

**MINISTRY OF FINANCE
MINISTRY OF LOCAL GOVERNMENT, RURAL DEVELOPMENT AND
CO-OPERATIVES
CHITTAGONG WATER SUPPLY AND SEWERAGE AUTHORITY (CWASA)
THE PEOPLE'S REPUBLIC OF BANGLADESH**

**PREPARATORY SURVEY
ON
CHITTAGONG WATER SUPPLY
IMPROVEMENT PROJECT
IN
THE PEOPLE'S REPUBLIC OF
BANGLADESH**

**FINAL REPORT
VOLUME II**

**SUPPORTING REPORT
&
DATA BOOK**

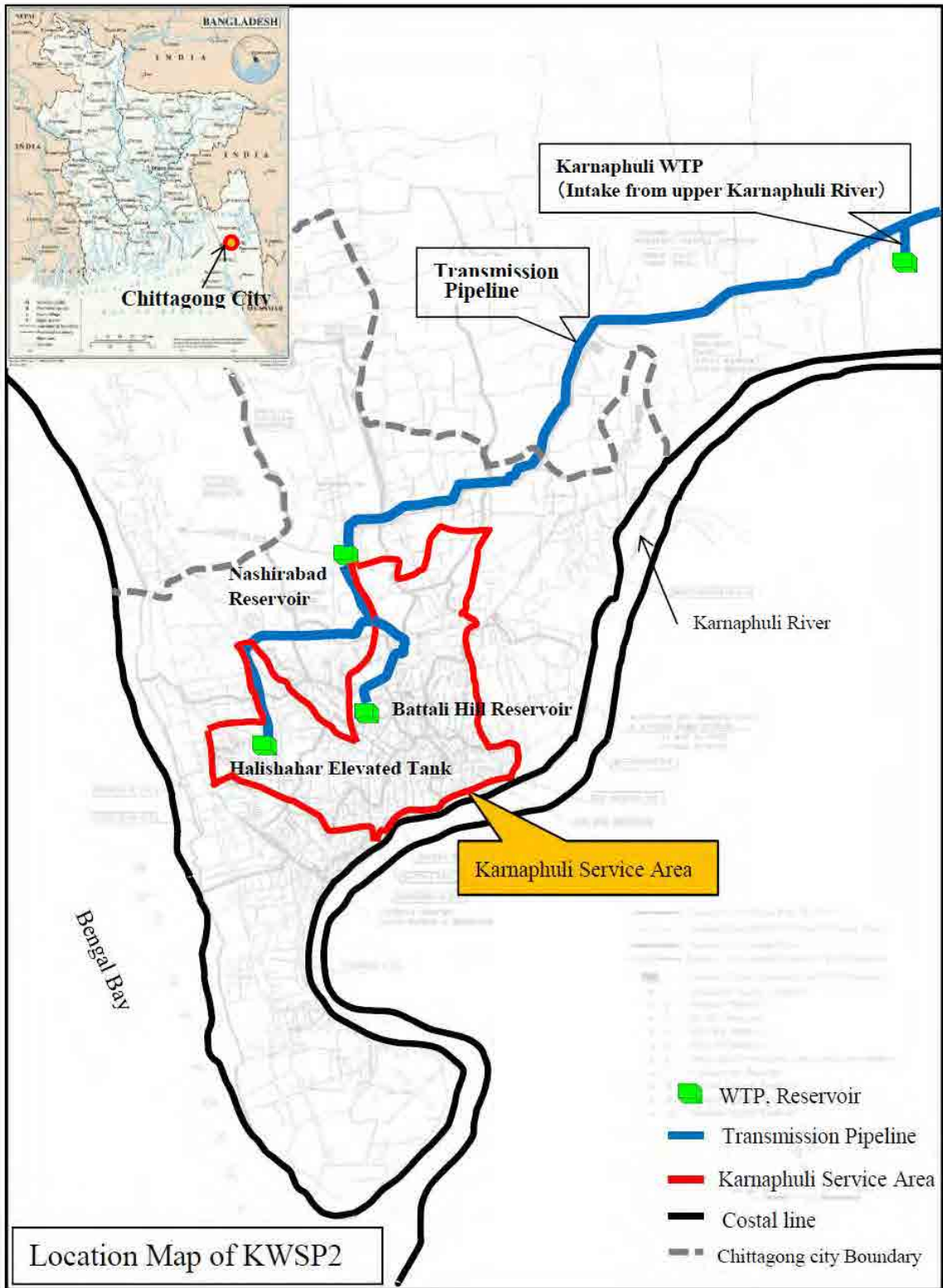
MARCH 2013

**JAPAN INTERNATIONAL COOPERATION AGENCY
NJS CONSULTANTS CO., LTD.**

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ON
CHITTAGONG WATER SUPPLY IMPROVEMENT PROJECT
IN
THE PEOPLE’S REPUBLIC OF BANGLADESH**

**FINAL REPORT
VOLUME II
SUPPORTING REPORT & DATA BOOK**

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PART 1

SUPPORTING REPORT

CHAPTER 1

BACKGROUND AND OUTLINE OF THE SURVEY

CHAPTER 1 BACKGROUND AND OUTLINE OF THE SURVEY

1.1 The Minutes of Meeting of the Preparatory Survey (January 22nd, 2012)

B/4-1

THE MINUTES OF MEETINGS
ON
THE PREPARATORY SURVEY
ON
CHITTAGONG WATER SUPPLY IMPROVEMENT PROJECT
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

Dhaka, January 22nd, 2012

The Government of the People's Republic of Bangladesh (hereinafter referred to as "GOB") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") have made several preliminary discussions and confirmed the necessity of the Chittagong Water Supply Improvement Project (hereinafter referred to as "the Project") from 26 November to 2 December, 2011. Accordingly, JICA dispatched a mission on the Project headed by Mr. Ueki Masahiro, Advisor, Water Resources Management Division I, Global Environment Department, JICA (hereinafter referred to as "the JICA Mission") to Bangladesh from January 14 to January 24, 2012 in order to develop scope and implementation arrangements of the Preparatory Survey on Chittagong Water Supply Improvement Project (hereinafter referred to as "the Preparatory Survey") which will study feasibility of the Project.

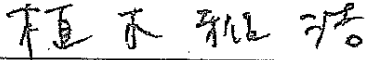
The main points discussed during the mission are described in the Annex 1. The scope and implementing arrangements of the Preparatory Survey are described in the Annex 2.

Conduct of the Preparatory Survey is subject to the approval by the competent higher authorities of both sides. It should be noted that implementation of the Preparatory Survey does not imply any decision or commitment by JICA to extend its loan for the Project at this stage.

Annex 1: Main Points Discussed

Annex 2: Scope and Implementing Arrangements of the Preparatory Survey

For
Japan International Cooperation Agency




Ueki Masahiro
Leader
The JICA Mission

For Economic Relations Division, Ministry of
Finance



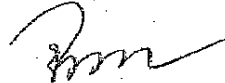
Mohammad Shafiqul Azam
Additional Secretary

For Local Government Division, Ministry of
Local Government, Rural Development and
Co-operatives



Zuena Aziz
Joint Secretary (WS)

For
Chittagong Water Supply
and Sewerage Authority



A.K.M. Fazlullah
Managing Director

Annex 1

MAIN POINTS DISCUSSED

(1) The effective use of the results of previous studies

The study team of the Preparatory Survey shall, upon verification, utilize the results of the previous studies conducted by various donors (such as population and water demand projections and the concepts of facilities planning except for distribution network), so that the Preparatory Survey can be implemented effectively within a relatively short period.

(2) Expansion of Karnaphuli water treatment plant

The Project will expand the production capacity of the Karnaphuli water treatment plant by 136,000 cu m/d,

(3) Improvement of distribution network

1. The Project will improve the distribution network which is located within the projected Karnaphuli Service Area. The target year for the improvement of distribution network will be 2030.

2. Karnaphuli Service Area proposed by Special Assistance for Project Formulation (SAPROF) will be reviewed in the Preparatory Survey taking the important aspects into consideration such as water demand in the target year, water supply capacity and priority supply areas.

3. The entire model area (Zones I-IV) of PANI Project will be included in Karnaphuli Service Area in the Preparatory Survey.

4. Karnaphuli Service Area will be self-contained and physically separated from other service areas. Accordingly, the planning of distribution network in the Preparatory Survey will be limited to only within the Karnaphuli Service Area.

(4) Other donors

The Preparatory Survey should be carried out without waiting for holistic mapping, modeling and detailed planning of distribution network in the entire CWASA area, which may be assisted by World Bank.

(5) Development Project Proposal (DPP) Approval Process

EIA and DPP approval are needed if both Governments decide to sign a Loan Agreement. Both sides confirmed that the EIA and DPP approval process is expected as follows and take necessary procedure to follow the schedule.

<EIA Approval Process>

- August 2012 : No Objection Certificate from Deputy Commissioner of Chittagong District for land use
- August 2012 : Submission of IEE to DOE from CWASA.
- September 2012 : DOE's approval of Site Clearance Certificate(SCC) (30 days in DOE)
- November 2012: Submission of EIA to DOE from CWASA
- December 2012: DOE's approval of Environmental Clearance Certificate(ECC) (15 days in DOE)

<DPP Approval Process>

- November 2012 : Submission of DPP to LGD from CWASA
- Deliberation on DPP (LGD : 30days, Planning Commission : 30 days, Decision by PEC : 10 days)
- February 2013 : DPP approval by ECNEC

The JICA Mission explained to the Bangladeshi side that JICA would tentatively schedule to dispatch the mission team on Yen Loan as follows;

<JICA Mission Team>

- August 2012: Fact Finding Mission

- December 2012: Appraisal Mission

(6) Organizational Aspects

Improvement of CWASA's management capacity will not be included in the scope of the Preparatory Survey because it is included in the consulting service in Kamaphuli Water Supply Project which is currently being implemented. However, study on the organizational aspects related to the operation and maintenance of the facilities to be constructed under the Project will be included in the scope of the Preparatory Survey.



Annex 2

**SCOPE AND IMPLEMENTING ARRANGEMENTS
OF THE PREPARATORY SURVEY**

I. BACKGROUND AND OBJECTIVE OF THE PREPARATORY SURVEY

Chittagong City, the second largest city of Bangladesh, has a present total population of 2.7 million with a population growth rate of 3.3 % per year from 1991 to 2001 in the CWASA's administrative area of about 200 sq.km. While a rapid growth of population corresponding to expansion of economic activities has been observed, provision of basic infrastructure including water supply service has always been inadequate. Water supply service in Chittagong is operated by Chittagong Water Supply and Sewerage Authority (CWASA), but its supply capacity (168,000 cu.m/day) is far smaller than water demand in the existing service area and narrowing this gap is deemed urgent task of CWASA.

CWASA has availed of a Japanese ODA Loan to implement "Karnaphuli Water Supply Project" to increase the CWASA's supply capacity by 136,000 cu.m/day in line with the recommendations of SAPROF (2005). This project is expected to be completed by year 2014.

Although significant increase of water supply capacity is expected in the near future, there are several key issues to be resolved, such as improvement of transmission and distribution system and further expansion of the Karnaphuli water treatment plant to meet the future demand. In order to address these key issues, both sides agreed to conduct the Preparatory Survey on "Chittagong Water Supply Improvement Project."

II. OBJECTIVES OF THE PROJECT

The objective of the Project is to increase the supply of water for consumer and industrial use by constructing new water supply facilities (intake, water treatment plant, transmission pipelines, reservoirs and distribution network), thereby contributing to the improvement of the living environment of the local residents and the investment environment in Chittagong city area

III. SCOPE OF THE PROJECT

1. Outline of the Project

- The second phase of Karnaphuli water treatment plant (136MLD) and related facilities (intake, water treatment plant, transmission pipelines, reservoirs and distribution networks, including its rehabilitation and expansion)
- Engineering consulting services (D/D, Construction supervision, etc.)

Outline of the Project might be subject to change based on the results of the Preparatory Survey.

2. Executing Agency

Chittagong Water Supply and Sewerage Authority (CWASA)

IV. SCOPE OF THE PREPARATORY SURVEY

The objective of the Preparatory Survey is to conduct a feasibility study of the proposed Project for consideration of project financing by JICA.

1. Survey Area

The Preparatory Survey will cover the jurisdiction area of Chittagong City Corporation as shown in Attachment 1, and its surrounding areas (for planning of intake, water treatment plant and transmission pipelines).

2. Terms of reference

(1) Basic Study

1-1 Collection and analysis of existing data and information on water supply sector in Bangladesh (including National Policy and Plan etc.)

1-2 Collection and analysis of present conditions of the Survey Area through existing data, information and field survey

- 1) Natural Conditions (meteorology, topography, hydrology, hydro-geology, etc.)
- 2) Socio-economic conditions and trends (population, industries, land use, social infrastructure, economic conditions, etc.)
- 3) Environment conditions (environmental laws and regulations, public health, etc.)

1-3 Collection and analysis of present conditions of water supply in the Survey Area through existing data and field survey;

1) Water demand and supply

2) Field survey,

- Existing water supply facilities
- Current conditions of non-revenue water
- Water sources

3) Water right and water quality,

4) Willingness-to-pay and affordability for water supply service,

5) On-going studies, plans and projects related to the Preparatory Survey (Karnaphuli Water Supply Project, Institutional Development Consultancy Service of CWASA etc.), and

6) Evaluation of present water supply conditions and identification of problems

(2) Chittagong Water Supply Improvement Project

2-1 Planning of the Project

- 1) Review of existing surveys (population/demand projection)
- 2) Identification of priority supply area from Karnaphuli water treatment plant
- 3) Identification of Karnaphuli Service Area
- 4) Planning of intake, raw water supply pipe and water treatment plant
- 5) Planning of transmission mains
- 6) Planning of primary distribution mains (zoning/sectorization)
- 7) Planning of secondary and tertiary distribution mains (District Meter Area)

2-2 Preliminary design of the Project

- 1) Topographic and route survey, geotechnical survey, and river cross-section survey if necessary
- 2) Project scope and preliminary design of the facilities (intake, water treatment plant, transmission pipelines, service reservoirs, distribution network)
- 3) Development of operation and maintenance plan related to the facilities to be constructed under the Project
- 4) Preliminary cost estimation
- 5) Comparison of the estimated project cost with other similar projects, to verify the appropriateness of the project cost
- 6) Project implementation schedule and confirmation of necessary procedures for the approval of project implementation (EIA, DPP, land acquisition etc.)

- 7) Procurement plan, method and contract packages of the Project
- 8) Financing plan of the Project
- 9) Economic and Financial analysis of the Project
- 10) Consideration of pro-poor components
- 11) Environmental and Social Assessment (preparation of Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Environmental Monitoring Plan (EMP) and Resettlement Action Plan (RAP))
- 12) Recommendation on TOR for consulting services (detailed design, construction supervision)
- 13) Project evaluation for the project implementation;
 - Technical evaluation
 - Economic and financial evaluation
 - Environmental and social evaluation
 - Institutional evaluation
- 14) Selection of key operation and effect indicators, setting up baseline and target data
- 15) Preparation of the institutional set-up for the Project implementation
- 16) Conclusions and recommendations

2. Required Expertise

JICA will select a survey team to carry out the Preparatory Survey. The team will be comprised of the following engineers and specialists:

- Team leader/Water supply planning
- Water supply A (intake facility/transmission/water treatment plant design)
- Water supply B (distribution network design)
- Mechanical/Electrical engineer
- Procurement planning/Cost estimation
- Economic and financial analysis
- Facility operation and maintenance
- Environmental and social consideration/Public hygiene

The assignment of engineers and specialists may be subject to change. The survey team may engage local consultants.

3. Steering Committee

The steering committee will be established by LGD comprising the representatives from ERD, LGD, Planning Commission, Implementation Monitoring and Evaluation Division (IMED), CWASA, JICA and its survey team.

V. SCHEDULE OF THE PREPARATORY SURVEY

The Preparatory Survey will be carried out in accordance with the tentative schedule attached in the Attachment 2. The schedule may be subject to change during the preparation and the course of the survey.

VI. REPORTS

The survey team will prepare and submit following reports in English to the GOB.

1. Inception Report:

Twenty copies will be submitted at the commencement of the first work period in Bangladesh. This report will cover basic approaches, plan of operation, work schedule, staffing, organization and others of the survey.

2. Interim Report:

Twenty copies will be submitted around three months after the commencement of the Preparatory Survey. This report will cover the results of the first half survey.

3. Draft Final Report:

Twenty copies will be submitted at the end of the last work period in Bangladesh. The member organization of the steering committee shall submit its comments within one month after the receipt of the Draft Final Report.

4. Final Report:

Thirty copies including electronic data will be submitted within one month after the receipt of the comments on the Draft Final Report.

VII. UNDERTAKING OF THE GOVERNMENT OF BANGLADESH

CWASA shall act as the counterpart agency to the survey team and also as a coordinating body with other organizations concerned for the smooth implementation of the Preparatory Survey.

CWASA shall, at its own expense, provide the survey team with the following items in cooperation with other organizations concerned:

1. security-related information as well as measures to ensure the safety of the survey team;
2. information as well as support in obtaining medical service.
3. data and information related to the Preparatory Survey
4. counterpart personnel from related organizations with the Chief Engineer of CWASA being a focal person;
5. authorization letters;
6. entry permits necessary for the survey team members to conduct field surveys;
7. support in making transportation arrangements such as providing a guide to destination and making appointments
8. support in obtaining other privileges and benefits if necessary; and
9. assistance to the team in customs clearance, exemption from any duties with respect to equipment, instruments, tools and other articles to be brought into and out of Bangladesh in connection with the implementation of the survey (provided by GOB).

GOB shall bear claims, if any arises, against the members of the survey team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in implementation of the Preparatory Survey, except when such claim arise from gross negligence or willful misconduct on the part of the member of the survey team.

VIII. CONSULTATION

JICA and GOB shall consult with each other in respect of any matter that may arise from or in connection with the Preparatory Survey.

IX. INFORMATION DISCLOSURE

The JICA Mission explained to GOB the JICA's policy of information disclosure as follows:

1. Based on the Information Disclosure Law of Japan, JICA has a policy to disclose information to the public. However, confidential information will be kept undisclosed, such as bidding information to secure fairness of tender procedures and other issues to be

mutually agreed.

2. Under the policy, the final report will be disclosed excluding confidential information to the public as soon as practical.

The JICA Mission and GOB agreed that such information related to bidding for procurement of goods and services such as cost estimate, B/Q, TOR and person-months should be kept confidential until a relevant contract agreement is concluded.

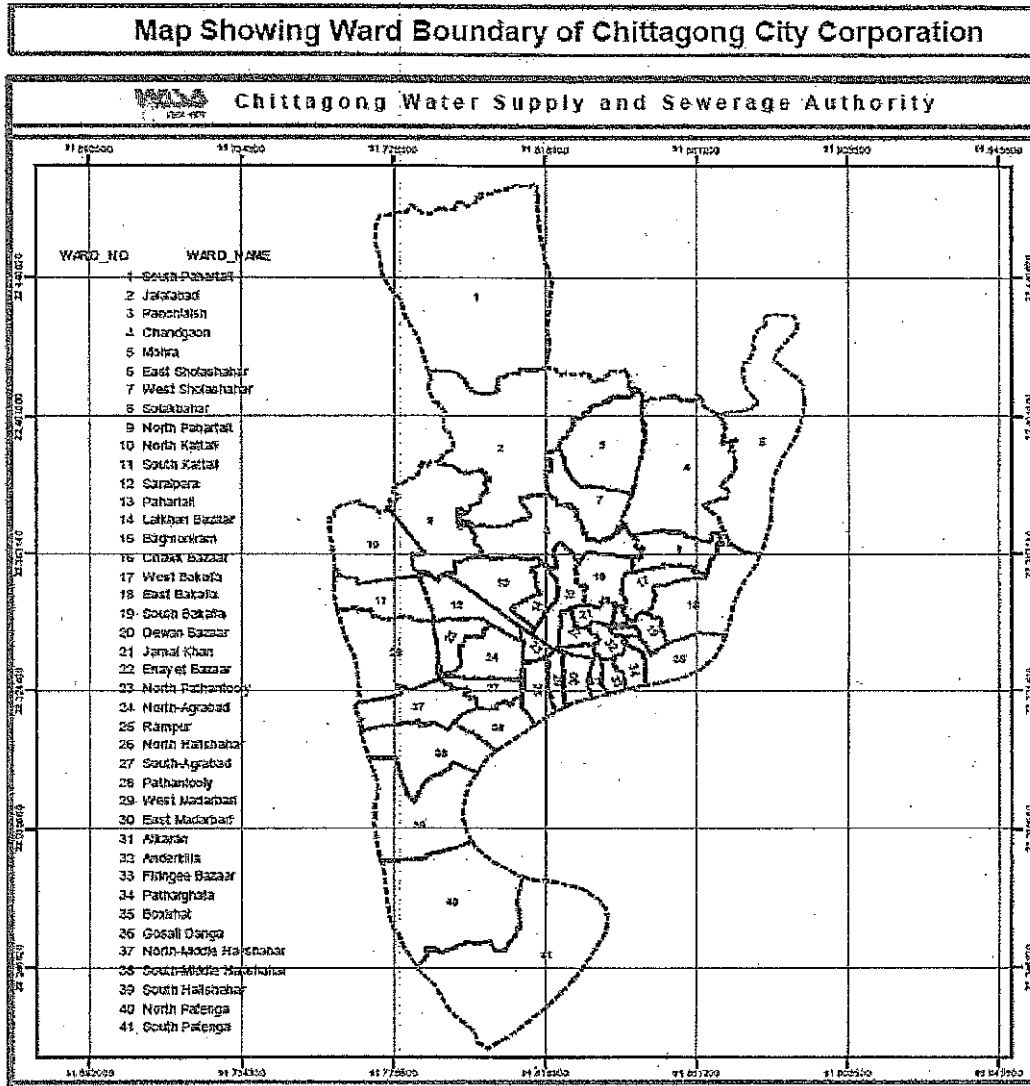
Other information which GOB requests to keep undisclosed, if any, will be so kept based on the mutual agreement between GOB and JICA. GOB agreed to submit a list of such information, if any, together with timing of disclosure to JICA by the time of the draft final report submission.

X. OTHERS

The JICA Mission and GOB confirmed that GOB expressed the possibility of making an official request to the Government of Japan for financing the Project after scrutinizing outcomes and recommendations of the Preparatory Survey.



Attachment 1



Attachment 2

Tentative Schedule

Year	First Year							
Month	1	2	3	4	5	6	7	8
Work in Japan	<input type="checkbox"/>			<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	
Work in Bangladesh	████████████████████			████████████████████			██████████	
Report	▲ IC/R			▲ IT/R		▲ DF/R		▲ F/R

IC/R: Inception Report.
 IT/R: Interim Report
 DF/R: Draft Final Report
 F/R: Final Report

3

1.2 (1) The Minutes of Meeting of the Steering Committee (May 24th, 2012)

THE MINUTES OF MEETING
OF
THE FIRST STEERING COMMITTEE MEETING
ON
THE PREPARATORY SURVEY
OF THE
CHITTAGONG WATER SUPPLY IMPROVEMENT PROJECT
IN
THE PEOPLES' REPUBLIC OF BANGLADESH
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PEOPLES' REPUBLIC OF BANGLADESH
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The first Steering Committee Meeting of the Preparatory Survey of the Chittagong Water Supply Improvement Project was held on May 24th, 2012, chaired by Ms. Zuena Aziz, Additional Secretary of the Local Government Division in presence of the Steering Committee members from the Government of Bangladesh (hereinafter referred to as "GOB") and Japan International Cooperation Agency (hereinafter referred to as "JICA"). Main points discussed and agreed in the meeting between the Bangladesh side and the Japanese side are presented in Annex 1.

Dhaka, May 24th, 2012

For Government of Bangladesh



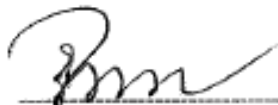
Shams Uddin Ahmed
Deputy Secretary (Water Supply)
Local Government Division, Ministry of
Local Government, Rural development and
Co-operatives

For Japan International Cooperation Agency



Masatoshi Momose
Team Leader
Survey Team for Chittagong Water Supply
Improvement Project

Witnessed by



A.K.M. Fazlullah
Managing Director
Chittagong Water Supply And Sewerage
Authority

Witnessed by



Sadanobu Sawara
Senior Advisor
JICA

Annex 1

Main Points Discussed in the Steering Committee Meeting

1. The Preparatory Survey Team, by referring to Annex 2, informed the Steering Committee about the outcome of the preliminary discussion held on May 21st, 2012 between the Survey Team and CWASA on the contents of the Inception Report.
2. The Preparatory Survey Team explained the contents of the Inception Report to the Steering Committee and the scope of the Survey and the basic approaches presented in the Report were agreed in principle by the Steering Committee.
3. The Steering Committee confirmed that the capacity of the Karnaphuli water treatment plant had been changed from 136,000m³/day to 143,000m³/day during the detailed design stage of the Karnaphuli Phase 1 Project, and therefore that the capacity of the plant will be expanded by another 143,000m³/day under the Karnaphuli Phase 2 Project.
4. The Steering Committee confirmed the tentative schedule of the survey and related issues (IEE/EIA and DPP) as follows. The schedule is also shown in Annex 3.

<EIA Approval Process>

- August 2012 : No Objection Certificate from Deputy Commissioner of Chittagong District for land use
- August 2012 : Submission of IEE to DOE from CWASA.
- September 2012 : DOE's approval of Site Clearance Certificate(SCC) (30 days in DOE)
- November 2012: Submission of EIA to DOE from CWASA
- December 2012: DOE's approval of Environmental Clearance Certificate (ECC) (15 days in DOE)

<DPP Approval Process>

- October 2012 : Submission of DPP to LGD from CWASA
- Deliberation on DPP (LGD : 30days, Planning Commission : 30 days, Decision by PEC : 10 days)
- February 2013 : DPP approval by ECNEC



Annex 2

Memorandum of Discussions between JICA and CWASA on Inception Report for the Preparatory Survey on Chittagong Water Supply Improvement Project

Date: May 21st, 2012

Venue: CWASA Conference Room 1st Floor

Attendees:

1. Mr. A.K.M Fazlullah, CWASA, Managing Director
2. Mr. M.A. Karim Chy, CWASA, KWSP, CE/PD
3. Mr. A.K.M Nazrul Haque, CWASA, Executive Engineer
4. Mr. Muhamad Zahurul Hoque, CWASA, KWSP, Executive Engineer
5. Mr. Ratan Kumar Sarker, CWASA, DMD/Engineering
6. Mr. Sadanobu Sawara, JICA, Senior Technical Advisor
7. Mr. Kentaro Yokota, JICA, Deputy Director, South Asia Department
8. Mr. Asaoka Shogo, JICA, Global Environment Department
9. Mr. Tomonori Wakabayashi, JICA, Global Environment Department
10. Mr. Saki Md Zial Islam, JICA Bangladesh, Senior Program Officer
11. Mr. Masatoshi Momose, NJS, Team Leader, Survey Team
12. Mr. Takao Ochiai, NJS, Water Supply Engineer, Survey Team
13. Mr. Patrik Takeuchi, NJS, Financial Specialist, Survey Team
14. Mr. George B. Young Jr., NJS Team Leader, Phase I Project
15. Mr. Md Shafiullah, NJS, Deputy Team Leader, Phase I Project
16. Mr. Maximo Bugarin, NJS, Construction Engineer, Phase I Project
17. Mr. Md Ohidul Islam, NJS, Quantity Surveyor, Phase I Project

-
1. The Inception Report was explained by Mr. Masatoshi Momose, Team Leader of Preparatory Survey Team for Chittagong Water Supply Improvement Project. All participants understood and in principle accepted the general approach and methodology proposed for the implementation of the Preparatory Survey, especially the approach to set up the Karnaphuli Service Area.

2. Other issues discussed were as follows:



- 2.1. CWASA will try to provide the Survey Team with the official results of the 2011 population census conducted in 2011 for the CCC area by ward before June 1, 2012. It was agreed that if the official results are not available by the time, the KOICA's projection will be adopted in the Preparatory Survey.
- 2.2. It was confirmed that the sectorization of water distribution network in Karnaphuli Service Area will allow monitoring and control of flow and pressures in the area.
- 2.3. Ground water use through deep wells shall not be considered for the water supply plan in 2030. Groundwater sources that are used at present may be used in the future as the emergency reserve or as the point supply source for low income people.
- 2.4. The counterparts from CWASA for the Survey Team: Administration, Financial, Engineering and Environmental shall be designated by CWASA and informed to the Survey Team before May 24, 2012.
- 2.5. Counterpart for institutional improvement shall also be assigned and discussions shall be made on the developments so far made by CWASA by referring to the agreement for institutional improvement made November 2011 between JICA and CWASA.
- 2.6. CWASA will provide the Survey Team a copy of official documents which define the CWASA's responsibility area so that both sides can confirm the definition.
- 2.7. CWASA will confirm the necessary procedure on IEE/EIA and provide related information immediately after the commencement of the study.

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Annex 3

Tentative Schedule

Year	2012								2013		
Month	5	6	7	8	9	10	11	12	1	2	3
Work in Japan	□		□			□					
Work in Bangladesh	■				■		■				
Report	▲ ICR			▲ ITR		▲ DFIR		▲ FIR			
Mission on Yen Loan					▲ FF			▲ A/P			▲ L/A
EIA			▲▲ NOC IEE		▲ SCC		▲ EIA	▲ ECC			
DPP						▲ Submission	→ Deliberation			▲ Approval	

ICR: Inception Report ITR: Interim Report
 DFIR: Draft Final Report FIR: Final Report

FF: Fact Finding A/P: Appraisal L/A: Loan Agreement

NOC: No Objection Certificate IEE: Initial Environment Evaluation
 SCC: Site Clearance Certificate EIA: Environment Impact Assessment
 ECC: Environmental Clearance Certificate

1.2 (2) The Minutes of Meeting of the Steering Committee (July 18th, 2012)

**THE MINUTES OF MEETING
OF
THE SECOND STEERING COMMITTEE MEETING
ON
THE PREPARATORY SURVEY
OF THE
CHITTAGONG WATER SUPPLY IMPROVEMENT PROJECT
IN
THE PEOPLES' REPUBLIC OF BANGLADESH
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PEOPLES' REPUBLIC OF BANGLADESH
AND
SURVEY TEAM FOR PREPARATORY SURVEY ON CHITTAGONG WATER SUPPLY
IMPROVEMENT PROJECT**

The second Steering Committee Meeting of the Preparatory Survey for the Chittagong Water Supply Improvement Project was held on July 18th, 2012, chaired by Ms. Zuana Aziz, Additional Secretary of the Local Government Division in the presence of the Steering Committee members from the Government of Bangladesh (hereinafter referred to as "GOB") and Preparatory Survey Team for Preparatory Survey for Chittagong Water Supply Improvement Project (hereinafter referred to as "Preparatory Survey Team").

Main points discussed and agreed in the meeting between the Bangladesh side and the Preparatory Survey Team are presented in Annex 1.

Dhaka, July 18th, 2012

For Government of Bangladesh

For Preparatory Survey Team



Shams Uddin Ahmed
Deputy Secretary (Water Supply)
Local Government Division, Ministry of Local Government, Rural development and Co-operatives



Masatoshi Momose
Team Leader
Survey Team for Chittagong Water Supply Improvement Project

Annex 1

Main Points Discussed in the Steering Committee Meeting

1. The Preparatory Survey Team, by referring to Annex 2, informed the Steering Committee about the outcome of the discussions held on July 15th, 2012 between the Preparatory Survey Team and CWASA on the study results of the first field work with issues and problems for implementation of Phase 2 Project.
2. The Preparatory Survey Team explained the study results of first field work with issues and problems for implementation of Phase 2 Project to the Steering Committee. The framework for the projection of water demand, Karnaphuli service area selected and the manner of planning for water supply facilities presented by Preparatory Survey Team were agreed by the Steering Committee.
3. The Steering Committee confirmed the following issues and problems to solve them timely.

(1) Subsidiary Loan Agreement (SLA)

The agreement between Bangladesh Government and CWASA shall be made at one time for Phase 1 and Phase 2 SLAs after financial study for the two (2) Phase through this preparatory survey.

(2) Environmental approval for Phase 2 Project from DoE

It was confirmed that renewal of existing ESC and EIA for Phase 2 Karnaphuli Water Supply Project (Chittagong Water Supply Improvement Project) will be made timely by CWASA according to the instructions from DoE. All concerned parties for the Project will support CWASA to complete renewal on time before the dispatch of Japanese Fact Finding mission which is scheduled in September, 2012.

(3) Right of way for construction of conveyance and transmission pipelines

Concurrence from RHD for the construction of the conveyance and transmission pipelines in the Kaptai road for Phase 2 Project shall be obtained before the dispatch of Japanese Fact Finding mission.

(4) Cooperation needs by all concerned parties to achieve the plan for the improvement of Chittagong Water supply System

It was confirmed by all participants that contributions by concerned parties are important to achieve the plan under limited water sources and initial stage of operation



in comprehensive water supply. The major improvement and cooperation needs include the following:

- 1) Change of the attitude of customers in use of water and promotion of willingness to pay for improved level of service that will be provided upon completion of the Project
- 2) Proper Capacity Building of CWASA including human resources management, customer management, and budgetary and financial planning
- 3) Financial arrangements including tariff structure
- 4) Further improvement on NRW reduction, building on the successes of the PANI Project, as well as taking into account of the lessons learned in the Project
- 5) Cooperation by all concerned governmental agencies to improve the above mentioned items

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Annex 2

Memorandum of Discussions between Preparatory Survey Team and CWASA on the results of first field work with issues and problems for implementation of Phase 2 Project

Date: July 15th, 2012

Venue: CWASA Conference Room 1st Floor

Attendees:

1. Mr. A.K.M Fazlullah, CWASA, Managing Director
2. Mr. Ratan Kumar Sarker, CWASA, DMD/Engineering
3. Mr. ATM Hamunur Rashid, CWASA, DMD/finance
4. Mr. Md. Abdul Awd, CWASA, DMD/admin.
5. Mr. M.A. Karim Chy, CWASA, KWSP, CE/PO
6. Jane, Alam Shisajam, CWASA, PD, CWSIP
7. Mr. Muhamad Zahurul Hoque, CWASA, KWSP-1, Executive Engineer
8. Mr. A.K.M Nazrul Haque, CWASA, KWSP-2, Executive Engineer
9. Mr. Quazi. Yeakub. Simiy, CWASA, KWSP-3, Executive Engineer
10. Mr. Masatoshi Momose, Team Leader, Preparatory Survey Team
11. Mr. Kevin Anthony Holroyd, Water Supply Engineer, Preparatory Survey Team
12. Mr. Takao Ochilal, Water Supply Engineer, Preparatory Survey Team
13. Mr. Yasuaki Konda, Mechanical Engineer, Preparatory Survey Team
14. Mr. Akira Miura, Electrical Engineer, Preparatory Survey Team
15. Mr. Hirotsu Koike, Procurement Planning/Cost Estimate, Preparatory Survey Team
16. Mr. Patrik Takeuchi, Financial Specialist, Preparatory Survey Team
17. Mr. Satoshi Ohmoto., O&M Specialist, Preparatory Survey Team
18. Mr Md Shafiqul Islam, Water Supply Engineer, Local Consultants
19. Mr. Nazrul Islam, Water Supply Engineer, Local Consultants

-
1. The results of the first field work with issues and problems for implementation of Phase 2 Project were explained by the Preparatory Survey Team for the Chittagong Water Supply Improvement Project. All participants understood and agreed on the following frame work for planning water supply facilities.

(1) Population projection by ward for CCC area in 2030.



(2) Major factors to project water demand include domestic water consumption, other water consumption by commercial, institutional and industrial users, NRW and leakage percentages.

Proposed Karnaphuli service area was also agreed as a self-contained water supply system to be served by Karnaphuli Water Treatment Plant through Phase I and Phase 2 projects.

Manner of study to come up with distribution system after sectorization in the Karnaphuli service area was agreed as well as plan of water supply facilities as the expansion of Phase 1 Project.

2. Other major issues discussed and agreed are as follows:

2.1. Subsidiary Loan Agreement (SLA): The procedure for Phase 1 SLA is on-going in the Bangladesh government. However, the agreement between the Bangladesh government and CWASA shall be made at one time for Phase 1 and Phase 2 SLA.

2.2. Environmental approval for Phase 2 Project from DoE: It was confirmed that the renewal of existing Environmental Site Clearance (ESC) and EIA approval by DoE for Karnaphuli water Supply Project will be the requirement for Phase 2 Project. In this connection the following are required.

(1) CWASA will arrange renewal of ESC immediately.

(2) Official description on the responsible DoE office for renewal of the EIA approval shall be obtained by CWASA.

(3) Action plan to cope with the instructions from DoE after renewal of ESC will be prepared. CWASA will submit required documents supported by Preparatory Survey Team according to the action plan. CWASA will discuss with JICA Dhaka Office on the arrangements upon receipt of the comments and instructions from DoE.

2.3. Right of way for construction of conveyance and transmission pipelines along Kaptai road: Discussions for Phase 1 project among concerned parties are under way to get concurrence from RHD to install the pipelines in the road.

Approval from RHD for the construction of pipelines in the same road for Phase 2 Project shall be obtained before the appraisal of the proposed loan project by the fact finding mission from Japan which is scheduled in September, 2012.

2.4. Data/ information on the cost of similar projects as Phase 2 Project: Preparatory Survey Team will conduct comparative study on the construction cost of water supply facilities for Phase 2 Project with similar projects in Bangladesh. In this connection CWASA will arrange to collect data/information from Dhaka WASA.

2.5. DPP approval process

CWASA will prepare required documents to meet the schedule as agreed at the first Steering Committee Meeting with support by Preparatory Survey Team.



1.2 (3) The Minutes of Meeting of the Steering Committee (September 03th, 2012)

THE MINUTES OF MEETING
OF
THE THIRD STEERING COMMITTEE MEETING
ON
THE PREPARATORY SURVEY
OF THE
CHITTAGONG WATER SUPPLY IMPROVEMENT PROJECT
IN
THE PEOPLES' REPUBLIC OF BANGLADESH
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PEOPLES' REPUBLIC OF BANGLADESH
AND
SURVEY TEAM FOR PREPARATORY SURVEY ON CHITTAGONG WATER SUPPLY
IMPROVEMENT PROJECT

The third Steering Committee Meeting for the Preparatory Survey for the Chittagong Water Supply Improvement Project which was held on September 3rd, 2012, was chaired by Ms. Zuena Aziz, Additional Secretary of the Local Government Division in the presence of the Steering Committee members from the Government of Bangladesh (hereinafter referred to as "GOB") and the Preparatory Survey Team for Preparatory Survey for Chittagong Water Supply Improvement Project (hereinafter referred to as "Preparatory Survey Team"). The main points, which were discussed and agreed in the meeting between the Bangladesh side and the Preparatory Survey Team, are presented in Annex 1.

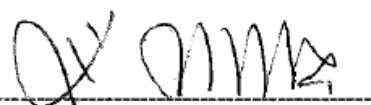
Dhaka, September 3rd, 2012

For Government of Bangladesh



Shams Uddin Ahmed
Deputy Secretary (Water Supply)
Local Government Division, Ministry of Local Government, Rural development and Co-operatives

For Preparatory Survey Team

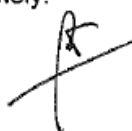


Masatoshi Momose
Team Leader
Survey Team for Chittagong Water Supply Improvement Project

Annex 1

Main Points Discussed in the Steering Committee Meeting

1. The Preparatory Survey Team, by referring to Annex 2, informed the Steering Committee about the outcome of the discussions held on August 30th, 2012 between the Preparatory Survey Team and CWASA on the Interim Report for the Preparatory Survey of the Chittagong Water Supply Improvement Project (KWSP Phase 2).
2. The Preparatory Survey Team explained the contents of the Interim Report to the Steering Committee. The framework for the projection of water demand, Kamaphuli service area, distribution system, environmental and social conditions and overall schedule for completion of the Survey Work, as presented by the Preparatory Survey Team were re-confirmed by the Steering Committee.
3. The Steering Committee confirmed the following issues and problems to solve them timely.
 - (1) Right of way for construction of conveyance and transmission pipelines
Approval from RHD for the construction of the conveyance and transmission pipelines in the Kaptai road for KWSP Phase 2 is urgent. In this regard, Bangladesh side shall make all efforts to obtain the concurrence from RHD before the dispatch of the Japanese Fact Finding mission.
 - (2) DPP approval process
CWASA will prepare required documents for the submission to the Government of Bangladesh by the middle of October. Concerned parties will support CWASA to get approval from the Government timely.



- (3) Distribution System
- (4) Plan of water supply facilities
- (5) Environmental and social conditions
- (6) Overall schedule for completion of Survey Work

2. Other major issues discussed and re-confirmed are as follows:

2.1. Environmental approval for KWSP Phase 2 from DoE: It was confirmed that the renewal of existing Environmental Site Clearance (ESC) and EIA approval by DoE for Kamaphuli water Supply Project will be the requirement for Phase 2 Project. Then, renewal of ESC was made by CWASA. CWASA needs to submit quarterly monitoring report for on-going Phase 1 project according to the conditions in the approval letter on EIA from DoE.

(1) Official description on the responsible DoE office for renewal of the EIA approval shall be obtained by CWASA. In addition, CWASA shall confirm with DoE, whether presentation on the changes in the scope of work for Phase 2 Project from the time approved by DoE on EIA, is required or not.

(2) CWASA will submit required documents supported by Preparatory Survey Team to meet the request from DoE.

2.2. Right of way for construction of conveyance and transmission pipelines along Kaptai road: Discussions for Phase 1 project among concerned parties are under way to get concurrence from RHD to install the pipelines in the road.

CWASA shall make all efforts to get approval from RHD for the construction of pipelines in the same road for KWSP Phase 2 before the appraisal of the proposed loan project by the fact finding mission from Japan.

2.3. DPP approval process

CWASA will prepare required documents for the submission to the Government of Bangladesh by the middle of October



Approval from RHD for the construction of pipelines in the same road for Phase 2 Project shall be obtained before the appraisal of the proposed loan project by the fact finding mission from Japan which is scheduled in September, 2012.

2.4. Data/ information on the cost of similar projects as Phase 2 Project: Preparatory Survey Team will conduct comparative study on the construction cost of water supply facilities for Phase 2 Project with similar projects in Bangladesh. In this connection CWASA will arrange to collect data/information from Dhaka WASA.

2.5. DPP approval process

CWASA will prepare required documents to meet the schedule as agreed at the first Steering Committee Meeting with support by Preparatory Survey Team.



Annex 2

Memorandum of Discussions between Preparatory Survey Team and CWASA on the Interim Report for the implementation of Phase 2 Project

Date: August 30th, 2012

Venue: CWASA Conference Room 1st Floor

Attendees:

1. Mr. A.K.M Fazlullah, CWASA, Managing Director
2. Mr. Ratan Lumar Sarker, CWASA, DMD/Engineering
3. Mr. ATM Mamunur Rashid, CWASA, DMD/finance
4. Mr. Md. Abdul Awal, CWASA, DMD/admin
5. Mr. M.A. Karim Chy, CWASA, KWSP, CE/PD
6. Mr. Jane, Alam Bhuiyan, CWASA, PD, CWSIP
7. Mr. Muhamad Zahurul Hoque, KWSP-1, Executive Engineer
8. Mr. A.K.M Nazrul Haque, CWASA, KWSP-2, Executive Engineer
9. Mr. Quazi. Yeakub. Shirajudowla, CWASA, KWSP-3, Executive Engineer
10. Mr. Masatoshi Momose, Team Leader, Preparatory Survey Team
11. Mr. Takao Ochiai, Water Supply Engineer, Preparatory Survey Team
12. Ms. Yasumi Tsutsui Environmental Specialist, Preparatory Survey Team
13. Mr. Md Shafiqul Islam, Water Supply Engineer, Local Consultants
14. Mr. Nazrul Islam, Water Supply Engineer, Local Consultants

1. The contents of the Interim Report, which was prepared based on the findings and study results from the first field work for the KWSP Phase 2, were explained by the Preparatory Survey Team. All participants re-confirmed the following frame work for preliminary design of water supply facilities and schedule for completion of Survey Work.

- (1) Water demand projection up to year 2030 including population projection and concerned factors, such as per capita water consumption, NRW and leakage percentages.
- (2) Karnaphuli service area as a self-contained water supply system to be served by Karnaphuli Water Treatment Plant through Phase I and Phase 2 projects.
- (3) Distribution System



- (4) Plan of water supply facilities
- (5) Environmental and social conditions
- (6) Overall schedule for completion of Survey Work

2. Other major issues discussed and re-confirmed are as follows:

2.1. Environmental approval for KWSP Phase 2 from DoE: It was confirmed that the renewal of existing Environmental Site Clearance (ESC) and EIA approval by DoE for Karnaphuli water Supply Project will be the requirement for Phase 2 Project. Then, renewal of ESC was made by CWASA. CWASA needs to submit quarterly monitoring report for on-going Phase 1 project according to the conditions in the approval letter on EIA from DoE.

- (1) Official description on the responsible DoE office for renewal of the EIA approval shall be obtained by CWASA. In addition, CWASA shall confirm with DoE, whether presentation on the changes in the scope of work for Phase 2 Project from the time approved by DoE on EIA, is required or not.
- (2) CWASA will submit required documents supported by Preparatory Survey Team to meet the request from DoE.

2.2. Right of way for construction of conveyance and transmission pipelines along Kaptai road: Discussions for Phase 1 project among concerned parties are under way to get concurrence from RHD to install the pipelines in the road.

CWASA shall make all efforts to get approval from RHD for the construction of pipelines in the same road for Phase 2 Project before the appraisal of the proposed loan project by the fact finding mission from Japan.

2.3. DPP approval process

CWASA will prepare required documents for the submission to the Government of Bangladesh by the middle of October.



1.2 (4) The Minutes of Meeting of the Steering Committee (November 15th, 2012)

THE MINUTES OF MEETING
OF
THE FOURTH STEERING COMMITTEE MEETING
ON
THE PREPARATORY SURVEY
ON
CHITTAGONG WATER SUPPLY IMPROVEMENT PROJECT
IN
THE PEOPLE'S REPUBLIC OF BANGLADESH
AGREED UPON BETWEEN
THE GOVERNMENT OF THE PEOPLES' REPUBLIC OF BANGLADESH
AND
THE PREPARATORY SURVEY TEAM OF
JAPAN INTERNATIONAL COOPERATION AGENCY

The fourth Steering Committee Meeting of the Preparatory Survey on Chittagong Water Supply Improvement Project (hereinafter referred to as "the Preparatory Survey") was held on November 15th, 2012, chaired by Ms. Zuena Aziz, Additional Secretary of the Local Government Division in the presence of the Steering Committee members from the Government of Bangladesh (hereinafter referred to as "GOB") and the Team for Preparatory Survey on Chittagong Water Supply Improvement Project (hereinafter referred to as "the Team").

The main points discussed in the meeting between the Bangladeshi side and the Japanese side are presented in Annex 1.

Dhaka, November 15th, 2012

For Government of Bangladesh



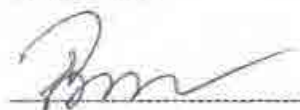
Shams Uddin Ahmed
Deputy Secretary (Water Supply)
Local Government Division, Ministry of Local Government, Rural development and Co-operatives

For Preparatory Survey Team




Masatoshi Momose
Team Leader
Team for Preparatory Survey on Chittagong Water Supply Improvement Project

Witnessed by



A.K.M. Fazlullah
Managing Director
Chittagong Water Supply and Sewerage Authority (CWASA)



Masahiro Ueki
JICA Mission Leader
JICA Global Environment Department

Annex 1

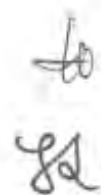
Main Points Discussed in the Steering Committee Meeting

1. The Team, by referring to Annex 2, reported the outcome of the discussions held on November 12th, 2012 between the Team and CWASA on the Draft Final Report (herein-after referred to as "DF/R") on the Preparatory Survey.
2. The Team explained the outline of the DF/R on the Preparatory Survey with the materials shown in Annex 3. In addition, The Team, by referring to Annex 2, reported the outcome of the discussions held on November 12th, 2012 between the Team and CWASA on DF/R. All participants attended in the Steering Committee understood and in principle accepted the contents of DF/R.
3. The progress on the actions to be taken, which were discussed and confirmed between the Follow-up Mission of JICA and Bangladesh side are as follows:
 - (1) DPP
DPP will be presented at the Board Meeting of CWASA scheduled on November 17, 2012. After the approval by the Board Members, DPP will be submitted to GOB.
 - (2) ESC
CWASA received ESC for KWSP 1 and 2 from DOE on November 13, 2012.
 - (3) Permission for the installation of the pipelines along Kaptai Road
The MOU between RHD and CWASA about road cutting covered Karnaphuli Water Supply Project (Phase 1 and 2) and it should be mentioned in the DPP.
4. Discussions made in the Steering Committee on the actions to be taken by concerned stakeholders.
 - (1) CWASA
CWASA will prepare and submit required documents as attached in Annex 2.
 - (2) For the implementation of KWSP 2, CWASA will not be financially sustainable. In this regard, three options: 1) a drastic increase in water tariff, 2) a substantial relaxation of lending terms of the GOB's subsidiary loan and 3) the intermediate countermeasures between 1) and 2) were discussed. As a result of discussions, it



was confirmed that the on-lending terms applied for KWASA should be also applied to CWASA for both Phase 1 and Phase 2, and that appropriate level of tariff should be studied on that basis.

- (3) The approval of the organogram of CWASA should be ensured by GOB before signing of the loan agreement.
- (4) Timely approval by GOB on the procurement of Consultants and contractors. KWSP 1 is scheduled to complete by the year 2015 to increase supply volume. It is very important to construct distribution network in KSA as early as possible. KWSP 2 covers the component for the construction of the distribution network. In this regard, timely approval by GOB for the procurement of Consultants and contractors are required. Bangladesh side will prepare to expedite the procedure for the procurement needs.
5. Both parties agreed that Bangladesh side shall send comments on DF/R to the Team through JICA Bangladesh office, if any, on or before November 30, 2012. The Team will reflect the comments from the Bangladeshi side to DF/R and finalize it as the Final Report (F/R). It will be delivered through JICA Bangladesh Office.



Annex 2

Memorandum of Discussions between the Team and CWASA on the Draft Final Report for the Preparatory Survey on Chittagong Water Supply Improvement Project (KWSP 2)

Date: November 12th, 2012

Venue: CWASA Conference Room 5th Floor

Attendees:

1. Mr. A.K.M Fazlullah, CWASA, Managing Director
2. Mr. Ratan Lumar Sarker, CWASA, DMD/Engineering
3. Mr. ATM Mamunur Rashid, CWASA, DMD/finance
4. Mr. Md. Abdul Awal, CWASA, DMD/admin
5. Mr. M.A. Karim Chy, CWASA, KWSP, CE/PD
6. Mr. Jane, Alam Bhuiyan, CWASA, PD, CWSIP
7. Mr. Muhamad Zahurul Hoque, KWSP-1, Executive Engineer
8. Mr. A.K.M Nazrul Haque, CWASA, KWSP-2, Executive Engineer
9. Mr. Quazi. Yeakub, Shirajudowla, CWASA, KWSP-3, Executive Engineer
10. Mr. Masahiro Ueki, JICA Mission Leader, JICA Global Environment Department
11. Mr. Sadanobu Sawara, JICA Global Environment Department
12. Mr. Tomonori Wakabayashi, JICA Global Environment Department
13. Mr. Masatoshi Momose, Team Leader, Preparatory Survey Team
14. Mr. Takao Ochiai, Water Supply Engineer, Preparatory Survey Team
15. Mr. Patric Takeuchi, Financial Specialist, Survey Team

1. The contents of the Draft Final Report, which was prepared based on the findings and study results, were explained by the Preparatory Survey Team. All participants understood and in principle accepted its contents.
2. As for Karnaphuli Service Area (KSA) proposed in the Preparatory Survey, some issues were raised by CWASA in advance of the dispatch of the Team. To justify the establishment of KSA, the Japanese side explained the concept and key issues regarding KSA. As a result of the discussion afterward, the following issues are agreed and confirmed by both sides.

2.1. Basic concept of KSA

a. Great urgency of KSA

Since KWSP-1 will start water transmission in 2014, the existing network, where KWSP-1 will supply water, should be improved and expanded as soon as possible. So KSA must be set up without waiting for holistic mapping, modeling and detailed planning of distribution network in the entire CCC area.

b. KSA as self-contained and physically separated

Since KWSP-1&2 cannot satisfy water demand in entire CCC area, KSA is needed to supply water with enough pressure, continuous supply & minimum water losses. And to maintain this situation, KSA must be self-contained and physically separated. Similar examples can be found in Japan as this idea is quite common in Japan.

c. KSA boundary

KSA is set to cover high priority area, not based on any hydraulic considerations, so that KSA boundary doesn't have to follow ward boundary.

d. New and old network in KSA

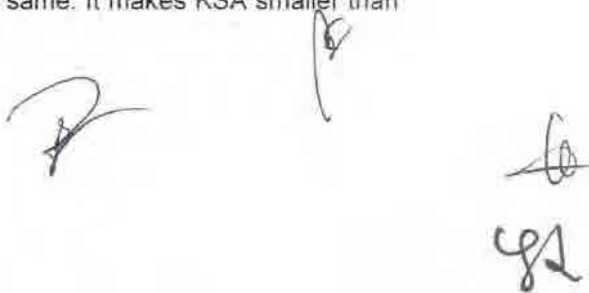
To install new network ensures low leakage & less interruption of supply service while to utilize and rehabilitate existing network force CWASA to work hard and spend a lot of time without remarkable outcomes. However, existing distribution mains, which run through KSA and deliver water outside KSA, remain as they are. (e.g. Mohara-Patenga)

2.2. Major issues regarding KSA

a. Difference between KSA and proposed service area in SAPROF report (2005)

Current situation is different from what was planned in SAPROF as follows:

- It is not likely that WTPs are materialized as scheduled in SAPROF report except for Karnaphuli 1&2, and
- CCC's Water demand in 2030 is 1.65 times as much as that in 2020 while the production volume of KWSP-1&2 is almost same. It makes KSA smaller than that in SAPROF.



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As for priority area to be covered, it is considered to include areas where water demand is high & urgent measures are needed in KSA. On the other hand, no consideration is given to priority area in SAPROF as its service area is simply set at hillside area.

Two reservoirs (Nashirabad & Batali Hill) are included in Karnaphuli system even in SAPROF. However, the capacity of two reservoirs isn't still sufficient for KSA even though KSA doesn't receive Madunaghat water

b. GIS data and maps on existing distribution network

Currently all data & information necessary for hydraulic simulation rehabilitation works for existing network aren't made available, such as location, material, diameter and condition. Against this situation, the best way to improve distribution network in KSA is to abandon all existing network, then design completely brand-new network.

c. Contribution toward improving water supply services outside KSA

After completion of KWSP-2 (Year 2020), water from Mohara (currently around 100,000m³/d of water from Mohara is supplied into KSA) will not be consumed in KSA and will be diverted 100% outside KSA. In addition, KWSP-1&2 can even supply water to neighboring areas of KSA until 2030, KSA & the areas outside KSA will be connected with emergency pipelines, of which spec & location can be identified only after World Bank study, which is supposed to target the distribution network outside KSA.

d. Different water supply quality inside and outside KSA

Water supply service will be significantly improved even outside KSA after completion of KWSP-1&2 as mentioned above. The supply conditions outside KSA can be further improved if additional supply from the Madunaghat WTP is materialized. On the other hand, service boundary will have to be established and unavoidable anyway unless supply capacity can satisfy the entire water demand of whole CCC area. To overcome this, CWASA has to make effort to establish the appropriate water supply areas outside KSA with support from GOB and/or donors.



e. Provisions to reduce the leakage in KSA until KWSP-2 is completed

According to the implementation schedule of KWSP-2, all the construction work will be completed at the end of Year 2020. However, distribution network will be newly constructed step by step after Year 2016. The sectors, which are the parts of PANI Project area and need most urgent improvement, will be completed at first, followed by other sectors. Time gap between the completion of KWSP1 and these prioritized sectors are expected to be around 2 years or less.

In addition, until KWSP-2 is completed, the pressure of Karnaphuli water will be reduced before the injection into existing network to minimize the leakage.

3. Other major issues discussed and re-confirmed are as follows:

3.1. DPP approval process

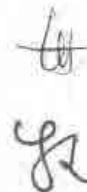
DPP will be presented at the Board Meeting of CWASA scheduled on November 17, 2012. After the approval by the Board Members, DPP will be submitted to GOB.

3.2. Extension of ESC for KWSP 2

CWASA has already submitted the application letter on the extension of ESC last month. CWASA confirmed with Chittagong DOE that DOE will issue ESC for KWSP 2 by November 15, 2012.

3.3 EOI

Draft EOI will be submitted by CWASA to JICA immediately and after concurrence from JICA, CWASA will advertise it within a week before December, 2012.



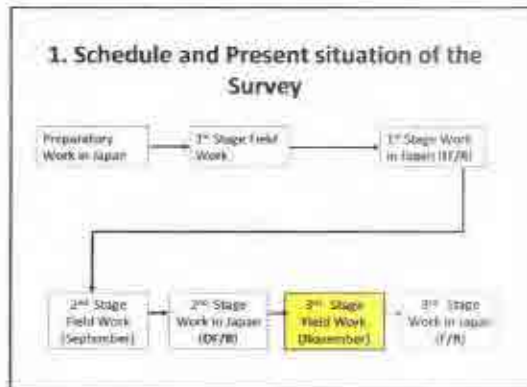
Annex 3 Presentation materials for Steering Committee

Preparatory Survey on Chittagong Water Supply Improvement Project

Draft Final Report (DF/R)

November 2012

JICA Study Team



2. Water Demand
(1) Population Projection (CCC Area)
a. M/P conducted by KOICA in August 2009.

	Population in 1990s			Population Projection		
	1991	2001	2007	2011	2015	2021
CCC	1,913,888	2,075,458	2,170,000	2,350,000	2,850,000	4,700,000
Average Rate(%)	4.3	4.3	1.80	2.74	2.35	

b. Population Projection in the Preparatory Survey (KWSP2)

	1991	2011	2015	2021	2030
CCC	1,800,000	2,026,500	1,887,500	4,135,000	4,600,000

Note: The Total population is projected as a size of total population.

(2). Water Demand Projection(CCC Area)

	2011	2015	2020	2025	2030
Daily Average	408,900	515,400	580,900	693,500	1,000,000
Daily Maximum	470,000	592,500	668,200	797,800	1,017,900

Conditions in 2030; Phase 2 Project is planned to be completed by 2020

- Per capita water consumption: 170lpcd (daily average)
- Housing types: Pucca, Semi-Pucca and Kutcha
- Served population; House Connection (100%), Hydrant (0%)
- Other water demand: Commercial, Institutional, industrial (about 20% of domestic demand) and Leakage Leakage = 10% (2030) NRW = 15% (2030)

Daily maximum : Daily average = 1.25 : 1.0
Hourly maximum : Daily maximum = 1.5 : 1.0

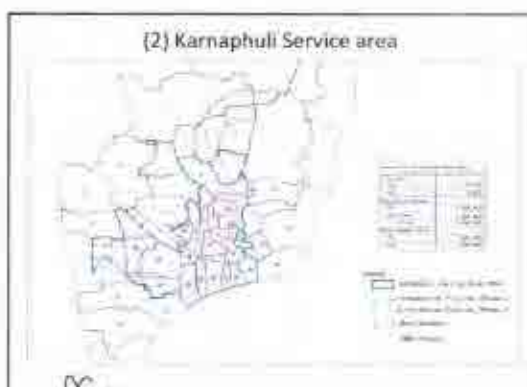
3. Establishment of Self-contained Karnaphuli Service Area (KSA)
(1) Priority Areas included in KSA

Priority Areas

a. PANI Project area
b. KWSP 1 area (Area where distribution mains are laid by KWSP 2)
c. High water demand area (high density population areas adjacent to PANI area)

→

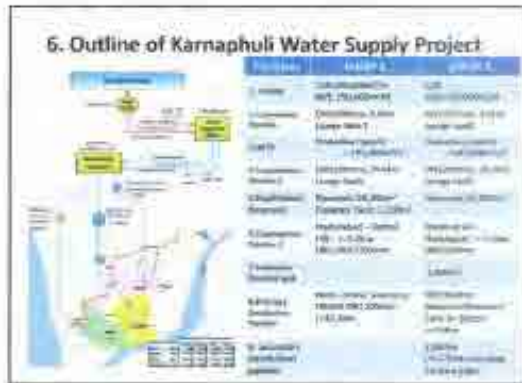
Total Supply volume from Karnaphuli WTP
286,000m³/d.
(KWSP 1 and KWSP 2)





5. Sectors are grouped by Service Reservoir/E.T

Service Reservoir/E.T	Area	Population	Total House Hold (Estimated)
Elevated Tenm	North	4,500	75,000
Karnaphuli Reservoir	Central	11,000	180,000
Mineral Water of Hillshaha	South	1,000	70,000
	Total		325,000



7. Environment Management Plan in Construction Stage

Presence and/or disturbance of business activities and living conditions affected by the construction work, in particular work for laying pipelines along existing roads may cause traffic congestion, resulting in nuisance and/or disturbance to business activities and living conditions in the project area.

Identification of possible impacts

Public health condition	Hydrologic condition
Working condition	Air pollution
Accidents	Water pollution
Surface soil erosion	Noise and vibration
	Solid waste disposal

8. Implementation Plan/Schedule and Project Cost

(1) Contract Packages

- Package 1: Intake Facilities, WTP and Distribution Reservoir/Elevated Tenm
- Package 2: Conveyance and Transmission Pipelines and Optical Fiber cable (from Mashrabad Reservoir to Hillshaha E.T)
- Package 3: Primary, Secondary and Tertiary Distribution Pipelines, Service Connections in DMAs and Optical fiber cable to each Sector
- Package 4: Procurement of Equipment and Vehicles (Several lots)

(Handwritten signatures and initials)

(Option 3)

unless any external conditions change
LGD&CWASA have to consider if this proposed water tariff is affordable to people in Chittagong city

Option 2: To relax lending terms of GOB's subsidiary loan as follows:
 1) To provide grant and/or equity participation for the whole amount of the funds required for the Phase 1 Project, which is equivalent to about 30% of the total fund requirements for KWSP 1 and KWSP 2.
 2) For the KWSP 2 Project, relaxing the lending terms as follows:
 a. Repayment of loan with 30 years installments after a 10 years grace period
 b. Interest rate at 1% per annum for both the Foreign and Local Loan Portions.
 c. Capitalize interest accrued during the initial 10 years so that annual payment of interest can be released during these years.
 LGD&ERD have to take necessary measures to subsidize CWASA.

10. Operation and Maintenance of Karnaphuli Water Supply System
 1. Sectorization (Sectors and DMAs) and SCADA system will ensure equitable water distribution and effective control of NRW/leakage within KSA
 2. KWS organization for O&M: Two Major Functional requirements;
 (1) Production (intake, WTP, transmission, reservoir/elev. tank) and
 (2) Distribution Pipeline

11. Environmental and Social Considerations
 (1) An IEE report and an EIA report submitted to the Department of Environment (DOE) at the time of KWSP 1 project preparation effectively cover both KWSP 1 and KWSP 2 of the Project.
 (2) DOE Chittagong informed CWASA of the need for the site clearance certificate for KWSP 2 of KWSP.
 (3) CWASA submitted the requisites to obtain the ESC for the KWSP 2, expecting that DOE Chittagong will issue the ESC in November 2012.

12. Recommendations
 For the smooth implementation of KWSP2, the following actions are to be taken by respective stakeholders.

(1) CWASA -to certainly execute Actions to be Taken (refer to next slide)	(2) LGD&ERD -to relax lending terms of GOB's subsidiary loan for CWASA to keep sound financial condition -to timely approve selection results for the procurement of Consults and Contractors -to approve Organogram of CWASA (PIU and O&M)	(3) JICA -to assist CWASA for the institutional improvement through PANI and IDC's activities -To provide CWASA with OJT during detailed design and construction supervision
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[Handwritten signatures and initials]

Actions to be Taken by CWASA			
Key Action and Information	Deadline	Key Action and Information	Deadline
Development Project Proposal (DPP)	Middle of NOV.2012	Total concept paper of KWSP2 system is prepared	November 30, 2012
Environmental Monitoring Report for KWAS1 is submitted to DOE	October 31, 2012 (Submitted)	Drafting EMI of KWAS1 is prepared	November 30, 2011
Extension of ESC for KWAS2 is approved by DOE	November 30, 2011	Draft EMI preparation started for KWSP2 and other water supply units is prepared	November 30, 2012
Permission of installation of transmission pipelines for KWSP2 is issued by PPH	January, 2013	PHI extension is completed	November 30, 2012
Final draft WFP including TOR for consulting contract is prepared and submitted to BIA	November 30, 2012	CWASA board will approve the contract in 2012/13 term	November 30, 2012
EOT is prepared and issued	December 30, 2012		

Thank you very much for your attention

CHAPTER 3

EXISTING WATER SUPPLY AND ON-GOING WATER SUPPLY PROJECT

CHAPTER 3 EXISTING WATER SUPPLY AND ON-GOING WATER SUPPLY PROJECT

3.4.1 Depreciation Rates

Category of Property, Plant and Equipment	Annual Depreciation Rates (%)
Building	2%
Mohara Water Treatment Plant	2%
Trunk & Distribution Main	2%
Pump & Booster	5%
Pump House	2%
Water Main (PVC Line)	2%
Meter Repairing Workshop	2%
Booster Station	2%
Water Reservoir	5%
Staff Quarter & Other Building	2%
Civil Work & Boundary Wall	10%
House Service Connection	2%
Meter Installation, Pump & Transformer	10%
Computers	10%
Electric Line Installation	15%
Transportation & Equipment	20%
Pipeline	2%
Other Constructions	6%
Sundries Assets	2%
Loose Tools & Equipment	10%
Intercom System	10%
Medical Equipment	10%
Vehicles	20%
Furniture & Fixtures	10%
Materials of Pump	6%
Tube Well	6%

3.4.5 Details Long-Term Loans

Name of Loans	FY2006/07				FY2007/08			FY2008/09		
	Opening Balance as at 01.07.'06	Loan received during the Period	Loan Payment during the Period	Closing Balance as to 30.06.'07	Loan received during the Period	Loan Payment during the Period	Closing Balance as to 30.06.'08	Loan received during the Period	Loan Payment during the Period	Closing Balance as to 30.06.'09
1. 1st IWSRP ^{*1)}	248,725,000	-		248,725,000			248,725,000			248,725,000
2 3rd IWSRP ^{*1)}	244,459,000	60,000,000		304,459,000	44,000,000	12,252,000	336,207,000	100,000,000	84,629,000	351,578,000
3 IDA Loan (1st Phase)	12,691,523		2,115,255	10,576,268		2,115,255	8,461,013		2,115,255	6,345,758
4 IDA Loan (2nd Phase)	331,755,913		57,854,645	273,901,268		60,361,103	213,540,165		56,907,561	156,632,604
5 Madunaghat Project	-			-			-			-
6 Reimbursement Loan for Sewerage	2,700,000			2,700,000			2,700,000			2,700,000
7 UAWMP ^{*2)}	5,329,000			5,329,000			5,329,000			5,329,000
8 Karnaphuli Water Supply Project (JICA Loan)	-			-	48,881,315		48,881,315	142,310,250		191,191,565
9 Mohara & Kalurghat Rehabilitation Project	-			-	10,000,000		10,000,000			10,000,000
10 Mohara Water Supply Extension Project	51,722,000	137,500,000	37,500,000	151,722,000		52,187,000	99,535,000			99,535,000
11 Karnaphuli Water Supply Project (GOB)	-	12,500,000		12,500,000	180,000,000	1,053,000	191,447,000	50,000,000	129,316,000	112,131,000
Total	897,382,436	210,000,000	97,469,900	1,009,912,536	282,881,315	127,968,358	1,164,825,493	292,310,250	272,967,816	1,184,167,927
(Note) *1) IWSRP: Water Supply & Rehabilitation Project										
*2) UAWMP: Unaccounted For Water Management Program										
(Source: CWASA Financial Statements)										

3.4.6 Change in Equity fund

Particulars	Capital Fund	Asset Revaluation Reserve	Excess Value of Assets due to Physical Verification	Retained Earnings	Total Equity Fund
FY 2006/07					
a. Balance as at 01.07.2006	1,070,287,680	45,473,332	280,067	(619,125,193)	496,915,886
b. Net income for the year				84,420,080	84,420,080
c. Payment to National Exchequer				(5,000,000)	(5,000,000)
d. Income tax paid				(6,000,000)	(6,000,000)
e. Loan transferred to equity/grant ^{*1)}	600,000				600,000
f. Loan paid from Equity					
g. Balance as at 30.06.2007	1,070,887,680	45,473,332	280,067	(545,705,113)	570,935,966
FY 2007/08					
a. Balance as at 01.07.2007	1,070,887,680	45,473,332	280,067	(545,705,113)	570,935,966
b. Net income for the year				107,449,237	107,449,237
c. Payment to National Exchequer				(5,000,000)	(5,000,000)
d. Income tax paid					
e. Loan transferred to equity					
f. Loan paid from Equity ^{*2)}	(10,779,000)				(10,779,000)
g. Balance as at 30.06.2008	1,060,108,680	45,473,332	280,067	(443,255,876)	662,606,203
FY 2008/09					
a. Balance as at 01.07.2008	1,060,108,680	45,473,332	280,067	(443,255,876)	662,606,203
b. Net income for the year				100,643,839	100,643,839
c. Payment to National Exchequer					
d. Income tax paid					
e. Loan transferred to equity/grant ^{*3)}	176,874,097				176,874,097
f. Loan paid from Equity ^{*4)}	(12,260,000)				(12,260,000)
g. Balance as at 30.06.2009	1,224,722,777	45,473,332	280,067	(342,612,037)	927,864,139
(Note) *1) Madunaghat Project Loan transferred to equity: increased from BDT83,265,000 as at the opening of FY2005/06 to BDT83,865,000 as at the closing of FY2006/07					
*2) Madunaghat Project Loan transferred to equity: decreased from BDT83,865,000 as at the opening of FY2006/07 to BDT73,086,000 as at the closing of FY2007/08 with repayment of BDT10,779,000 from equity during FY2007/08					
*3) Grant for Mohara & Kalurghat Rehabilitation Project in an amount of BDT74,339,097 and Equity for Mohara Water Supply Project in an amount of BDT102,535,000, thus amounting to BDT176,874,097 in total					
*4) Madunaghat Project Loan transferred to equity: decreased from BDT73,086,000 as at the opening of FY2008/08 to BDT60,826,000 as at the closing of FY2008/09 with repayment of BDT12,260,000 from equity during FY2008/09					
(Source: Audited Financial Statements for FY2006/07 to FY2008/09)					

3.4.7 Details of Retained Earnings

Particulars	As at Closing of FY2006/07 (30.06.2007)	As at Closing of FY2007/08 (30.06.2008)	As at Closing of FY2008/09 (30.06.2009)
a. Opening retained earnings as restated**	(619,125,193)	(545,705,113)	(443,255,876)
b. Net income for the year (see Income Statements)	84,420,080	107,449,237	100,643,839
c. Income tax paid	(6,000,000)	-	-
d. Payment to National Exchequer	(5,000,000)	(5,000,000)	-
e. Retained Earnings	(545,705,113)	(443,255,876)	(342,612,037)
(Note) **Accumulated Retained Earnings was recored as BDT619,125,193 as at the opening of FY2006/07 (01.07.2006)			
(Source: Audited Financial Statements for FY2006/07 to FY2008/09)			

CHAPTER 4

WATER DEMAND PROJECTION IN THE SURVEY AREA

Chapter 4 WATER DEMAND PROJECTION IN THE SURVEY AREA

4.2.1 (a) Location of the Survey Points



4.2.1(b) Survey Results by the PANI

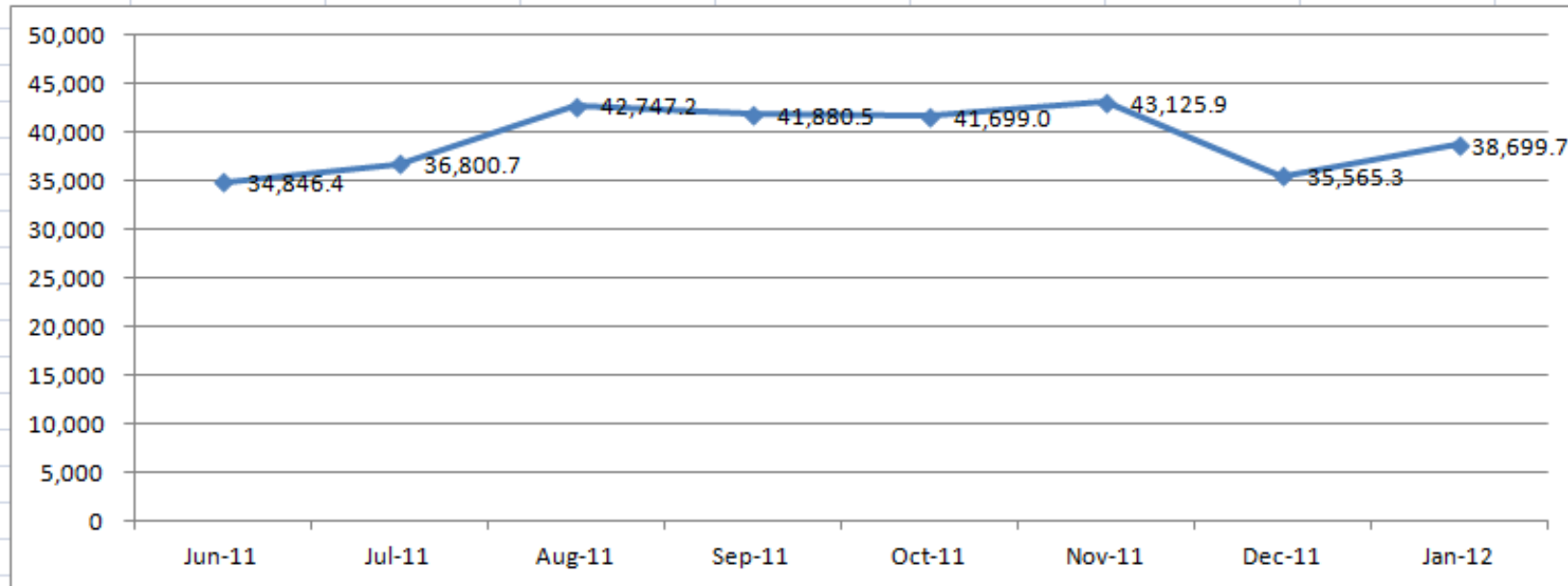
Account	Pilot Area	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12
120315	Chandgaon A	102.4	123.8	178.4	116.8	124.8	175.2	89.7	97.7
120333	Chandgaon A	205.7	316.3	398.4	327.4	223.3	438.7	244.7	287.5
120389	Chandgaon A	109.3	110.7	110.0	109.3	110.7	106.3	106.1	109.1
120420	Chandgaon A	37.2	42.1	39.9	33.2	37.0	42.4	21.2	21.0
120472	Chandgaon A	26.2	34.6	41.8	32.3	26.2	24.8	21.2	28.0
120473	Chandgaon A	226.1	267.8	352.6	151.6	36.9	43.1	163.2	114.3
120520	Chandgaon A	257.8	330.3	398.4	303.4	241.5	244.5	220.3	227.8
120587	Chandgaon A	134.5	102.6	139.4	210.9	213.9	235.2	212.1	226.0
120627	Chandgaon A	419.5	479.4	479.4	496.9	304.8	198.4	130.5	184.3
120629	Chandgaon A	81.3	119.8	138.1	123.1	104.6	139.4	73.4	78.5
120632	Chandgaon A	99.0	146.0	160.0	135.0	147.0	149.0	89.7	136.4
120633	Chandgaon A	185.9	223.7	275.8	230.5	229.5	234.5	203.9	123.5
120640	Chandgaon A	269.1	301.9	308.1	308.0	465.2	606.8	97.9	120.0
120644	Chandgaon A	57.0	27.2	182.3	146.6	130.8	145.2	106.1	109.1
120645	Chandgaon A	45.5	60.4	181.9	120.6	80.5	174.5	212.1	241.4
120653	Chandgaon A	412.6	553.8	759.4	490.8	519.5	524.5	416.1	481.0
120656	Chandgaon A	182.5	232.3	269.0	212.7	217.4	242.6	212.1	202.7
120667	Chandgaon A	239.4	370.6	458.4	323.0	308.0	330.0	81.6	250.7
120671	Chandgaon A	198.5	263.8	215.5	342.7	334.1	331.9	171.3	216.7
120674	Chandgaon A	160.6	183.2	109.4	113.4	128.8	125.2	130.5	161.1
120680	Chandgaon A	243.8	251.9	252.4	240.9	249.6	238.4	252.9	250.7
120691	Chandgaon A	491.9	559.7	434.8	813.4	732.4	631.6	538.4	578.4
120701	Chandgaon A	45.7	85.6	115.2	79.2	78.5	75.5	53.0	66.2
120712	Chandgaon A	75.4	94.6	100.0	95.4	87.5	101.5	97.9	91.8
120718	Chandgaon A	162.0	242.0	284.2	248.1	225.4	232.6	179.5	210.8
120719	Chandgaon A	107.0	42.4	22.5	92.1	66.4	40.6	21.2	31.9
120748	Chandgaon A	238.2	330.5	291.0	310.5	378.5	305.5	220.3	266.5
120762	Chandgaon A	207.9	138.4	289.4	191.9	193.3	80.7	24.5	237.8
120776	Chandgaon A	49.9	50.0	49.9	49.9	50.0	47.0	48.4	49.9
120781	Chandgaon A	242.8	475.4	560.3	430.3	531.6	538.4	399.7	446.4
120784	Chandgaon A	59.5	75.5	92.1	74.4	78.5	85.5	54.9	83.4
120785	Chandgaon A	77.0	109.0	100.3	98.9	129.1	34.2	106.6	50.9
120800	Chandgaon A	109.0	116.8	168.4	146.8	149.0	149.0	114.2	111.0
120801	Chandgaon A	204.3	207.4	274.5	264.1	261.7	330.3	277.4	333.6
120805	Chandgaon A	26.8	20.9	52.5	39.6	51.4	60.6	53.0	62.3
120810	Chandgaon A	154.8	175.2	268.7	248.1	201.2	266.8	203.9	169.9
120826	Chandgaon A	51.7	49.1	106.1	91.2	84.7	126.3	114.2	95.5
120830	Chandgaon A	386.5	311.9	541.9	572.1	501.1	452.9	334.5	493.6
120831	Chandgaon A	79.6	78.8	73.2	117.9	90.5	60.5	97.9	76.3
120866	Chandgaon A	228.6	239.3	207.7	166.7	177.2	174.8	138.7	73.9
120869	Chandgaon A	209.5	149.4	155.6	118.9	118.8	103.2	89.7	97.7
120884	Chandgaon A	21.5	21.0	21.0	24.8	39.5	31.3	30.0	21.3
120891	Chandgaon A	83.7	108.8	113.9	253.3	195.1	202.9	146.8	172.5
120895	Chandgaon A	181.0	58.9	165.4	106.7	77.5	84.5	65.3	138.6
120907	Chandgaon A	154.8	54.2	344.5	225.3	173.1	152.9	122.4	167.0
120913	Chandgaon A	366.3	244.4	184.4	177.6	196.9	228.7	203.9	193.1
120914	Chandgaon A	252.1	98.8	471.3	454.3	247.3	78.7	48.9	88.5
120947	Chandgaon A	176.6	243.7	324.5	233.8	251.7	270.3	179.5	195.4
120950	Chandgaon A	168.1	237.7	286.3	293.2	297.0	216.0	129.6	99.6
120956	Chandgaon A	37.7	67.3	99.7	48.3	36.6	107.1	106.1	256.2
120960	Chandgaon A	103.4	93.3	90.0	121.4	78.4	97.6	89.7	105.4
120977	Chandgaon A	83.2	119.8	105.8	155.4	130.8	113.2	97.9	115.0
120992	Chandgaon A	541.7	531.5	711.3	593.2	394.3	177.7	978.9	639.1
120997	Chandgaon A	100.8	108.1	142.3	125.0	136.9	157.1	122.4	93.4
121006	Chandgaon A	180.8	124.7	101.9	243.4	193.1	212.9	130.5	168.8
121010	Chandgaon A	34.3	37.5	34.8	26.6	36.5	37.5	29.4	29.9
121016	Chandgaon A	168.4	175.2	236.5	248.4	275.8	284.2	269.2	324.0
121033	Chandgaon A	176.9	197.3	151.6	115.1	66.4	26.6	21.2	175.1
121071	Chandgaon A	81.1	105.1	101.9	123.4	100.2	82.8	61.2	75.8
121081	Chandgaon A	24.7	32.7	34.9	54.3	39.6	21.3	47.5	22.8
121082	Chandgaon A	359.1	495.4	344.5	626.1	601.7	560.3	440.5	494.3
121106	Chandgaon A	94.3	146.1	184.3	140.4	147.0	169.0	155.0	166.6
121120	Chandgaon A	21.8	30.7	29.1	38.6	42.9	21.4	35.8	21.5
121123	Chandgaon A	70.6	84.0	113.8	88.0	96.8	113.4	77.5	94.9
121134	Chandgaon A	115.1	110.7	166.5	146.8	149.0	199.0	212.1	195.0
121144	Chandgaon A	323.5	372.3	540.6	429.1	451.0	469.0	367.1	315.2
121145	Chandgaon A	210.1	270.8	380.9	300.4	346.3	339.7	252.9	281.6
121146	Chandgaon A	104.8	146.0	208.4	202.6	193.2	166.8	32.6	208.7
121147	Chandgaon A	20.0	21.0	21.0	20.0	21.0	20.7	21.3	21.0
121149	Chandgaon A	76.7	54.3	78.2	76.5	67.4	47.6	57.1	90.3
121184	Chandgaon A	50.8	81.8	106.5	85.3	76.5	77.5	81.6	34.7
121204	Chandgaon A	134.7	187.8	206.2	176.0	179.2	144.8	24.5	21.8
121205	Chandgaon A	222.8	213.8	164.9	158.0	162.2	231.1	130.5	130.1
121226	Chandgaon A	388.2	238.9	683.9	450.8	283.7	540.3	383.4	318.8
121243	Chandgaon A	135.2	64.3	153.9	162.8	193.3	138.7	407.9	432.8

121270	Chandgaon A	20.1	21.1	20.9	20.0	20.9	20.1	21.2	21.0
121272	Chandgaon A	56.4	108.2	90.6	89.9	81.4	35.6	95.9	97.0
121285	Chandgaon A	325.8	511.0	559.9	589.1	450.6	459.4	285.5	304.5
121289	Chandgaon A	103.2	132.1	140.7	115.3	126.8	135.2	106.1	116.9
121314	Chandgaon A	226.7	230.8	181.6	224.9	225.4	242.6	130.5	199.8
121389	Chandgaon A	24.4	36.3	64.2	36.7	46.9	29.9	114.2	149.7
121424	Chandgaon A	22.4	23.4	32.9	22.8	20.9	20.1	31.0	23.3
121433	Chandgaon A	168.6	213.0	217.1	185.8	205.4	270.6	220.3	212.3
121444	Chandgaon A	38.6	50.1	54.4	48.1	50.5	48.9	40.8	47.9
121464	Chandgaon A	170.6	273.9	437.1	395.0	317.9	558.1	114.2	265.8
121504	Chandgaon A	85.2	103.7	61.6	169.7	96.5	173.5	114.2	111.0
121510	Chandgaon A	224.9	169.0	190.3	206.7	195.2	186.8	187.6	189.5
121511	Chandgaon A	29.8	32.6	36.2	27.2	33.2	26.8	36.7	24.5
121525	Chandgaon A	196.8	241.6	306.5	261.9	243.5	266.5	220.3	266.5
121554	Chandgaon A	190.5	253.7	229.7	202.6	217.4	222.6	122.4	167.0
121555	Chandgaon A	180.8	221.5	310.6	151.9	134.9	167.1	179.5	133.4
121602	Chandgaon A	265.5	394.8	462.3	379.0	370.4	341.6	293.7	329.5
121674	Chandgaon A	542.8	320.3	383.5	358.2	303.9	286.1	220.3	243.3
121679	Chandgaon A	38.6	47.3	58.1	55.6	83.6	47.4	38.3	41.9
121695	Chandgaon A	46.1	21.9	79.1	21.9	40.3	40.3	41.7	41.0
121705	Chandgaon A	192.4	294.6	344.1	267.3	291.9	328.1	220.3	282.0
121714	Chandgaon A	92.0	95.0	95.0	92.0	95.0	92.4	97.9	95.7
121756	Chandgaon A	275.0	280.8	312.3	341.9	360.3	379.7	163.2	191.7
121770	Chandgaon A	277.7	318.1	233.2	440.6	333.9	296.1	203.9	216.4
121786	Chandgaon A	51.6	44.5	23.5	92.0	70.4	27.6	77.5	52.3
121816	Chandgaon A	20.6	21.0	21.0	46.1	25.8	20.8	21.3	21.0
121819	Chandgaon A	100.7	104.0	104.0	100.7	41.9	33.2	24.5	32.6
121844	Chandgaon A	20.0	21.0	21.0	20.0	21.0	20.7	21.3	21.0
121878	Chandgaon A	281.4	227.4	582.9	409.7	481.3	498.7	326.3	422.1
121948	Chandgaon A	218.3	205.8	222.6	235.6	217.4	310.6	252.9	250.7
121986	Chandgaon A	258.1	348.4	394.2	349.4	382.5	455.5	301.8	339.1
121987	Chandgaon A	302.5	576.6	454.5	319.4	334.2	345.8	277.4	217.5
121988	Chandgaon A	111.2	118.8	120.0	111.2	118.8	113.2	116.3	116.4
122005	Chandgaon A	123.1	153.3	143.4	131.3	155.0	171.0	122.4	167.0
122012	Chandgaon A	26.0	22.0	44.5	33.3	42.3	45.7	39.2	39.8
122031	Chandgaon A	65.4	75.7	136.3	94.6	68.8	97.6	106.1	109.1
122044	Chandgaon A	95.4	98.5	94.5	94.2	98.8	95.2	97.9	98.8
122062	Chandgaon A	91.6	76.5	61.9	67.6	94.6	109.4	81.6	95.8
122063	Chandgaon A	182.7	208.4	199.4	262.2	241.5	254.5	171.3	216.7
122080	Chandgaon A	36.5	41.3	42.2	38.5	57.6	72.0	61.2	68.0
122082	Chandgaon A	20.1	20.9	21.0	20.1	20.9	20.1	21.2	97.7
122125	Chandgaon A	201.3	173.1	113.5	283.4	243.4	212.6	28.6	238.7
122140	Chandgaon A	285.7	347.1	357.8	309.1	318.1	341.9	261.1	291.2
122242	Chandgaon A	21.5	31.7	30.1	20.3	67.4	22.2	30.0	21.3
122256	Chandgaon A	126.0	100.4	109.8	84.2	104.3	101.3	71.0	76.4
122350	Chandgaon A	88.5	89.3	87.6	84.1	87.0	83.8	86.5	148.8
122356	Chandgaon A	165.7	93.0	166.5	130.5	185.3	168.7	122.4	151.5
122420	Chandgaon A	49.9	45.1	57.1	51.6	58.4	56.6	32.6	38.3
122512	Chandgaon A	271.9	280.9	277.3	269.3	279.8	274.2	277.4	279.4
122562	Chandgaon A	35.4	176.4	125.8	83.4	94.4	114.0	89.7	89.9
122621	Chandgaon A	399.4	416.2	413.8	400.0	410.6	399.4	416.1	411.4
122626	Chandgaon A	252.0	209.3	369.4	383.4	326.0	380.0	244.7	287.5
122647	Chandgaon A	178.9	184.9	184.9	178.9	246.3	243.3	171.3	193.5
122686	Chandgaon A	109.7	93.6	159.7	152.7	110.6	199.4	97.9	138.2
122723	Chandgaon A	320.8	459.2	564.5	472.3	509.4	500.6	448.7	426.5
122763	Chandgaon A	164.8	112.6	87.9	368.5	265.4	232.6	106.1	202.0
122789	Chandgaon A	109.5	127.4	155.6	126.9	120.8	153.2	89.7	151.9
122808	Chandgaon A	122.8	151.0	176.1	138.8	163.1	152.9	97.9	115.0
122847	Chandgaon A	188.5	229.5	280.3	224.1	259.7	262.3	187.6	166.2
122931	Chandgaon A	208.4	221.0	200.8	214.2	221.4	262.6	171.3	193.5
123019	Chandgaon A	56.7	68.1	94.4	79.4	83.5	76.5	36.7	50.9
123044	Chandgaon A	200.6	209.4	210.0	200.6	209.4	200.6	212.1	210.5
123048	Chandgaon A	20.1	20.9	21.0	20.1	20.9	20.1	21.2	21.0
123054	Chandgaon A	212.3	272.8	331.8	265.5	259.7	240.3	163.2	276.8
123306	Chandgaon A	329.8	341.9	338.7	329.5	340.2	325.8	334.5	338.8
123319	Chandgaon A	214.2	257.7	310.3	245.9	215.4	270.6	228.4	237.4
123344	Chandgaon A	133.1	149.5	150.0	207.8	239.3	62.7	193.8	151.4
123349	Chandgaon A	351.4	447.3	191.6	389.1	380.3	379.7	310.0	348.7
123362	Chandgaon A	232.1	328.5	421.9	331.6	352.3	369.7	285.5	320.0
123366	Chandgaon A	190.2	179.2	252.6	236.3	207.3	258.7	228.4	260.6
123370	Chandgaon A	23.8	49.1	50.0	20.9	21.0	23.7	21.3	21.0
123377	Chandgaon A	36.0	28.8	56.6	39.8	43.3	53.7	48.9	53.6
123378	Chandgaon A	180.5	251.7	245.8	270.5	241.5	264.5	228.4	280.0
123435	Chandgaon A	43.1	20.9	21.0	20.1	165.3	358.7	155.0	166.6
123457	Chandgaon A	115.1	110.7	174.5	140.8	138.9	177.1	155.0	135.6
123499	Chandgaon A	20.1	28.2	22.7	20.1	20.9	20.1	22.8	23.7
123590	Chandgaon A	42.2	21.8	21.0	20.0	21.0	20.7	21.3	21.0
123620	Chandgaon A	557.8	277.4	655.4	737.7	776.6	1,001.0	375.3	417.6
123679	Chandgaon A	20.0	21.0	21.0	20.0	21.0	20.7	21.3	21.0
123710	Chandgaon A	184.4	235.6	322.6	225.8	281.9	328.1	236.6	208.3

123767	Chandgaon A	43.6	68.3	83.3	64.4	76.5	85.5	62.8	39.7
123862	Chandgaon A	40.0	23.5	32.3	22.8	28.2	55.8	44.9	75.9
123996	Chandgaon A	197.0	300.6	311.4	212.0	82.4	160.6	33.4	139.2
124102	Chandgaon A	472.2	344.4	92.3	119.7	173.2	354.8	342.6	379.3
124201	Chandgaon A	189.7	199.2	240.3	233.0	226.3	219.1	228.4	229.6
124231	Chandgaon A	206.5	255.5	214.5	208.0	243.6	188.4	163.2	207.2
124313	Chandgaon A	198.7	221.0	192.6	196.4	201.3	238.7	171.3	209.0
124381	Chandgaon A	258.3	215.8	271.7	246.5	257.7	250.3	179.5	195.4
124459	Chandgaon A	321.3	197.9	668.4	471.6	469.1	452.9	342.6	371.6
124536	Chandgaon A	236.3	304.1	142.6	523.4	400.2	325.8	163.2	114.3
124562	Chandgaon A	53.3	79.6	101.4	85.6	97.0	99.4	83.3	66.7
125066	Chandgaon A	400.0	265.5	407.4	407.1	386.5	393.5	416.1	411.4
125130	Chandgaon A	51.9	73.3	82.2	72.1	78.5	75.5	57.1	71.0
125312	Chandgaon A	20.1	21.1	20.9	20.6	221.7	251.8	179.5	203.1
125329	Chandgaon A	22.8	36.3	44.0	36.7	37.6	38.4	29.4	33.7
125364	Chandgaon A	229.9	300.6	385.0	292.4	312.1	331.9	212.1	218.2
125486	Chandgaon A	221.7	355.7	234.2	162.1	353.7	121.6	251.9	163.0
125539	Chandgaon A	68.5	84.0	83.2	82.3	94.8	108.8	89.7	97.7
125713	Chandgaon A	20.1	20.9	21.0	20.1	20.9	20.1	21.2	21.0
125793	Chandgaon A	154.8	134.8	130.0	145.2	126.8	153.2	21.2	97.7
125883	Chandgaon A	20.2	21.0	447.6	122.5	20.9	54.1	600.6	996.0
126014	Chandgaon A	180.8	181.2	236.5	232.4	158.9	287.1	220.3	204.6
126032	Chandgaon A	318.0	400.8	325.2	306.1	562.0	540.0	310.0	302.3
126182	Chandgaon A	430.6	428.8	325.2	642.1	565.4	660.6	579.2	665.0
126198	Chandgaon A	244.8	181.0	151.9	133.0	171.2	254.8	212.1	195.0
126256	Chandgaon A	20.1	20.9	21.0	20.1	20.9	20.1	32.6	23.6
126268	Chandgaon A	360.0	161.5	114.2	811.4	681.9	516.1	375.3	433.1
126283	Chandgaon A	351.1	316.0	449.1	370.9	392.6	487.4	375.3	378.9
126346	Chandgaon A	20.1	20.9	21.0	24.1	29.2	21.8	21.2	21.0
126381	Chandgaon A	41.2	55.6	51.9	53.7	47.3	52.7	33.4	30.8
126694	Chandgaon A	20.1	20.9	24.2	20.8	20.9	24.1	21.2	28.0
126775	Chandgaon A	453.5	580.0	273.2	354.1	410.4	392.3	490.0	620.0
126846	Chandgaon A	327.1	390.6	514.8	376.5	390.6	487.4	318.2	327.3
126872	Chandgaon A	36.1	40.3	44.0	28.7	61.5	55.5	47.3	57.1
127045	Chandgaon A	91.2	93.6	123.2	113.2	110.7	91.3	57.1	55.5
127054	Chandgaon A	31.9	21.0	28.7	20.3	36.5	21.2	31.0	21.3
127056	Chandgaon A	22.3	21.0	21.0	20.0	21.0	20.7	21.3	21.0
127057	Chandgaon A	24.2	21.0	21.0	21.0	29.7	21.0	21.3	21.0
127082	Chandgaon A	20.7	29.7	21.3	20.0	21.0	20.7	21.3	21.0
127309	Chandgaon A	24.1	37.3	50.5	70.3	87.6	157.4	155.0	127.9
127443	Chandgaon A	333.2	441.3	461.6	457.1	446.8	405.2	261.1	337.7
127542	Chandgaon A	215.6	165.0	208.4	162.6	191.3	238.7	163.2	129.7
127590	Chandgaon A	544.7	332.7	366.0	632.7	946.5	1,293.5	1,468.4	1,183.2
127910	Chandgaon A	22.9	21.0	21.0	29.7	21.3	20.7	21.3	21.0
127918	Chandgaon A	20.8	20.9	21.0	20.1	294.3	174.2	135.0	138.9
300140	Chandgaon A	550.0	600.0	550.0	700.0	800.0	420.0	650.0	650.0
320363	Chandgaon A	20.0	21.0	21.0	23.0	22.0	20.0	21.0	21.0
320364	Chandgaon A	120.0	50.0	60.0	90.0	100.0	130.0	120.0	120.0
320425	Chandgaon A	70.0	60.0	60.0	70.0	75.0	70.0	70.0	70.0
320427	Chandgaon A	330.0	300.0	310.0	330.0	320.0	380.0	370.0	400.0
320444	Chandgaon A	209.0	216.0	216.0	209.0	200.0	190.0	160.0	150.0
320449	Chandgaon A	950.0	680.0	630.0	700.0	700.0	700.0	800.0	700.0
320455	Chandgaon A	74.0	21.0	85.0	140.0	150.0	150.0	150.0	150.0
320475	Chandgaon A	110.0	100.0	110.0	120.0	130.0	110.0	110.0	110.0
320505	Chandgaon A	96.0	60.0	42.0	43.0	27.0	48.0	80.0	75.0

4.2.2 Seasonal fluctuation in daily water consumption

Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Average
34,846.4	36,800.7	42,747.2	41,880.5	41,699.0	43,125.9	35,565.3	38,699.7	39,420.6
0.88	0.93	1.08	1.06	1.06	1.09	0.90	0.98	1.00

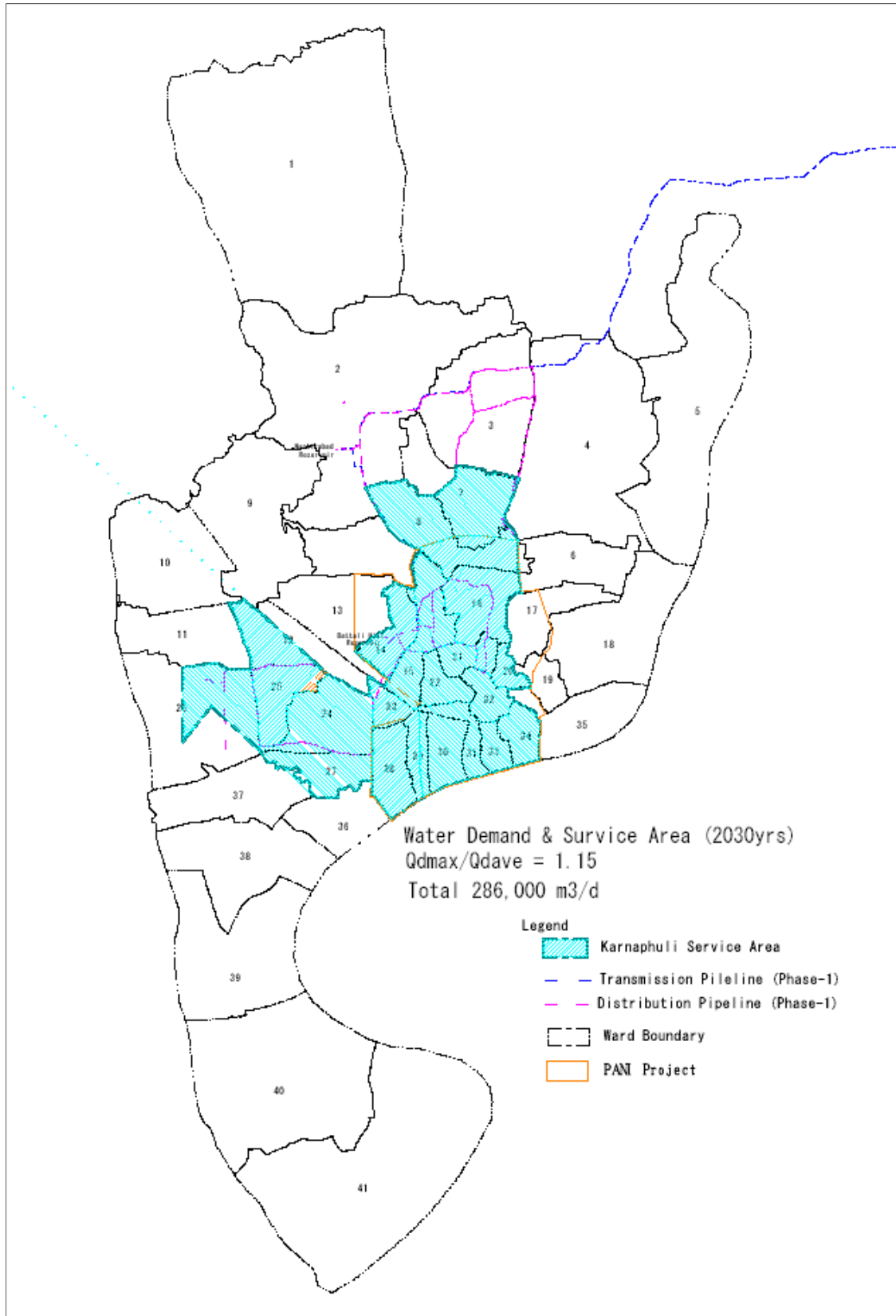


CHAPTER 5

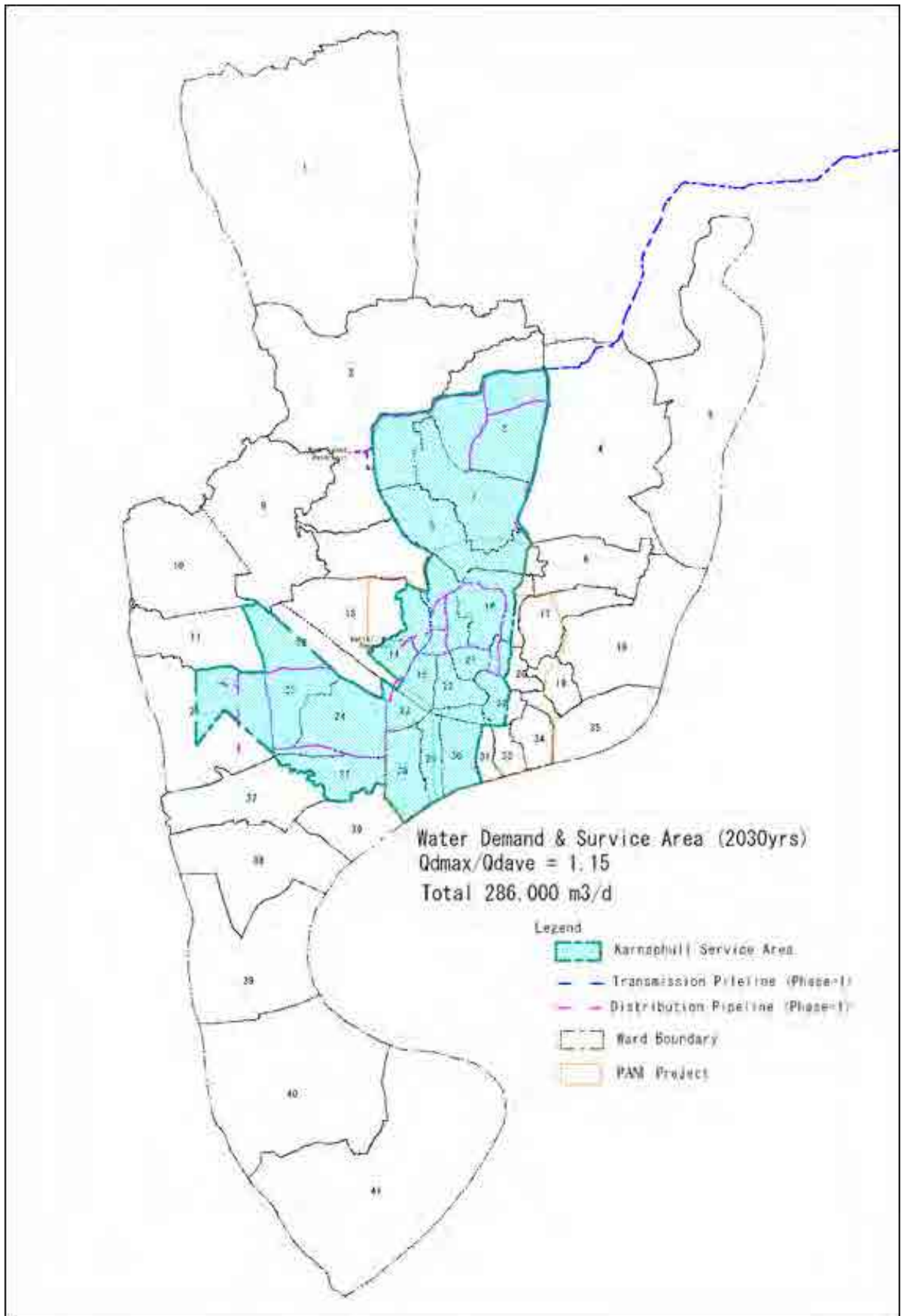
ESTABLISHMENT OF KARNAPHULI SERVICE AREA

CHAPTER 5 ESTABLISHMENT OF KARNAPHULI SERVICE AREA



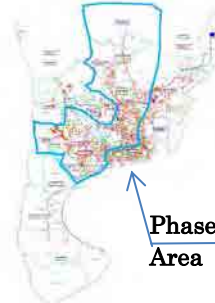
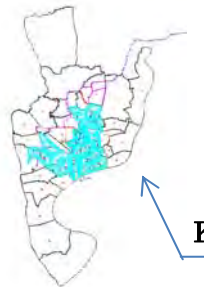
5.2.1 (a) KSA (Case-1)



5.2.1 (b) KSA (Case-2)



5.3.1 Comparison of Basic Conditions among SAPROF, Phase 1 Project and Phase 2 Projects

	SAPROF		KWSP (Phase 1)	KWSP (Phase 2)
	Phase 1	Phase 2		
Target Year	2010	2020	2010	2030
Water Source (m ³ /d)	Karnaphuli WTP = 136,000 Madunaght WTP = 45,500 Total = 181,500	Karnaphuli WTP = 272,000 Madunaght WTP = 45,500 Total = 317,500	Karnaphuli WTP = 143,000 Madunaght WTP = 45,500 Total = 188,500	Karnaphuli WTP = 286,000
Service Area	CCC area and its surrounding area	CCC area and its surrounding area	CCC area and its surrounding area	Priority area (KSA)
				
Major Facilities				
1) Conveyance Pipe	DN 1200mm	DN1200mm	DN1200mm	DN1200mm
2) Transmission Pipe	DN 1200mm	DN1200mm	DN1200mm	DN1200mm
3) Reservoir and Elevated Tank	3no. (2R + 1ET) -Nashirabad Reservoir (17,500m ³) and Elevated Tank (1,750m ³) -Battali Hill Reservoir=27,300m ³	8no. (4R + 4ET) -Nashirabad Reservoir (17,500m ³) and Elevated Tank (1,750m ³) -Battali Hill Reservoir =27,300m ³ -Salimpur (Reservoir + E.T) -Halishahar (Reservoir + E/T) -Kulshi E.T	3no. (2R + 1ET) -Nashirabad Reservoir (26,300m ³) and Elevated Tank (2,200m ³) -Battali Hill Reservoir =8,500m ³	5no (3R + 2ET) -Nashirabad Reservoir (26,300m ³ +24,800m ³) and Elevated Tank (2,200m ³) -Battali Hill Reservoir =8,500m ³ - Halishahar E.T= 2,400m ³
4) Booster P.S	Kulshi (rehabilitation)	-	Kulshi (rehabilitation)	-
Distribution System	Use existing distribution network (connected by main distribution pipeline)		Use existing distribution network (connected by main distribution pipeline)	All distribution pipeline are constructed, establishing Sectors and DMAs

Note) R; Reservoir, ET; Elevated Tank

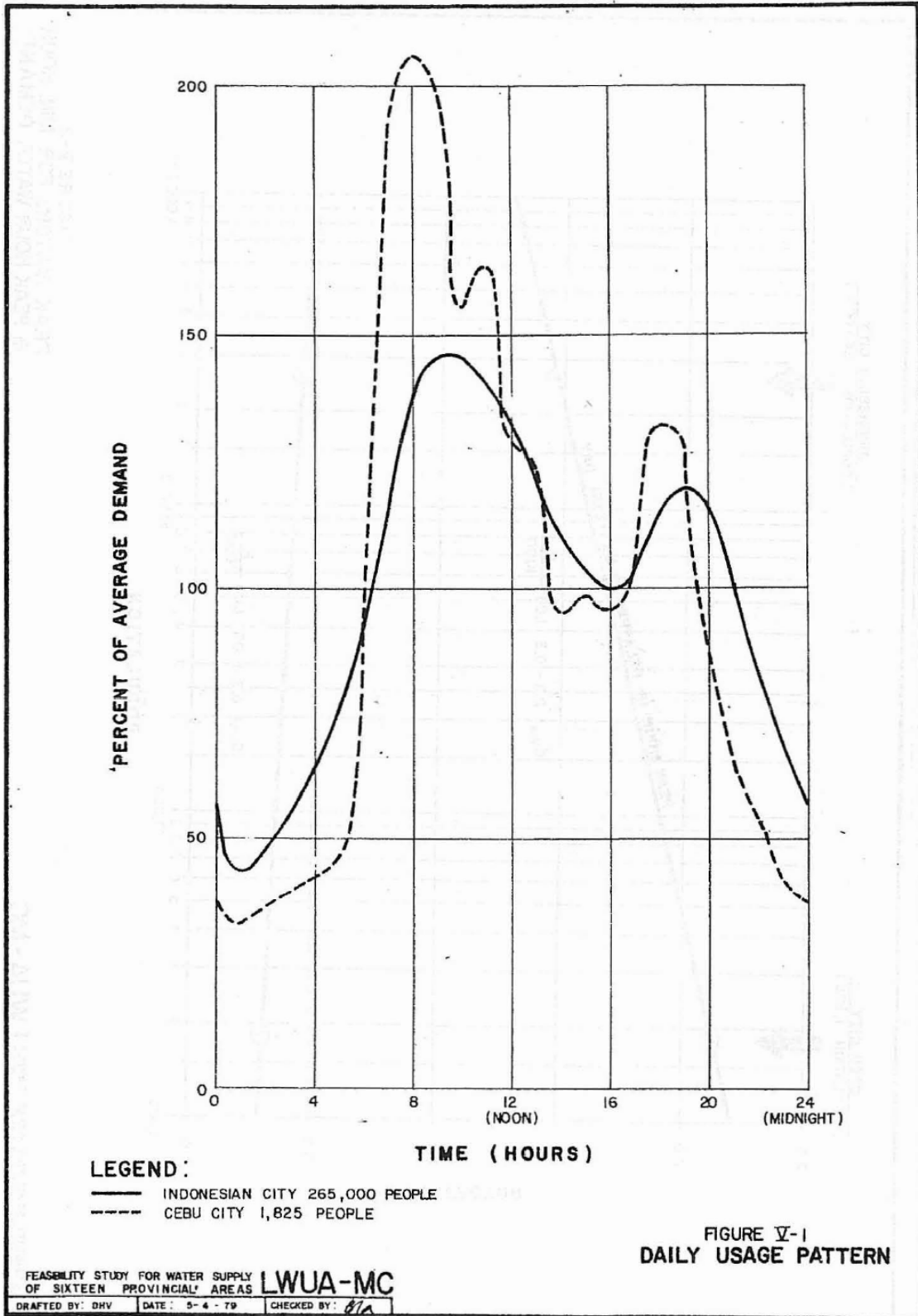
5.3.2 Conditions and Events from SAPROF to KWSP2 with reference to the Change of Service Area to be covered

Project	Target Year	Service Area	Water Source/Construction of Distribution network	Construction Plan
SAPROF (prepared in 2005)	Phase 1: 2010	Service area covers entire CCC area, which is divided into two by provision of different water source. (1) Western part of the city (hilly area including KSA) (2) Eastern part of the city	KWSP 1 & Madunaghat WTPs Mohara & Kalurghat WYPs	- Plan of Madunaghat Phase 1 WTP - Expansion Plan of Mohara WTP
	Phase 2: 2020	(1) Western part of the city: Partial increase provided by additional supply from KWSP 2 (2) Eastern part of the city: Partial decrease, but almost same area as Phase 1	KWSP 1 & 2 and Madunaghat WTPs Mohara & Kalurghat WTPs	- Plan of KWSP 1& 2 and Madunaghat WTPs (Concerned projects were not decided) - Expansion Plan of Mohara WTP
KWSP 1	2010 (D/D started on May,2008)	The part of western service area of the city in SAPROF including highly populated and Haliashahar areas. The area along western seashore is planned for next phase project.	- KWSP 1 and Madunaghat WTPs (same as Phase 1 SAPROF) - Construct main pipelines to connect to existing distribution network	-In 2008, Construction of Madunaghat Phase 1WTPs was planned financed by Italy (to be constructed in 2015), but the plan was canceled. Then, WB succeeded the project after project appraisal on May 2010. -Technical assistance by JICA (PANT) started in 2010.
KWSP 2	2030 (Preparatory Survey started on May 2012)	The KSA was identified to supply water from KWSP 1&2 WTPs, because the urgency to construct distribution pipelines to connect to main pipelines to be constructed by KWSP 1 and the delay of construction of Madunaghat WTP. The KSA is reduced from that in	-KWSP 1 & 2 WTPs -All distribution pipelines are to be newly constructed.	-Construction plan for Madunaghat WTP was postponed for long time -KSA was determined to establish self-contained water supply system.

CHAPTER 6
DISTRIBUTION SYSTEM

CHAPTER 6 DISTRIBUTION SYSTEM

6.2.1 Fluctuation Pattern of Hourly Water Use in Cirebon City, Indonesia and Philippines



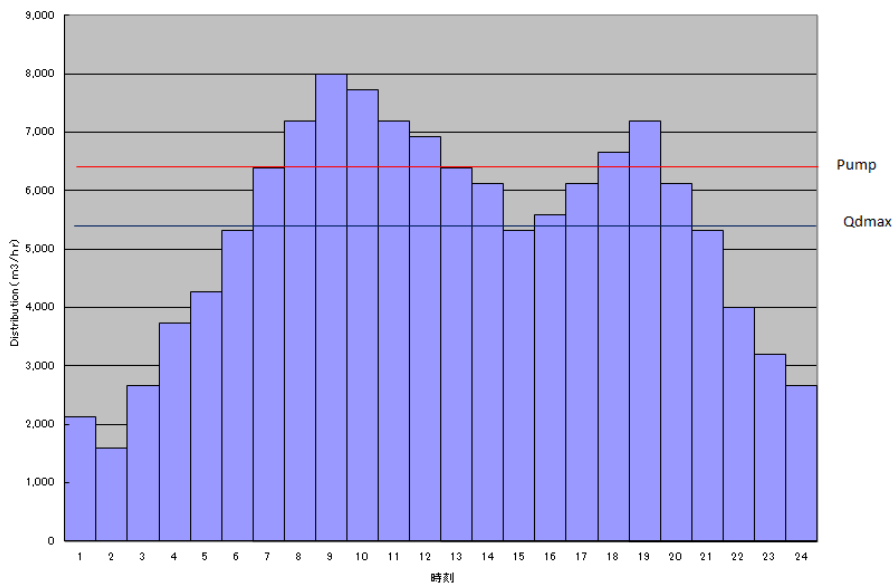
6.2.2 Calculation of Battali Hill Reservoir

Calculation of Reservoir Volume (Battali Hill)

1 Daily Maximum Demand		128,000 m ³ /d
2 Hourly average distribution		
128,000 m ³ /d ÷ 24 hr/d =		5,330 m ³ /hr
3 Pump	$\frac{1.15}{1.15} = 1.2$	6,130 m ³ /hr

Hourly fluctuation and Distribution

Hr	Fluctuation	WD	Accum. WD	Hourly average	Insufficient	Cumulative	Actual pump	Balance	Reserved	Number of
		(m ³ /hr)	Σ①	distribution	Volume	Volume	rate	③-①	Water	
		①		②	②-①	Σ(②-①)	③		Σ(③-①)	Operation
1	0.400	2,132	2,132	6,130	0	0	6,130	3,998	3,998	3
2	0.300	1,599	3,731	6,130	0	0	4,090	2,491	6,489	2
3	0.500	2,665	6,396	6,130	0	0	4,090	1,425	7,914	2
4	0.700	3,731	10,127	6,130	0	0	3,070	-661	7,253	1.5
5	0.800	4,264	14,391	6,130	0	0	4,090	-174	7,079	2
6	1.000	5,330	19,721	6,130	0	0	6,130	800	7,879	3
7	1.200	6,396	26,117	6,130	266	266	6,130	-266	7,613	3
8	1.350	7,196	33,313	6,130	1,066	1,332	6,130	-1,066	6,548	3
9	1.500	7,995	41,308	6,130	1,865	3,197	6,130	-1,865	4,683	3
10	1.450	7,729	49,036	6,130	1,599	4,795	6,130	-1,599	3,084	3
11	1.350	7,196	56,232	6,130	1,066	5,861	6,130	-1,066	2,019	3
12	1.300	6,929	63,161	6,130	799	6,660	6,130	-799	1,220	3
13	1.200	6,396	69,557	6,130	266	6,926	6,130	-266	954	3
14	1.150	6,130	75,686	6,130	0	6,926	6,130	1	954	3
15	1.000	5,330	81,016	6,130	0	6,926	6,130	800	1,754	3
16	1.050	5,597	86,613	6,130	0	6,926	6,130	534	2,288	3
17	1.150	6,130	92,742	6,130	0	6,926	6,130	1	2,288	3
18	1.250	6,663	99,405	6,130	533	7,458	6,130	-533	1,756	3
19	1.350	7,196	106,600	6,130	1,066	8,524	6,130	-1,066	690	3
20	1.150	6,130	112,730	6,130	0	8,524	6,130	1	691	3
21	1.000	5,330	118,060	6,130	0	8,524	6,130	800	1,491	3
22	0.750	3,998	122,057	6,130	0	8,524	3,070	-928	563	1.5
23	0.600	3,198	125,255	6,130	0	8,524	3,070	-128	435	1.5
24	0.500	2,665	127,920	6,130	0	8,524	2,250	-415	20	1.1
計	24.000	127,920			1.6	8,500	127,940			
		≒ 128,000				Volume (Phase-1) =	8,500			



CHAPTER 7

PRELIMINARY DESIGN OF THE WATER SUPPLY FACILITIES

CHAPTER 7 PRELIMINARY DESIGN OF THE WATER SUPPLY FACILITIES

7.7.1 Water Quality Test

Conditions on river water quality examination of Karnaphuli River near intake point are summarized in Table 7.5.1 (a)

Table 7.5.1 (a) Conditions for Water Quality Test

Item	Conditions	Remarks
Sampling Period	July 17 th to Sep. 30 th (Normally every Sunday, 10:00 – 14:00)	Total 15 times of sampling was executed
Sampling Point	3 points (right side, center line and left side of the river) just upstream of Godown Bridge	See Figure 7.5.1 (a) and 7.5.1 (b)
Parameter to be analyzed	<ul style="list-style-type: none"> • Turbidity • Electro-conductivity • water temperature 	Turbidity and EC are measured at Mohara WTP Laboratory
Other meteorological data	<ul style="list-style-type: none"> • rain condition of sampling day and a few days before sampling day • Tide 	

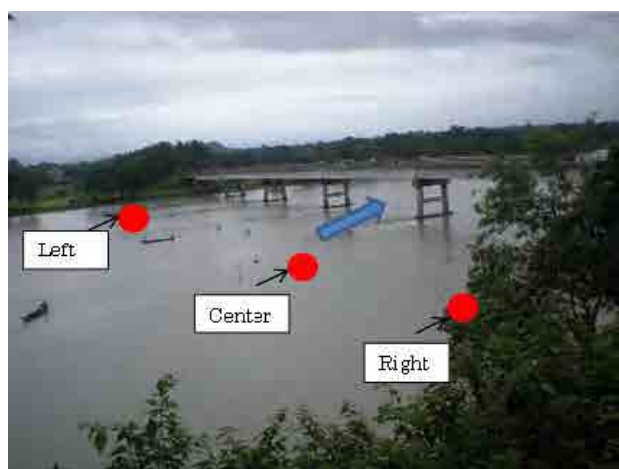


Figure 7.5.1 (a) Sampling Points



Figure 7.5.1 (b) Collected Samples

Water Quality Test results are summarized in Table 7.5.1 (b) to 7.5.1 (d) and the results of turbidity are presented in figure 7.5.1 (c). It is noted that turbidity in right side is much higher than that in left side only on June.24. About 3 km upstream of the intake point, a tributary joins to the main river at the right bank side. Turbidity of this tributary seemed to have affected to the main river by the heavy rain. This phenomenon occurred only in very heavy rain day, while other data show that turbidity is not different by the location of sampling point, right, left and center, in no-rain or not-heavy rainy days.

From the examination results, it is concluded that turbidity goes up over 200 during heavy rain, especially in case that rainy days have continued, while rain fall only in the sampling day does not affect to the turbidity so much.

Table 7.5.1 (b) Water Quality Test Results (1/3)

Sampling Date		17-Jun	24-Jun			28-Jun	1-Jul			8-Jul			17-Jul		
Sampling Time		10-40 am	1-10 pm			1-50 pm	11-00 am			10-40 am			11-00 am		
Rain Condition	Sampling Day	No Rain	Rain			No Rain	No Rain			No Rain			No Rain		
	FewDay Ago	Rain	Heavy Rain			Heavy Rain	Heavy Rain			Rain			Rain		
Tidal Condition		Medium	High			Medium	Medium			Low			Low		
Location		Center	Right	Center	Left	Center	Right	Center	Left	Right	Center	Left	Right	Center	Left
Turbidity (NTU)		80.0	380.0	290.0	220.0	124.0	200.0	186.0	220.0	92.0	87.0	80.0	40.0	44.0	50.0
Electro Conductivity (EC) μ S/cm		112.3	94.3	81.5	84.4	119.9	103.1	104.3	104.2	100.0	97.0	95.2	94.2	92.2	90.6
Water Temperature (0 $^{\circ}$)		27.0	29.0	28.5	29.0	30.0	24.6	24.4	26.4	29.3	29.1	29.3	28.5	28.0	28.0
Date of Test		17-Jun	27-Jun			28-Jun	1-Jul			8-Jul			17-Jul		

Table 7.5.1 (c) Water Quality Test Results (2/3)

Sampling Date		22-Jul			29-Jul			5-Aug			12-Aug			4-Sep		
Sampling Time		10-40 am			11-00 am			10-30 am			10-40 am			11-30 am		
Rain Condition	Sampling Day	No Rain			No Rain			No Rain			Rain			Rain		
	FewDay Ago	Rain			Rain			Rain			Rain			No Rain		
Tidal Condition		Low			Low			Low			High			Low		
Location		Right	Center	Left	Right	Center	Left	Right	Center	Left	Right	Center	Left	Right	Center	Left
Turbidity (NTU)		36.0	32.0	43.0	22.0	24.0	34.0	16.0	18.0	20.0	190.0	230.0	180.0	80.0	40.0	60.0
Electro Conductivity (EC) μ S/cm		92.0	106.0	90.0	95.4	86.8	93.4	93.9	88.9	96.4	105.8	91.0	93.8	107.7	108.9	105.9
Water Temperature		28.5	28.5	28.5	28.5	28.5	28.0	28.6	28.4	28.4	25.9	26.0	25.9	27.5	28.3	28.0
Date of Test		22-Jul			29-Jul			5-Aug			12-Aug			4-Sep		

Table 7.5.1 (d) Water Quality Test Results (3/3)

Sampling Date		9-Sep			16-Sep			24-Sep			30-Sep		
Sampling Time		10-50 am			10-30 am			10-40 am			10-30 am		
Rain Condition	Sampling Day	No Rain			No Rain			Rain			No Rain		
	FewDay Ago	No Rain			No Rain			No Rain			No Rain		
Tidal Condition		Low			Low			Low			Low		
Location		Right	Center	Left	Right	Center	Left	Right	Center	Left	Right	Center	Left
Turbidity (NTU)		50.0	35.0	40.0	24.0	24.0	25.0	22.0	18.0	20.0	20.0	18.0	18.0
Electro Conductivity (EC) μ S/cm		91.0	88.2	72.0	103.5	99.9	97.9	108.4	103.5	103.1	101.3	101.5	102.1
Water Temperature		28.5	27.5	28.3	28.1	28.3	28.5	28.6	28.4	28.3	27.8	28.0	28.5
Date of Test		9-Sep			16-Sep			24-Sep			30-Sep		

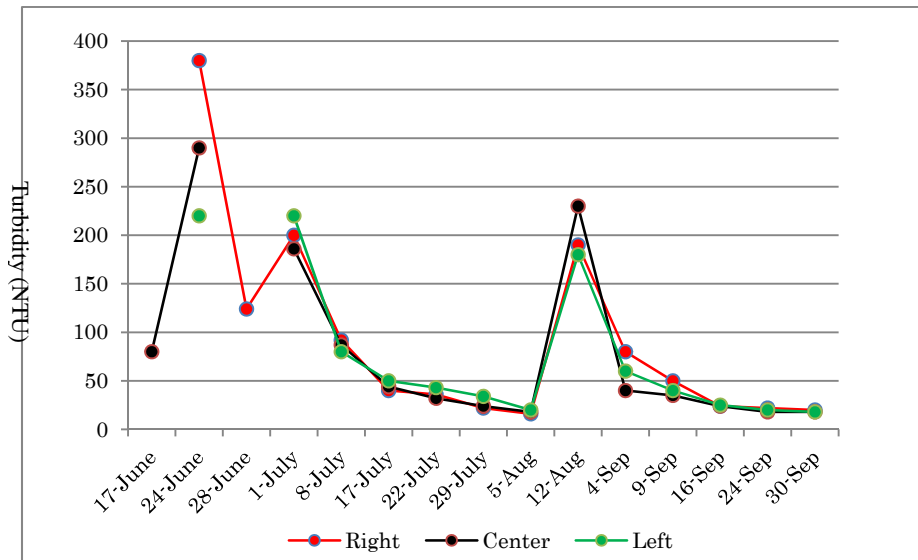
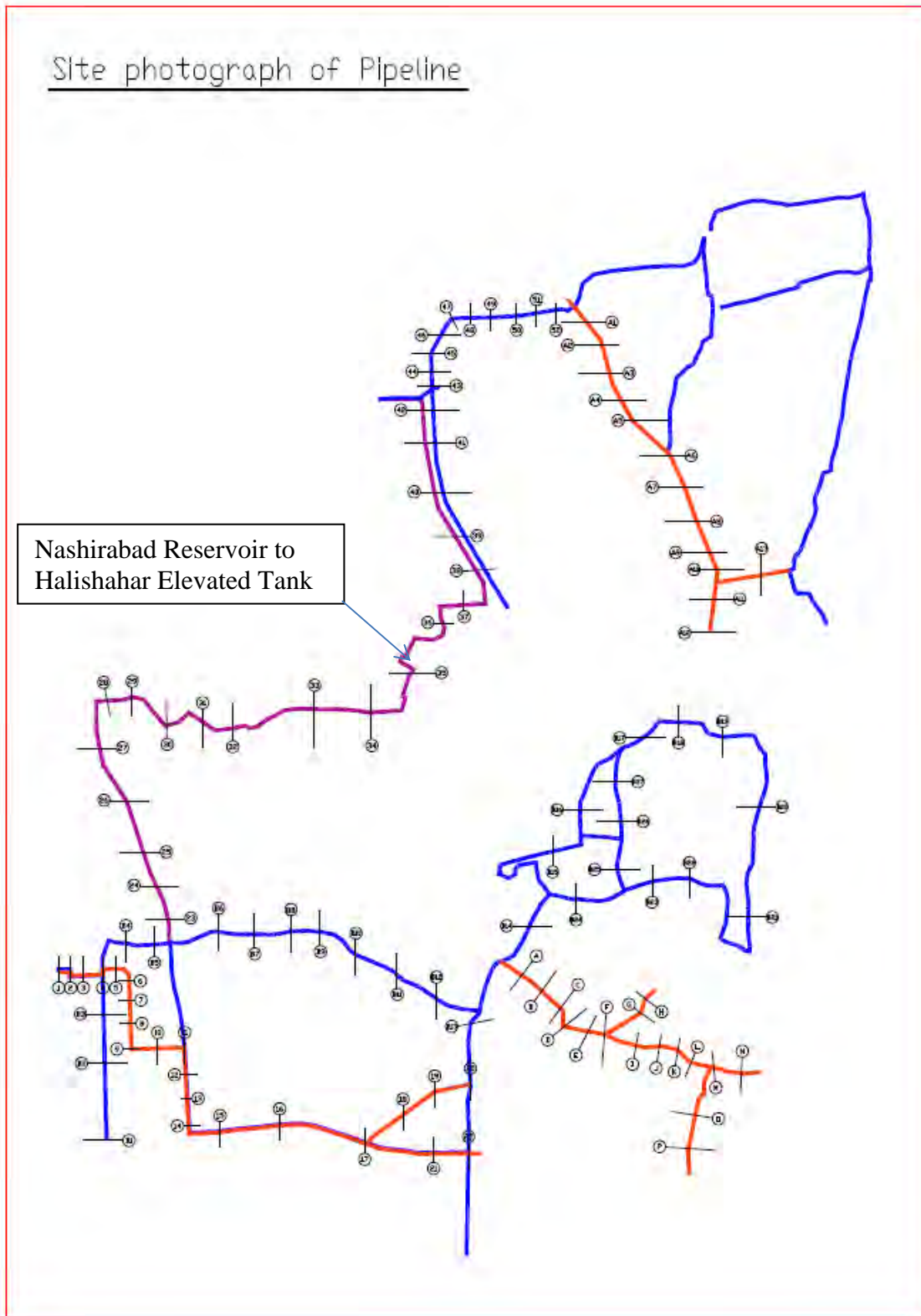


Figure 7.5.1 (c) Turbidity Test Results

The turbidity of Karnaphuli River is much lower than that of Halda River from which Mohara WTP takes water. Pre-sedimentation basin is used at the WTP intermittently during rainy season. In this regard, pre-sedimentation basin designed for Phase 1 can be commonly used for both Phase 1 and 2.

7.8.1 Route Conditions from Nashirabad Reservoir to Halishahar Elevated Tank



Chittagong Polytechnic Institute to Bayezid Bostami main road up to the KDS steel. No. of photographs have been taken on Purple colour pipe line route from 23 to 42.

It is also mention here that Alongkar circle RHD main road to A.K.Khan road circle, road pavement width is (15.00m+15.00m) & road shoulder is (3.00m+ 3.00m) approximately. i.e, Right of Way is 36.00m approximately.

From A .K .Khan road circle to USTC(University of Science & Technology, Chittagong) Chittagong Veterinary & Animal Science university gate to Rail gate, pavement width is 10.00m & shoulder is (2.00m+2.00m) approximately. So total Right of Way is 14.00m approximately.

Start from Rail gate to Chittagong Polytechnic Institute to Bayezid Bostami main road, pavement width is 6.00m & shoulder is (2.00m+2.00m) approximately. So total Right of Way is 10.00m approximately

From Bayezid Bostami main road up to the KDS steel. , pavement width is (6.00m+6.00m) & road shoulder is (3.00m+ 3.00m) approximately. i.e, Right of Way is 18.00m approximately.

Purple colour pipe line route photograph no. is 23 to 42 given below:



Photo-23



Photo-24



Photo-25



Photo-26



Photo-27



Photo-28



Photo-29



Photo-30



Photo-31



Photo-32



Photo-33



Photo-34



Photo-35



Photo-36



Photo-37

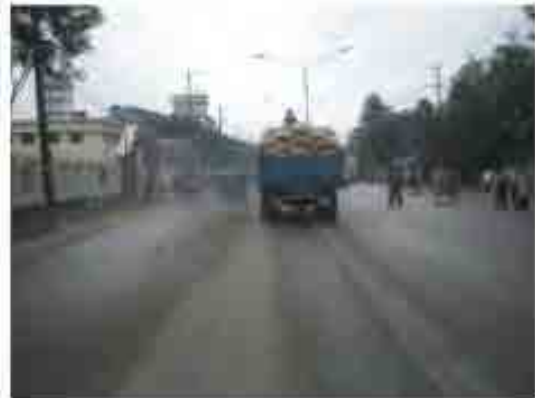


Photo-38



Photo-39



Photo-40



Photo-41



Photo-42

CHAPTER 8

CONSTRUCTION PLAN OF WATER SUPPLY FACILITIES

CHAPTER 8 CONSTRUCTION PLAN OF WATER SUPPLY FACILITIES

8.5.3 Manner of Connection of Pipes between CWASA Pipe and Private Pipe

