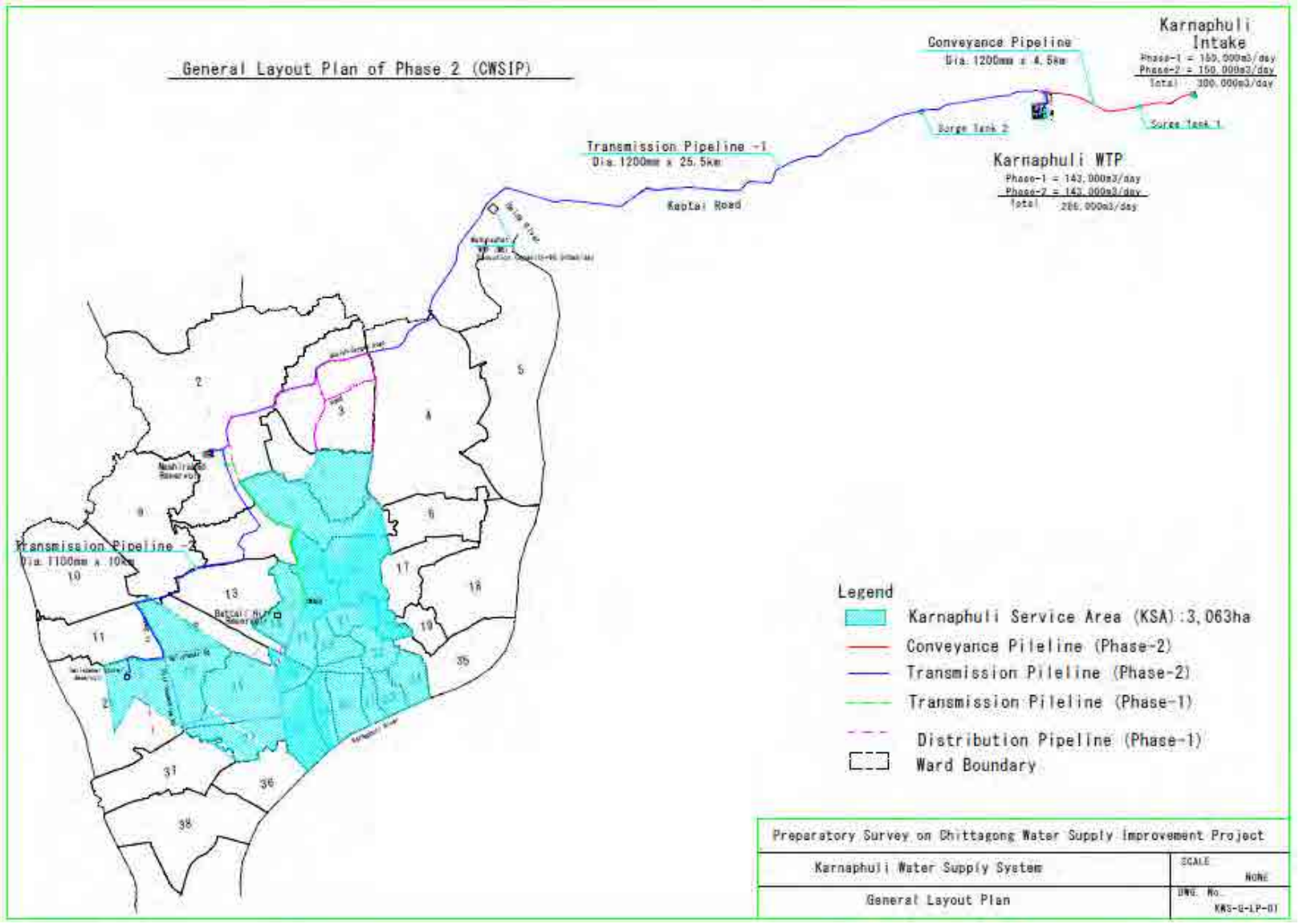
(2) Office space
Provide an office space in CWASA with necessary equipment, furniture and utility. However, the Consultant's requirement for office space, including necessary equipment, furniture and utilities, shall be clearly stated in the proposal with its rental cost for the case where CWASA would be unable to provide such facilities;

(3) Cooperation and counterpart staff
Appoint counterpart officials, agent and representative as may be necessary for effective implementation of the Consulting Services;

(4) Assistance and exemption
Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to:

- work permit and such other documents;
- entry and exit visas, residence permits, exchange permits and such other documents
- clearance through customs;
- instructions and information to officials, agent and representatives of the GOB;
- exemption from any requirement for registration to practice their profession;
- privilege pursuant to the applicable law in Bangladesh.

Attachment 1



Attachment 2

	Position	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
1	Team Leader											87
2	Water Treatment Expert											9
3	Intake & WTP Engineer											49
4	Chief Pipeline Engineer											73
5	Pipeline Engineer (1)											69
6	Pipeline Engineer (2) / Hydologist											69
7	Pipeline Engineer (3)											12
8	Pipeline Engineer (4)											12
9	Structure Engineer											9
10	Mechanical Equipment Engineer											26
11	Electrical Equipment Engineer											26
12	O&M Specialist (WTP)											8
13	O&M Specialist (Pipe)											12
14	Specification Specialist											3
15	Environment/social campaign specialist											12
16	Costing Engineer											5
17	Contract Specialist											24
1	Depty Team Leader (for Local Engineer)											100
2	Senior Engineer (Intake and WTP)											54
3	Senior Engineer (Pipeline-1)											79
4	Senior Engineer (Pipeline-2)											75
5	Senior Engineer (Pipeline-3)											75
6	Senior Engineer (Pipeline-4)											75
7	Senior Engineer (Pipeline-5)											75
8	Senior Engineer (Pipeline-6)											13
9	Senior Engineer (Pipeline-7)											13
10	Senior Engineer (Pipeline-8)											13
11	Senior Engineer (Pipeline-9)											13
12	Senior Engineer (Pipeline-10)											13
13	Senior Engineer (Structure)											10
14	Senior Engineer (Mechanical)											46
15	Senior Engineer (Electrical)											46
16	Senior Engineer (Architect)											12
17	Senior Engineer (Architect AM & AE)											12
18	Engineer (Topographic Specialist)											5
19	Engineer (Geotechnical Specialist)											3
20	Environment/social campaign specialist											12
21	Engineer (Specification Specialist)											3
22	Senior Engineer (Quantity Surveyor)											41
23	Senior Engineer (Quantity Surveyor)											68
	[Total of Pro-A]	**40**	**86**	**33**	**76**	**68**	**68**	**63**	**51**	**18**	**2**	**505**
	[Total of Pro-B]	**66**	**144**	**16**	**124**	**137**	**144**	**96**	**89**	**38**	**2**	**856**
	[Total of Pro-A+Pro-B]	106	230	49	200	205	212	159	140	56	4	1,361

11.7 Basis of Cost estimation for Construction works of Phase 2

1. Basis of cost estimation for Phase 2

Biddings of Karnaphuli Water Supply Project (Phase 1) were conducted as bellow times;

Table 11.1 Bidding Submission Date

Contract	date
C-1 Intake and WTP	20th July, 2010
C-2 Pipeline	27th July, 2010
C-3 Reservoir	19th April,2010

Construction Cost of Phase 2 will be estimated by referring the Phase 1 because conditions of construction such as local material, labour, soil, and traffic etc. are almost same one. However, basically Price escalation should be considered during 2 or 3 years as bellow;

Foreign price; $(1+ 1\%)^3 = 1.03 =$about 1.05
Local Price; $(1+3\%)^3 = 1.09 =$ about 1.10

On the other hand, the contracted price of C-1 was discounted as bellow so that appropriate cost should be considered.

Table 11.2 Contracted Price of C-1

Description		Amounts	
		Local Currency Portion (BDT)	Foreign Currency Portion (JPY)
A.	Grand Total of BOQ Amounts**1)	1,658,099,640	2,192,889,754
B.	Less: Discount**2)	165,848,561	220,109,665
C.	Accepted Contract Amount (A. - B.)	1,492,251,079	1,972,780,089

2. Pipeline

2.1 Analysis of Phase 1 Project (C-2)

(1) Composition of construction cost

Construction cost of pipeline for Phase 1 was consisted of following items as shown in Table 11.3

Table 11.3 Items of Construction Cost for Pipeline in Phase 1Project

Item		Work/ Material	
1	Supply of Pipes, Valve s and Fittings	DI Pipe and Steel Pipe	Standard S/S joints
			Restrained joint system
		Air Valves and Associated pipes & Fittings	
		Washout Valve and Associated Pipes &	

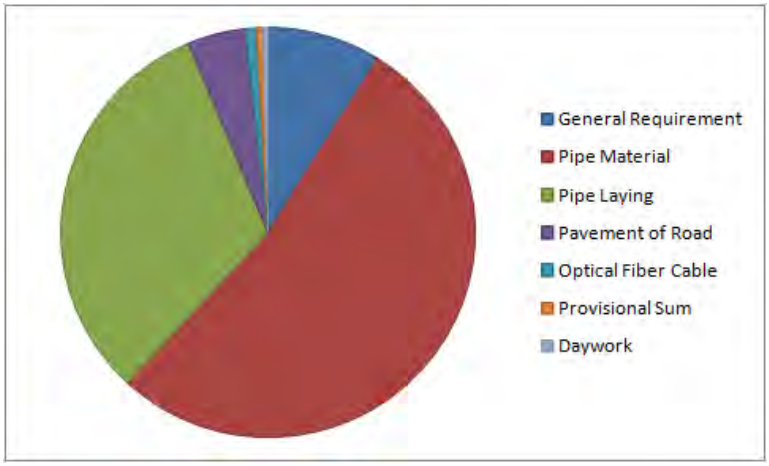
		Fittings	
		Butterfly Valve and Associated Pipes & Fittings	
		Butterfly Valve and Associated Pipes & Fittings	
2	Laying and Fitting of Pipes, Valve and Fittings	Pipe works-DI Pipes	Standard S/S joints depending on excavation depth
			Restrained joint system depending on excavation depth
		Pipe works -Fittings	
		Fittings for Air Valves	
		Fittings for Washout	
		Fittings for Valves	
		Steel Pipes for over crossing	
		Steel pipes for over crossing with pile	
		Water Course/Culvert Crossings	
		Pipe Jacking	
3	Payment for permanent road reinstatement		

(2) Composition of the Contracted cost for C-2 in Phase 1 Project

The Contracted cost for C-2 in Phase1 Project is shown in Table 2, in which Pipe Material cost, ranging from DN300mm to DN 1200mm, cover more than 50% of Total Cost. However, Material Cost of Conveyance/Transmission Pipe from Intake/WTP, to Battali Hill Reservoir via. Nashirabad Reservoir, which are almost DN1200mm pipe, account for about 80% of total material cost.

Table 11.4 Cost Breakdown of C-2 (Pipeline) in Phase 1 Project

KMJV (Rev.)		JPY	
Part 1	General Requirement	786,621,231	8.8%
Part 2-1	Pipe Material	4,712,108,490	53.0%
Part 2-2	Pipe Laying	2,833,713,887	31.9%
Part 2-3	Pavement of Road	399,932,949	4.5%
Part 3	Optical Fiber Cable	77,906,678	0.9%
Part 4	Provisional Sum	46,627,783	0.5%
Part 5	Daywork	33,597,135	0.4%
Total		8,890,508,153	100.0%
Note)	Revised BOQ submitted on 22nd August 2011		



(3) Unit price of pipe in Phase 1 Project

<Material Cost>

According to Table 11.5, Unit price of Restrained Joint System is more than 1.5 times than Unit price of Standards S/S Joints. Compared with the published price in Japan, in case of more than DN 900mm pipes, Unit price of Standard S/S Joints are almost same as Published price in Japan (2009). However, in case of less than DN 700mm pipes imported from India, Unit price of Standard S/S Joints are almost 50% of the Published price in Japan (2009).

Table 11.5 Contracted Unit Price of pipe material in Phase1 Project

(JPY/m)

Dia.	Phase1 Project				Published Price in Japan (2009); K type	
	Standard S/S Joints		Restrained Joint System			
1200mm	100,000	(100)	200,000	(200)	120,300	(120)
1000mm	95,000	(100)	135,000	(142)	87,200	(92)
900mm	68,000	(100)	112,000	(165)	72,300	(106)
800mm	-		98,000		68,300	
700mm	30,000	(100)	67,000	(223)	54,800	(183)
500mm	17,000	(100)	28,000	(165)	32,500	(191)
450mm	15,000	(100)	23,000	(153)	27,500	(183)
400mm	12,000	(100)	20,000	(167)	23,500	(196)
300mm	8,000	(100)	12,500	(156)	16,500	(206)

Note) Unit Prices are rounded and DI Pipes of less than DN700m are imported from India.

<Pipe laying Cost by excavation depth>

Compared with pipe laying cost in Japan, Cost of Phase 1 is about 50%.

Table 11.6 Contracted Unit Price of Pipe Laying in Phase1 Project

(JPY/m)

Dia.	Phase1 Project Standard S/S Joints		Rough cost estimation in Japan
1200mm	1.5m<d<2m	27,000	46,000
	2m<d<3m	27,000	
	3m<d<5m	52,500	
	d>5m	72,500	
1000mm	1.5m<d<2m	-	41,000
	2m<d<3m	49,000	
	3m<d<5m	59,000	
	d>5m	81,500	
900mm	1.5m<d<2m	25,000	36,500
	2m<d<3m	27,000	
	3m<d<5m	42,000	
	d>5m	-	
800mm	1.5m<d<2m	-	
	2m<d<3m	29,000	
	3m<d<5m	-	
	d>5m	-	
700mm	1.5m<d<2m	16,000	32,000
	2m<d<3m	23,000	
	3m<d<5m	38,000	
	d>5m	-	
500mm	1.5m<d<2m	14,000	27,000
	2m<d<3m	17,500	
	3m<d<5m	33,000	
	d>5m	-	
450mm	1.5m<d<2m	13,500	26,000
	2m<d<3m	16,500	
	3m<d<5m	32,000	
	d>5m	-	
400mm	1.5m<d<2m	13,000	25,000
	2m<d<3m	14,500	
	3m<d<5m	30,000	
	d>5m	-	
300mm	1.5m<d<2m	13,500	23,000
	2m<d<3m	14,000	
	3m<d<5m	27,000	
	d>5m	-	

Note) Pipe laying cost depends on soil condition etc.

(4) Total unit construction cost of pipeline works

Total construction cost of pipeline works in Phase1 including pipe material cost (standard S/S straight pipe, restrained joint system, air valve, washout, butterfly valve etc), and pipe laying cost (depending on excavation depth, fittings works, pipe over crossing works, under passing, pipe jacking works etc.) are summarized in Table 11.7. But road pavement is not included in this price.

Table 11.7 Total Unit Construction Cost of Pipeline Works in Phase 1

Location	Dia.	Unit Price (per m)			Reference
		Taka	JPY	Converted JPY	
Conveyance Pipeline	1200mm	26,500	137,000	168,800	
Transmission Pipeline 1 (WTP to Nashirabad Reservoir)	1200mm	28,700	164,000	198,440	Including Water bridge, jacking etc
Transmission Pipeline 2 (Nashirabad Reservoir to Battali Hill Reservoir)	1200mm	26,700	160,000	192,040	
	1000mm	67,000	189,000	269,400	Including jacking
Distribution pipeline					
N 5.1	1200mm	16,500	150,000	169,800	
N5.2	900mm	11,000	95,000	108,200	
N5.3	450mm	10,000	25,500	37,500	
N5.4	300mm	9,000	17,000	27,800	
N5.5	400mm	7,700	23,000	32,240	
N5.6	300mm	8,300	18,500	28,460	
N5.7	400mm	7,700	21,500	30,740	
N5.8	300mm	8,500	19,000	29,200	
N5.9	400mm	7,500	20,000	29,000	
N5.10	700mm	12,000	54,500	68,900	
C6.6	500mm	10,000	35,000	47,000	
C6.7	400mm	8,500	22,000	32,200	
C6.8	500mm	11,000	31,500	44,700	
C6.9	400mm	8,000	20,500	30,100	
C6.10	300mm	9,500	18,000	29,400	
S7.1	900mm	24,000	110,500	139,300	
S7.2	700mm	17,500	49,500	70,500	
S7.3	500mm	18,500	38,000	60,200	
S7.4	300mm	13,500	27,000	43,200	
S7.5	400mm	8,800	21,500	32,060	
S7.7	300mm	8,000	15,500	25,100	
S7.8	400mm	9,500	23,000	34,400	
S7.9	500mm	9,500	25,500	36,900	
S7.10	700mm	9,000	45,000	55,800	
S7.11	300mm	6,700	14,500	22,540	

Note) 1 BDT = 1.2 JPY in 2010, figures are rounded.

2.2 Proposed Unit Price for Phase 2

(1) Pipeline works

Table 11.8 shows the proposed total unit construction cost of pipeline works in Phase2 including price escalation for distribution Pipeline.

Table 11.8 Proposed Total Unit Construction Cost of Pipeline Works in Phase 2

Material	Dia.	Unit Price (m)			
		Phase1 Project		Phase 2 Project	
		Taka	JPY	Taka	JPY
DIP	1200mm	26,500	137,000	25,000	150,000
	1200mm	28,700	164,000		
	1200mm	26,700	160,000		
	1200mm	16,500	150,000		
	1100mm	-	-	21,000	125,000
	1000mm	67,000	189,000	19,000	110,000
	900mm	11,000	95,000	17,000	100,000
	900mm	24,000	110,500		
	800mm	-	-	16,390	82,500
	700mm	12,000	54,500	14,080	54,450
	700mm	17,500	49,500		
	700mm	9,000	45,000		
	600mm	-	-	13,640	45,100
	500mm	10,000	35,000	13,200	35,750
	500mm	18,500	38,000		
	500mm	9,500	25,500		
	500mm	11,000	31,500		
	450mm	10,000	25,500	11,110	30,250
	400mm	7,700	23,000	9,020	24,200
	400mm	7,700	21,500		
	400mm	7,500	20,000		
	400mm	8,500	22,000		
	400mm	8,000	20,500		
	400mm	8,800	21,500		
	400mm	9,500	23,000		
	300mm	9,000	17,000	10,010	20,350
	300mm	8,300	18,500		
	300mm	8,500	19,000		
	300mm	9,500	18,000		
	300mm	13,500	27,000		
	300mm	8,000	15,500		
	300mm	6,700	14,500		
PVC	250mm	-	-	9,350	12,100
	200mm	-	-	9,350	8,250
	150mm	-	-	9,350	5,170
	100mm	-	-	9,350	2,640
	75mm	-	-	8,800	1,760

Note) Material cost of PVC is applied by price in Japan

(2) Sector Inlet Chamber

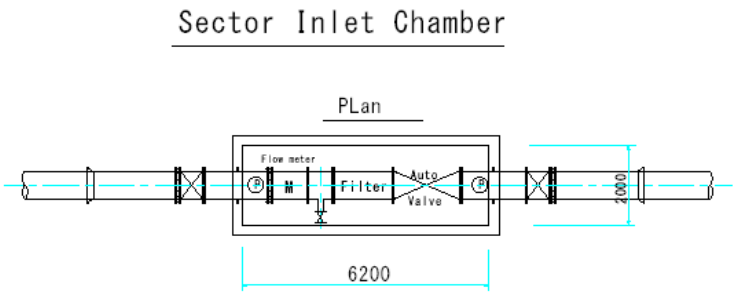


Table 11.9 Total Cost of Sector Inlet Chamber

	Unit	Quantity	Rate		Total	
			Taka	JPY	Taka	JPY
Pressure Control Valve	Set	10		6,400,000		64,000,000
Maintenance Valve	Set	20		2,000,000		40,000,000
Distribution Flow	Set	10		6,000,000		60,000,000
Distribution Pressure	Set	10		300,000		3,000,000
Valve Control Panel	Set	10		3,000,000		30,000,000
Telemetry System (Local)	Set	10		5,000,000		50,000,000
Telemetry System (Central)	Set	1		10,000,000		10,000,000
Central Monitoring System	Set	1		20,000,000		20,000,000
Other (10%)	Ls	1				27,700,000
Chamber	Nr	10	500,000		5,000,000	
Total					5,000,000	304,700,000

(3) DMA Inlet Chamber

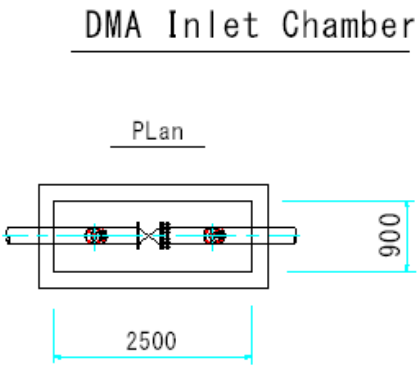
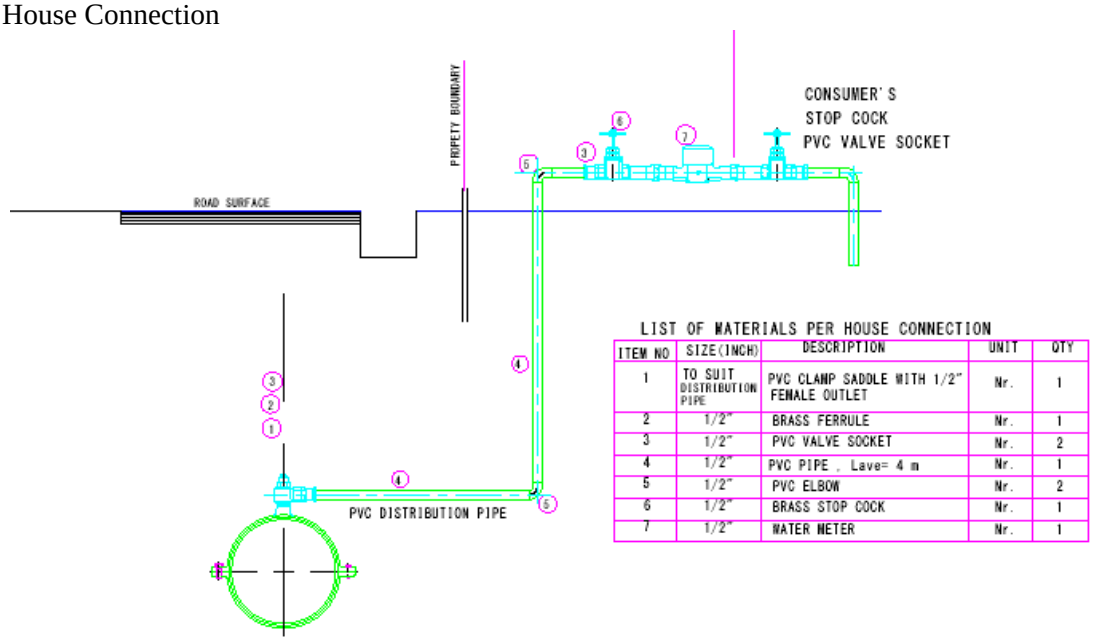


Table 11.10 Unit Cost of DMA Inlet Chamber

	Unit	Quantity	Rate		Total	
			Taka	JPY	Taka	JPY
Fire Hydrant	set	2		30,000		60,000
Valve	set	1		200,000		200,000
Chamber	Nr	1	70,000		70,000	
Total					70,000	260,000

(4) House Connection



LIST OF MATERIALS PER HOUSE CONNECTION

ITEM NO	SIZE(INCH)	DESCRIPTION	UNIT	QTY
1	TO SUIT DISTRIBUTION PIPE	PVC CLAMP SADDLE WITH 1/2" FEMALE OUTLET	Nr.	1
2	1/2"	BRASS FERRULE	Nr.	1
3	1/2"	PVC VALVE SOCKET	Nr.	2
4	1/2"	PVC PIPE , Lave= 4 m	Nr.	1
5	1/2"	PVC ELBOW	Nr.	2
6	1/2"	BRASS STOP COCK	Nr.	1
7	1/2"	WATER METER	Nr.	1

Table 11.11 Unit Cost of House Connection

	Unit	Quantity	Rate		Total	
			Taka	JPY	Taka	JPY
Saddle & Ferrules (100mm)	set	1		3,000		3,000
PVC Pipe (20mm)	m	6		250		1,500
Valve (20mm)	set	1		2,000		2,000
Water Meter	set	1		4,000		4,000
Laying works	Ls	1			3,000	
Total					3,000	10,500

3. Intake and Water Treatment Plant

Appropriate Bided price of C-1, compared with Engineer's estimates, is applied for Phase 2 Project.

Table 11.12 Bided price of Phase 1

		LC (Taka)	FC(JPY)	reference
Intake	Plant Mechanical Works	13,113,000	212,940,000	Phase 1
		6,640,000	64,640,000	Phase 2
	Plant Electrical Works	12,318,000	250,938,000	Phase 1
		24,503,050	220,527,450	Phase 2
	No1. Surge Tank	13,747,573	8,596,692	Phase 1
		15,122,000	9,500,000	Phase 2 (10%up)
WTP	Sedimentation Basin	302,625,038	84,112,518	Phase 1
	ditto	214,123,383	74,942,120	Without Pile
		235,536,000	82,436,000	Phase 2 (10%up)
	Pile (1m)	5,390	560	Phase 1
		6,000	620	Phase 2 (10%up)
	Filter	159,523,050	46,164,724	Phase 1
		175,475,000	50,781,000	Phase 2 (10%up)
	Filter Drain Tank	57,268,307	16,956,246	$V=6,900m^3$
		8,300 taka/m^3	2,500JPY/m^3	Without Pile

		LC (Taka)	FC(JPY)	reference
		9,130 taka/m^3	2,750JPY/m^3	Phase 2 (10%up)
	Clear Well Reservoir	160,008,793	55,783,470	Phase 1
		176,010,000	61,362,000	Phase 2 (10%up)
	Electrical Building	25,614,039	2,662,867	Phase 1
		28,175,000	2,930,000	Phase 2 (10%up)
	Chlorine Building	21,202,946	2,857,512	Phase 1
		23,323,000	3,143,000	Phase 2 (10%up)
	Site works	282,297,345	29,319,687	10.5ha
		3,500 taka/m^2	350JPY/m^2	Road in Phase 2
	No.2 Surge Tank	18,667,628	10,026,962	Phase 1
		20,534,000	11,030,000	Phase 2 (10%up)
	Plant Mechanical Works	73,248,000	748,795,000	Phase 1
		101,524,000	970,790,000	Phase 2
	Plant Electrical Works	33,730,783	592,213,000	Phase 1
		91,993,550	827,941,950	Phase 2

<Mechanical Works for Phase 2> Intake

Item	Description	Unit	Quantity	Rate Component Local (Taka)	Rate Component Foreign (Yen)	Total Amount Component Local (Taka)	Total Amount Component Foreign (Yen)
	Intake Facility						
1	Intake Pump and Motor complete	Nr	2	2,131,000	21,310,000	4,262,000	42,620,000
2	Check Valve	Nr	2	187,200	1,872,000	374,400	3,744,000
3	Discharge Valve (HV)	Nr	2	78,000	780,000	156,000	1,560,000
4	Discharge Valve (MV)	Nr	2	274,000	2,740,000	548,000	5,480,000
5	Flow Control Valve complete	Nr	1	800,000	8,000,000	800,000	8,000,000
6	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				3,136,000
7	Installation of all pipe work, valves and fittings	LS	Lump Sum			500,000	100,000
					Bill Total to No. Summary	6,640,400	64,640,000

<Electrical Works for Phase 2> Intake

Item	Description	Unit	Quantity	Rate Component Local (Taka)	Rate Component Foreign (Yen)	Total Amount Component Local (Taka)	Total Amount Component Foreign (Yen)	Custom Duty, (Taka)
	Intake Facilities (Electrical) -Phase2							
	Power Supply Facilities	lot	1			6,600,000	59,400,000	
	・33kV VCB, 1000kVA Transformer							
	Standby Generator Facilities	lot	1			8,930,000	80,370,000	
	・1000kVA Diesel Engine Generator							
	Control & Operation Facilities	lot	1			4,522,000	40,698,000	
	・Pump Starter Panel (3kV VFD), 400V MCC, Local Panel							
	Instrumentation Facilities	lot	1			963,500	8,671,500	
	・Electromagnetic Flow Meter, Indication Panel							
	SCADA & Automatic Control Facilities	lot	1			1,260,000	11,340,000	
	・PLC Panel, SCADA System							
	Other Necessary Item	lot	1			2,227,550	20,047,950	
					Intake Facilities (Electrical) -Phase2	24,503,050	220,527,450	

<Mechanical Works for Phase 2> WTP

Item	Description	Unit	Quantity	Rate		Total Amount	
				Component		Component	
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)
	Mixing Chamber/ Clarifier Facility						
1	Flash Mixer complete	Nr	2	606,000	6,060,000	1,212,000	12,120,000
2	Inlet Weir complete	Nr	2	882,000	8,820,000	1,764,000	17,640,000
3	Inlet Gate complete	Nr	8	188,000	1,880,000	1,504,000	15,040,000
4	Sludge Collector complete	Nr	8	2,475,000	24,750,000	19,800,000	198,000,000
5	De-sludge Valve complete	Nr	32	143,000	1,430,000	4,576,000	45,760,000
6	Drain Pump complete	Nr	4	60,000	600,000	240,000	2,400,000
7	Polymer Tank complete	Nr	2	68,000	680,000	136,000	1,360,000
8	Alum Share Box complete	Nr	1	84,000	840,000	84,000	840,000
9	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				17,550,000
10	Installation of all pipe work, valves and fittings	LS	Lump Sum			4,100,000	700,000
	Filter Facility						
1	Inflow Valve complete	Nr	10	193,200	1,932,000	1,932,000	19,320,000
2	Filtrated & Backwash Valve complete	Nr	10	217,440	2,174,400	2,174,400	21,744,000
3	Surface-wash valve complete	Nr	10	62,160	621,600	621,600	6,216,000
4	Wash Waste Valve and Franged Spigot with Puddle Dia.1000mm	Nr	10	495,000	4,950,000	4,950,000	49,500,000
5	Drain Pump complete	Nr	4	31,080	310,800	124,320	1,243,200
6	Surface-wash Pipe Unit complete	Nr	10	792,000	7,920,000	7,920,000	79,200,000
7	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				39,760,000
8	Installation of all pipe work, valves and fittings	LS	Lump Sum			4,000,000	700,000

Item	Description	Unit	Quantity	Rate		Total Amount	
				Component		Component	
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)
	Clear Well Facility						
1	Transmission Pump and Motor complete	Nr	5	2,124,000	21,240,000	10,620,000	106,200,000
2	Suction Valve -1	Nr	5	46,560	465,600	232,800	2,328,000
3	Check Valve -1	Nr	5	156,000	1,560,000	780,000	7,800,000
4	Discharge Valve -1(HV)	Nr	5	40,080	400,800	200,400	2,004,000
5	Discharge Valve -1(MV)	Nr	5	147,600	1,476,000	738,000	7,380,000
6	Surface wash Pump and Motor complete	Nr	3	167,000	1,670,000	501,000	5,010,000
7	Suction Valve -2	Nr	3	24,720	247,200	74,160	741,600
8	Check Valve -2	Nr	3	87,480	874,800	262,440	2,624,400
9	Discharge Valve -2	Nr	3	24,720	247,200	74,160	741,600
10	Isolation Valve	Nr	2	240,000	2,400,000	480,000	4,800,000
11	Drain Pump complete	Nr	4	31,080	310,800	124,320	1,243,200
12	Overhead Crane complete	Nr	1	580,800	5,808,000	580,800	5,808,000
13	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				24,280,000
14	Installation of all pipe work, valves and fittings	LS	Lump Sum			2,400,000	400,000
	Chemical Facility						
1	ALUM Mixer complete	Nr	2	124,680	1,246,800	249,360	2,493,600
2	ALUM Pump and Motor complete	Nr	4	207,960	2,079,600	831,840	8,318,400
3	LIME Mixer complete	Nr	2	157,560	1,575,600	315,120	3,151,200
4	LIME Pump and Motor complete	Nr	3	242,520	2,425,200	727,560	7,275,600
5	Lime Dust Collector	Nr	2	196,920	1,969,200	393,840	3,938,400
6	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				3,140,000
7	Installation of all pipe work, valves and fittings	LS	Lump Sum			900,000	200,000

Item	Description	Unit	Quantity	Rate		Total Amount	
				Component		Component	
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)
	Chlorine Facility						
1	Chlorine Cylinder	Nr	18	135,000	1,350,000	2,430,000	24,300,000
2	Weight Scale complete	Nr	2	139,200	1,392,000	278,400	2,784,000
3	Chlorinator complete	Nr	3	558,000	5,580,000	1,674,000	16,740,000
4	Chlorine Booster Pump and Motor complete	Nr	3	10,000	100,000	30,000	300,000
5	Chlorine Booster Valve complete	Nr	1	16,000	160,000	16,000	160,000
6	Chlorine Crane complete	Nr	1	504,000	5,040,000	504,000	5,040,000
7	Exhaust Fan complete	Nr	7	41,000	410,000	287,000	2,870,000
8	Chlorine Leak Detector complete	Nr	1	11,000	110,000	11,000	110,000
9	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				2,170,000
10	Installation of all pipe work, valves and fittings	LS	Lump Sum			700,000	100,000
	Sludge Receiving Tank Facility						
1	Sludge Inlet Valve complete	Nr	4	120,000	1,200,000	480,000	4,800,000
2	Isolation Gate complete	Nr	1	100,000	1,000,000	100,000	1,000,000
3	Sludge Mixer complete	Nr	6	100,000	1,000,000	600,000	6,000,000
4	De-Sludge Pump and Motor complete	Nr	4	200,000	2,000,000	800,000	8,000,000
5	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				1,980,000
6	Installation of all pipe work, valves and fittings	LS	Lump Sum			600,000	100,000
	Sludge Thickener Facility						
1	Thickener 1 complete	Nr	2	4,000,000	40,000,000	8,000,000	80,000,000
2	Thickener 2 complete	Nr	2	3,100,000	31,000,000	6,200,000	62,000,000
3	Thickened Sludge Pump 1 complete	Nr	4	100,000	1,000,000	400,000	4,000,000
4	Thickened Sludge Pump 2 complete	Nr	3	150,000	1,500,000	450,000	4,500,000
5	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				3,525,000
6	Installation of all pipe work, valves and fittings	LS	Lump Sum			1,100,000	200,000
	Supernatant Tank Facility						
1	Sludge Inlet Valve complete	Nr	2	120,000	1,200,000	240,000	2,400,000
2	Isolation Gate complete	Nr	1	100,000	1,000,000	100,000	1,000,000
3	Supernatant Pump complete	Nr	4	150,000	1,500,000	600,000	6,000,000
4	Supply all pipe work, valves and fittings complete (Excluded the above-mentioned valves)	LS	Lump Sum				940,000
5	Installation of all pipe work, valves and fittings	LS	Lump Sum			300,000	100,000
					Bill Total to No. Summary	101,524,520	970,090,200

<Electrical Works for Phase 2> WTP

Item	Description	Unit	Quantity	Rate		Total Amount		
				Component		Component		Custom Duty,
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)	(Taka)
	WTP Facilities (Electrical) -Phase2							
	Power Supply Facilities	lot	1			10,368,000	93,312,000	
	・33kV VCB, 3500kVA Transformer							
	Standby Generator Facilities	lot	1			33,200,000	298,800,000	
	・3500kVA Diesel Engine Generator							
	Control & Operation Facilities	lot	1			25,604,000	230,436,000	
	・Pump Starter Panel (3kV VFD, 3kV Soft Starter), 400V MCC, Local Panel							
	Instrumentation Facilities	lot	1			6,728,500	60,556,500	
	・Electromagnetic Flow Meter, Ultrasonic Level Sensor, Indication Panel							
	SCADA & Automatic Control Facilities	lot	1			7,730,000	69,570,000	
	・PLC Panel, SCADA System							
	Other Necessary Item	lot	1			8,363,050	75,267,450	
WTP Facilities (Electrical) -Phase2						91,993,550	827,941,950	

4. Nashirabad Reservoir and Halishahar Elevated Tank

Bided price of C-3 is applied for Phase 2 Project as shown in Table 11.12.

Table 11.12 Bided price of Phase 1

	LC (Taka)	FC(JPY)	reference
Nashirabad Reservoir	268,299,154	0	V=26,300m^3
	10,200taka/m^3	0	Phase 1
	11,220taka/m^3		Phase 2 (10%up)
Elevated Tank	69,121,392	0	V=2,200m^3
	31,420taka/m^3	0	
	34,600taka/m^3		Phase 2 (10%up)
Guard & Electrical House	2,103,486	0	Phase 1
	2,314,000		Phase 2 (10%up)

Table 11.13 Construction cost for Phase 2

	LC (Taka)	FC(JPY)	reference
Nashirabad Reservoir			
1) Mechanical Works	13,039,000	118,353,000	
2) Electrical Works	36,078,900	324,710,100	
Halishahar Elevated Tank			
1) Mechanical Works	1,600,000	14,400,000	
2) Electrical Works	200,000	2,000,000	

<Mechanical Works for Phase 2> Nashirabad Reservoir

Item	Description	Unit	Quantity	Rate (Component)		Total Amount (Component)	
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)
1	Battali Hill Transmission Pump and Motor complete (dismantlement)	Nr	5	57,500	517,500	287,500	2,587,500
2	Battali Hill Transmission Pump and Motor complete	Nr	5	1,657,440	14,916,960	8,287,200	74,584,800
3	Halishar Transmission Pump and Motor complete(Reinstallation)	Nr	4	115,100	1,035,900	460,400	4,143,600
4	Suction Valve - 3 and Discharge Valve - 3 complete	Nr	8	68,400	615,600	547,200	4,924,800
5	Check Valve - 3 complete	Nr	4	106,800	961,200	427,200	3,844,800
6	Inlet Valve-1 (Nashirabad Reservoir) complete	Nr	1	465,600	4,190,400	465,600	4,190,400
7	Isolation Valve-2	Nr	2	379,200	3,412,800	758,400	6,825,600
8	Drain Pump complete	Nr	2	52,800	475,200	105,600	950,400
9	Supply all pipe w ork, valves and fittings complete (excluded the above mentioned valves)	LS	Lump sum			-	16,101,144
10	Installation of all pipe work, Valves and fittings	LS	Lump sum			1,700,000	200,000
					Bill Total to No. Summary	13,039,100	118,353,044

<Mechanical Works for Phase 2> Halishahar Elevated Tank

Item	Description	Unit	Quantity	Rate (Component)		Total Amount (Component)	
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)
1	Motor Driven Discharge / Bypass Batterfly Valve complete	Nr	2	800,000	7,200,000	1,600,000	14,400,000
					Bill Total to No. Summary	1,600,000	14,400,000

<Electrical Works for Phase 2> Nashirabad Reservoir

Item	Description	Unit	Quantity	Rate		Total Amount		
				Component		Component		Custom Duty,
				Local (Taka)	Foreign (Yen)	Local (Taka)	Foreign (Yen)	(Taka)
	Nashirabad Facilities (Electrical) -Phase2							
	Power Supply Facilities	lot	1			9,414,000	84,726,000	
	・11kV VCB, 2000kVA Transformer, LV Transformer							
	Standby Generator Facilities	lot	1			8,930,000	80,370,000	
	・1000kVA Diesel Engine Generator							
	Control & Operation Facilities	lot	1			11,078,000	99,702,000	
	・Pump Starter Panel (3kV Soft Starter), 400V MCC, Local Panel							
	Instrumentation Facilities	lot	1			1,037,000	9,333,000	
	・Electromagnetic Flow Meter, Ultrasonic Level Sensor, Indication Panel							
	SCADA & Automatic Control Facilities	lot	1			2,340,000	21,060,000	
	・PLC Panel, SCADA System							
	Other Necessary Item	lot	1			3,279,900	29,519,100	
Nashirabad Facilities (Electrical) -Phase2						36,078,900	324,710,100	0

Quantity Survey of Pipeline

Upstream to Sector Valve

Primary Distribution Pipeline

Sector	Diameter (mm)										Total
	200	300	400	500	600	700	800	900	1000	1200	(m)
0 Sector	-	-	-	-	-	-	-	-	-	-	-
A Sector	0	0	0	0	0	0	0	0	0	0	0
B Sector	0	0	0	0	0	74	1,374	0	0	0	1,448
C Sector	0	0	0	0	0	0	43	0	0	0	43
D Sector	0	0	0	0	0	0	0	0	0	0	0
E Sector	0	0	0	0	0	0	0	0	0	0	0
F Sector	0	0	0	0	44	0	84	2	1,185	0	1,315
G Sector	0	0	0	0	0	0	2	0	0	0	2
H Sector	0	0	0	0	0	0	0	0	0	0	0
I Sector	0	0	0	0	0	17	925	0	1,644	0	2,586
J Sector	0	0	0	0	0	0	0	0	2,538	0	2,538
Total of KSA	0	0	0	0	44	91	2,428	2	5,367	0	7,932

Sector Valve to DMA

Secondary Distribution Pipeline

Sector	Diameter (mm)										Total
	200	300	400	500	600	700	800	900	1000	1200	(m)
0 Sector	-	-	-	-	-	-	-	-	-	-	0
A Sector	5,989	2,161	0	167	0	0	0	0	0	0	8,317
B Sector	4,065	918	385	816	867	161	0	0	0	0	7,212
C Sector	2,001	1,094	1,472	216	0	0	105	0	0	0	4,888
D Sector	5,866	2,662	167	833	0	0	0	0	0	0	9,528
E Sector	6,444	660	127	692	0	0	0	0	0	0	7,923
F Sector	5,468	3,007	0	0	559	0	0	0	0	0	9,034
G Sector	6,305	3,211	427	244	1,240	0	893	0	0	0	12,320
H Sector	5,168	1,798	1,162	0	1,581	0	60	0	0	0	9,769
I Sector	11,383	1,355	1,046	0	529	507	0	0	0	0	14,820
J Sector	22,194	1,189	270	0	0	0	0	0	0	0	23,653
Total of KSA	74,883	18,055	5,056	2,968	4,776	668	1,058	0	0	0	107,464

Tertiary Distribution Pipeline

Sector	Area			Number of DMA	Sub-Main Pipe Length	Service Pipe Length	All Pipe Length
	Actual		CCC				
	(m2)	(ha)	(ha)	(-)	(m)	(m)	(m)
A Sector	1,317,996	131.80	**192**	12	8,317	**23,040**	31,357
B Sector	1,998,710	199.87	**216**	13	8,660	**25,920**	34,580
C Sector	1,208,861	120.89	**158**	10	4,931	**18,960**	23,891
D Sector	2,666,800	266.68	**352**	22	9,528	**42,240**	51,768
E Sector	2,876,881	287.69	**216**	13	7,923	**25,920**	33,843
F Sector	2,546,988	254.70	**220**	14	10,349	**26,400**	36,749
G Sector	3,594,125	359.41	**425**	26	12,322	**51,000**	63,322
H Sector	2,390,623	239.06	**257**	16	9,769	**30,840**	40,609
I Sector	4,241,692	424.17	**356**	22	17,406	**42,720**	60,126
J Sector	5,981,981	598.20	**671**	42	26,191	**80,520**	106,711
Total of KSA	28,824,657	2,882.47	**3,063**	190	115,396	**367,560**	482,956

Area of Pilot DMA	16.15	(ha)	
Pipe Density in D Sector	120	(m/ha)	←Without Sub-Main Pipe 118m/ha
Pipe Density in DMA-D1~D3	177	(m/ha)	←Includes Sub-Main Pipe
DMA Valve	4	(N/DMA)	

Area of D Sector	**267**	(ha)
Pipe Density in D Sector (without Sub-Main	**118**	(m/ha)

Area of DMA-D1	**13.64**	(ha)
Pipe Length in DMA-D1	**2628**	(m)
Pipe Density in DMA-D1	**193**	(m/ha)

Area of DMA-D2	**19.5**	(ha)
Pipe Length in DMA-D2	**3024**	(m)
Pipe Density in DMA-D2	**155**	(m/ha)

Area of DMA-D3	**15.32**	(ha)
Pipe Length in DMA-D3	**2939**	(m)
Pipe Density in DMA-D3	**192**	(m/ha)

Average	Area of DMA-D1～D3	**48.46**	(ha)
	Pipe Length in DMA-D1～D3 (with Sub-Ma	**8591**	(m)
	Pipe Density in DMA-D1～D3 (with Sub-Ma	**177**	(m/ha)
	Valve Density in DMA-D1～D3	**0.4**	(N/ha)

<Obstacles along the Kaptai road>

Obstacles Along the Roadway

Table: Number of Obstructions from the Centerline of Kaptai Road

SL NO	Description	20m from Centerline	10m from Centerline
1	Shop	166	117
2	House	31	19
3	Graveyard	4	9
4	School	5	2
5	Mosque	2	7
6	Pole of Electric (PDB)	278	237
7	Passenger Shed	5	1
8	Private Toilet	6	5

Note: It should be noted that there are hundred of young & old trees within the 10M and 20M zone.

Phase 2 Pipeline

Phase 1 Pipeline

11.8 Comparison of Construction Cost with similar Projects

Notes of Meeting with Md. Serajuddin, DWASA Project Director, Saidabad Water Treatment Plant Phase II Project at DWASA (10.30 am on 10th September 2012).

Attended by: Kevin Holroyd (NJS)
Mir Towfiq Hussain (BETS Dhaka Office)

Details of Saidabad Water Treatment Plant Phase II Project as follows:

1. General Details of Project

- ✓ Production capacity of WTP: 225 MLD
- ✓ Treatment process is conventional with lamella plate settlers used. The project includes preliminary treatment to remove/reduce levels of ammonia for both Phases I and II (total production capacity of 450 MLD). Sludge is thickened in circular gravity thickeners. No new subsequent sludge treatment (i.e. dewatering) is included in the project. The Phase I sludge drying beds and lagoons will be used.
- ✓ Standby generation provided for 100% of duty equipment. Piling required.
- ✓ Sludge from the Phase I WTP has been and is being used to fill the site, which has a total area of about 30 hectares. It is intended that Phase III of the WTP, with the same capacity as each of Phases I and II will be constructed on this site. (Note that probable or definite that the Feasibility Study for Phase III will be financed by a grant from France).
- ✓ Project also includes about 10 km of transmission pipelines (about 5.5 km of DN 1,000 mm and more than 2 km each of DN 800 mm and 600 mm).
- ✓ Tenderers were provided with raw water quality and some site investigations.
- ✓ Site for Phase II had been filled by DWASA prior to contract commencing.
- ✓ Contractor is Danish with a French company 'responsible' for process design. This company used patented equipment.

2. Implementation Schedule

- ✓ Tendering Commenced approximately June 2009
- ✓ Contract Commencement Date June 2010
- ✓ Contract Completion Date December 2012
- ✓ Contract Period 30 months (including detailed design, additional site investigation, construction, commissioning and performance testing)
- ✓ Contract is FIDIC Yellow Book (Plant and Design Build), with Contractor responsible for detailed design (as stated above).
- ✓ Currently it is hoped that completion will be 15 days earlier than the contractual completion date. There have been no extensions of time given.

3. Project Cost

- ✓ Contract sum about 85 million EURO, exclusive of taxes. Financed by Government of Denmark.

- ✓ Contribution of GOB for taxes and other items is about 15 million EURO.
- ✓ Contract is lump sum.
- ✓ Mr. Serajuddin is reluctant to give a breakdown of costs for confidentiality reasons, but stated that if NJS sends him a schedule then he will provide some information.
- ✓ Cost of transmission pipelines is more than 5 million EURO (exclusive of taxes).

4. Design Criteria and Specifications and Related Issues

- ✓ Most specifications based on British Standards. There is no requirement for a minimum % of mechanical and electrical plant and equipment to be sourced from Denmark (source of finance) and Contractor free to propose equipment from any country.
- ✓ Major items of equipment sources from various countries including France and Germany, with some equipment from China (small % of total cost I think). Equipment from France includes that which is part of the patented process.
- ✓ Transmission pipes supplied by Saint Gobain and manufactured in China.

5. Bidding Method

- ✓ ICB used with requirement that Contractor/lead partner in a Joint Venture is from Denmark. Experience of similar type of project was a requirement of the PQ/Bidding process.

6. Terms and Conditions

- ✓ Lump sum contract with provision for variations. It is understood that variations have not been significant in terms of amount.
- ✓ No provision for price escalation.
- ✓ Payment based on a schedule, with progress payments every 2 months. No detailed bill of quantities.

7. Construction Supervision

- ✓ Carried out by consultant.

CHAPTER 12

FINANCIAL AND ECONOMIC CONSIDERATIONS

CHAPTER 12 FINANCIAL AND ECONOMIC CONSIDERATIONS

12.2 Financial Forecast of Phase 1 and Phase 2 Projects based on Varied Conditions

12.2.1 Project Cost for Financial Forecast

Particulars		FC Portion (JPY mil.)	LC Portion (BDT mil.)	Combined Total (BDT mil.) *5)
Phase 1 Project				
A.	Financing Requirements	10,843.12	9,873.73	19,632.54
B.	Financing Plan			
	JICA Loan *1)	12,131.89		10,918.70
	GOB Local Loan *2)		8,713.84	8,713.84
	Total	12,131.89	8,713.84	19,632.54
Phase 2 Project				
A.	Financing Requirements			
A-1	Eligible Portion			
a.	Gross Construction Costs	15,979.43	15,350.77	31,892.62
b.	Consulting Services Costs	1,785.00	1,363.00	3,210.83
	Eligible Portion - Total	17,764.43	16,713.77	35,103.46
A-2	Non-eligible Portion			
a.	Administration Costs	-	10.00	10.00
b.	VAT	-	2,514.00	2,514.00
c.	Import Tax & Banking Charges	-	5,014.86	5,014.86
d.	Interest during Construction	19.47	0.00	20.16
	Non-eligible Portion - Total	19.47	7,538.86	7,559.02
A-3.	Grand Total	17,783.90	24,252.63	42,662.48
B.	Financing Plan			
	JICA Loan (to be proposed) *3)	17,764.43	16,713.77	35,103.46
	GOB Local Loan *4)	19.47	7,538.86	7,559.02
	Total	17,783.90	24,252.63	42,662.48

(Note)

Excluding costs for service connections and costs for procurement of water meters for service connections, as these costs can be covered with service connection charges.

*1) JICA Loan provided for Phase 1 Project
*2) Remaining Balance of the Financing Requirements
*3) Eligible portion of the Financing Requirements
*4) Non-eligible portion of the Financing Requirements
*5) Exchange Rate:
- Phase 1: BDT 0.90 = JPY 1.0
- Phase 2: BDT 1 = JPY 0.966

12.2.2 Summary of Financial Forecast

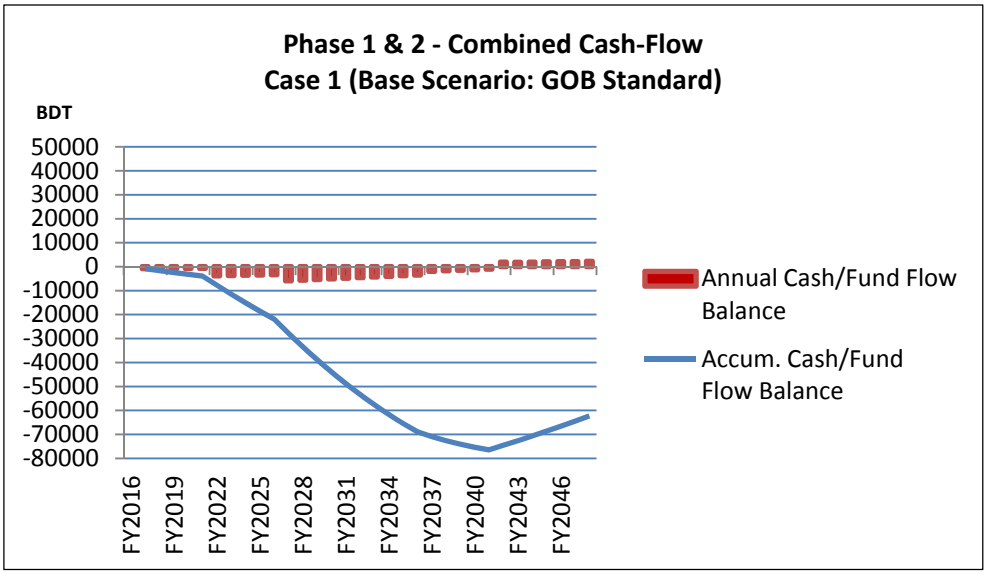
	Case 1: Base Scenario (GOB standard)	Case 2	Case 3	Case 4
Water Tariff	5% increase annually	5% increase annually	**7.5% increase annually**	5% increase annually
Proportion of Grant/Equity	0%	0%	0%	0%
Interest Rate (FC/LC)	5%/4%	2% for Phase 1&2 (Capitalize interest incurred during the grace period)	2% for Phase 1&2 (Capitalize interest incurred during the grace period)	1% for Phase 1&2 (Capitalize interest incurred during the grace period)
Grace Period/ Repayment Period	5 years/15years	10 years/ 30 years for Phase 2	10 years/ 30 years for Phase 2	10 years/ 30 years for Phase 1&2
Currency Risk	GOB	GOB	GOB	GOB
Phase 1 & 2 Combined Cash-flow	• Negative from FY2016 to FY2040 • Accumulated cash-flow negative during the whole period	• Positive until FY 2025 then turning to negative in FY 2026 onward • Accumulated cash-flow positive until FY 2030 then turning to negative in FY 2031 onward	• Positive until FY 2030 then turning to negative in FY 2031 to 2037. After FY2038 become positive. • Accumulated cash-flow positive until FY 2033 then turning to negative until FY 2044, but after 2045FY become positive.	• Positive until FY 2025 then turning to negative in FY 2026 onward excluding FY 2029 & 2030 • Accumulated cash-flow positive until FY 2031 then turning to negative in FY 2032 onward

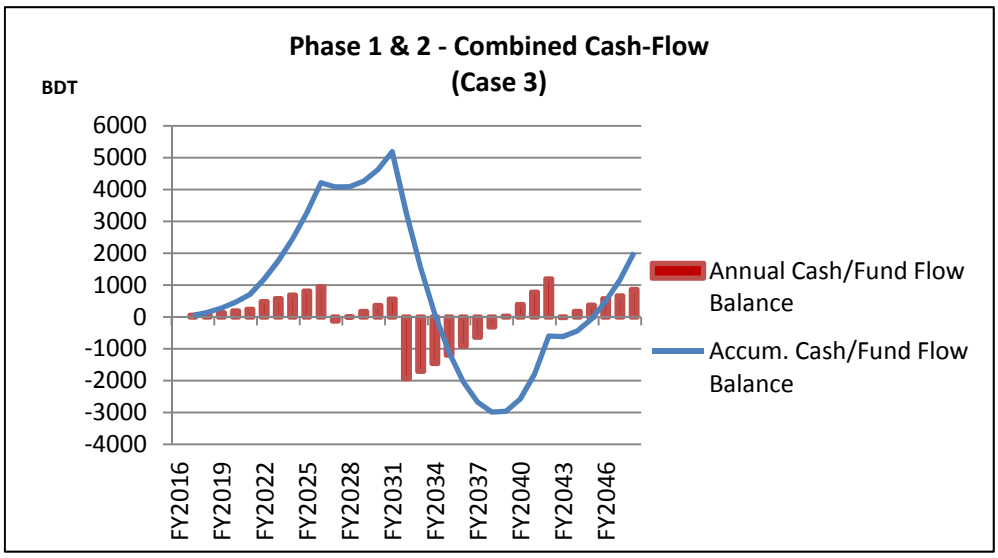
	Case 5	Case 6	Case 7	Case 8
Water Tariff	**7% increase annually**	5% increase annually based on present tariff rate	Increase as per Note 1	5% increase annually based on present tariff rate
Proportion of Grant/Equity	0%	Whole amount of Phase 1	0%	Whole amount of Phase 1
Interest Rate (FC/LC)	1% for Phase 1&2 (Capitalize interest incurred during the grace period)	1% for Phase 2 (Capitalize interest incurred during the grace period)	5%/4%	2% for Phase 2 (Capitalize interest incurred during the grace period)
Grace Period/ Repayment Period	10 years/ 30 years for Phase 1&2	10 years/ 30 years for Phase 2	5 years/15 year	17 years/ 23 years for Phase 2
Currency Risk	GOB	GOB	GOB	GOB
Phase 1 & 2 Combined Cash-flow	• Positive until FY 2030 then turning to negative in FY 2031 to 2036. After FY2037 become positive. • Accumulated cash-flow positive in whole years	• Positive from FY 2016 to FY2030 and negative from FY2031 to FY2042. After FY2043 become positive • Accumulated cash-flow positive in whole years	• Positive every year from FY2016 to FY2047, except FY2021, FY2026, FY2028 and FY2028 • Accumulated cash-flow positive in whole years	• Positive from FY2016 to FY2037 then turning to negative from FY2038 on-ward • Accumulated cash-flow positive in whole years

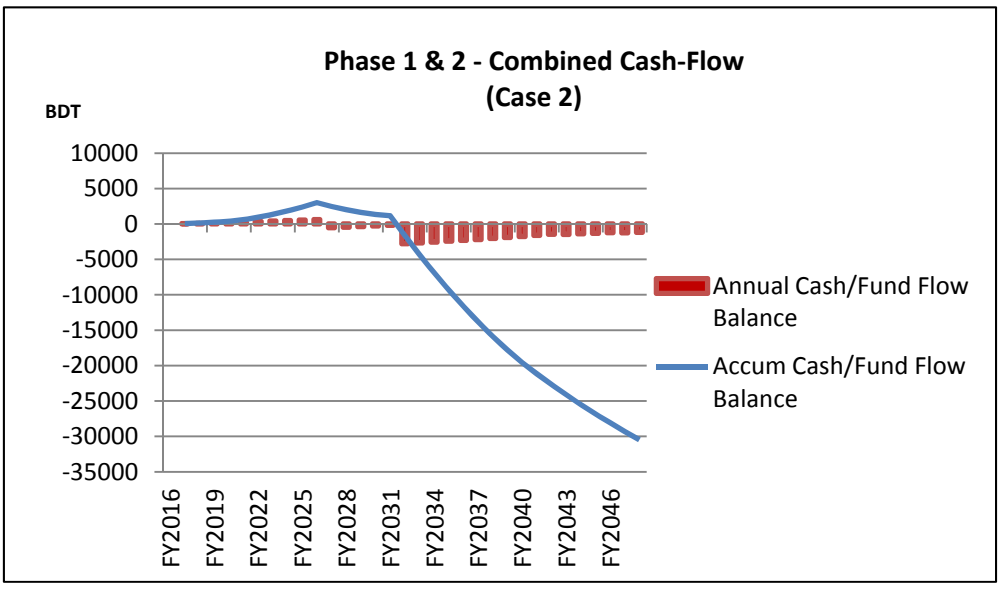
(Note) Increase in water tariff for Case 7

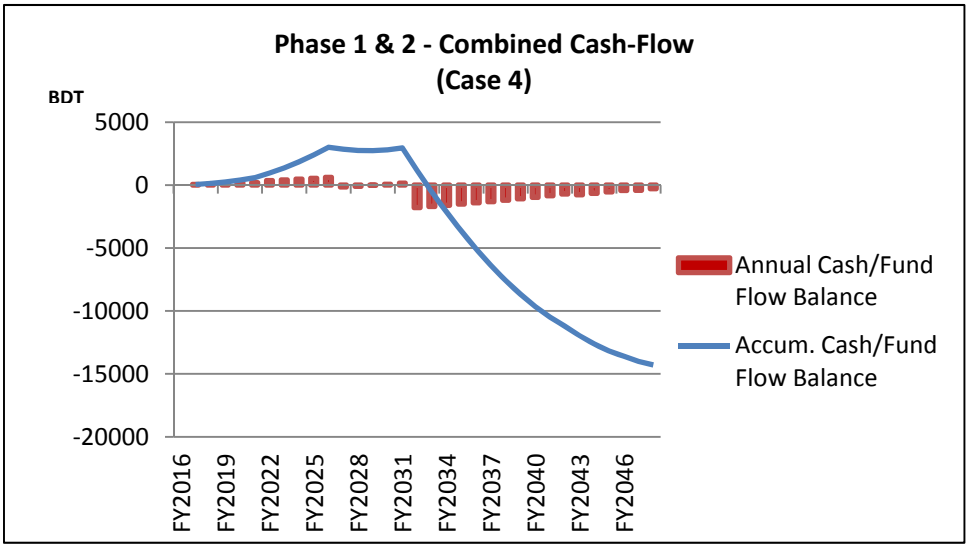
- Increase in 2016 by 4.6 times of the 2012 rates (Rate in FY2016: Tk. 24.31 for domestic; Tk. 68.86 for non-domestic)
- 3.0% increase every year (2017-2020)
- Increase in 2021 by 1.4 times of the 2020 rates
- 2% increase every year (2022-2025)
- Increase in 2026 by 10% of the 2025 rates
- No increase (2027 onward)

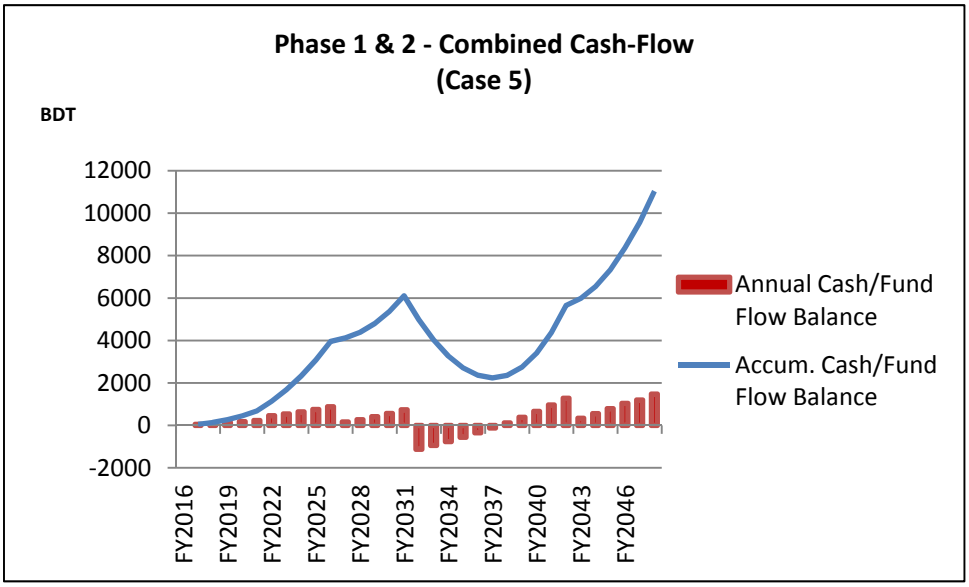
12.2.3 Graphs showing Cash-Flow of Each Case

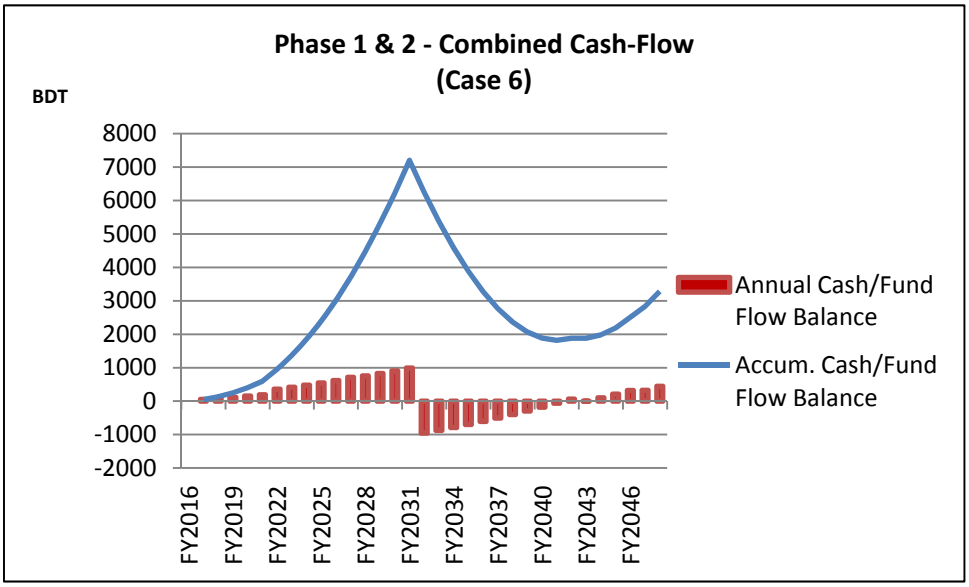


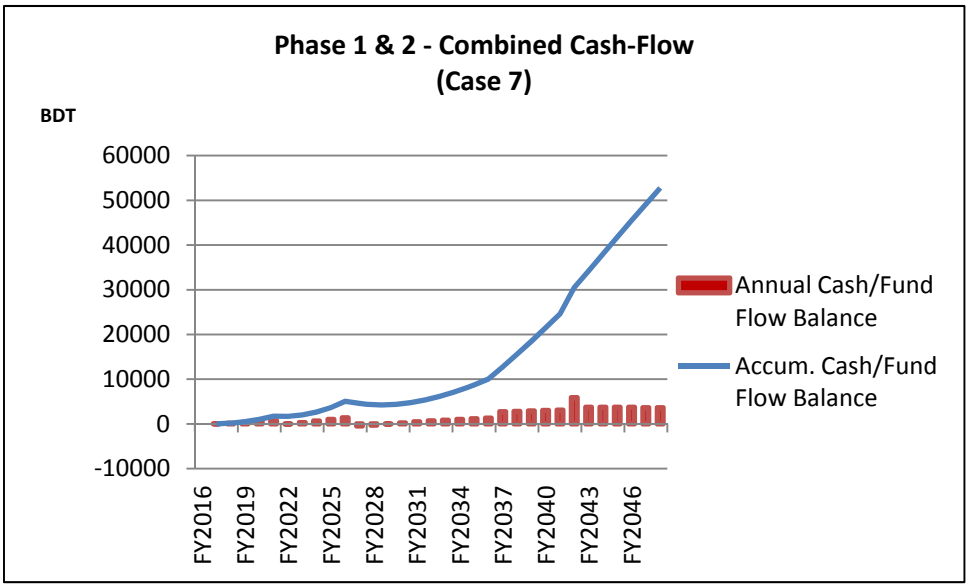


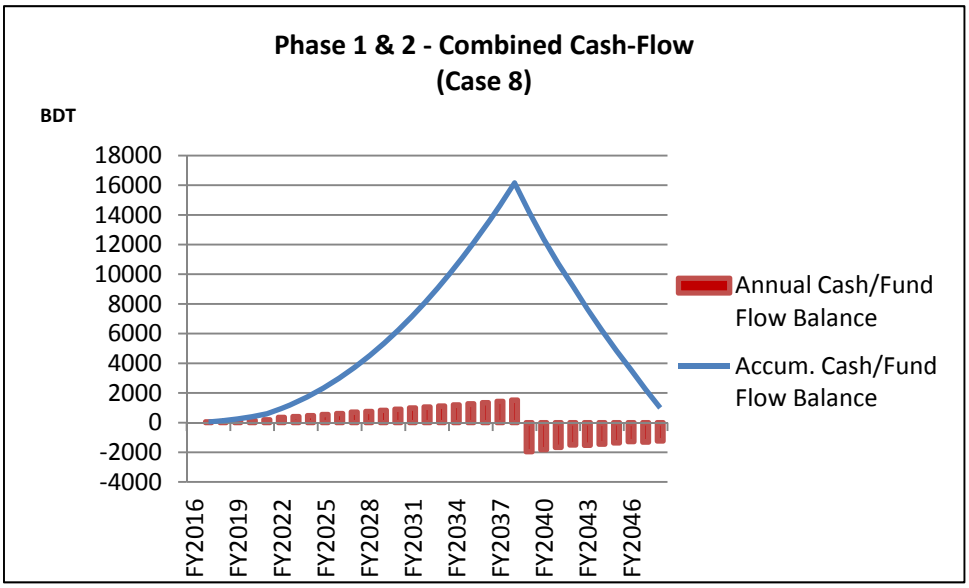



Phase 1 & 2 - Combined Cash-Flow
(Case 4)
BDT
5000
0
-5000
-10000
-15000
-20000
FY2016
FY2019
FY2022
FY2025
FY2028
FY2031
FY2034
FY2037
FY2040
FY2043
FY2046
Annual Cash/Fund Flow Balance
Accum. Cash/Fund Flow Balance


Phase 1 & 2 - Combined Cash-Flow
(Case 5)
BDT
12000
10000
8000
6000
4000
2000
0
-2000
FY2016
FY2019
FY2022
FY2025
FY2028
FY2031
FY2034
FY2037
FY2040
FY2043
FY2046
Annual Cash/Fund Flow Balance
Accum. Cash/Fund Flow Balance


Phase 1 & 2 - Combined Cash-Flow
(Case 6)
BDT
8000
7000
6000
5000
4000
3000
2000
1000
0
-1000
-2000
FY2016
FY2019
FY2022
FY2025
FY2028
FY2031
FY2034
FY2037
FY2040
FY2043
FY2046
Annual Cash/Fund Flow Balance
Accum. Cash/Fund Flow Balance


Phase 1 & 2 - Combined Cash-Flow
(Case 7)
BDT
60000
50000
40000
30000
20000
10000
0
-10000
FY2016
FY2019
FY2022
FY2025
FY2028
FY2031
FY2034
FY2037
FY2040
FY2043
FY2046
Annual Cash/Fund Flow Balance
Accum. Cash/Fund Flow Balance


Phase 1 & 2 - Combined Cash-Flow
(Case 8)
BDT
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
-2000
-4000
FY2016
FY2019
FY2022
FY2025
FY2028
FY2031
FY2034
FY2037
FY2040
FY2043
FY2046
Annual Cash/Fund Flow Balance
Accum. Cash/Fund Flow Balance

12.2.4 Debt-service and Cash-flow of Each Case

(1) Case 1

Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Foreign Loan (FL) Portion (BDT mil.)	10,918.70	55.62%	35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)	8,713.84	44.38%	7,559.02	17.72%
Total Amount (BDT mil.)	19,632.54	100.00%	42,662.48	100.00%

Terms and Conditions of Subsidiary Loan

- Repayment of loans with 15 annual installments after 5 years grace period
- Interest at 5% for Foreign Loan Portion and 4% for BOD Local Loan Portion
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2					
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL (5%)	Interest for LL (4%)	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL (5%)	Interest for LL (4%)	Interest - Total
FY2016	19,632.54	0.00	19,632.54	545.94	348.55	894.49						
FY2017	19,632.54	0.00	19,632.54	545.94	348.55	894.49						
FY2018	19,632.54	0.00	19,632.54	545.94	348.55	894.49						
FY2019	19,632.54	0.00	19,632.54	545.94	348.55	894.49						
FY2020	19,632.54	0.00	19,632.54	545.94	348.55	894.49						
FY2021	19,632.54	1,308.84	18,323.70	509.54	325.32	834.86	42,662.48	0.00	42,662.48	1,755.17	302.36	2,057.53
FY2022	18,323.70	1,308.84	17,014.86	473.14	302.08	775.22	42,662.48	0.00	42,662.48	1,755.17	302.36	2,057.53
FY2023	17,014.86	1,308.84	15,706.02	436.75	278.84	715.59	42,662.48	0.00	42,662.48	1,755.17	302.36	2,057.53
FY2024	15,706.02	1,308.84	14,397.18	400.35	255.61	655.96	42,662.48	0.00	42,662.48	1,755.17	302.36	2,057.53
FY2025	14,397.18	1,308.84	13,088.34	363.96	232.37	596.33	42,662.48	0.00	42,662.48	1,755.17	302.36	2,057.53
FY2026	13,088.34	1,308.84	11,779.50	327.56	209.13	536.69	42,662.48	2,844.17	39,818.31	1,638.16	282.20	1,920.36
FY2027	11,779.50	1,308.84	10,470.66	291.16	185.89	477.05	39,818.31	2,844.17	36,974.14	1,521.15	262.05	1,783.20
FY2028	10,470.66	1,308.84	9,161.82	254.77	162.66	417.43	36,974.14	2,844.17	34,129.97	1,404.14	241.89	1,646.03
FY2029	9,161.82	1,308.84	7,852.98	218.37	139.42	357.79	34,129.97	2,844.17	31,285.80	1,287.13	221.73	1,508.86
FY2030	7,852.98	1,308.84	6,544.14	181.98	116.18	298.16	31,285.80	2,844.17	28,441.63	1,170.11	201.57	1,371.68
FY2031	6,544.14	1,308.84	5,235.30	145.58	92.95	238.53	28,441.63	2,844.17	25,597.46	1,053.10	181.42	1,234.52
FY2032	5,235.30	1,308.84	3,926.46	109.19	69.71	178.90	25,597.46	2,844.17	22,753.29	936.09	161.26	1,097.35
FY2033	3,926.46	1,308.84	2,617.62	72.79	46.47	119.26	22,753.29	2,844.17	19,909.12	819.08	141.10	960.18
FY2034	2,617.62	1,308.84	1,308.78	36.39	23.24	59.63	19,909.12	2,844.17	17,064.95	702.07	120.94	823.01
FY2035	1,308.78	1,308.78	0.00	0.00	0.00	0.00	17,064.95	2,844.17	14,220.78	585.06	100.79	685.85
FY2036	0.00	0.00	0.00	0.00	0.00	0.00	14,220.78	2,844.17	11,376.61	468.04	80.63	548.67
FY2037	0.00	0.00	0.00	0.00	0.00	0.00	11,376.61	2,844.17	8,532.44	351.03	60.47	411.50
FY2038	0.00	0.00	0.00	0.00	0.00	0.00	8,532.44	2,844.17	5,688.27	234.02	40.31	274.33
FY2039	0.00	0.00	0.00	0.00	0.00	0.00	5,688.27	2,844.17	2,844.10	117.01	20.16	137.17
FY2040	0.00	0.00	0.00	0.00	0.00	0.00	2,844.10	2,844.10	0.00	0.00	0.00	0.00

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	894.49	894.49	(842.20)	(842.20)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(842.20)	(842.20)
FY2017	(337.26)	418.42	81.16	0.00	894.49	894.49	(813.33)	(1,655.53)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(813.33)	(1,655.53)
FY2018	(302.15)	418.42	116.27	0.00	894.49	894.49	(778.22)	(2,433.76)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(778.22)	(2,433.76)
FY2019	(264.39)	418.42	154.03	0.00	894.49	894.49	(740.46)	(3,174.21)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(740.46)	(3,174.21)
FY2020	(228.46)	418.42	189.96	0.00	894.49	894.49	(704.53)	(3,878.74)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	(704.53)	(3,878.74)
FY2021	(195.60)	416.01	220.41	1,308.84	834.86	2,143.70	(1,923.29)	(5,802.04)	(795.56)	935.06	139.50	0.00	2,057.53	2,057.53	(1,918.03)	(1,918.03)	(3,841.32)	(7,720.06)
FY2022	(172.32)	416.01	243.69	1,308.84	775.22	2,084.06	(1,840.37)	(7,642.41)	(763.21)	935.06	171.85	0.00	2,057.53	2,057.53	(1,885.68)	(3,803.70)	(3,726.05)	(11,446.11)
FY2023	(142.38)	416.01	273.63	1,308.84	715.59	2,024.43	(1,750.80)	(9,393.20)	(731.72)	935.06	203.34	0.00	2,057.53	2,057.53	(1,854.19)	(5,657.89)	(3,604.98)	(15,051.10)
FY2024	(118.55)	416.01	297.46	1,308.84	655.96	1,964.80	(1,667.34)	(11,060.54)	(687.47)	935.06	247.59	0.00	2,057.53	2,057.53	(1,809.94)	(7,467.83)	(3,477.27)	(18,528.37)
FY2025	(108.21)	416.01	307.80	1,308.84	596.33	1,905.17	(1,597.37)	(12,657.91)	(624.98)	935.06	310.08	0.00	2,057.53	2,057.53	(1,747.45)	(9,215.27)	(3,344.82)	(21,873.19)
FY2026	(61.69)	416.01	354.32	1,308.84	536.69	1,845.53	(1,491.21)	(14,149.12)	(552.91)	909.60	356.69	2,844.17	1,920.36	4,764.53	(4,407.84)	(13,623.12)	(5,899.05)	(27,772.24)
FY2027	(38.34)	416.01	377.67	1,308.84	477.05	1,785.89	(1,408.22)	(15,557.34)	(529.48)	909.60	380.12	2,844.17	1,783.20	4,627.37	(4,247.25)	(17,870.36)	(5,655.46)	(33,427.70)
FY2028	(2.44)	416.01	413.57	1,308.84	417.43	1,726.27	(1,312.70)	(16,870.04)	(493.50)	909.60	416.10	2,844.17	1,646.03	4,490.20	(4,074.10)	(21,944.46)	(5,386.80)	(38,814.50)
FY2029	36.01	416.01	452.02	1,308.84	357.79	1,666.63	(1,214.61)	(18,084.65)	(454.96)	909.60	454.64	2,844.17	1,508.86	4,353.03	(3,898.39)	(25,842.85)	(5,113.00)	(43,927.50)
FY2030	77.32	416.01	493.33	1,308.84	298.16	1,607.00	(1,113.67)	(19,198.32)	(413.27)	909.60	496.33	2,844.17	1,371.68	4,215.85	(3,719.52)	(29,562.37)	(4,833.19)	(48,760.69)
FY2031	112.72	416.01	528.73	1,308.84	238.53	1,547.37	(1,018.64)	(20,216.95)	(377.77)	909.60	531.83	2,844.17	1,234.52	4,078.69	(3,546.86)	(33,109.23)	(4,565.49)	(53,326.18)
FY2032	145.79	416.01	561.80	1,308.84	178.90	1,487.74	(925.94)	(21,142.89)	(344.59)	909.60	565.01	2,844.17	1,097.35	3,941.52	(3,376.51)	(36,485.74)	(4,302.45)	(57,628.63)
FY2033	339.77	256.96	596.73	1,308.84	119.26	1,428.10	(831.37)	(21,974.26)	(309.53)	909.60	600.07	2,844.17	960.18	3,804.35	(3,204.28)	(39,690.01)	(4,035.64)	(61,664.27)
FY2034	376.70	256.96	633.66	1,308.84	59.63	1,368.47	(734.81)	(22,709.07)	(272.49)	909.60	637.11	2,844.17	823.01	3,667.18	(3,030.07)	(42,720.08)	(3,764.88)	(65,429.15)
FY2035	416.00	256.96	672.96	1,308.78	0.00	1,308.78	(635.82)	(23,344.89)	(233.06)	909.60	676.54	2,844.17	685.85	3,530.02	(2,853.48)	(45,573.56)	(3,489.30)	(68,918.45)
FY2036	457.33	256.96	714.29	0.00	0.00	0.00	714.29	(22,630.59)	(191.60)	909.60	718.00	2,844.17	548.67	3,392.84	(2,674.84)	(48,248.40)	(1,960.55)	(70,879.00)
FY2037	501.00	256.96	757.96	0.00	0.00	0.00	757.96	(21,872.63)	(147.79)	909.60	761.81	2,844.17	411.50	3,255.67	(2,493.86)	(50,742.27)	(1,735.90)	(72,614.90)
FY2038	547.09	256.96	804.05	0.00	0.00	0.00	804.05	(21,068.58)	(20.90)	828.93	808.03	2,844.17	274.33	3,118.50	(2,310.47)	(53,052.73)	(1,506.42)	(74,121.31)
FY2039	595.68	256.96	852.64	0.00	0.00	0.00	852.64	(20,215.94)	27.84	828.93	856.77	2,844.17	137.17	2,981.34	(2,124.57)	(55,177.30)	(1,271.92)	(75,393.24)
FY2040	647.19	256.96	904.15	0.00	0.00	0.00	904.15	(19,311.79)	79.50	828.93	908.43	2,844.10	0.00	2,844.10	(1,935.67)	(57,112.97)	(1,031.52)	(76,424.76)
FY2041	769.13	189.50	958.63	0.00	0.00	0.00	958.63	(18,353.16)	134.14	828.93	963.07	0.00	0.00	0.00	963.07	(56,149.90)	1,921.70	(74,503.06)
FY2042	826.55	189.50	1,016.05	0.00	0.00	0.00	1,016.05	(17,337.11)	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(55,320.97)	1,844.98	(72,658.08)
FY2043	913.43	189.50	1,102.93	0.00	0.00	0.00	1,102.93	(16,234.19)	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(54,492.04)	1,931.86	(70,726.23)
FY2044	1,004.65	189.50	1,194.15	0.00	0.00	0.00	1,194.15	(15,040.04)	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(53,663.11)	2,023.08	(68,703.15)
FY2045	1,100.43	189.50	1,289.93	0.00	0.00	0.00	1,289.93	(13,750.12)	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(52,834.18)	2,118.86	(66,584.30)
FY2046	1,201.00	189.50	1,390.50	0.00	0.00	0.00	1,390.50	(12,359.62)	0.00	718.35	718.35	0.00	0.00	0.00	718.35	(52,115.83)	2,108.85	(64,475.45)
FY2047	1,306.59	189.50	1,496.09	0.00	0.00	0.00	1,496.09	(10,863.54)	0.00	718.35	718.35	0.00	0.00	0.00	718.35	(51,397.48)	2,214.44	(62,261.02)

(2) Case 2
Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Grant/Equity Amount (BDT mil.)	nil		nil	
Subsidiary Loan				
Foreign Loan (FL) Portion (BDT mil.)	10,918.70	55.62%	35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)	8,713.84	44.38%	7,559.02	17.72%
Subsidiary Loan Amount (BDT mil.)	19,632.54	100.00%	42,662.48	100.00%
Capitalized amount of interest payable during the grace period (BDT mil.)	3,926.51		8,532.50	
Total Loan Amount including capitalized interest (BDT mil.)	23,559.05		51,194.98	

Terms and Conditions of Subsidiary Loan

- No grant/equity participation
- For Phase 1 and Phase 2 Projects:
  a. Repayment of loans with 30 annual installments after 10 years grace
  b. Interest at 2% for Foreign Loan Portion and BOD Local Loan Portion
  c. Interest payable during the initial 10 years to be capitalized
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2			
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL (2%)	Interest for LL (2%)	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL & LL (2%)
FY2016	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2017	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2018	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2019	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2020	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2021	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2022	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2023	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2024	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2025	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2026	23,559.05	785.30	22,773.75	253.31	202.16	455.47	51,194.98	0.00	51,194.98	0.00
FY2027	22,773.75	785.30	21,988.45	244.58	195.19	439.77	51,194.98	0.00	51,194.98	0.00
FY2028	21,988.45	785.30	21,203.15	235.84	188.22	424.06	51,194.98	0.00	51,194.98	0.00
FY2029	21,203.15	785.30	20,417.85	227.11	181.25	408.36	51,194.98	0.00	51,194.98	0.00
FY2030	20,417.85	785.30	19,632.55	218.37	174.28	392.65	51,194.98	0.00	51,194.98	0.00
FY2031	19,632.55	785.30	18,847.25	209.64	167.31	376.95	51,194.98	1,706.50	49,488.48	989.77
FY2032	18,847.25	785.30	18,061.95	200.90	160.33	361.23	49,488.48	1,706.50	47,781.98	955.64
FY2033	18,061.95	785.30	17,276.65	192.17	153.36	345.53	47,781.98	1,706.50	46,075.48	921.51
FY2034	17,276.65	785.30	16,491.35	183.43	146.39	329.82	46,075.48	1,706.50	44,368.98	887.38
FY2035	16,491.35	785.30	15,706.05	174.70	139.42	314.12	44,368.98	1,706.50	42,662.48	853.25
FY2036	16,491.35	785.30	15,706.05	174.70	139.42	314.12	42,662.48	1,706.50	40,955.98	819.12
FY2037	15,706.05	785.30	14,920.75	165.96	132.45	298.41	40,955.98	1,706.50	39,249.48	784.99
FY2038	14,920.75	785.30	14,135.45	157.23	125.48	282.71	39,249.48	1,706.50	37,542.98	750.86
FY2039	14,135.45	785.30	13,350.15	148.49	118.51	267.00	37,542.98	1,706.50	35,836.48	716.73
FY2040	13,350.15	785.30	12,564.85	139.76	111.54	251.30	35,836.48	1,706.50	34,129.98	682.60
FY2041	12,564.85	785.30	11,779.55	131.02	104.57	235.59	34,129.98	1,706.50	32,423.48	648.47
FY2042	11,779.55	785.30	10,994.25	122.29	97.60	219.89	32,423.48	1,706.50	30,716.98	614.34

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	0.00	0.00	52.29	52.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.29	52.29
FY2017	(337.26)	418.42	81.16	0.00	0.00	0.00	81.16	133.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.16	133.45
FY2018	(302.15)	418.42	116.27	0.00	0.00	0.00	116.27	249.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	116.27	249.71
FY2019	(264.39)	418.42	154.03	0.00	0.00	0.00	154.03	403.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	154.03	403.75
FY2020	(228.46)	418.42	189.96	0.00	0.00	0.00	189.96	593.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	189.96	593.71
FY2021	(195.60)	416.01	220.41	0.00	0.00	0.00	220.41	814.11	(795.56)	935.06	139.50	0.00	0.00	0.00	139.50	139.50	359.91	953.62
FY2022	(172.32)	416.01	243.69	0.00	0.00	0.00	243.69	1,057.80	(763.21)	935.06	171.85	0.00	0.00	0.00	171.85	311.36	415.54	1,369.16
FY2023	(142.38)	416.01	273.63	0.00	0.00	0.00	273.63	1,331.44	(731.72)	935.06	203.34	0.00	0.00	0.00	203.34	514.70	476.98	1,846.13
FY2024	(118.55)	416.01	297.46	0.00	0.00	0.00	297.46	1,628.90	(687.47)	935.06	247.59	0.00	0.00	0.00	247.59	762.29	545.06	2,391.19
FY2025	(108.21)	416.01	307.80	0.00	0.00	0.00	307.80	1,936.70	(624.98)	935.06	310.08	0.00	0.00	0.00	310.08	1,072.38	617.88	3,009.07
FY2026	(61.69)	416.01	354.32	785.30	455.47	1,240.77	(886.45)	1,050.25	(552.91)	909.60	356.69	0.00	0.00	0.00	356.69	1,429.06	(529.76)	2,479.31
FY2027	(38.34)	416.01	377.67	785.30	439.77	1,225.07	(847.40)	202.85	(529.48)	909.60	380.12	0.00	0.00	0.00	380.12	1,809.19	(467.27)	2,012.04
FY2028	(2.44)	416.01	413.57	785.30	424.06	1,209.36	(795.79)	(592.94)	(493.50)	909.60	416.10	0.00	0.00	0.00	416.10	2,225.29	(379.69)	1,632.35
FY2029	36.01	416.01	452.02	785.30	408.36	1,193.66	(741.64)	(1,334.58)	(454.96)	909.60	454.64	0.00	0.00	0.00	454.64	2,679.93	(287.00)	1,345.35
FY2030	77.32	416.01	493.33	785.30	392.65	1,177.95	(684.62)	(2,019.20)	(413.27)	909.60	496.33	0.00	0.00	0.00	496.33	3,176.26	(188.29)	1,157.06
FY2031	112.72	416.01	528.73	785.30	376.95	1,162.25	(633.52)	(2,652.71)	(377.77)	909.60	531.83	1,706.50	989.77	2,696.27	(2,164.44)	1,011.82	(2,797.95)	(1,640.89)
FY2032	145.79	416.01	561.80	785.30	361.23	1,146.53	(584.73)	(3,237.44)	(344.59)	909.60	565.01	1,706.50	955.64	2,662.14	(2,097.13)	(1,085.31)	(2,681.86)	(4,322.75)
FY2033	339.77	256.96	596.73	785.30	345.53	1,130.83	(534.10)	(3,771.54)	(309.53)	909.60	600.07	1,706.50	921.51	2,628.01	(2,027.94)	(3,113.24)	(2,562.03)	(6,884.78)
FY2034	376.70	256.96	633.66	785.30	329.82	1,115.12	(481.46)	(4,253.00)	(272.49)	909.60	637.11	1,706.50	887.38	2,593.88	(1,956.77)	(5,070.01)	(2,438.23)	(9,323.01)
FY2035	416.00	256.96	672.96	785.30	314.12	1,099.42	(426.46)	(4,679.46)	(233.06)	909.60	676.54	1,706.50	853.25	2,559.75	(1,883.21)	(6,953.22)	(2,309.67)	(11,632.68)
FY2036	457.33	256.96	714.29	785.30	314.12	1,099.42	(385.13)	(5,064.58)	(191.60)	909.60	718.00	1,706.50	819.12	2,525.62	(1,807.62)	(8,760.84)	(2,192.75)	(13,825.43)
FY2037	501.00	256.96	757.96	785.30	298.41	1,083.71	(325.75)	(5,390.33)	(147.79)	909.60	761.81	1,706.50	784.99	2,491.49	(1,729.68)	(10,490.53)	(2,055.43)	(15,880.86)
FY2038	547.09	256.96	804.05	785.30	282.71	1,068.01	(263.96)	(5,654.29)	(20.90)	828.93	808.03	1,706.50	750.86	2,457.36	(1,649.33)	(12,139.85)	(1,913.29)	(17,794.14)
FY2039	595.68	256.96	852.64	785.30	267.00	1,052.30	(199.66)	(5,853.95)	27.84	828.93	856.77	1,706.50	716.73	2,423.23	(1,566.46)	(13,706.31)	(1,766.11)	(19,560.26)
FY2040	647.19	256.96	904.15	785.30	251.30	1,036.60	(132.45)	(5,986.40)	79.50	828.93	908.43	1,706.50	682.60	2,389.10	(1,480.67)	(15,186.98)	(1,613.12)	(21,173.38)
FY2041	769.13	189.50	958.63	785.30	235.59	1,020.89	(62.26)	(6,048.66)	134.14	828.93	963.07	1,706.50	648.47	2,354.97	(1,391.90)	(16,578.88)	(1,454.16)	(22,627.54)
FY2042	826.55	189.50	1,016.05	785.30	219.89	1,005.19	10.86	(6,037.80)	0.00	828.93	828.93	1,706.50	614.34	2,320.84	(1,491.91)	(18,070.79)	(1,481.05)	(24,108.59)
FY2043	861.32	189.50	1,050.82	785.30	204.17	989.47	61.35	(5,976.46)	0.00	828.93	828.93	1,706.50	580.21	2,286.71	(1,457.78)	(19,528.57)	(1,396.43)	(25,505.03)
FY2044	895.23	189.50	1,084.73	785.30	188.47	973.77	110.96	(5,865.50)	0.00	828.93	828.93	1,706.50	546.08	2,252.58	(1,423.65)	(20,952.22)	(1,312.69)	(26,817.72)
FY2045	928.10	189.50	1,117.60	785.30	172.76	958.06	159.54	(5,705.97)	0.00	828.93	828.93	1,706.50	511.95	2,218.45	(1,389.52)	(22,341.74)	(1,229.98)	(28,047.71)
FY2046	959.73	189.50	1,149.23	785.30	157.06	942.36	206.87	(5,499.10)	0.00	718.35	718.35	1,706.50	477.82	2,184.32	(1,465.97)	(23,807.71)	(1,259.10)	(29,306.81)
FY2047	989.94	189.50	1,179.44	785.30	141.36	926.66	252.78	(5,246.33)	0.00	718.35	718.35	1,706.50	443.69	2,150.19	(1,431.84)	(25,239.55)	(1,179.06)	(30,485.88)

(2) Case 3
Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Grant/Equity Amount (BDT mil.)	nil		nil	
Subsidiary Loan				
Foreign Loan (FL) Portion (BDT mil.)	10,918.70	55.62%	35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)	8,713.84	44.38%	7,559.02	17.72%
Subsidiary Loan Amount (BDT mil.)	19,632.54	100.00%	42,662.48	100.00%
Capitalized amount of interest payable during the grace period (BDT mil.)	3,926.51		8,532.50	
Total Loan Amount including capitalized interest (BDT mil.)	23,559.05		51,194.98	

Terms and Conditions of Subsidiary Loan
- No grant/equity participation
- For Phase 1 and Phase 2 Projects:
  a. Repayment of loans with 30 annual installments after 10 years grace
  b. Interest at 2% for Foreign Loan Portion and BOD Local Loan Portion
  c. Interest payable during the initial 10 years to be capitalized
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2			
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL (2%)	Interest for LL (2%)	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL & LL (2%)
FY2016	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2017	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2018	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2019	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2020	23,559.05	0.00	23,559.05	0.00	0.00	0.00				
FY2021	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2022	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2023	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2024	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2025	23,559.05	0.00	23,559.05	0.00	0.00	0.00	51,194.98	0.00	51,194.98	0.00
FY2026	23,559.05	785.30	22,773.75	253.31	202.16	455.47	51,194.98	0.00	51,194.98	0.00
FY2027	22,773.75	785.30	21,988.45	244.58	195.19	439.77	51,194.98	0.00	51,194.98	0.00
FY2028	21,988.45	785.30	21,203.15	235.84	188.22	424.06	51,194.98	0.00	51,194.98	0.00
FY2029	21,203.15	785.30	20,417.85	227.11	181.25	408.36	51,194.98	0.00	51,194.98	0.00
FY2030	20,417.85	785.30	19,632.55	218.37	174.28	392.65	51,194.98	0.00	51,194.98	0.00
FY2031	19,632.55	785.30	18,847.25	209.64	167.31	376.95	51,194.98	1,706.50	49,488.48	989.77
FY2032	18,847.25	785.30	18,061.95	200.90	160.33	361.23	49,488.48	1,706.50	47,781.98	955.64
FY2033	18,061.95	785.30	17,276.65	192.17	153.36	345.53	47,781.98	1,706.50	46,075.48	921.51
FY2034	17,276.65	785.30	16,491.35	183.43	146.39	329.82	46,075.48	1,706.50	44,368.98	887.38
FY2035	16,491.35	785.30	15,706.05	174.70	139.42	314.12	44,368.98	1,706.50	42,662.48	853.25
FY2036	16,491.35	785.30	15,706.05	174.70	139.42	314.12	42,662.48	1,706.50	40,955.98	819.12
FY2037	15,706.05	785.30	14,920.75	165.96	132.45	298.41	40,955.98	1,706.50	39,249.48	784.99
FY2038	14,920.75	785.30	14,135.45	157.23	125.48	282.71	39,249.48	1,706.50	37,542.98	750.86
FY2039	14,135.45	785.30	13,350.15	148.49	118.51	267.00	37,542.98	1,706.50	35,836.48	716.73
FY2040	13,350.15	785.30	12,564.85	139.76	111.54	251.30	35,836.48	1,706.50	34,129.98	682.60
FY2041	12,564.85	785.30	11,779.55	131.02	104.57	235.59	34,129.98	1,706.50	32,423.48	648.47
FY2042	11,779.55	785.30	10,994.25	122.29	97.60	219.89	32,423.48	1,706.50	30,716.98	614.34

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	0.00	0.00	52.29	52.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.29	52.29
FY2017	(329.21)	418.42	89.21	0.00	0.00	0.00	89.21	141.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	89.21	141.50
FY2018	(283.16)	418.42	135.26	0.00	0.00	0.00	135.26	276.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	135.26	276.75
FY2019	(231.00)	418.42	187.42	0.00	0.00	0.00	187.42	464.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	187.42	464.18
FY2020	(177.27)	418.42	241.15	0.00	0.00	0.00	241.15	705.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	241.15	705.33
FY2021	(125.51)	416.01	290.50	0.00	0.00	0.00	290.50	995.82	(743.38)	935.06	191.68	0.00	0.00	0.00	191.68	191.68	482.18	1,187.51
FY2022	(81.98)	416.01	334.03	0.00	0.00	0.00	334.03	1,329.85	(691.19)	935.06	243.87	0.00	0.00	0.00	243.87	435.56	577.90	1,765.41
FY2023	(28.07)	416.01	387.94	0.00	0.00	0.00	387.94	1,717.80	(636.18)	935.06	298.88	0.00	0.00	0.00	298.88	734.44	686.83	2,452.23
FY2024	21.26	416.01	437.27	0.00	0.00	0.00	437.27	2,155.07	(561.91)	935.06	373.15	0.00	0.00	0.00	373.15	1,107.59	810.43	3,262.66
FY2025	56.88	416.01	472.89	0.00	0.00	0.00	472.89	2,627.96	(459.89)	935.06	475.17	0.00	0.00	0.00	475.17	1,582.77	948.06	4,210.72
FY2026	140.04	416.01	556.05	785.30	455.47	1,240.77	(684.72)	1,943.24	(351.18)	909.60	558.42	0.00	0.00	0.00	558.42	2,141.18	(126.30)	4,084.42
FY2027	197.66	416.01	613.67	785.30	439.77	1,225.07	(611.40)	1,331.84	(293.48)	909.60	616.12	0.00	0.00	0.00	616.12	2,757.31	4.73	4,089.15
FY2028	274.83	416.01	690.84	785.30	424.06	1,209.36	(518.52)	813.32	(216.23)	909.60	693.37	0.00	0.00	0.00	693.37	3,450.68	174.85	4,264.00
FY2029	359.69	416.01	775.70	785.30	408.36	1,193.66	(417.96)	395.36	(131.28)	909.60	778.32	0.00	0.00	0.00	778.32	4,229.00	360.36	4,624.36
FY2030	452.69	416.01	868.70	785.30	392.65	1,177.95	(309.25)	86.11	(37.80)	909.60	871.80	0.00	0.00	0.00	871.80	5,100.80	562.55	5,186.91
FY2031	542.21	416.01	958.22	785.30	376.95	1,162.25	(204.03)	(117.91)	51.85	909.60	961.45	1,706.50	989.77	2,696.27	(1,734.82)	3,365.98	(1,938.84)	3,248.07
FY2032	632.95	416.01	1,048.96	785.30	361.23	1,146.53	(97.57)	(215.48)	142.71	909.60	1,052.31	1,706.50	955.64	2,662.14	(1,609.83)	1,756.15	(1,707.40)	1,540.67
FY2033	890.34	256.96	1,147.30	785.30	345.53	1,130.83	16.47	(199.01)	241.19	909.60	1,150.79	1,706.50	921.51	2,628.01	(1,477.22)	278.94	(1,460.74)	79.93
FY2034	996.61	256.96	1,253.57	785.30	329.82	1,115.12	138.45	(60.56)	347.59	909.60	1,257.19	1,706.50	887.38	2,593.88	(1,336.69)	(1,057.75)	(1,198.24)	(1,118.31)
FY2035	1,111.64	256.96	1,368.60	785.30	314.12	1,099.42	269.18	208.62	462.78	909.60	1,372.38	1,706.50	853.25	2,559.75	(1,187.37)	(2,245.12)	(918.19)	(2,036.50)
FY2036	1,236.19	256.96	1,493.15	785.30	314.12	1,099.42	393.73	602.36	587.48	909.60	1,497.08	1,706.50	819.12	2,525.62	(1,028.54)	(3,273.66)	(634.81)	(2,671.31)
FY2037	1,370.55	256.96	1,627.51	785.30	298.41	1,083.71	543.80	1,146.16	722.02	909.60	1,631.62	1,706.50	784.99	2,491.49	(859.87)	(4,133.54)	(316.07)	(2,987.38)
FY2038	1,516.04	256.96	1,773.00	785.30	282.71	1,068.01	704.99	1,851.15	948.32	828.93	1,777.25	1,706.50	750.86	2,457.36	(680.11)	(4,813.64)	24.88	(2,962.49)
FY2039	1,673.15	256.96	1,930.11	785.30	267.00	1,052.30	877.81	2,728.96	1,105.62	828.93	1,934.55	1,706.50	716.73	2,423.23	(488.68)	(5,302.32)	389.14	(2,573.36)
FY2040	1,842.87	256.96	2,099.83	785.30	251.30	1,036.60	1,063.23	3,792.19	1,275.52	828.93	2,104.45	1,706.50	682.60	2,389.10	(284.65)	(5,586.97)	778.58	(1,794.78)
FY2041	2,093.83	189.50	2,283.33	785.30	235.59	1,020.89	1,262.44	5,054.63	1,459.20	828.93	2,288.13	1,706.50	648.47	2,354.97	(66.84)	(5,653.81)	1,195.60	(599.18)
FY2042	2,291.94	189.50	2,481.44	785.30	219.89	1,005.19	1,476.25	6,530.88	0.00	828.93	828.93	1,706.50	614.34	2,320.84	(1,491.91)	(7,145.72)	(15.66)	(614.84)
FY2043	2,433.82	189.50	2,623.32	785.30	204.17	989.47	1,633.85	8,164.72	0.00	828.93	828.93	1,706.50	580.21	2,286.71	(1,457.78)	(8,603.50)	176.07	(438.78)
FY2044	2,578.90	189.50	2,768.40	785.30	188.47	973.77	1,794.63	9,959.35	0.00	828.93	828.93	1,706.50	546.08	2,252.58	(1,423.65)	(10,027.15)	370.98	(67.80)
FY2045	2,726.93	189.50	2,916.43	785.30	172.76	958.06	1,958.37	11,917.71	0.00	828.93	828.93	1,706.50	511.95	2,218.45	(1,389.52)	(11,416.67)	568.85	501.04
FY2046	2,877.77	189.50	3,067.27	785.30	157.06	942.36	2,124.91	14,042.62	0.00	718.35	718.35	1,706.50	477.82	2,184.32	(1,465.97)	(12,882.64)	658.94	1,159.98
FY2047	3,030.76	189.50	3,220.26	785.30	141.36	926.66	2,293.60	16,336.21	0.00	718.35	718.35	1,706.50	443.69	2,150.19	(1,431.84)	(14,314.48)	861.76	2,021.73

(4) Case 4
Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Grant/Equity Amount (BDT mil.)	19,632.54	100.00%		
Subsidiary Loan				
Foreign Loan (FL) Portion (BDT mil.)	10,918.70	55.62%	35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)	8,713.84	44.38%	7,559.02	17.72%
Subsidiary Loan Amount (BDT mil.)	19,632.54	100.00%	42,662.48	100.00%
Capitalized amount of interest payable during the grace period (BDT mil.)	1,963.25		4,266.25	
Total Loan Amount including capitalized interest (BDT mil.)	21,595.79		46,928.73	

Terms and Conditions of Subsidiary Loan
- No grant/equity to be provided
- For Phase 1 and Phase 2 Projects:
  a. Repayment of loans with 30 annual installments after 10 years grace
  b. Interest at 1% for Foreign Loan Portion and BOD Local Loan Portion
  c. Interest payable during the initial 10 years to be capitalized
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2			
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL	Interest for LL	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL & LL (1%)
FY2016	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2017	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2018	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2019	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2020	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2021	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2022	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2023	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2024	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2025	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2026	21,595.79	654.42	20,941.37	116.47	92.95	209.42	46,928.73	0.00	46,928.73	0.00
FY2027	20,941.37	654.42	20,286.95	112.83	90.04	202.87	46,928.73	0.00	46,928.73	0.00
FY2028	20,286.95	654.42	19,632.53	109.19	87.14	196.33	46,928.73	0.00	46,928.73	0.00
FY2029	19,632.53	654.42	18,978.11	105.55	84.23	189.78	46,928.73	0.00	46,928.73	0.00
FY2030	18,978.11	654.42	18,323.69	101.91	81.33	183.24	46,928.73	0.00	46,928.73	0.00
FY2031	18,323.69	654.42	17,669.27	98.27	78.42	176.69	46,928.73	1,564.29	45,364.44	453.64
FY2032	17,669.27	654.42	17,014.85	94.63	75.52	170.15	45,364.44	1,564.29	43,800.15	438.00
FY2033	17,014.85	654.42	16,360.43	90.99	72.62	163.61	43,800.15	1,564.29	42,235.86	422.36
FY2034	16,360.43	654.42	15,706.01	87.35	69.71	157.06	42,235.86	1,564.29	40,671.57	406.72
FY2035	15,706.01	654.42	15,051.59	83.71	66.81	150.52	40,671.57	1,564.29	39,107.28	391.07
FY2036	15,706.01	654.42	15,051.59	83.71	66.81	150.52	39,107.28	1,564.29	37,542.99	375.43
FY2037	15,051.59	654.42	14,397.17	80.07	63.90	143.97	37,542.99	1,564.29	35,978.70	359.79
FY2038	14,397.17	654.42	13,742.75	76.43	61.00	137.43	35,978.70	1,564.29	34,414.41	344.14
FY2039	13,742.75	654.42	13,088.33	72.79	58.09	130.88	34,414.41	1,564.29	32,850.12	328.50
FY2040	13,088.33	654.42	12,433.91	69.15	55.19	124.34	32,850.12	1,564.29	31,285.83	312.86
FY2041	12,433.91	654.42	11,779.49	65.51	52.28	117.79	31,285.83	1,564.29	29,721.54	297.22
FY2042	11,779.49	654.42	11,125.07	61.87	49.38	111.25	29,721.54	1,564.29	28,157.25	281.57

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	0.00	0.00	52.29	52.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.29	52.29
FY2017	(337.26)	418.42	81.16	0.00	0.00	0.00	81.16	133.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.16	133.45
FY2018	(302.15)	418.42	116.27	0.00	0.00	0.00	116.27	249.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	116.27	249.71
FY2019	(264.39)	418.42	154.03	0.00	0.00	0.00	154.03	403.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	154.03	403.75
FY2020	(228.46)	418.42	189.96	0.00	0.00	0.00	189.96	593.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	189.96	593.71
FY2021	(195.60)	416.01	220.41	0.00	0.00	0.00	220.41	814.11	(795.56)	935.06	139.50	0.00	0.00	0.00	139.50	139.50	359.91	953.62
FY2022	(172.32)	416.01	243.69	0.00	0.00	0.00	243.69	1,057.80	(763.21)	935.06	171.85	0.00	0.00	0.00	171.85	311.36	415.54	1,369.16
FY2023	(142.38)	416.01	273.63	0.00	0.00	0.00	273.63	1,331.44	(731.72)	935.06	203.34	0.00	0.00	0.00	203.34	514.70	476.98	1,846.13
FY2024	(118.55)	416.01	297.46	0.00	0.00	0.00	297.46	1,628.90	(687.47)	935.06	247.59	0.00	0.00	0.00	247.59	762.29	545.06	2,391.19
FY2025	(108.21)	416.01	307.80	0.00	0.00	0.00	307.80	1,936.70	(624.98)	935.06	310.08	0.00	0.00	0.00	310.08	1,072.38	617.88	3,009.07
FY2026	(61.69)	416.01	354.32	654.42	209.42	863.84	(509.52)	1,427.18	(552.91)	909.60	356.69	0.00	0.00	0.00	356.69	1,429.06	(152.83)	2,856.24
FY2027	(38.34)	416.01	377.67	654.42	202.87	857.29	(479.62)	947.56	(529.48)	909.60	380.12	0.00	0.00	0.00	380.12	1,809.19	(99.49)	2,756.75
FY2028	(2.44)	416.01	413.57	654.42	196.33	850.75	(437.18)	510.38	(493.50)	909.60	416.10	0.00	0.00	0.00	416.10	2,225.29	(21.08)	2,735.67
FY2029	36.01	416.01	452.02	654.42	189.78	844.20	(392.18)	118.20	(454.96)	909.60	454.64	0.00	0.00	0.00	454.64	2,679.93	62.46	2,798.13
FY2030	77.32	416.01	493.33	654.42	183.24	837.66	(344.33)	(226.13)	(413.27)	909.60	496.33	0.00	0.00	0.00	496.33	3,176.26	152.00	2,950.13
FY2031	112.72	416.01	528.73	654.42	176.69	831.11	(302.38)	(528.50)	(377.77)	909.60	531.83	1,564.29	453.64	2,017.93	(1,486.10)	1,690.16	(1,788.47)	1,161.66
FY2032	145.79	416.01	561.80	654.42	170.15	824.57	(262.77)	(791.27)	(344.59)	909.60	565.01	1,564.29	438.00	2,002.29	(1,437.28)	252.88	(1,700.05)	(538.39)
FY2033	339.77	256.96	596.73	654.42	163.61	818.03	(221.30)	(1,012.57)	(309.53)	909.60	600.07	1,564.29	422.36	1,986.65	(1,386.58)	(1,133.69)	(1,607.87)	(2,146.26)
FY2034	376.70	256.96	633.66	654.42	157.06	811.48	(177.82)	(1,190.39)	(272.49)	909.60	637.11	1,564.29	406.72	1,971.01	(1,333.90)	(2,467.59)	(1,511.72)	(3,657.98)
FY2035	416.00	256.96	672.96	654.42	150.52	804.94	(131.98)	(1,322.37)	(233.06)	909.60	676.54	1,564.29	391.07	1,955.36	(1,278.82)	(3,746.41)	(1,410.80)	(5,068.78)
FY2036	457.33	256.96	714.29	654.42	150.52	804.94	(90.65)	(1,413.01)	(191.60)	909.60	718.00	1,564.29	375.43	1,939.72	(1,221.72)	(4,968.13)	(1,312.37)	(6,381.15)
FY2037	501.00	256.96	757.96	654.42	143.97	798.39	(40.43)	(1,453.44)	(147.79)	909.60	761.81	1,564.29	359.79	1,924.08	(1,162.27)	(6,130.41)	(1,202.70)	(7,583.85)
FY2038	547.09	256.96	804.05	654.42	137.43	791.85	12.20	(1,441.24)	(20.90)	828.93	808.03	1,564.29	344.14	1,908.43	(1,100.40)	(7,230.80)	(1,088.20)	(8,672.04)
FY2039	595.68	256.96	852.64	654.42	130.88	785.30	67.34	(1,373.90)	27.84	828.93	856.77	1,564.29	328.50	1,892.79	(1,036.02)	(8,266.82)	(968.67)	(9,640.72)
FY2040	647.19	256.96	904.15	654.42	124.34	778.76	125.39	(1,248.51)	79.50	828.93	908.43	1,564.29	312.86	1,877.15	(968.72)	(9,235.54)	(843.33)	(10,484.05)
FY2041	769.13	189.50	958.63	654.42	117.79	772.21	186.42	(1,062.09)	134.14	828.93	963.07	1,564.29	297.22	1,861.51	(898.44)	(10,133.98)	(712.02)	(11,196.07)
FY2042	826.55	189.50	1,016.05	654.42	111.25	765.67	250.38	(811.71)	0.00	828.93	828.93	1,564.29	281.57	1,845.86	(1,016.93)	(11,150.91)	(766.55)	(11,962.62)
FY2043	913.43	189.50	1,102.93	654.42	104.70	759.12	343.81	(467.91)	0.00	828.93	828.93	1,564.29	265.93	1,830.22	(1,001.29)	(12,152.20)	(657.48)	(12,620.11)
FY2044	1,004.65	189.50	1,194.15	654.42	98.16	752.58	441.57	(26.34)	0.00	828.93	828.93	1,564.29	250.29	1,814.58	(985.65)	(13,137.85)	(544.08)	(13,164.19)
FY2045	1,100.43	189.50	1,289.93	654.42	91.61	746.03	543.90	517.55	0.00	828.93	828.93	1,564.29	234.64	1,798.93	(970.00)	(14,107.85)	(426.10)	(13,590.30)
FY2046	1,201.00	189.50	1,390.50	654.42	85.07	739.49	651.01	1,168.56	0.00	718.35	718.35	1,564.29	219.00	1,783.29	(1,064.94)	(15,172.79)	(413.93)	(14,004.23)
FY2047	1,306.59	189.50	1,496.09	654.42	78.53	732.95	763.14	1,931.69	0.00	718.35	718.35	1,564.29	203.36	1,767.65	(1,049.30)	(16,222.09)	(286.16)	(14,290.40)

(5) Case 5
Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Grant/Equity Amount (BDT mil.)	19,632.54	100.00%		
Subsidiary Loan				
Foreign Loan (FL) Portion (BDT mil.)	10,918.70	55.62%	35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)	8,713.84	44.38%	7,559.02	17.72%
Subsidiary Loan Amount (BDT mil.)	19,632.54	100.00%	42,662.48	100.00%
Capitalized amount of interest payable during the grace period (BDT mil.)	1,963.25		4,266.25	
Total Loan Amount including capitalized interest (BDT mil.)	21,595.79		46,928.73	

Terms and Conditions of Subsidiary Loan

- No grant/equity to be provided
- For Phase 1 and Phase 2 Projects:
  a. Repayment of loans with 30 annual installments after 10 years grace
  b. Interest at 1% for Foreign Loan Portion and BOD Local Loan Portion
  c. Interest payable during the initial 10 years to be capitalized
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2			
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL	Interest for LL	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL & LL (1%)
FY2016	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2017	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2018	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2019	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2020	21,595.79	0.00	21,595.79	0.00	0.00	0.00				
FY2021	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2022	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2023	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2024	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2025	21,595.79	0.00	21,595.79	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2026	21,595.79	654.42	20,941.37	116.47	92.95	209.42	46,928.73	0.00	46,928.73	0.00
FY2027	20,941.37	654.42	20,286.95	112.83	90.04	202.87	46,928.73	0.00	46,928.73	0.00
FY2028	20,286.95	654.42	19,632.53	109.19	87.14	196.33	46,928.73	0.00	46,928.73	0.00
FY2029	19,632.53	654.42	18,978.11	105.55	84.23	189.78	46,928.73	0.00	46,928.73	0.00
FY2030	18,978.11	654.42	18,323.69	101.91	81.33	183.24	46,928.73	0.00	46,928.73	0.00
FY2031	18,323.69	654.42	17,669.27	98.27	78.42	176.69	46,928.73	1,564.29	45,364.44	453.64
FY2032	17,669.27	654.42	17,014.85	94.63	75.52	170.15	45,364.44	1,564.29	43,800.15	438.00
FY2033	17,014.85	654.42	16,360.43	90.99	72.62	163.61	43,800.15	1,564.29	42,235.86	422.36
FY2034	16,360.43	654.42	15,706.01	87.35	69.71	157.06	42,235.86	1,564.29	40,671.57	406.72
FY2035	15,706.01	654.42	15,051.59	83.71	66.81	150.52	40,671.57	1,564.29	39,107.28	391.07
FY2036	15,706.01	654.42	15,051.59	83.71	66.81	150.52	39,107.28	1,564.29	37,542.99	375.43
FY2037	15,051.59	654.42	14,397.17	80.07	63.90	143.97	37,542.99	1,564.29	35,978.70	359.79
FY2038	14,397.17	654.42	13,742.75	76.43	61.00	137.43	35,978.70	1,564.29	34,414.41	344.14
FY2039	13,742.75	654.42	13,088.33	72.79	58.09	130.88	34,414.41	1,564.29	32,850.12	328.50
FY2040	13,088.33	654.42	12,433.91	69.15	55.19	124.34	32,850.12	1,564.29	31,285.83	312.86
FY2041	12,433.91	654.42	11,779.49	65.51	52.28	117.79	31,285.83	1,564.29	29,721.54	297.22
FY2042	11,779.49	654.42	11,125.07	61.87	49.38	111.25	29,721.54	1,564.29	28,157.25	281.57

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	0.00	0.00	52.29	52.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.29	52.29
FY2017	(330.88)	418.42	87.54	0.00	0.00	0.00	87.54	139.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	87.54	139.83
FY2018	(287.03)	418.42	131.39	0.00	0.00	0.00	131.39	271.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	131.39	271.21
FY2019	(237.86)	418.42	180.56	0.00	0.00	0.00	180.56	451.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	180.56	451.78
FY2020	(187.95)	418.42	230.47	0.00	0.00	0.00	230.47	682.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	230.47	682.25
FY2021	(140.08)	416.01	275.93	0.00	0.00	0.00	275.93	958.17	(754.22)	935.06	180.84	0.00	0.00	0.00	180.84	180.84	456.77	1,139.02
FY2022	(100.84)	416.01	315.17	0.00	0.00	0.00	315.17	1,273.34	(706.21)	935.06	228.85	0.00	0.00	0.00	228.85	409.70	544.02	1,683.04
FY2023	(52.13)	416.01	363.88	0.00	0.00	0.00	363.88	1,637.23	(656.27)	935.06	278.79	0.00	0.00	0.00	278.79	688.49	642.68	2,325.71
FY2024	(8.43)	416.01	407.58	0.00	0.00	0.00	407.58	2,044.81	(588.56)	935.06	346.50	0.00	0.00	0.00	346.50	1,034.99	754.09	3,079.80
FY2025	21.61	416.01	437.62	0.00	0.00	0.00	437.62	2,482.43	(495.16)	935.06	439.90	0.00	0.00	0.00	439.90	1,474.90	877.52	3,957.32
FY2026	96.59	416.01	512.60	654.42	209.42	863.84	(351.24)	2,131.19	(394.63)	909.60	514.97	0.00	0.00	0.00	514.97	1,989.86	163.73	4,121.05
FY2027	146.29	416.01	562.30	654.42	202.87	857.29	(294.99)	1,836.20	(344.85)	909.60	564.75	0.00	0.00	0.00	564.75	2,554.62	269.77	4,390.82
FY2028	214.01	416.01	630.02	654.42	196.33	850.75	(220.73)	1,615.47	(277.05)	909.60	632.55	0.00	0.00	0.00	632.55	3,187.17	411.82	4,802.64
FY2029	287.99	416.01	704.00	654.42	189.78	844.20	(140.20)	1,475.27	(202.98)	909.60	706.62	0.00	0.00	0.00	706.62	3,893.79	566.42	5,369.06
FY2030	368.63	416.01	784.64	654.42	183.24	837.66	(53.02)	1,422.25	(121.88)	909.60	787.72	0.00	0.00	0.00	787.72	4,681.51	734.70	6,103.76
FY2031	445.02	416.01	861.03	654.42	176.69	831.11	29.92	1,452.18	(45.37)	909.60	864.23	1,564.29	453.64	2,017.93	(1,153.70)	3,527.81	(1,123.77)	4,979.99
FY2032	521.67	416.01	937.68	654.42	170.15	824.57	113.11	1,565.29	31.40	909.60	941.00	1,564.29	438.00	2,002.29	(1,061.29)	2,466.52	(948.18)	4,031.81
FY2033	763.32	256.96	1,020.28	654.42	163.61	818.03	202.25	1,767.54	114.13	909.60	1,023.73	1,564.29	422.36	1,986.65	(962.92)	1,503.61	(760.66)	3,271.15
FY2034	852.31	256.96	1,109.27	654.42	157.06	811.48	297.79	2,065.33	203.25	909.60	1,112.85	1,564.29	406.72	1,971.01	(858.16)	645.45	(560.37)	2,710.78
FY2035	948.18	256.96	1,205.14	654.42	150.52	804.94	400.20	2,465.53	299.27	909.60	1,208.87	1,564.29	391.07	1,955.36	(746.49)	(101.04)	(346.29)	2,364.49
FY2036	1,051.60	256.96	1,308.56	654.42	150.52	804.94	503.62	2,969.16	402.84	909.60	1,312.44	1,564.29	375.43	1,939.72	(627.28)	(728.32)	(123.66)	2,240.83
FY2037	1,162.74	256.96	1,419.70	654.42	143.97	798.39	621.31	3,590.47	514.14	909.60	1,423.74	1,564.29	359.79	1,924.08	(500.34)	(1,228.67)	120.97	2,361.80
FY2038	1,282.58	256.96	1,539.54	654.42	137.43	791.85	747.69	4,338.16	714.80	828.93	1,543.73	1,564.29	344.14	1,908.43	(364.70)	(1,593.36)	382.99	2,744.80
FY2039	1,411.40	256.96	1,668.36	654.42	130.88	785.30	883.06	5,221.22	843.79	828.93	1,672.72	1,564.29	328.50	1,892.79	(220.07)	(1,813.43)	663.00	3,407.79
FY2040	1,550.20	256.96	1,807.16	654.42	124.34	778.76	1,028.40	6,249.62	982.77	828.93	1,811.70	1,564.29	312.86	1,877.15	(65.45)	(1,878.88)	962.95	4,370.74
FY2041	1,766.69	189.50	1,956.19	654.42	117.79	772.21	1,183.98	7,433.60	1,131.98	828.93	1,960.91	1,564.29	297.22	1,861.51	99.40	(1,779.48)	1,283.38	5,654.12
FY2042	1,926.95	189.50	2,116.45	654.42	111.25	765.67	1,350.78	8,784.38	0.00	828.93	828.93	1,564.29	281.57	1,845.86	(1,016.93)	(2,796.41)	333.85	5,987.97
FY2043	2,125.51	189.50	2,315.01	654.42	104.70	759.12	1,555.89	10,340.26	0.00	828.93	828.93	1,564.29	265.93	1,830.22	(1,001.29)	(3,797.70)	554.60	6,542.56
FY2044	2,338.05	189.50	2,527.55	654.42	98.16	752.58	1,774.97	12,115.23	0.00	828.93	828.93	1,564.29	250.29	1,814.58	(985.65)	(4,783.35)	789.32	7,331.88
FY2045	2,565.45	189.50	2,754.95	654.42	91.61	746.03	2,008.92	14,124.14	0.00	828.93	828.93	1,564.29	234.64	1,798.93	(970.00)	(5,753.35)	1,038.92	8,370.79
FY2046	2,808.81	189.50	2,998.31	654.42	85.07	739.49	2,258.82	16,382.96	0.00	718.35	718.35	1,564.29	219.00	1,783.29	(1,064.94)	(6,818.29)	1,193.88	9,564.67
FY2047	3,069.34	189.50	3,258.84	654.42	78.53	732.95	2,525.89	18,908.84	0.00	718.35	718.35	1,564.29	203.36	1,767.65	(1,049.30)	(7,867.59)	1,476.59	11,041.25

(6) Case 6
Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Grant/Equity Amount (BDT mil.)	19,632.54	100.00%		
Subsidiary Loan				
Foreign Loan (FL) Portion (BDT mil.)			35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)			7,559.02	17.72%
Subsidiary Loan Amount (BDT mil.)			42,662.48	100.00%
Capitalized amount of interest payable during the grace period (BDT mil.)			4,266.25	
Total Loan Amount including capitalized interest (BDT mil.)			46,928.73	

Terms and Conditions of Subsidiary Loan

- Grant/equity to be provided for the whole amount of Phase 1 Project
- For Phase 2 Project:
  a. Repayment of loans with 30 annual installments after 10 years grace
  b. Interest at 1% for Foreign Loan Portion and BOD Local Loan Portion
  c. Interest payable during the initial 10 years to be capitalized
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2			
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL	Interest for LL	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL & LL (1%)
FY2016	0.00	0.00	0.00	0.00	0.00	0.00				
FY2017	0.00	0.00	0.00	0.00	0.00	0.00				
FY2018	0.00	0.00	0.00	0.00	0.00	0.00				
FY2019	0.00	0.00	0.00	0.00	0.00	0.00				
FY2020	0.00	0.00	0.00	0.00	0.00	0.00				
FY2021	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2022	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2023	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2024	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2025	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2026	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2027	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2028	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2029	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2030	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	0.00	46,928.73	0.00
FY2031	0.00	0.00	0.00	0.00	0.00	0.00	46,928.73	1,564.29	45,364.44	453.64
FY2032	0.00	0.00	0.00	0.00	0.00	0.00	45,364.44	1,564.29	43,800.15	438.00
FY2033	0.00	0.00	0.00	0.00	0.00	0.00	43,800.15	1,564.29	42,235.86	422.36
FY2034	0.00	0.00	0.00	0.00	0.00	0.00	42,235.86	1,564.29	40,671.57	406.72
FY2035	0.00	-0.06	0.06	0.00	0.00	0.00	40,671.57	1,564.29	39,107.28	391.07
FY2036	0.00	0.00	0.00	0.00	0.00	0.00	39,107.28	1,564.29	37,542.99	375.43
FY2037	0.00	0.00	0.00	0.00	0.00	0.00	37,542.99	1,564.29	35,978.70	359.79
FY2038	0.00	0.00	0.00	0.00	0.00	0.00	35,978.70	1,564.29	34,414.41	344.14
FY2039	0.00	0.00	0.00	0.00	0.00	0.00	34,414.41	1,564.29	32,850.12	328.50
FY2040	0.00	0.00	0.00	0.00	0.00	0.00	32,850.12	1,564.29	31,285.83	312.86
FY2041	0.00	0.00	0.00	0.00	0.00	0.00	31,285.83	1,564.29	29,721.54	297.22
FY2042	0.00	0.00	0.00	0.00	0.00	0.00	29,721.54	1,564.29	28,157.25	281.57

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	0.00	0.00	52.29	52.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.29	52.29
FY2017	(337.26)	418.42	81.16	0.00	0.00	0.00	81.16	133.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.16	133.45
FY2018	(302.15)	418.42	116.27	0.00	0.00	0.00	116.27	249.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	116.27	249.71
FY2019	(264.39)	418.42	154.03	0.00	0.00	0.00	154.03	403.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	154.03	403.75
FY2020	(228.46)	418.42	189.96	0.00	0.00	0.00	189.96	593.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	189.96	593.71
FY2021	(195.60)	416.01	220.41	0.00	0.00	0.00	220.41	814.11	(795.56)	935.06	139.50	0.00	0.00	0.00	139.50	139.50	359.91	953.62
FY2022	(172.32)	416.01	243.69	0.00	0.00	0.00	243.69	1,057.80	(763.21)	935.06	171.85	0.00	0.00	0.00	171.85	311.36	415.54	1,369.16
FY2023	(142.38)	416.01	273.63	0.00	0.00	0.00	273.63	1,331.44	(731.72)	935.06	203.34	0.00	0.00	0.00	203.34	514.70	476.98	1,846.13
FY2024	(118.55)	416.01	297.46	0.00	0.00	0.00	297.46	1,628.90	(687.47)	935.06	247.59	0.00	0.00	0.00	247.59	762.29	545.06	2,391.19
FY2025	(108.21)	416.01	307.80	0.00	0.00	0.00	307.80	1,936.70	(624.98)	935.06	310.08	0.00	0.00	0.00	310.08	1,072.38	617.88	3,009.07
FY2026	(61.69)	416.01	354.32	0.00	0.00	0.00	354.32	2,291.02	(552.91)	909.60	356.69	0.00	0.00	0.00	356.69	1,429.06	711.01	3,720.08
FY2027	(38.34)	416.01	377.67	0.00	0.00	0.00	377.67	2,668.69	(529.48)	909.60	380.12	0.00	0.00	0.00	380.12	1,809.19	757.80	4,477.88
FY2028	(2.44)	416.01	413.57	0.00	0.00	0.00	413.57	3,082.26	(493.50)	909.60	416.10	0.00	0.00	0.00	416.10	2,225.29	829.67	5,307.55
FY2029	36.01	416.01	452.02	0.00	0.00	0.00	452.02	3,534.28	(454.96)	909.60	454.64	0.00	0.00	0.00	454.64	2,679.93	906.66	6,214.21
FY2030	77.32	416.01	493.33	0.00	0.00	0.00	493.33	4,027.61	(413.27)	909.60	496.33	0.00	0.00	0.00	496.33	3,176.26	989.66	7,203.87
FY2031	112.72	416.01	528.73	0.00	0.00	0.00	528.73	4,556.35	(377.77)	909.60	531.83	1,564.29	453.64	2,017.93	(1,486.10)	1,690.16	(957.36)	6,246.51
FY2032	145.79	416.01	561.80	0.00	0.00	0.00	561.80	5,118.15	(344.59)	909.60	565.01	1,564.29	438.00	2,002.29	(1,437.28)	252.88	(875.48)	5,371.03
FY2033	339.77	256.96	596.73	0.00	0.00	0.00	596.73	5,714.88	(309.53)	909.60	600.07	1,564.29	422.36	1,986.65	(1,386.58)	(1,133.69)	(789.84)	4,581.19
FY2034	376.70	256.96	633.66	0.00	0.00	0.00	633.66	6,348.54	(272.49)	909.60	637.11	1,564.29	406.72	1,971.01	(1,333.90)	(2,467.59)	(700.24)	3,880.95
FY2035	416.00	256.96	672.96	0.00	0.00	0.00	672.96	7,021.50	(233.06)	909.60	676.54	1,564.29	391.07	1,955.36	(1,278.82)	(3,746.41)	(605.86)	3,275.09
FY2036	457.33	256.96	714.29	0.00	0.00	0.00	714.29	7,735.80	(191.60)	909.60	718.00	1,564.29	375.43	1,939.72	(1,221.72)	(4,968.13)	(507.43)	2,767.66
FY2037	501.00	256.96	757.96	0.00	0.00	0.00	757.96	8,493.76	(147.79)	909.60	761.81	1,564.29	359.79	1,924.08	(1,162.27)	(6,130.41)	(404.31)	2,363.35
FY2038	547.09	256.96	804.05	0.00	0.00	0.00	804.05	9,297.81	(20.90)	828.93	808.03	1,564.29	344.14	1,908.43	(1,100.40)	(7,230.80)	(296.35)	2,067.01
FY2039	595.68	256.96	852.64	0.00	0.00	0.00	852.64	10,150.45	27.84	828.93	856.77	1,564.29	328.50	1,892.79	(1,036.02)	(8,266.82)	(183.37)	1,883.63
FY2040	647.19	256.96	904.15	0.00	0.00	0.00	904.15	11,054.60	79.50	828.93	908.43	1,564.29	312.86	1,877.15	(968.72)	(9,235.54)	(64.57)	1,819.06
FY2041	769.13	189.50	958.63	0.00	0.00	0.00	958.63	12,013.23	134.14	828.93	963.07	1,564.29	297.22	1,861.51	(898.44)	(10,133.98)	60.19	1,879.25
FY2042	826.55	189.50	1,016.05	0.00	0.00	0.00	1,016.05	13,029.28	0.00	828.93	828.93	1,564.29	281.57	1,845.86	(1,016.93)	(11,150.91)	(0.88)	1,878.37
FY2043	913.43	189.50	1,102.93	0.00	0.00	0.00	1,102.93	14,132.20	0.00	828.93	828.93	1,564.29	265.93	1,830.22	(1,001.29)	(12,152.20)	101.64	1,980.00
FY2044	1,004.65	189.50	1,194.15	0.00	0.00	0.00	1,194.15	15,326.35	0.00	828.93	828.93	1,564.29	250.29	1,814.58	(985.65)	(13,137.85)	208.50	2,188.50
FY2045	1,100.43	189.50	1,289.93	0.00	0.00	0.00	1,289.93	16,616.27	0.00	828.93	828.93	1,564.29	234.64	1,798.93	(970.00)	(14,107.85)	319.93	2,508.42
FY2046	1,201.00	189.50	1,390.50	0.00	0.00	0.00	1,390.50	18,006.77	0.00	718.35	718.35	1,564.29	219.00	1,783.29	(1,064.94)	(15,172.79)	325.56	2,833.98
FY2047	1,306.59	189.50	1,496.09	0.00	0.00	0.00	1,496.09	19,502.85	0.00	718.35	718.35	1,564.29	203.36	1,767.65	(1,049.30)	(16,222.09)	446.79	3,280.76

(7) Case 7
Debt-service: Same as Case 1
Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	488.20	418.42	906.62	0.00	894.49	894.49	12.13	12.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.13	12.13
FY2017	641.29	418.42	1,059.71	0.00	894.49	894.49	165.22	177.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	165.22	177.35
FY2018	814.73	418.42	1,233.15	0.00	894.49	894.49	338.66	516.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	338.66	516.00
FY2019	993.73	418.42	1,412.15	0.00	894.49	894.49	517.66	1,033.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	517.66	1,033.67
FY2020	1,161.59	418.42	1,580.01	0.00	894.49	894.49	685.52	1,719.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	685.52	1,719.19
FY2021	1,996.68	416.01	2,412.69	1,308.84	834.86	2,143.70	268.99	1,988.17	837.05	935.06	1,772.11	0.00	2,057.53	2,057.53	(285.42)	(285.42)	(16.43)	1,702.76
FY2022	2,074.46	416.01	2,490.47	1,308.84	775.22	2,084.06	406.41	2,394.58	1,028.63	935.06	1,963.69	0.00	2,057.53	2,057.53	(93.84)	(379.25)	312.57	2,015.33
FY2023	2,177.90	416.01	2,593.91	1,308.84	715.59	2,024.43	569.48	2,964.07	1,208.15	935.06	2,143.21	0.00	2,057.53	2,057.53	85.68	(293.57)	655.17	2,670.49
FY2024	2,245.98	416.01	2,661.99	1,308.84	655.96	1,964.80	697.19	3,661.26	1,436.29	935.06	2,371.35	0.00	2,057.53	2,057.53	313.82	20.25	1,011.02	3,681.51
FY2025	2,250.90	416.01	2,666.91	1,308.84	596.33	1,905.17	761.74	4,423.00	1,734.13	935.06	2,669.19	0.00	2,057.53	2,057.53	611.66	631.92	1,373.40	5,054.91
FY2026	2,660.49	416.01	3,076.50	1,308.84	536.69	1,845.53	1,230.97	5,653.97	2,169.27	909.60	3,078.87	2,844.17	1,920.36	4,764.53	(1,685.66)	(1,053.75)	(454.69)	4,600.22
FY2027	2,645.71	416.01	3,061.72	1,308.84	477.05	1,785.89	1,275.83	6,929.80	2,154.57	909.60	3,064.17	2,844.17	1,783.20	4,627.37	(1,563.20)	(2,616.94)	(287.36)	4,312.86
FY2028	2,677.17	416.01	3,093.18	1,308.84	417.43	1,726.27	1,366.91	8,296.71	2,186.11	909.60	3,095.71	2,844.17	1,646.03	4,490.20	(1,394.49)	(4,011.43)	(27.58)	4,285.28
FY2029	2,708.05	416.01	3,124.06	1,308.84	357.79	1,666.63	1,457.43	9,754.14	2,217.08	909.60	3,126.68	2,844.17	1,508.86	4,353.03	(1,226.35)	(5,237.78)	231.08	4,516.36
FY2030	2,738.36	416.01	3,154.37	1,308.84	298.16	1,607.00	1,547.37	11,301.51	2,248.52	909.60	3,158.12	2,844.17	1,371.68	4,215.85	(1,057.73)	(6,295.51)	489.64	5,006.00
FY2031	2,736.88	416.01	3,152.89	1,308.84	238.53	1,547.37	1,605.52	12,907.04	2,247.15	909.60	3,156.75	2,844.17	1,234.52	4,078.69	(921.94)	(7,217.45)	683.59	5,689.59
FY2032	2,719.20	416.01	3,135.21	1,308.84	178.90	1,487.74	1,647.47	14,554.51	2,229.57	909.60	3,139.17	2,844.17	1,097.35	3,941.52	(802.35)	(8,019.80)	845.12	6,534.71
FY2033	2,859.92	256.96	3,116.88	1,308.84	119.26	1,428.10	1,688.78	16,243.29	2,211.34	909.60	3,120.94	2,844.17	960.18	3,804.35	(683.41)	(8,703.20)	1,005.38	7,540.09
FY2034	2,840.93	256.96	3,097.89	1,308.84	59.63	1,368.47	1,729.42	17,972.71	2,192.45	909.60	3,102.05	2,844.17	823.01	3,667.18	(565.13)	(9,268.33)	1,164.29	8,704.38
FY2035	2,821.23	256.96	3,078.19	1,308.78	0.00	1,308.78	1,769.41	19,742.12	2,172.87	909.60	3,082.47	2,844.17	685.85	3,530.02	(447.55)	(9,715.88)	1,321.86	10,026.24
FY2036	2,800.82	256.96	3,057.78	0.00	0.00	0.00	3,057.78	22,799.91	2,152.57	909.60	3,062.17	2,844.17	548.67	3,392.84	(330.67)	(10,046.55)	2,727.11	12,753.35
FY2037	2,779.66	256.96	3,036.62	0.00	0.00	0.00	3,036.62	25,836.53	2,131.53	909.60	3,041.13	2,844.17	411.50	3,255.67	(214.54)	(10,261.10)	2,822.08	15,575.43
FY2038	2,757.73	256.96	3,014.69	0.00	0.00	0.00	3,014.69	28,851.22	2,190.38	828.93	3,019.31	2,844.17	274.33	3,118.50	(99.19)	(10,360.28)	2,915.50	18,490.94
FY2039	2,734.99	256.96	2,991.95	0.00	0.00	0.00	2,991.95	31,843.17	2,167.77	828.93	2,996.70	2,844.17	137.17	2,981.34	15.36	(10,344.92)	3,007.32	21,498.25
FY2040	2,711.43	256.96	2,968.39	0.00	0.00	0.00	2,968.39	34,811.56	2,144.34	828.93	2,973.27	2,844.10	0.00	2,844.10	129.17	(10,215.75)	3,097.56	24,595.81
FY2041	2,754.46	189.50	2,943.96	0.00	0.00	0.00	2,943.96	37,755.52	2,120.04	828.93	2,948.97	0.00	0.00	0.00	2,948.97	(7,266.78)	5,892.93	30,488.74
FY2042	2,729.14	189.50	2,918.64	0.00	0.00	0.00	2,918.64	40,674.16	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(6,437.85)	3,747.57	34,236.31
FY2043	2,729.14	189.50	2,918.64	0.00	0.00	0.00	2,918.64	43,592.79	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(5,608.92)	3,747.57	37,983.87
FY2044	2,729.14	189.50	2,918.64	0.00	0.00	0.00	2,918.64	46,511.43	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(4,779.99)	3,747.57	41,731.44
FY2045	2,729.14	189.50	2,918.64	0.00	0.00	0.00	2,918.64	49,430.06	0.00	828.93	828.93	0.00	0.00	0.00	828.93	(3,951.06)	3,747.57	45,479.00
FY2046	2,729.14	189.50	2,918.64	0.00	0.00	0.00	2,918.64	52,348.70	0.00	718.35	718.35	0.00	0.00	0.00	718.35	(3,232.71)	3,636.99	49,115.99
FY2047	2,729.14	189.50	2,918.64	0.00	0.00	0.00	2,918.64	55,267.33	0.00	718.35	718.35	0.00	0.00	0.00	718.35	(2,514.36)	3,636.99	52,752.97

(8) Case 8
Debt-service

Subsidiary Loan Amount	Phase 1		Phase 2	
Grant/Equity Amount (BDT mil.)	19,632.54	100.00%		
Subsidiary Loan				
Foreign Loan (FL) Portion (BDT mil.)			35,103.46	82.28%
Local Loan (LL) Portion (BDT mil.)			7,559.02	17.72%
Subsidiary Loan Amount (BDT mil.)			42,662.48	100.00%
Capitalized amount of interest payable during the grace period (BDT mil.)			14,505.24	
Total Loan Amount including capitalized interest (BDT mil.)			57,167.72	

Terms and Conditions of Subsidiary Loan

- Grant/equity to be provided for the whole amount of Phase 1 Project
- For Phase 2 Project:
  a. Repayment of loans with 23 annual installments after 17 years grace
  b. Interest at 2% for Foreign Loan Portion and BOD Local Loan Portion
  c. Interest payable during the initial 16 years to be capitalized
- Assuming Phase 1 starts operation in FY2016 and Phase 2 in FY 2021

(In BDT mil.)

Fiscal Year	Phase 1						Phase 2			
	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL (5%)	Interest for LL (4%)	Interest - Total	Outstanding of Principal at the Bigining of FY	Repayment during the Year	Outstanding of Principal at the Closing FY	Interest for FL & LL (2%)
FY2016	0.00	0.00	0.00	0.00	0.00	0.00				
FY2017	0.00	0.00	0.00	0.00	0.00	0.00				
FY2018	0.00	0.00	0.00	0.00	0.00	0.00				
FY2019	0.00	0.00	0.00	0.00	0.00	0.00				
FY2020	0.00	0.00	0.00	0.00	0.00	0.00				
FY2021	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2022	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2023	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2024	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2025	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2026	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2027	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2028	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2029	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2030	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2031	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2032	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2033	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2034	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2035	0.00	-0.06	0.06	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2036	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2037	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	0.00	57,167.72	0.00
FY2038	0.00	0.00	0.00	0.00	0.00	0.00	57,167.72	2,485.55	54,682.17	1,093.64
FY2039	0.00	0.00	0.00	0.00	0.00	0.00	54,682.17	2,485.55	52,196.62	1,043.93
FY2040	0.00	0.00	0.00	0.00	0.00	0.00	52,196.62	2,485.55	49,711.07	994.22
FY2041	0.00	0.00	0.00	0.00	0.00	0.00	49,711.07	2,485.55	47,225.52	944.51
FY2042	0.00	0.00	0.00	0.00	0.00	0.00	47,225.52	2,485.55	44,739.97	894.80

Cash-flow

Fiscal Year	Phase 1 Project								Phase 2 Project								Phase 1 & 2 -Combined	
	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	A. Fund Inflow			B. Fund Outflow			Balance (A. - B.)	Accum. Fund	Annual Cash/Fund Flow Balance	Accum. Fund
	Operating Income	Depr.	Total	Repayment of Loan	Interest Payment	Total			Operating Income (Profit/Loss)	Depr.	Total	Repayment of Loan	Interest Payment	Total				
FY2016	(366.13)	418.42	52.29	0.00	0.00	0.00	52.29	52.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	52.29	52.29
FY2017	(337.26)	418.42	81.16	0.00	0.00	0.00	81.16	133.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	81.16	133.45
FY2018	(302.15)	418.42	116.27	0.00	0.00	0.00	116.27	249.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	116.27	249.71
FY2019	(264.39)	418.42	154.03	0.00	0.00	0.00	154.03	403.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	154.03	403.75
FY2020	(228.46)	418.42	189.96	0.00	0.00	0.00	189.96	593.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	189.96	593.71
FY2021	(195.60)	416.01	220.41	0.00	0.00	0.00	220.41	814.11	(795.56)	935.06	139.50	0.00	0.00	0.00	139.50	139.50	359.91	953.62
FY2022	(172.32)	416.01	243.69	0.00	0.00	0.00	243.69	1,057.80	(763.21)	935.06	171.85	0.00	0.00	0.00	171.85	311.36	415.54	1,369.16
FY2023	(142.38)	416.01	273.63	0.00	0.00	0.00	273.63	1,331.44	(731.72)	935.06	203.34	0.00	0.00	0.00	203.34	514.70	476.98	1,846.13
FY2024	(118.55)	416.01	297.46	0.00	0.00	0.00	297.46	1,628.90	(687.47)	935.06	247.59	0.00	0.00	0.00	247.59	762.29	545.06	2,391.19
FY2025	(108.21)	416.01	307.80	0.00	0.00	0.00	307.80	1,936.70	(624.98)	935.06	310.08	0.00	0.00	0.00	310.08	1,072.38	617.88	3,009.07
FY2026	(61.69)	416.01	354.32	0.00	0.00	0.00	354.32	2,291.02	(552.91)	909.60	356.69	0.00	0.00	0.00	356.69	1,429.06	711.01	3,720.08
FY2027	(38.34)	416.01	377.67	0.00	0.00	0.00	377.67	2,668.69	(529.48)	909.60	380.12	0.00	0.00	0.00	380.12	1,809.19	757.80	4,477.88
FY2028	(2.44)	416.01	413.57	0.00	0.00	0.00	413.57	3,082.26	(493.50)	909.60	416.10	0.00	0.00	0.00	416.10	2,225.29	829.67	5,307.55
FY2029	36.01	416.01	452.02	0.00	0.00	0.00	452.02	3,534.28	(454.96)	909.60	454.64	0.00	0.00	0.00	454.64	2,679.93	906.66	6,214.21
FY2030	77.32	416.01	493.33	0.00	0.00	0.00	493.33	4,027.61	(413.27)	909.60	496.33	0.00	0.00	0.00	496.33	3,176.26	989.66	7,203.87
FY2031	112.72	416.01	528.73	0.00	0.00	0.00	528.73	4,556.35	(377.77)	909.60	531.83	0.00	0.00	0.00	531.83	3,708.09	1,060.57	8,264.44
FY2032	145.79	416.01	561.80	0.00	0.00	0.00	561.80	5,118.15	(344.59)	909.60	565.01	0.00	0.00	0.00	565.01	4,273.10	1,126.81	9,391.25
FY2033	339.77	256.96	596.73	0.00	0.00	0.00	596.73	5,714.88	(309.53)	909.60	600.07	0.00	0.00	0.00	600.07	4,873.18	1,196.81	10,588.06
FY2034	376.70	256.96	633.66	0.00	0.00	0.00	633.66	6,348.54	(272.49)	909.60	637.11	0.00	0.00	0.00	637.11	5,510.29	1,270.77	11,858.83
FY2035	416.00	256.96	672.96	0.00	0.00	0.00	672.96	7,021.50	(233.06)	909.60	676.54	0.00	0.00	0.00	676.54	6,186.83	1,349.50	13,208.33
FY2036	457.33	256.96	714.29	0.00	0.00	0.00	714.29	7,735.80	(191.60)	909.60	718.00	0.00	0.00	0.00	718.00	6,904.83	1,432.29	14,640.62
FY2037	501.00	256.96	757.96	0.00	0.00	0.00	757.96	8,493.76	(147.79)	909.60	761.81	0.00	0.00	0.00	761.81	7,666.63	1,519.77	16,160.39
FY2038	547.09	256.96	804.05	0.00	0.00	0.00	804.05	9,297.81	(20.90)	828.93	808.03	2,485.55	1,093.64	3,579.19	(2,771.16)	4,895.48	(1,967.11)	14,193.29
FY2039	595.68	256.96	852.64	0.00	0.00	0.00	852.64	10,150.45	27.84	828.93	856.77	2,485.55	1,043.93	3,529.48	(2,672.71)	2,222.77	(1,820.06)	12,373.22
FY2040	647.19	256.96	904.15	0.00	0.00	0.00	904.15	11,054.60	79.50	828.93	908.43	2,485.55	994.22	3,479.77	(2,571.34)	(348.57)	(1,667.19)	10,706.03
FY2041	769.13	189.50	958.63	0.00	0.00	0.00	958.63	12,013.23	134.14	828.93	963.07	2,485.55	944.51	3,430.06	(2,466.99)	(2,815.56)	(1,508.36)	9,197.67
FY2042	826.55	189.50	1,016.05	0.00	0.00	0.00	1,016.05	13,029.28	0.00	828.93	828.93	2,485.55	894.80	3,380.35	(2,551.42)	(5,366.98)	(1,535.37)	7,662.30
FY2043	861.32	189.50	1,050.82	1.00	0.00	1.00	1,049.82	14,079.09	0.00	828.93	828.93	2,485.55	845.09	3,330.64	(2,501.71)	(7,868.69)	(1,451.89)	6,210.40
FY2044	895.23	189.50	1,084.73	2.00	0.00	2.00	1,082.73	15,161.82	0.00	828.93	828.93	2,485.55	795.38	3,280.93	(2,452.00)	(10,320.69)	(1,369.27)	4,841.13
FY2045	928.10	189.50	1,117.60	3.00	0.00	3.00	1,114.60	16,276.41	0.00	828.93	828.93	2,485.55	745.67	3,231.22	(2,402.29)	(12,722.98)	(1,287.69)	3,553.43
FY2046	959.73	189.50	1,149.23	4.00	0.00	4.00	1,145.23	17,421.64	0.00	718.35	718.35	2,485.55	695.96	3,181.51	(2,463.16)	(15,186.14)	(1,317.93)	2,235.50
FY2047	989.94	189.50	1,179.44	5.00	0.00	5.00	1,174.44	18,596.07	0.00	718.35	718.35	2,485.55	646.24	3,131.79	(2,413.44)	(17,599.58)	(1,239.00)	996.49

12.3 Financial Sensitivity Analysis

(1) Financial Cash Flow with 10% Decrease in O&M Cost

(BDT mil.)

Fiscal Year	Capital Investment	Capital Investment Replacement	O & M Cost	Water Revenue	Net Return
2013	262.58	-	-	-	(262.58)
2014	620.98	-	-	-	(620.98)
2015	991.84	-	-	-	(991.84)
2016	8,614.20	-	-	-	(8,614.20)
2017	8,863.68	-	-	-	(8,863.68)
2018	8,582.95	-	-	-	(8,582.95)
2019	2,333.75	-	-	-	(2,333.75)
2020	2,352.04	-	-	-	(2,352.04)
2021	360.75	-	250.89	469.44	(142.20)
2022	19.54	-	264.50	505.02	220.98
2023	-	-	278.12	541.33	263.21
2024	-	-	291.74	578.37	286.63
2025	-	-	305.35	616.15	310.80
2026	-	-	305.35	623.48	318.13
2027	-	-	305.35	623.48	318.13
2028	-	-	305.35	623.48	318.13
2029	-	-	305.35	623.48	318.13
2030	-	-	305.35	623.48	318.13
2031	-	-	305.35	623.48	318.13
2032	-	-	305.35	623.48	318.13
2033	-	-	305.35	623.48	318.13
2034	-	-	305.35	623.48	318.13
2035	-	447.05	305.35	623.48	(128.92)
2036	-	-	305.35	623.48	318.13
2037	-	447.05	305.35	623.48	(128.92)
2038	-	-	305.35	623.48	318.13
2039	-	-	305.35	623.48	318.13
2040	-	447.05	305.35	623.48	(128.92)
2041	-	-	305.35	623.48	318.13
2042	-	-	305.35	623.48	318.13
2043	-	-	305.35	623.48	318.13
2044	-	-	305.35	623.48	318.13
2045	-	-	305.35	623.48	318.13
2046	-	-	305.35	623.48	318.13
2047	-	-	305.35	623.48	318.13
2048	-	-	305.35	623.48	318.13
2049	-	-	305.35	623.48	318.13
2050	-	-	305.35	623.48	318.13
	33,002.31	1,341.16	9,024.36	18,297.33	(25,070.50)
FNPV:	(25,067.76)	FOCC:	0.78%	FIRR:	-6.55%

(2) Financial Cash Flow with 5% Decrease in O&M Cost

(BDT mil.)

Fiscal Year	Capital Investment	Capital Investment Replacement	O & M Cost	Water Revenue	Net Return
2013	262.58	-	-	-	(262.58)
2014	620.98	-	-	-	(620.98)
2015	991.84	-	-	-	(991.84)
2016	8,614.20	-	-	-	(8,614.20)
2017	8,863.68	-	-	-	(8,863.68)
2018	8,582.95	-	-	-	(8,582.95)
2019	2,333.75	-	-	-	(2,333.75)
2020	2,352.04	-	-	-	(2,352.04)
2021	360.75	-	264.83	469.44	(156.13)
2022	19.54	-	279.20	505.02	206.28
2023	-	-	293.57	541.33	247.76
2024	-	-	307.94	578.37	270.43
2025	-	-	322.31	616.15	293.83
2026	-	-	322.31	623.48	301.17
2027	-	-	322.31	623.48	301.17
2028	-	-	322.31	623.48	301.17
2029	-	-	322.31	623.48	301.17
2030	-	-	322.31	623.48	301.17
2031	-	-	322.31	623.48	301.17
2032	-	-	322.31	623.48	301.17
2033	-	-	322.31	623.48	301.17
2034	-	-	322.31	623.48	301.17
2035	-	447.05	322.31	623.48	(145.89)
2036	-	-	322.31	623.48	301.17
2037	-	447.05	322.31	623.48	(145.89)
2038	-	-	322.31	623.48	301.17
2039	-	-	322.31	623.48	301.17
2040	-	447.05	322.31	623.48	(145.89)
2041	-	-	322.31	623.48	301.17
2042	-	-	322.31	623.48	301.17
2043	-	-	322.31	623.48	301.17
2044	-	-	322.31	623.48	301.17
2045	-	-	322.31	623.48	301.17
2046	-	-	322.31	623.48	301.17
2047	-	-	322.31	623.48	301.17
2048	-	-	322.31	623.48	301.17
2049	-	-	322.31	623.48	301.17
2050	-	-	322.31	623.48	301.17
	33,002.31	1,341.16	9,525.71	18,297.33	(25,571.86)
FNPV:	(25,485.95)	FOCC:	0.78%	FIRR:	-6.80%

(3) Financial Cash Flow with 5% Increase in O&M Cost

(BDT mil.)

Fiscal Year	Capital Investment	Capital Investment Replacement	O & M Cost	Water Revenue	Net Return
2013	262.58	-	-	-	(262.58)
2014	620.98	-	-	-	(620.98)
2015	991.84	-	-	-	(991.84)
2016	8,614.20	-	-	-	(8,614.20)
2017	8,863.68	-	-	-	(8,863.68)
2018	8,582.95	-	-	-	(8,582.95)
2019	2,333.75	-	-	-	(2,333.75)
2020	2,352.04	-	-	-	(2,352.04)
2021	360.75	-	292.70	469.44	(184.01)
2022	19.54	-	308.59	505.02	176.89
2023	-	-	324.47	541.33	216.85
2024	-	-	340.36	578.37	238.01
2025	-	-	356.24	616.15	259.90
2026	-	-	356.24	623.48	267.24
2027	-	-	356.24	623.48	267.24
2028	-	-	356.24	623.48	267.24
2029	-	-	356.24	623.48	267.24
2030	-	-	356.24	623.48	267.24
2031	-	-	356.24	623.48	267.24
2032	-	-	356.24	623.48	267.24
2033	-	-	356.24	623.48	267.24
2034	-	-	356.24	623.48	267.24
2035	-	447.05	356.24	623.48	(179.82)
2036	-	-	356.24	623.48	267.24
2037	-	447.05	356.24	623.48	(179.82)
2038	-	-	356.24	623.48	267.24
2039	-	-	356.24	623.48	267.24
2040	-	447.05	356.24	623.48	(179.82)
2041	-	-	356.24	623.48	267.24
2042	-	-	356.24	623.48	267.24
2043	-	-	356.24	623.48	267.24
2044	-	-	356.24	623.48	267.24
2045	-	-	356.24	623.48	267.24
2046	-	-	356.24	623.48	267.24
2047	-	-	356.24	623.48	267.24
2048	-	-	356.24	623.48	267.24
2049	-	-	356.24	623.48	267.24
2050	-	-	356.24	623.48	267.24
	33,002.31	1,341.16	10,528.42	18,297.33	(26,574.56)
FNPV:	(26,322.33)	FOCC:	0.78%	FIRR:	-7.35%

(4) Financial Cash Flow with 10% Increase in O&M Cost

(BDT mil.)

Fiscal Year	Capital Investment	Capital Investment Replacement	O & M Cost	Water Revenue	Net Return
2013	262.58	-	-	-	(262.58)
2014	620.98	-	-	-	(620.98)
2015	991.84	-	-	-	(991.84)
2016	8,614.20	-	-	-	(8,614.20)
2017	8,863.68	-	-	-	(8,863.68)
2018	8,582.95	-	-	-	(8,582.95)
2019	2,333.75	-	-	-	(2,333.75)
2020	2,352.04	-	-	-	(2,352.04)
2021	360.75	-	306.64	469.44	(197.95)
2022	19.54	-	323.28	505.02	162.20
2023	-	-	339.92	541.33	201.40
2024	-	-	356.57	578.37	221.80
2025	-	-	373.21	616.15	242.94
2026	-	-	373.21	623.48	250.27
2027	-	-	373.21	623.48	250.27
2028	-	-	373.21	623.48	250.27
2029	-	-	373.21	623.48	250.27
2030	-	-	373.21	623.48	250.27
2031	-	-	373.21	623.48	250.27
2032	-	-	373.21	623.48	250.27
2033	-	-	373.21	623.48	250.27
2034	-	-	373.21	623.48	250.27
2035	-	447.05	373.21	623.48	(196.78)
2036	-	-	373.21	623.48	250.27
2037	-	447.05	373.21	623.48	(196.78)
2038	-	-	373.21	623.48	250.27
2039	-	-	373.21	623.48	250.27
2040	-	447.05	373.21	623.48	(196.78)
2041	-	-	373.21	623.48	250.27
2042	-	-	373.21	623.48	250.27
2043	-	-	373.21	623.48	250.27
2044	-	-	373.21	623.48	250.27
2045	-	-	373.21	623.48	250.27
2046	-	-	373.21	623.48	250.27
2047	-	-	373.21	623.48	250.27
2048	-	-	373.21	623.48	250.27
2049	-	-	373.21	623.48	250.27
2050	-	-	373.21	623.48	250.27
	33,002.31	1,341.16	11,029.77	18,297.33	(27,075.92)
FNPV:	(26,740.52)	FOCC:	0.78%	FIRR:	-7.65%

(5) Financial Cash Flow with 252% Increase in Tariff

(BDT mil.)

Fiscal Year	Capital Investment	Capital Investment Replacement	O & M Cost	Water Revenue	Net Return
2013	262.58	-	-	-	(262.58)
2014	620.98	-	-	-	(620.98)
2015	991.84	-	-	-	(991.84)
2016	8,614.20	-	-	-	(8,614.20)
2017	8,863.68	-	-	-	(8,863.68)
2018	8,582.95	-	-	-	(8,582.95)
2019	2,333.75	-	-	-	(2,333.75)
2020	2,352.04	-	-	-	(2,352.04)
2021	360.75	-	278.77	1,267.60	628.08
2022	19.54	-	293.89	1,363.66	1,050.23
2023	-	-	309.02	1,461.70	1,152.68
2024	-	-	324.15	1,561.72	1,237.57
2025	-	-	339.28	1,663.72	1,324.45
2026	-	-	339.28	1,683.53	1,344.25
2027	-	-	339.28	1,683.53	1,344.25
2028	-	-	339.28	1,683.53	1,344.25
2029	-	-	339.28	1,683.53	1,344.25
2030	-	-	339.28	1,683.53	1,344.25
2031	-	-	339.28	1,683.53	1,344.25
2032	-	-	339.28	1,683.53	1,344.25
2033	-	-	339.28	1,683.53	1,344.25
2034	-	-	339.28	1,683.53	1,344.25
2035	-	447.05	339.28	1,683.53	897.20
2036	-	-	339.28	1,683.53	1,344.25
2037	-	447.05	339.28	1,683.53	897.20
2038	-	-	339.28	1,683.53	1,344.25
2039	-	-	339.28	1,683.53	1,344.25
2040	-	447.05	339.28	1,683.53	897.20
2041	-	-	339.28	1,683.53	1,344.25
2042	-	-	339.28	1,683.53	1,344.25
2043	-	-	339.28	1,683.53	1,344.25
2044	-	-	339.28	1,683.53	1,344.25
2045	-	-	339.28	1,683.53	1,344.25
2046	-	-	339.28	1,683.53	1,344.25
2047	-	-	339.28	1,683.53	1,344.25
2048	-	-	339.28	1,683.53	1,344.25
2049	-	-	339.28	1,683.53	1,344.25
2050	-	-	339.28	1,683.53	1,344.25
	33,002.31	1,341.16	10,027.07	49,406.69	5,036.15
FNPV:	25.37	FOCC:	0.78%	FIRR:	0.78%

12.4 Economic Sensitivity Analysis

(1) Economic Cash Flow with 10% Decrease in O&M Cost

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	216.32	469.44	3,964.25	3,943.31
2022	14.84	-	228.17	505.02	3,964.25	4,226.25
2023	-	-	240.03	541.33	3,964.25	4,265.55
2024	-	-	251.89	578.37	3,964.25	4,290.74
2025	-	-	263.74	616.15	3,964.25	4,316.66
2026	-	-	263.74	623.48	3,964.25	4,323.99
2027	-	-	263.74	623.48	3,964.25	4,323.99
2028	-	-	263.74	623.48	3,964.25	4,323.99
2029	-	-	263.74	623.48	3,964.25	4,323.99
2030	-	-	263.74	623.48	3,964.25	4,323.99
2031	-	-	263.74	623.48	3,964.25	4,323.99
2032	-	-	263.74	623.48	3,964.25	4,323.99
2033	-	-	263.74	623.48	3,964.25	4,323.99
2034	-	-	263.74	623.48	3,964.25	4,323.99
2035	-	344.47	263.74	623.48	3,964.25	3,979.52
2036	-	-	263.74	623.48	3,964.25	4,323.99
2037	-	344.47	263.74	623.48	3,964.25	3,979.52
2038	-	-	263.74	623.48	3,964.25	4,323.99
2039	-	-	263.74	623.48	3,964.25	4,323.99
2040	-	344.47	263.74	623.48	3,964.25	3,979.52
2041	-	-	263.74	623.48	3,964.25	4,323.99
2042	-	-	263.74	623.48	3,964.25	4,323.99
2043	-	-	263.74	623.48	3,964.25	4,323.99
2044	-	-	263.74	623.48	3,964.25	4,323.99
2045	-	-	263.74	623.48	3,964.25	4,323.99
2046	-	-	263.74	623.48	3,964.25	4,323.99
2047	-	-	263.74	623.48	3,964.25	4,323.99
2048	-	-	263.74	623.48	3,964.25	4,323.99
2049	-	-	263.74	623.48	3,964.25	4,323.99
2050	-	-	263.74	623.48	3,964.25	4,323.99
	25,072.73	1,033.40	7,793.73	18,297.33	118,927.62	103,325.09
	ENPV:	3,476.45	EOCC:	10%	EIRR:	11.94%

(2) Economic Cash Flow with 5% Decrease in O&M Cost

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	228.34	469.44	3,964.25	3,931.29
2022	14.84	-	240.85	505.02	3,964.25	4,213.58
2023	-	-	253.37	541.33	3,964.25	4,252.22
2024	-	-	265.88	578.37	3,964.25	4,276.74
2025	-	-	278.40	616.15	3,964.25	4,302.00
2026	-	-	278.40	623.48	3,964.25	4,309.34
2027	-	-	278.40	623.48	3,964.25	4,309.34
2028	-	-	278.40	623.48	3,964.25	4,309.34
2029	-	-	278.40	623.48	3,964.25	4,309.34
2030	-	-	278.40	623.48	3,964.25	4,309.34
2031	-	-	278.40	623.48	3,964.25	4,309.34
2032	-	-	278.40	623.48	3,964.25	4,309.34
2033	-	-	278.40	623.48	3,964.25	4,309.34
2034	-	-	278.40	623.48	3,964.25	4,309.34
2035	-	344.47	278.40	623.48	3,964.25	3,964.87
2036	-	-	278.40	623.48	3,964.25	4,309.34
2037	-	344.47	278.40	623.48	3,964.25	3,964.87
2038	-	-	278.40	623.48	3,964.25	4,309.34
2039	-	-	278.40	623.48	3,964.25	4,309.34
2040	-	344.47	278.40	623.48	3,964.25	3,964.87
2041	-	-	278.40	623.48	3,964.25	4,309.34
2042	-	-	278.40	623.48	3,964.25	4,309.34
2043	-	-	278.40	623.48	3,964.25	4,309.34
2044	-	-	278.40	623.48	3,964.25	4,309.34
2045	-	-	278.40	623.48	3,964.25	4,309.34
2046	-	-	278.40	623.48	3,964.25	4,309.34
2047	-	-	278.40	623.48	3,964.25	4,309.34
2048	-	-	278.40	623.48	3,964.25	4,309.34
2049	-	-	278.40	623.48	3,964.25	4,309.34
2050	-	-	278.40	623.48	3,964.25	4,309.34
	25,072.73	1,033.40	8,226.72	18,297.33	118,927.62	102,892.10
	ENPV:	3,414.57	EOCC:	10%	EIRR:	11.91%

(3) Economic Cash Flow with 5% Increase in O&M Cost

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	252.37	469.44	3,964.25	3,907.26
2022	14.84	-	266.20	505.02	3,964.25	4,188.23
2023	-	-	280.04	541.33	3,964.25	4,225.55
2024	-	-	293.87	578.37	3,964.25	4,248.76
2025	-	-	307.70	616.15	3,964.25	4,272.70
2026	-	-	307.70	623.48	3,964.25	4,280.03
2027	-	-	307.70	623.48	3,964.25	4,280.03
2028	-	-	307.70	623.48	3,964.25	4,280.03
2029	-	-	307.70	623.48	3,964.25	4,280.03
2030	-	-	307.70	623.48	3,964.25	4,280.03
2031	-	-	307.70	623.48	3,964.25	4,280.03
2032	-	-	307.70	623.48	3,964.25	4,280.03
2033	-	-	307.70	623.48	3,964.25	4,280.03
2034	-	-	307.70	623.48	3,964.25	4,280.03
2035	-	344.47	307.70	623.48	3,964.25	3,935.57
2036	-	-	307.70	623.48	3,964.25	4,280.03
2037	-	344.47	307.70	623.48	3,964.25	3,935.57
2038	-	-	307.70	623.48	3,964.25	4,280.03
2039	-	-	307.70	623.48	3,964.25	4,280.03
2040	-	344.47	307.70	623.48	3,964.25	3,935.57
2041	-	-	307.70	623.48	3,964.25	4,280.03
2042	-	-	307.70	623.48	3,964.25	4,280.03
2043	-	-	307.70	623.48	3,964.25	4,280.03
2044	-	-	307.70	623.48	3,964.25	4,280.03
2045	-	-	307.70	623.48	3,964.25	4,280.03
2046	-	-	307.70	623.48	3,964.25	4,280.03
2047	-	-	307.70	623.48	3,964.25	4,280.03
2048	-	-	307.70	623.48	3,964.25	4,280.03
2049	-	-	307.70	623.48	3,964.25	4,280.03
2050	-	-	307.70	623.48	3,964.25	4,280.03
	25,072.73	1,033.40	9,092.69	18,297.33	118,927.62	102,026.13
	ENPV:	3,290.79	EOCC:	10%	EIRR:	11.84%

(4) Economic Cash Flow with 10% Increase in O&M Cost

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	264.39	469.44	3,964.25	3,895.24
2022	14.84	-	278.88	505.02	3,964.25	4,175.55
2023	-	-	293.37	541.33	3,964.25	4,212.21
2024	-	-	307.86	578.37	3,964.25	4,234.76
2025	-	-	322.35	616.15	3,964.25	4,258.05
2026	-	-	322.35	623.48	3,964.25	4,265.38
2027	-	-	322.35	623.48	3,964.25	4,265.38
2028	-	-	322.35	623.48	3,964.25	4,265.38
2029	-	-	322.35	623.48	3,964.25	4,265.38
2030	-	-	322.35	623.48	3,964.25	4,265.38
2031	-	-	322.35	623.48	3,964.25	4,265.38
2032	-	-	322.35	623.48	3,964.25	4,265.38
2033	-	-	322.35	623.48	3,964.25	4,265.38
2034	-	-	322.35	623.48	3,964.25	4,265.38
2035	-	344.47	322.35	623.48	3,964.25	3,920.91
2036	-	-	322.35	623.48	3,964.25	4,265.38
2037	-	344.47	322.35	623.48	3,964.25	3,920.91
2038	-	-	322.35	623.48	3,964.25	4,265.38
2039	-	-	322.35	623.48	3,964.25	4,265.38
2040	-	344.47	322.35	623.48	3,964.25	3,920.91
2041	-	-	322.35	623.48	3,964.25	4,265.38
2042	-	-	322.35	623.48	3,964.25	4,265.38
2043	-	-	322.35	623.48	3,964.25	4,265.38
2044	-	-	322.35	623.48	3,964.25	4,265.38
2045	-	-	322.35	623.48	3,964.25	4,265.38
2046	-	-	322.35	623.48	3,964.25	4,265.38
2047	-	-	322.35	623.48	3,964.25	4,265.38
2048	-	-	322.35	623.48	3,964.25	4,265.38
2049	-	-	322.35	623.48	3,964.25	4,265.38
2050	-	-	322.35	623.48	3,964.25	4,265.38
	25,072.73	1,033.40	9,525.67	18,297.33	118,927.62	101,593.15
	ENPV:	3,228.91	EOCC:	10%	EIRR:	11.81%

(5) Economic Cash Flow with 10% Decrease in WTP

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	422.53	4,000.05	3,908.15
2022	14.84	-	253.53	454.55	4,000.05	4,186.23
2023	-	-	266.70	487.23	4,000.05	4,220.58
2024	-	-	279.87	520.57	4,000.05	4,240.75
2025	-	-	293.05	554.57	4,000.05	4,261.57
2026	-	-	293.05	561.18	4,000.05	4,268.18
2027	-	-	293.05	561.18	4,000.05	4,268.18
2028	-	-	293.05	561.18	4,000.05	4,268.18
2029	-	-	293.05	561.18	4,000.05	4,268.18
2030	-	-	293.05	561.18	4,000.05	4,268.18
2031	-	-	293.05	561.18	4,000.05	4,268.18
2032	-	-	293.05	561.18	4,000.05	4,268.18
2033	-	-	293.05	561.18	4,000.05	4,268.18
2034	-	-	293.05	561.18	4,000.05	4,268.18
2035	-	344.47	293.05	561.18	4,000.05	3,923.71
2036	-	-	293.05	561.18	4,000.05	4,268.18
2037	-	344.47	293.05	561.18	4,000.05	3,923.71
2038	-	-	293.05	561.18	4,000.05	4,268.18
2039	-	-	293.05	561.18	4,000.05	4,268.18
2040	-	344.47	293.05	561.18	4,000.05	3,923.71
2041	-	-	293.05	561.18	4,000.05	4,268.18
2042	-	-	293.05	561.18	4,000.05	4,268.18
2043	-	-	293.05	561.18	4,000.05	4,268.18
2044	-	-	293.05	561.18	4,000.05	4,268.18
2045	-	-	293.05	561.18	4,000.05	4,268.18
2046	-	-	293.05	561.18	4,000.05	4,268.18
2047	-	-	293.05	561.18	4,000.05	4,268.18
2048	-	-	293.05	561.18	4,000.05	4,268.18
2049	-	-	293.05	561.18	4,000.05	4,268.18
2050	-	-	293.05	561.18	4,000.05	4,268.18
	25,072.73	1,033.40	8,659.70	16,468.90	120,001.39	101,704.46
	ENPV:	3,251.71	EOCC:	10%	EIRR:	11.82%

(6) Economic Cash Flow with 5% Decrease in WTP

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	445.82	3,982.15	3,913.55
2022	14.84	-	253.53	479.61	3,982.15	4,193.39
2023	-	-	266.70	514.09	3,982.15	4,229.54
2024	-	-	279.87	549.27	3,982.15	4,251.54
2025	-	-	293.05	585.14	3,982.15	4,274.24
2026	-	-	293.05	592.11	3,982.15	4,281.21
2027	-	-	293.05	592.11	3,982.15	4,281.21
2028	-	-	293.05	592.11	3,982.15	4,281.21
2029	-	-	293.05	592.11	3,982.15	4,281.21
2030	-	-	293.05	592.11	3,982.15	4,281.21
2031	-	-	293.05	592.11	3,982.15	4,281.21
2032	-	-	293.05	592.11	3,982.15	4,281.21
2033	-	-	293.05	592.11	3,982.15	4,281.21
2034	-	-	293.05	592.11	3,982.15	4,281.21
2035	-	344.47	293.05	592.11	3,982.15	3,936.74
2036	-	-	293.05	592.11	3,982.15	4,281.21
2037	-	344.47	293.05	592.11	3,982.15	3,936.74
2038	-	-	293.05	592.11	3,982.15	4,281.21
2039	-	-	293.05	592.11	3,982.15	4,281.21
2040	-	344.47	293.05	592.11	3,982.15	3,936.74
2041	-	-	293.05	592.11	3,982.15	4,281.21
2042	-	-	293.05	592.11	3,982.15	4,281.21
2043	-	-	293.05	592.11	3,982.15	4,281.21
2044	-	-	293.05	592.11	3,982.15	4,281.21
2045	-	-	293.05	592.11	3,982.15	4,281.21
2046	-	-	293.05	592.11	3,982.15	4,281.21
2047	-	-	293.05	592.11	3,982.15	4,281.21
2048	-	-	293.05	592.11	3,982.15	4,281.21
2049	-	-	293.05	592.11	3,982.15	4,281.21
2050	-	-	293.05	592.11	3,982.15	4,281.21
	25,072.73	1,033.40	8,659.70	17,376.60	119,464.51	102,075.28
	ENPV:	3,301.27	EOCC:	10%	EIRR:	11.85%

(7) Economic Cash Flow with 5% Increase in WTP

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	493.07	3,946.10	3,924.74
2022	14.84	-	253.53	530.43	3,946.10	4,208.16
2023	-	-	266.70	568.57	3,946.10	4,247.97
2024	-	-	279.87	607.47	3,946.10	4,273.70
2025	-	-	293.05	647.15	3,946.10	4,300.20
2026	-	-	293.05	654.85	3,946.10	4,307.91
2027	-	-	293.05	654.85	3,946.10	4,307.91
2028	-	-	293.05	654.85	3,946.10	4,307.91
2029	-	-	293.05	654.85	3,946.10	4,307.91
2030	-	-	293.05	654.85	3,946.10	4,307.91
2031	-	-	293.05	654.85	3,946.10	4,307.91
2032	-	-	293.05	654.85	3,946.10	4,307.91
2033	-	-	293.05	654.85	3,946.10	4,307.91
2034	-	-	293.05	654.85	3,946.10	4,307.91
2035	-	344.47	293.05	654.85	3,946.10	3,963.44
2036	-	-	293.05	654.85	3,946.10	4,307.91
2037	-	344.47	293.05	654.85	3,946.10	3,963.44
2038	-	-	293.05	654.85	3,946.10	4,307.91
2039	-	-	293.05	654.85	3,946.10	4,307.91
2040	-	344.47	293.05	654.85	3,946.10	3,963.44
2041	-	-	293.05	654.85	3,946.10	4,307.91
2042	-	-	293.05	654.85	3,946.10	4,307.91
2043	-	-	293.05	654.85	3,946.10	4,307.91
2044	-	-	293.05	654.85	3,946.10	4,307.91
2045	-	-	293.05	654.85	3,946.10	4,307.91
2046	-	-	293.05	654.85	3,946.10	4,307.91
2047	-	-	293.05	654.85	3,946.10	4,307.91
2048	-	-	293.05	654.85	3,946.10	4,307.91
2049	-	-	293.05	654.85	3,946.10	4,307.91
2050	-	-	293.05	654.85	3,946.10	4,307.91
	25,072.73	1,033.40	8,659.70	19,218.05	118,383.07	102,835.29
	ENPV:	3,402.96	EOCC:	10%	EIRR:	11.90%

(8) Economic Cash Flow with 10% Increase in WTP

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	516.36	3,928.21	3,930.14
2022	14.84	-	253.53	555.49	3,928.21	4,215.32
2023	-	-	266.70	595.42	3,928.21	4,256.93
2024	-	-	279.87	636.17	3,928.21	4,284.50
2025	-	-	293.05	677.72	3,928.21	4,312.87
2026	-	-	293.05	685.78	3,928.21	4,320.94
2027	-	-	293.05	685.78	3,928.21	4,320.94
2028	-	-	293.05	685.78	3,928.21	4,320.94
2029	-	-	293.05	685.78	3,928.21	4,320.94
2030	-	-	293.05	685.78	3,928.21	4,320.94
2031	-	-	293.05	685.78	3,928.21	4,320.94
2032	-	-	293.05	685.78	3,928.21	4,320.94
2033	-	-	293.05	685.78	3,928.21	4,320.94
2034	-	-	293.05	685.78	3,928.21	4,320.94
2035	-	344.47	293.05	685.78	3,928.21	3,976.48
2036	-	-	293.05	685.78	3,928.21	4,320.94
2037	-	344.47	293.05	685.78	3,928.21	3,976.48
2038	-	-	293.05	685.78	3,928.21	4,320.94
2039	-	-	293.05	685.78	3,928.21	4,320.94
2040	-	344.47	293.05	685.78	3,928.21	3,976.48
2041	-	-	293.05	685.78	3,928.21	4,320.94
2042	-	-	293.05	685.78	3,928.21	4,320.94
2043	-	-	293.05	685.78	3,928.21	4,320.94
2044	-	-	293.05	685.78	3,928.21	4,320.94
2045	-	-	293.05	685.78	3,928.21	4,320.94
2046	-	-	293.05	685.78	3,928.21	4,320.94
2047	-	-	293.05	685.78	3,928.21	4,320.94
2048	-	-	293.05	685.78	3,928.21	4,320.94
2049	-	-	293.05	685.78	3,928.21	4,320.94
2050	-	-	293.05	685.78	3,928.21	4,320.94
	25,072.73	1,033.40	8,659.70	20,125.76	117,846.18	103,206.11
	ENPV:	3,452.53	EOCC:	10%	EIRR:	11.93%

(9) Economic Cash Flow with 10% Decrease in Indirect Benefit

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	469.44	3,531.93	3,486.95
2022	14.84	-	253.53	505.02	3,531.93	3,768.58
2023	-	-	266.70	541.33	3,531.93	3,806.56
2024	-	-	279.87	578.37	3,531.93	3,830.43
2025	-	-	293.05	616.15	3,531.93	3,855.03
2026	-	-	293.05	623.48	3,531.93	3,862.37
2027	-	-	293.05	623.48	3,531.93	3,862.37
2028	-	-	293.05	623.48	3,531.93	3,862.37
2029	-	-	293.05	623.48	3,531.93	3,862.37
2030	-	-	293.05	623.48	3,531.93	3,862.37
2031	-	-	293.05	623.48	3,531.93	3,862.37
2032	-	-	293.05	623.48	3,531.93	3,862.37
2033	-	-	293.05	623.48	3,531.93	3,862.37
2034	-	-	293.05	623.48	3,531.93	3,862.37
2035	-	344.47	293.05	623.48	3,531.93	3,517.90
2036	-	-	293.05	623.48	3,531.93	3,862.37
2037	-	344.47	293.05	623.48	3,531.93	3,517.90
2038	-	-	293.05	623.48	3,531.93	3,862.37
2039	-	-	293.05	623.48	3,531.93	3,862.37
2040	-	344.47	293.05	623.48	3,531.93	3,517.90
2041	-	-	293.05	623.48	3,531.93	3,862.37
2042	-	-	293.05	623.48	3,531.93	3,862.37
2043	-	-	293.05	623.48	3,531.93	3,862.37
2044	-	-	293.05	623.48	3,531.93	3,862.37
2045	-	-	293.05	623.48	3,531.93	3,862.37
2046	-	-	293.05	623.48	3,531.93	3,862.37
2047	-	-	293.05	623.48	3,531.93	3,862.37
2048	-	-	293.05	623.48	3,531.93	3,862.37
2049	-	-	293.05	623.48	3,531.93	3,862.37
2050	-	-	293.05	623.48	3,531.93	3,862.37
	25,072.73	1,033.40	8,659.70	18,297.33	105,958.02	89,489.52
	ENPV:	1,451.46	EOCC:	10%	EIRR:	10.84%

(10) Economic Cash Flow with 5% Decrease in Indirect Benefit

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	469.44	3,748.22	3,703.24
2022	14.84	-	253.53	505.02	3,748.22	3,984.87
2023	-	-	266.70	541.33	3,748.22	4,022.85
2024	-	-	279.87	578.37	3,748.22	4,046.72
2025	-	-	293.05	616.15	3,748.22	4,071.32
2026	-	-	293.05	623.48	3,748.22	4,078.65
2027	-	-	293.05	623.48	3,748.22	4,078.65
2028	-	-	293.05	623.48	3,748.22	4,078.65
2029	-	-	293.05	623.48	3,748.22	4,078.65
2030	-	-	293.05	623.48	3,748.22	4,078.65
2031	-	-	293.05	623.48	3,748.22	4,078.65
2032	-	-	293.05	623.48	3,748.22	4,078.65
2033	-	-	293.05	623.48	3,748.22	4,078.65
2034	-	-	293.05	623.48	3,748.22	4,078.65
2035	-	344.47	293.05	623.48	3,748.22	3,734.19
2036	-	-	293.05	623.48	3,748.22	4,078.65
2037	-	344.47	293.05	623.48	3,748.22	3,734.19
2038	-	-	293.05	623.48	3,748.22	4,078.65
2039	-	-	293.05	623.48	3,748.22	4,078.65
2040	-	344.47	293.05	623.48	3,748.22	3,734.19
2041	-	-	293.05	623.48	3,748.22	4,078.65
2042	-	-	293.05	623.48	3,748.22	4,078.65
2043	-	-	293.05	623.48	3,748.22	4,078.65
2044	-	-	293.05	623.48	3,748.22	4,078.65
2045	-	-	293.05	623.48	3,748.22	4,078.65
2046	-	-	293.05	623.48	3,748.22	4,078.65
2047	-	-	293.05	623.48	3,748.22	4,078.65
2048	-	-	293.05	623.48	3,748.22	4,078.65
2049	-	-	293.05	623.48	3,748.22	4,078.65
2050	-	-	293.05	623.48	3,748.22	4,078.65
	25,072.73	1,033.40	8,659.70	18,297.33	112,446.66	95,978.15
	ENPV:	2,402.63	EOCC:	10%	EIRR:	11.36%

(11) Economic Cash Flow with 5% Increase in Indirect Benefit

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	469.44	4,180.54	4,135.56
2022	14.84	-	253.53	505.02	4,180.54	4,417.19
2023	-	-	266.70	541.33	4,180.54	4,455.17
2024	-	-	279.87	578.37	4,180.54	4,479.04
2025	-	-	293.05	616.15	4,180.54	4,503.64
2026	-	-	293.05	623.48	4,180.54	4,510.97
2027	-	-	293.05	623.48	4,180.54	4,510.97
2028	-	-	293.05	623.48	4,180.54	4,510.97
2029	-	-	293.05	623.48	4,180.54	4,510.97
2030	-	-	293.05	623.48	4,180.54	4,510.97
2031	-	-	293.05	623.48	4,180.54	4,510.97
2032	-	-	293.05	623.48	4,180.54	4,510.97
2033	-	-	293.05	623.48	4,180.54	4,510.97
2034	-	-	293.05	623.48	4,180.54	4,510.97
2035	-	344.47	293.05	623.48	4,180.54	4,166.51
2036	-	-	293.05	623.48	4,180.54	4,510.97
2037	-	344.47	293.05	623.48	4,180.54	4,166.51
2038	-	-	293.05	623.48	4,180.54	4,510.97
2039	-	-	293.05	623.48	4,180.54	4,510.97
2040	-	344.47	293.05	623.48	4,180.54	4,166.51
2041	-	-	293.05	623.48	4,180.54	4,510.97
2042	-	-	293.05	623.48	4,180.54	4,510.97
2043	-	-	293.05	623.48	4,180.54	4,510.97
2044	-	-	293.05	623.48	4,180.54	4,510.97
2045	-	-	293.05	623.48	4,180.54	4,510.97
2046	-	-	293.05	623.48	4,180.54	4,510.97
2047	-	-	293.05	623.48	4,180.54	4,510.97
2048	-	-	293.05	623.48	4,180.54	4,510.97
2049	-	-	293.05	623.48	4,180.54	4,510.97
2050	-	-	293.05	623.48	4,180.54	4,510.97
	25,072.73	1,033.40	8,659.70	18,297.33	125,416.26	108,947.75
	ENPV:	4,303.86	EOCC:	10%	EIRR:	12.37%

(12) Economic Cash Flow with 10% Increase in Indirect Benefit

(BDT mil.)

Year	Capital Investment	Replacement Costs	O & M Cost	Willing To Pay (WTP)	Economic Benefits	Net Benefit
2013	199.49	-	-	-	-	(199.49)
2014	471.78	-	-	-	-	(471.78)
2015	753.53	-	-	-	-	(753.53)
2016	6,544.44	-	-	-	-	(6,544.44)
2017	6,733.97	-	-	-	-	(6,733.97)
2018	6,520.70	-	-	-	-	(6,520.70)
2019	1,773.01	-	-	-	-	(1,773.01)
2020	1,786.91	-	-	-	-	(1,786.91)
2021	274.07	-	240.35	469.44	4,396.57	4,351.59
2022	14.84	-	253.53	505.02	4,396.57	4,633.22
2023	-	-	266.70	541.33	4,396.57	4,671.20
2024	-	-	279.87	578.37	4,396.57	4,695.07
2025	-	-	293.05	616.15	4,396.57	4,719.67
2026	-	-	293.05	623.48	4,396.57	4,727.01
2027	-	-	293.05	623.48	4,396.57	4,727.01
2028	-	-	293.05	623.48	4,396.57	4,727.01
2029	-	-	293.05	623.48	4,396.57	4,727.01
2030	-	-	293.05	623.48	4,396.57	4,727.01
2031	-	-	293.05	623.48	4,396.57	4,727.01
2032	-	-	293.05	623.48	4,396.57	4,727.01
2033	-	-	293.05	623.48	4,396.57	4,727.01
2034	-	-	293.05	623.48	4,396.57	4,727.01
2035	-	344.47	293.05	623.48	4,396.57	4,382.54
2036	-	-	293.05	623.48	4,396.57	4,727.01
2037	-	344.47	293.05	623.48	4,396.57	4,382.54
2038	-	-	293.05	623.48	4,396.57	4,727.01
2039	-	-	293.05	623.48	4,396.57	4,727.01
2040	-	344.47	293.05	623.48	4,396.57	4,382.54
2041	-	-	293.05	623.48	4,396.57	4,727.01
2042	-	-	293.05	623.48	4,396.57	4,727.01
2043	-	-	293.05	623.48	4,396.57	4,727.01
2044	-	-	293.05	623.48	4,396.57	4,727.01
2045	-	-	293.05	623.48	4,396.57	4,727.01
2046	-	-	293.05	623.48	4,396.57	4,727.01
2047	-	-	293.05	623.48	4,396.57	4,727.01
2048	-	-	293.05	623.48	4,396.57	4,727.01
2049	-	-	293.05	623.48	4,396.57	4,727.01
2050	-	-	293.05	623.48	4,396.57	4,727.01
	25,072.73	1,033.40	8,659.70	18,297.33	131,897.22	115,428.72
	ENPV:	5,253.91	EOCC:	10%	EIRR:	12.85%