JAPAN INTERNATIONAL COOPERATION AGENCY
PEOPLE'S REPUBLIC OF BANGLADESH
LOCAL GOVERNMENT, RURAL DEVELOPMENT
AND COOPERATIVES (LGRD)

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
BALANCING, MODERNIZING, REHABILITATION
AND EXPANSION
OF
CHANDNIGHAT WATER TREATMENT PLANT

DECEMBER 1992

NIPPON JOGESUIDO SEKKEI CO., LTD.

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PREFACE

In Response to a request from the Government of the People's Republic of Bangladesh, the Government of Japan decided to conduct a basic design study on the project for Balancing, Modernizing, Rehabilitation and Expansion of Chandnighat Water Treatment Plant and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Bangladesh a study team headed by Mr. Seiyu Kamata, Head of Planning Research Section, Yokosuka City Water Bureau and constituted by members of Nippon Jogesuido Sekkei Co., Ltd., from April 9 to June 7, 1992.

The team held discussions with the officials concerned of the Government of Bangladesh, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Bangladesh in order to discuss a draft report and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the People's Republic of Bangladesh for their close cooperation extended to the teams.

December, 1992

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency

December, 1992

Mr. Kensuke Yanagiya
President
Japan International Cooperation Agency
Tokyo, Japan

Letter of Transmittal

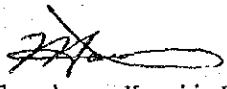
We are pleased to submit to you the basic design study report on the Project for Balancing, Modernizing, Rehabilitation and Expansion of Chandnighat Water Treatment Plant in People's Republic of Bangladesh.

This study has been made by Nippon Jogesuido Sekkei Co., Ltd., based on a contract with JICA, from March 31, 1992 to December 15, 1992. Throughout the study, we have taken into full consideration of the present situation in Bangladesh, and have planned the most appropriate project in the scheme of Japan's grant aid.

We wish to take this opportunity to express our sincere gratitude to the officials concerned of JICA, the Ministry of Foreign Affairs, the Ministry of Health and Welfare and the Bangladesh Embassy in Japan. We also wish to express our deep gratitude to the officials concerned of the Local Government, Rural Development and Cooperatives (LGRD) and the Dhaka Water Supply and Sewerage Authority, JICA Bangladesh Office, Embassy of Japan in Bangladesh for their close cooperation and assistance during our study.

At last, we hope that this report will be effectively used for the promotion of the project.

Very truly yours,



Team leader, Kenji Hori
Basic Design Study Team on
the Project for Balancing, Modernizing,
Rehabilitation and Expansion of
Chandnighat Water Treatment Plant
Nippon Jogesuido Sekkei Co., Ltd.

SUMMARY

SUMMARY

The present water supply system for entire Dhaka City is largely dependent on ground water with surface water works as its supplement. Due to rapid increase of the population in Dhaka City, the present water supply volume is quite insufficient in meeting the expected demand for water.
Under the above circumstances, the Government of Bangladesh prepared an emergency project plan to improve the existing facilities of the Chandnighat Water Treatment Plant which was constructed about 120 years ago to increase the water production, and has requested the Government of Japan to extend Grant Aid Cooperation for its execution.

In response to this request, the Government of Japan decided to study the Project, and in December 1991, Japan International Cooperation Agency (JICA) dispatched a Preliminary Study team to Bangladesh to study the background and details of the Project.

From the result of the Preliminary Study, it was confirmed that the Government of Bangladesh strongly requested on early implementation of the Project with assistance of the Government of Japan. JICA agreed to carry out a Basic Design Study for Chandnighat Water Treatment Plant provided that the Bangladesh Government gives confirmation of full cooperation from the people living in the concerned area, and bears the liabilities for execution of the Project. This is because the Project can not be expected to perform smoothly on schedule without proper understanding and cooperation of the local inhabitants, since the area is in the downtown of the old Dhaka where street vendors are occupying work-space at the both side of the road as a place to earn their living. In response to this, the Government of Bangladesh confirmed an agreement with the said proposal and assured their full cooperation and also informed on the subject to the Japanese side.

After confirmation on the same, JICA dispatched a Basic Design Study team to Bangladesh for investigative of the Project site and collection of supplemental data and information expanding on the results of the preliminary survey.

Back in Japan, the members of the Basic Design Study team analyzed the results of their investigation activities in Bangladesh and composed a draft report. In October 1992, the Study team places for explaining the draft report to

Bangladesh counter part.

This report is to present the results of Basic Design Study on the Project for Balancing, Modernizing, Rehabilitation and Expantion of Chandnighat Water Treatment Plant on the basis of mentioned field survey in the above taking into consideration of technical and economical aspects.

The Dhaka Water Supply and Sewerage Authority (DWASA) has assumed the responsibility for supplying drinking water throughout Dhaka Metropolitan Area, which is also the executing agency for this Project.

The Project area is under DWASA's Maintenance, Operation, Distribution and Services (MODS) Zone II in which the Chandnighat Water Treatment Plant is located. The Project consists of the rehabilitation and expansion of the Chandnighat Plant and improvement of distribution main pipe conveying effectively increased treated water into the existing distribution network in the Project area.

The expansion plan requested by DWASA through the Government of Bangladesh was to develop and strengthen the existing treatment capacity of 17,000 m^3/d (3.7 Million Gallon per Day:MGD) up to 39,000 m^3/d (8.6 MGD). In the Preliminary Study stage, however, DWASA requested to plan for increase of its production capacity as much as possible to deal with the problem of water shortage in the area.

Through employment of high-rate settler module in the existing sedimentation basin, the capacity of the basin was confirmed to expand the treatment capacity up to maximum 50,000 m^3/d (11 MGD) as observed by the both parties. Simultaneously, rehabilitation of the main distribution pipe in the Project area was also proposed by DWASA to Japanese side. The Preliminary Study team understood the necessity of such rehabilitation and agreed to include it in the Project, which was incorporated in the Minutes of Meeting signed between DWASA and the Preliminary Study Mission.

The Basic Design Study team studied and examined the present condition of the Plant facilities and their operation and management system, as well as the background of the request and implementation of the Project. As the result of a comprehensive examination, it is recommended that the capacity of the Plant

to be expanded up to 8.6 MGD, which is the capacity of the original request of DWASA through the Government of Bangladesh.

The reason for such recommendation are as follows:

1) Employment of high-rate settler module in the existing sedimentation basin cannot be recommended because of its technical, operational and maintenance stand points as mentioned below:

   - An open space between the end of the settler module and existing base of the sedimentation basin will have a gap of 0.8 m only after installation of the high-rate settler module, which is insufficient space to work for removal of sludge and cleaning of the basin by manually.

   - Since the existing sedimentation basin was constructed about 120 years ago and its sidewall has been designed as gravity retaining wall with brick and soil. Additional load of new construction is not allowable taking consideration of strength of the structure. Moreover, there is no sufficient evidence whether it will be possible to construct supplemental fulcrums on the existing concrete base so as to install the settler module, because the base of the sedimentation basin is not likely to be of reinforced concrete.

2) Therefore, expansion of treatment capacity in the sedimentation process can only be enhanced by mean of construction of new sedimentation basin.

3) Reviewing the location plan for construction it was found that it was impossible to construct the sedimentation basins and filter having a capacity of 11 MGD in the project site for limitation of the space, even if high-rate setter module was employed for sedimentation basin to enhance its capacity,but limited to 8.6 MGD for construction of expansion facilities in it.

As a result of the examination on the rehabilitation and expansion plan of the facilities, the contents of the request was appropriated as a whole, but it is recommended to change some items from view point of technical, operation and maintenance aspects so as to develop the system of water works.

Major objects to be changed are as follows:

1) Water Intake and Distribution Pump Facilities

There are two pump stations in water intake pump facility and distribution pump facility, respectively. These pump stations are in operation as a stand by facility at present, but the two pump stations are to be operated continuously after completion of the Project.

Although these pump facilities are planned to be used as it is, according to the request, three pump units of pump station No. 1 for water intake pump facility and three pump units of pump station No. 2 for distribution will be replaced with its operation panel, because of severe superannuation.

2) Service Reservoir.

Previously, there were five over head tanks in the water service area covered by the Chandnighat water works. Water used to be charged in the over head tanks through the rising supply pipes. But, these rising supply pipes are now converted into a delivery main so as to give direct supply of water, resulting such tanks became an incapable facility and a few have been removed at present. Accordingly the existing water supply system of the Chandnighat water works has no function in respect of reserving supply water in either inside or outside of the Treatment Plant.

Construction of new clear water reservoir having a capacity of 1,000 m^3 is planned in the request, the sum of total capacity of the reservoir together with existing ones will stand 2,450 m^3 that is equivalent to detention time of 1.5 hours which is the same as the present condition. Accordingly, the rehabilitated plant can not reserve the water produced in night-time during stop over period of supply, as it is in practice, in other words that is one kind of system loss.

Aiming to reserve the water produced in night-time,a service reservoir of 5,700 m^3 will be constructed in this Project instead of a clear water reservoir of 1,000 m^3 as mentioned in the request.

3) Substation in Chandnighat Plant

In the request, it was assumed to increase the electrical power supply due to expansion of treatment capacity of the Plant, hence the existing transformar is planned to charge for bigger capacity from the existing capacity of 800 kVA to 1,100 kVA.

As a result of the survey, it was found out that the water intake pump facility receives its electrical power supply directly from the distribution line of the Dhaka Electric Service Authority(DESA).
On the other hand, the pump station No. 1 has an emergency power line for operation of the pump from the substation in the Chandnighat Plant which was included and counted as a power consumption load for the substation in the Plant.

Therefore, the electrical power capacity of the substation in the Chandnighat Plant is confirmed to have enough supply of power to meet consumption load even after the rehabilitation of the Plant, providing water intake pump station No. 1 will be supplied power from the substation for the water intake pump facility only. Accordingly the existing substation in the Plant will be used as it is, which has been discussed and agreed upon by DWASA's engineers in the meeting held on May 25, 1992, with this study team.

Recommended rehabilitation and expansion plan after reviewing the contents of the request made by the Government of Bangladesh is summarized as follows:

The treatment capacity of the Chandnighat Plant will be expanded up to 39,000 m^3/d (8.6 MGD). For this purpose, sedimentation basin to meet the requirement for expanded capacity will be newly constructed. As for filtration facility, non-valve type filter will be constructed to meeting the requirement for expanded capacity. As mentioned earlier three superannuated pump units for water intake and for distribution facilities with operational panels will be replaced, respectively. Aiming to reserve the water produced during nighttime, a service reservoir will be constructed instead of a clear water reservoir. Chemical dosing facilities for coagulant, pre-chlorination and post-chlorination processess will be replaced with standard water quality test equipment for the improvement of water quality management. Moreover, rehabili-

tation of the distribution main pipe will be installed about 4 km for improvement of water supply conditions in the Project area.

This Project is to be implemented urgently to recover the water shortage of the planned area, and thereby relife the inhabitant of the old Dhaka from their long awaited problem with water. When this plan is executed the treatment capacity of the plant is expected to increase from the existing capacity of 17,000m^3/d up to 39,000m^3/d,thereby the water supply sufficient rate will be increased from the present state of apporox.70 % up to approx.86 % for whole area of Zone II. The benefit of this Project will be equally shared by everyone living in that area. Considering the above, it has also been judged appropriate to implement the Project with a grant aid assistance from Japan as early as possible.

When the Project is due to be executed under the Japanese Grant Aid Assistance, it is necessary a period of 5.5 months for consultant engineering services including detailed design and preparation for bidding and another 32 months for construction works after contract agreement is signed between DWASA and Japanese general contractor.

The following are the recommendations presented to DWASA which we felt necessary for the effective and smooth implementation of this Project.

(1) Improvement of Management System of DWASA

1) The task and work of the Planning and Monitoring Cell be reviewed and reorganized to meet two fold desk works in order to implement projects smoothly on schedule. Along this line, it is suggested that the Planning and Monitoring Cell should have a planning desk for developing new projects and management desk for planning promotion and execution of implementing projects separately and act upon to ensure coordination to maintain liaison between concerned government and authorities and the people living in the project site.

2) Assignment of an in-charge-of counterpart engineer for the project, who may be belong to MODS circle, should arrange with dispatch. The engineer must be assigned for the stage of not only construction period but also from detailed design stage upto full turn-key of the project con-

sistently in order to deeply understand of the design policy, conception and the scope of works of the Project to cope with the problem which might take place during the construction period between the client and contractor.

(2) Provision for Operation and Maintenance Expense

The present operational condition of the existing water treatment plant is not sufficient due to insufficient chemical dosing, causing iron content is over WHO standard. Therefore, more careful water quality management is required.

Since the production capacity of the Plant when the plan is executed under this Project will be increased approx. 2.5 times of the existing capability, its operation and maintenance cost is estimated to be increased upto approx. 2.8 times. Therefore, DWASA should make provision for such operation and maintenance expense and add to annual budget in order to undertake maintenance of the rehabilitated facilities to keep it in proper operation.

(3) Promotion of Leakage Detection Control Programme

When this plan is executed the treatment capacity of the plant is expected to increase from the existing capacity of 17,000 m^3/d up to 39,000 m^3/d, thereby the water supply insufficient ratio will be improved from the present state of approx. 30 % up to approx. 10 % for Chandnighat water works service area and 30 % up to 14 % for whole area of Zone II, respectively.

However, even though the strength of the production capacity of the Plant is enhanced under this Project, the actual effectiveness for use of water is not expected at its planned level without improvement of system loss due to present water leakage status. Therefore, it is recommended that the leakage detection control programme, which is scheduled to implement from the year 1992,should commence for this area in priority basis and ahead of the other areas of Dhaka city.
Therefore, it is also recommended that the Project must be undertaken on the premise that DWASA submits an action plan on the leakage detection

and control programme for MODS Zone II to the Government of Japan.

(4) Reinforcement of Water Quality Control System

DWASA has its own water quality control laboratory and is analyzing water to be supplied as a routine work. But, the laboratory is incapable to analyze heavy metals and harmful materials in water which is affected by industrial waste.
Since there is a potential water pollution from the waste disposed in the river water by industries and local inhabitants surrounding the banks of Burhiganga river, it is necessary to establish a patrol system around the water intake area to maintains water quality, with the understanding that safety and clear water supply is an appointed task for water works.

For this purpose, it is recommended to establish a water quality management system by means of expansion of the DWASA water quality laboratory or to make arrangement to contract analysis for harmful materials. Moreover, it is also recommended to consider in having a serious discussion between authorities concerned in relation to preservation of the water quality of the Buriganga River.

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ABBREVIATIONS

ABBREVIATIONS (in Alphabetical order)	NAME IN FULL
B M R E P	Balancing, Modernizing, Rehabilitation and Expansion Project
B P D B	Bangladesh Power Development Board
C D S T	Custom Duty and Sales Tax
Chandnighat W.W	Chandnighat Water Works
C W A S A	Chittagone Water Supply and Sewerage Authority
D E S A	Dhaka Electric Service Authority
D P H E	Department of Public Health Engineering
D W A S A	Dhaka Water Supply and Sewerage Authority
E W S P	Dhaka City Emergency Water Supply project
L D C P	Leakage Detection Control Programme
L G R D	Ministry of Local Government, Rural Development and Cooperatives
M G D (=IMGD)	Million Galon per Day
M O D S	Maintenance, Operation, Distribution and Services
W H O	World Health Organization
W T P	Water Treatment Plant

CHAPTER 1 INTRODUCTION

CHAPTER 1. INTRODUCTION

The Dhaka Water Supply and Sewerage Authority (DWASA) has assumed the responsibility for supplying drinking water and to maintain sewerage system throughout Dhaka Metropolitan Area. The present water supply system for entire Dhaka City is largely dependent on ground water with surface water works as its supplement. In April, 1992, a total of 162 deep tubewells are in operation at Dhaka Metro. and another additional deep tubewell development scheme such as the DWASA III Project financed by the World Bank is underway. However, due to rapid increase of the population in the city of Dhaka, the present water supply volume is quite insufficient in meeting the expected demand for water.

Under above circumstances, the Government of Bangladesh prepared an emergency project plan to improve the existing facilities of the Chandnighat Water Treatment Plant to increase water production and has requested the Government of Japan for Grant Aid Cooperation for its execution.

In response to the request made by the Government of Bangladesh, the Government of Japan decided to conduct a study concerning the above project, and Japan International Cooperation Agency (JICA) dispatched a Preliminary Study team, headed by Mr. Seiyu Kamata, Head of Planning Research Section, Yokosuka City Water Bureau to Bangladesh for a period of 16 days from December 7 to 22, 1991.

The team had a series of discussion with concerned official of the Government of Bangladesh to confirm the background and details of the Project and also the system for the implementation of the Project.

From the result of above Preliminary Study, it was confirmed that the Government of Bangladesh strongly requested an early implementation of the Project with the assistance of the Government of Japan. For this reason, the Government of Japan decided to execute the Basic Design Study for the Project. Accordingly, as a follow up to the previous, JICA organised a Basic Design Study team, which was again headed by Mr. Seiyu Kamata. The said mission visited Bangladesh for a period of 60 days from April 9 to June 7, 1992 to undertake the survey works.

Upon returning to Japan, the Basic Design Study team analysed the results of the field surveys, and undertook preparation of the draft report of the findings. In October 1992, the Basic Design Study team visited Bangladesh to brief the representatives of the Government of Bangladesh on the draft report and discuss its details with them. As result of the discussion both sides agreed on the contents of the draft report.

This report is to present the results of the Basic Design Study mentioned in the above. A list of the member of the Basic Design Study team, the time schedule of the field survey, a list of interviewees and the Minutes of Discussion are attached at the end of this report.

CHAPTER 2 BACKGROUND OF THE PROJECT

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 Background of the project

From the beginning, major projects for improvement of the water supply for Dhaka City have been implemented in association with the World Bank. The Third Dhaka Water Supply Project, which consists of the installation of deep tubewells and water distribution system mainly, were completed in 1990. In those scheme, the feasibility study of water supply aiming upto year 2010 was carried out by the World Bank in order to cope up with future water demand.

However, due to unexpected and growing demand for water, DWASA continued facing great problem with its water supply shortage. In order to resolve these problems, DWASA has commenced crash programs of supplying additional water from ground sources, namely Crush Program for Deep Tubewells funded by the Government of Bangladesh and Dhaka WASA III Project, Water Supply and Sanitation Urgent Expansion Project, that has been funded by the World Bank/IDA. Under these projects additional 90 deep tubewells will be developed by the end of year 1992.

The gap, however, between supplied water and demand for water is estimated to be of 120 million gallon per day (MGD) in the beginning of 1992. This gap is widening every day owing to delay in development of new water sources.

More than 95% of water supplied to the consumers of Dhaka City is ground water. However, the World Bank has made well recommendation in the Dhaka WASA IV Project that surface water should be developed for the future use as bulk water supply instead of the ground water.

In the above study, new water treatment plant at Saidabad with initial capacity of 100 MGD was planned to carry out along with other works under DWASA - IV Project. On the other hand, DWASA has commenced another project, namely Emergency Water Supply Project (EWSP) under French/Bangladesh joint cooperation for feasibility study. The aim of the project is to construct a new water treatment plant having a capacity of 50 MGD near China-Bangladesh Friendship Bridge and has been nego-

tiated for removal of the construction site to Saidabad between authorities concerned.

It means that such projects are still under feasibility study stage and it could be said that, at earliest, the new water treatment plant having a treatment capacity of 50 MGD could not be completed until 1997. In order to covering the water shortage in whole area of the city, water treatment plant having a capacity of 100 MGD will be essential for running water works by the year 2000.

Accordingly, taking into consideration of the actual conditions that surrounds DWASA in respect of water supply, concerned project for Rehabilitation and Expansion of Chandnighat Water Treatment Plant is focused for implementation urgently as the most feasible way.

Dhaka Water Supply and Sewerage Authority (DWASA) will be responsible for the implementation and administration of the Project. It may be noted that DWASA operates under the directive of Ministry of Local Government, Rural Development and Cooperatives (LGRD) of the Government of Bangladesh.

DWASA has been managing the water supply and sewerage services system in Metro Dhaka area. Such operations are undertaken by its MODS (Maintenance, Operation, Distribution and Services) Circle and the total area for service facility comes under Zone I to Zone VI inside Dhaka City and Zone VII covers Narayanganj area, as shown in Fig. 2-1.

2.2 Outline of the Request

2.2.1 Background of the Request

The water supply area of Chandnighat Water Treatment Plant covers almost all of the old city of Dhaka, which is one of the most vital business district having lots of small scale industries and commercial enterprises.

The population of the area is around 0.8 million. The demand for water in the area has increased drastically due to high concentration of

people and workers. However, there is no other adequate or alternative sources of water supply in the area because further development of deep tubewells was discouraged by the World Bank so as to prevent interference of wells and also the establishment of new treatment plant was postponed due to the financial constrains in the part of DWASA.

On the other hand, most of the facilities at the Chandnighat Plant, which is the sole water treatment plant in the city, has been deteriorated from constant operation and the production capacity of treated water has come down to 3.7 MGD. However, the pump facilities of water intake and water distribution have been found to be of the capacity of around 10 MGD, respectively. Therefore, with rehabilitation of the existing water treatment facilities, it aims to increase the capacity of the Plant without a huge investment and for long period.

Under this circumstances, the Government of Bangladesh formulated a project to strengthen the treatment capacity of the Chandnighat Treatment Plant, and placed formal request to the Government of Japan for extending its grant aid to execute the rehabilitation and expansion of the Plant.

2.2.2 Outline of the Request

Shown below is the outline of the request, which is summarized on the basis of the contents of the request submitted by DWASA through the Government of Bangladesh in May 1991 and also the confirmation on the subject by JICA Preliminary Study team in December 1991. In which the improvement of existing main pipes for the water distribution network in the Project area was included as additional request from the Government of Bangladesh.

(1) Objectives of the Project

The main objective of this Project is to rehabilitate the Chandnighat Water Supply Systems in the old city of Dhaka, and thereby make an active contribution to the improvement of water supply situation in the area.

(2) Project Area

The Project area is under DWASA's MODS Zone II in which the Chandnighat Water Treatment Plant is located, which is shown in Fig. 2-2.

(3) Expansion of Treatment Capacity

Current production capacity of the Chandnighat Treatment Plant is 17,000 m^3/d (3.7MGD). The capacity of the whole plant is limited due to the improper filtration facility, which is comparatively smaller than the capacity of the water intake facility and water distribution facility.

The capacity of water intake and water distribution facilities are 41,500 m^3/d (9.1 MGD) and 40,500 m^3/d (8.9 MGD), respectively. This figure is being assumed, provided that the design tolerance for the capacity is 10%. Therefore, treatment capacity of the Plant can be expected to increase upto 39,000 m^3/d (8.6 MGD) taking consideration of water loss of about 5%, which is consumed inside of the Water Treatment Plant as sludge drain, back wash waste for filters and so on as shown below:

Intake Pump Capacity = 10.1 MGD

10.1 MGD x 0.09 x 0.95 = 8.6 MGD

(4) Rehabilitation Plan

1) Water Intake Facility

- Water intake pipe

At present, there are two units of the water intake pipe, and each has two lines for the raw water lead piping in order to take the river water and introduce it into the water intake pump.

This water intake pipes will remain as it is but water flushing pipings will be installed under this Project. To facilitate removal of the silt and sand the same will be introduced into the raw water load piping.

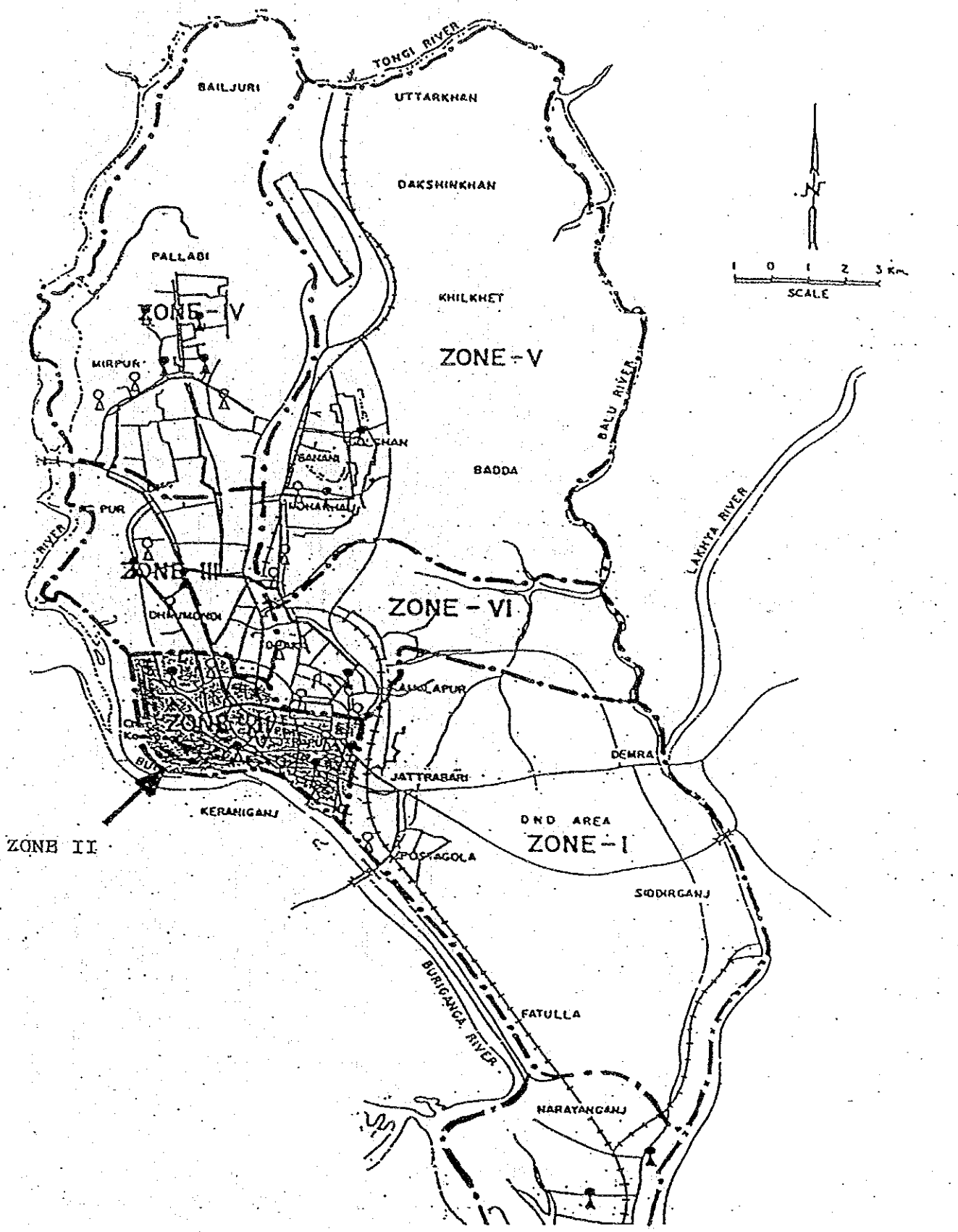
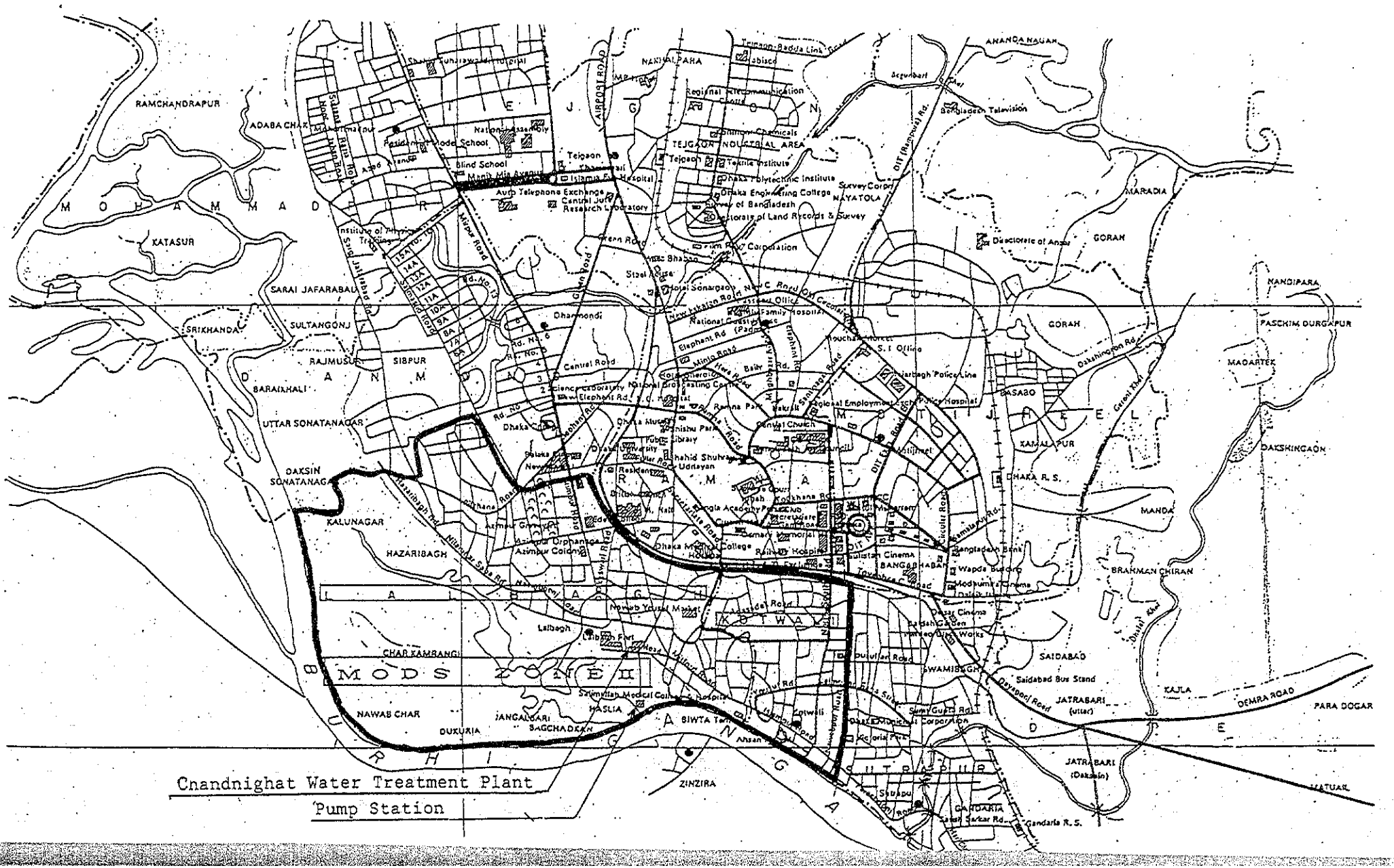


Fig. 2-1 Jurisdiction Area of DWASA

Fig. 2-2 Map for MODS ZONE II



- Water intake pump

There are two pump stations - one pump station has three units of pump having the specifications of 2.64 MGD X 65 ft, and the other has also three units of pump having that of 2.4 MGD X 65 ft including one pump unit as a stand-by, respectively.

These pumps are in operational condition and will be used as it is in the Project with only replacement of compound gauge, pressure gauge and so on. As an extra facility, electrical flow meter will be installed to make sure the flow rate of raw water pumped into the Water Treatment Plant.

- Electrical substation

The existing facility being operated without any major problem, and its capacity of 750 KVA will be sufficient for the operation after completion of the Project. Therefore, the existing facility will remain and be used as it is in the Project.

2) Water Treatment Facilities

- Pre-settling / receiving well

There is no pre-settling / receiving well in the existing facilities, but there is a small size of connection well between the transmission pipe and succeeding process, which will be used as it is in the Project.

- Mixing well

With the capacity of the existing well (about $18m^3$), the treatment of approximate 25,000 m^3/d will be maximum.

As mentioned below, one-eight portion of the second chamber of the existing flocculation basin (coagulation / sedimentation basin) will be used for the said purpose. In addition to it, a flush mixer will be installed to make sure the mixing of injected chemical into the water.

- Flocculation basin

In this Project, the third chamber of existing coagulation / sedimentation basin will be used as the flocculation basin.

Required source of energy for flocculation will be derived through mechanical method by installation of flocculator.

- Water channel to the sedimentation basin

The water channel will be modified in conformity with the designed flow rate of 39,000 m^3/d.

- Sedimentation basin

With the capacity of existing sedimentation basin, the treatment of 27,000 m^3/day will be maximum. For increase of this capacity, construction of an additional basin or installation of inclined plates (high-rate settler module) in the existing basins may be selected. Considering the installation space and continuity for operation of the facilities, construction of an additional basin is not advantageous.

Therefore, increase of the treatment capacity by this Project will be ensured by the following modifications and installation of the inclined plates.

Besides, as mentioned hereinafter, the filtration facility will be installed newly at the northern side of the existing sedimentation basins and the settled water should be pumped duly upto their requisit elevation.

So, the pump pit, in which the settled water transfer pumps will be installed in order to pump the settled water into the filtration facility, is designed to be in the existing sedimentation basins.

The following modification of the sedimentation basin will be done in the Project.

- To construct the settled water basin at the downstream of the basins by providing partition walls.

- To provide baffle wall at the inlet part.

- To remove the obstacle structure, that stands in the midst of the basin.

- To install settled water collection trough at the outlet of the modified basin.

- Filtration facility

There are in total 10 units of filter in the existing treatment facilities. The capacity of each unit is as follows :

- Jewel filter : 0.41 MGD/unit X 6 units
- Paterson filter (small) : 0.35 MGD/unit X 2 units
- Paterson filter (large) : 0.92 MGD/unit X 2 units

The jewel filters were constructed about 120 years ago and as such deteriorated severely. Other filters are also imcapable to operate at required level.

Therefore, new filters replacing the old ones will be constructed in the Project. But, the existing filters shall be used until the completion of construction of the new filter.

- Clear water reservoir

In the existing facilities there are two clear water reservoirs with the capacity of 945 m^3 and 607 m^3 respectively. The existing clear water reservoirs will be used as it is. In addition to which, one more reservoirs will be constructed in the Project with the capacity of 1,000 m^3.

Thus, the total capacity of clear water reservoirs will stand at 2,550 m^3 and the detention time will be around 1.5 hours.

- Distribution pump facility

All of existing pumps are being operated without any major problem. Therefore, they will remain and be used as it is in the Project.

- Chemical dosing facilities

The existing facilities as a whole are rather deteriorated and their present condition and capacity will not be sufficient to cope with the treatment of 39,000m^3/day. So, in the Project, the existing facilities will be replaced by the facilities newly designed, based on the following design criteria.

- Alum dosing system
  Quantity of water to be treated: 39,000m^3/day
  Maximum dosage : 35 mg/l
  Dosing point : Mixing well
  Chemical density : Approx. 1.5% as Al_2O_3 by weight

- Calcium hypochlorite dosing system
  Quantity of water to be treated: 39,000m^3/day
  Maximum dosage
  Pre-chlorination : 12 mg/l
  Dosing point
  Pre-chlorination : Mixing well
  Chemical density : Approx. 4% as effective chlorine by weight

- Post-chlorination system
  Quantity of water to be treated: 39,000m^3/day
  Maximum dosage : 2 mg/l
  Dosing point : After filtration process

Besides that, the post-chlorination is being performed by using the chlorine gas at present, but it is recommended that the calcium hypochlorite be used instead of the chlorine gas, as a preventive measure and security against gas leakage. This prevention should be taken as because the Water Treatment Facility is located near the densely popu-

lated area.

- Electrical substation facilities

The existing facilities are being operated without any major problem, but it is assessed that the margin of the transformer capacity will be exhausted from increase of motors to be incorporated in the Project. Therefore, modification of the distribution panel will be imperative.

Accordingly, the transformer capacity will be increased to 1,000 KVA. The main switchgear and distribution panel will be replaced concurrently.

In addition to above, an operation room, measuring 6mW X 20mL X 4mH will be constructed to install these facilities so as to ensure prompt and proper supply of water for the Project. Inside the operation room, a space will be provided for keeping laboratory facilities.

- Private interphone system

A private interphone system will be installed to keep close communication between operators, those are working at water intake facilities and water treatment facilities.

- Water sampling system

At present there is no proper water sampling system and the sampling works are being done manualy by the operators.

In the Project, proper water sampling system through sampling pump and piping will be introduced. The new laboratory room will be used for the purpose of undertaking sampling of items as listed below:

- Raw water
- Flocculated water
- Settled water
- Filtered water
- Treated water

- Water quality testing equipment

There is no water quality testing equipment excepting pH and residual chlorine. Therefore, water quality testing equipment will be provided for the daily operation, which includes pH, residual chlorine and jar-tester, etc.

(6) Additional Request

Appended below are some additional request made by DWASA in the discussion meeting held with the Preliminary Study team in December 1991.

1) Expansion of Treatment Capacity

DWASA requested to consider the increase of the treatment capacity upto 50,000 m^3/d (11 MGD) in place of 39,000 m^3/d (8.6 MGD) which has been recommended in the Project for rehabilitation and expansion of treatment capacity of the Chandnighat Treatment Plant.

2) Improvement of Existing Distribution Pipe

Improvement of existing main pipes for the water distribution network in the Project area be included in this Project to ensure smooth supply of water after increase of distribution water volume by rehabilitated Chandnighat Plant. The total length of main pipes requested for improvement shall be approximately 5,000 m.

2.3 Outline of the Water Supply in the Project Area

2.3.1 Present Status of Water Works

(1) Water Source

There are 24 deep tubewells and one (1) water treatment plant in Zone II as shown in Fig. 2-3.

Table 2-1 shows a specification and operational conditions of 24 deep tubewells. A standard design criteria for structure of deep tubewells

in DWASA is shown in Appendix B-1, and also static water level and operating water level of deep tubewells in Zone II are shown in Appendices B-2 and B-3.

The results of the study on the present status of the deep tubewells in Zone II are summarized as follows:

- Well depth	:	ave.	137 m
		range	87 m to 169 m
- Production capacity	:	ave.	4,570 m^3/d (1.00 MGD)
		range	2,900 m^3/d to 7,500 m^3/d
- Static water level	:	ave.	15.4 m
		range	9.45 m to 19.8 m
- Draw down	:	ave.	11.4 m
		range	3.0 m to 25.2m
- Pressure of pump delivery : Depending on the deep tubewell under operating water level and pump design head		ave.	4.6 kg/cm^2
		range	4.0 kg/cm^2 to 5.6kg/cm^2

In connection to the above, it can be mentioned that there should have been a record for static water level and operating water level during the time when the well was constructed, and then it is considered that the present draw down of water level in the wells is more larger, but such supported data could not be procured. Therefore, the present condition of the pressure of the pump delivery can only be ascertained from the results of field survey shown in previous Table 2-1

Since the year 1874, the Chandnighat water works is playing a vital role of being the sole source for water supply in the old part of Dhaka City. However, due to rapid development and unexpected growth of the population the water works has become inadequate for water supply services in that area.

Fig. 2-3 Location Map for Chandnighat Water Works, Deep Tube Wells, Distribution Mains

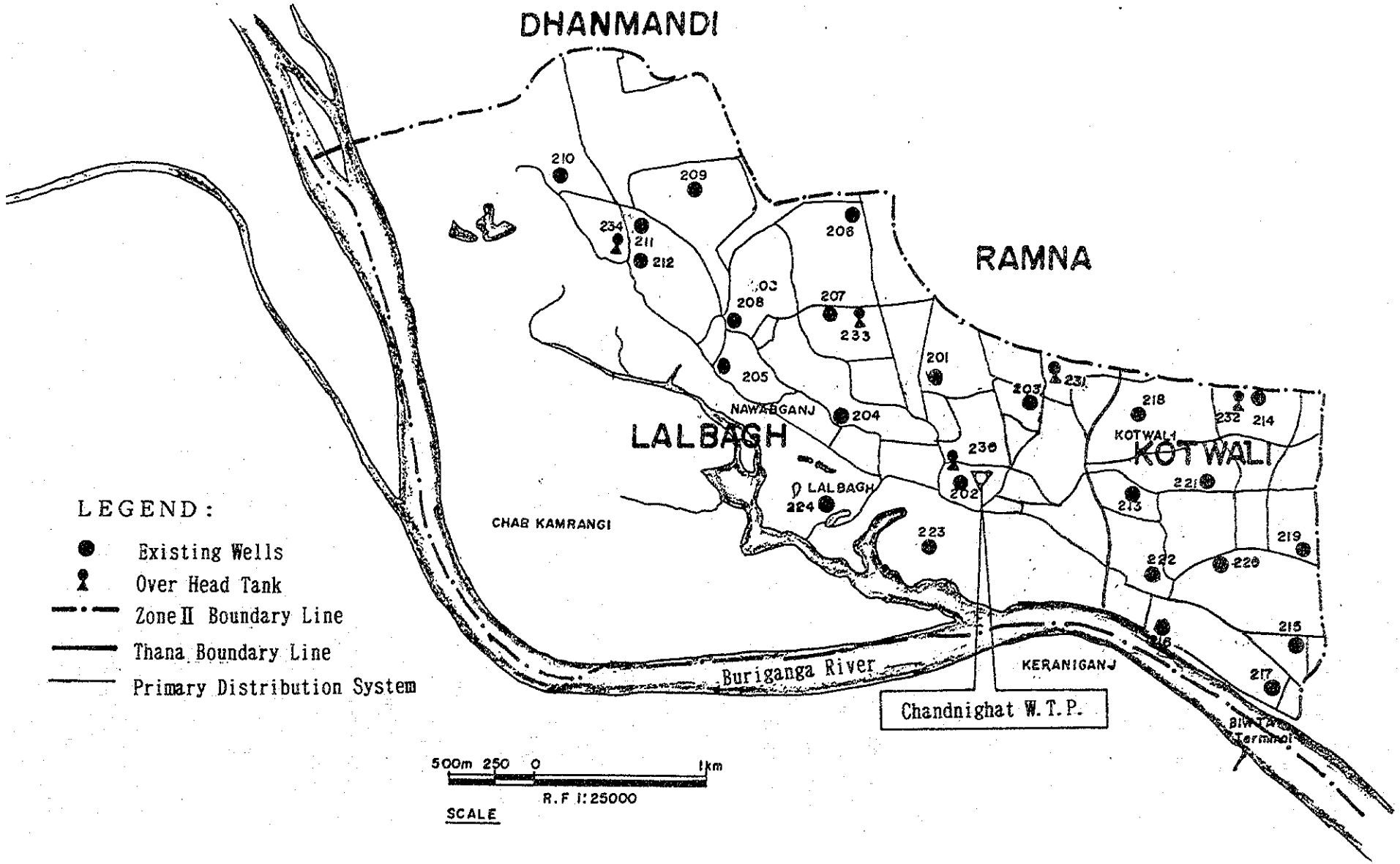


Table 2-1 Equipments and Operational Status for Deep Tubewells

No.	Name of Deep Wells	Pump			Motor	Operational Status			Remarks
		Type	Capacity (m³/m)	Head (m)	Capacity (k w)	Flow rate (m³/D)	Pressure (Kg/cm²)	Service hour(hr)	
201	Dhakeswari	T	2.45	75.0	30.0	2,900	—	22.0	
202	Chandnighat	S	4.90	〃	55.0	6,050	3.2	24.0	Over Head Tank, Generator
203	Bakshebazar	S	2.45	〃	33.0	2,880	1.9	22.0	Over Head Tank
204	Rahamatullah	T	〃	〃	〃	2,510	—	〃	
205	Nawabganj	S	3.68	〃	46.0	3,600	—	20.0	
206	Azimpur (NO.6)	T	〃	〃	37.0	3,360	1.4	〃	Over Head Tank
207	Azimpur (NO.7)	T	4.90	〃	55.0	5,280	2.2	22.0	
208	Peelkhana (NO.2)	T	〃	〃	〃	7,450	—	24.0	
209	Peelkhana (NO.3)	T	〃	〃	〃	7,530	2.6	〃	Generator
210	Hazaribag (NO.3)	S	3.68	〃	37.0	5,040	—	22.0	
211	Hazaribag (NO.6)	T	4.90	〃	55.0	5,130	—	19.0	
212	Hazaribag (NO.5)	T	3.68	〃	75.0	5,020	4.8	22.0	Over Head Tank, Generator
213	Abul Hasnat	S	〃	〃	33.0	2,880	0.8	20.0	
214	Pulbaria	T	4.90	〃	55.0	5,520	—	23.0	Over Head Tank, Generator
215	Jagannath Collage	T	〃	〃	〃	4,080	3.2	20.0	
216	Mitford Hopspital	S	3.68	〃	45.0	4,200	—	〃	Generator
217	Simson Road	S	4.90	〃	63.0	4,680	—	〃	
218	Agamashi Lane	T	〃	〃	55.0	5,280	1.2	〃	
219	Dholi KhaL	S	3.68	〃	46.0	5,020	—	22.0	
220	S.D Park	S	4.90	〃	63.0	4,680	—	20.0	
221	Bangladesh Math	T	3.68	〃	37.0	3,360	—	〃	
222	Armanitora	T	4.90	〃	55.0	4,490	—	22.0	
223	Islambagh	T	〃	〃	〃	3,760	3.4	19.0	
224	Rajanarayan Das Road	T	〃	〃	〃	4,900	4.0	24.0	
TOTAL						109,600			
AVERAGE			(4.17)	(75.0)	(49.3)	(4,570)		(21.4)	

Note-1) T : Turbine Pump、 S : Submersible Pump

2) Figures in "Operational Status" are investigated during Site survey, carried out on May 1992

(2) Production Capacity

Table 2-2 shows a production capacity of water quoted from the monthly management report of DWASA.

Table 2-2 Production Capacity of Water in Zone II

Month	Deep Tubewell	Treatment Plant	Total
July, '91	92,690m^3/d	16,910 m^3/d	109,600m^3/d
August	111,470	16,910	128,380
September	97,280	16,910	114,190
October	93,870	16,910	110,780
November	98,650	15,320	113,970
December	83,920	16,230	100,150
Jan., '92	84,740	11,550	96,290
February	94,740	15,680	110,420
March	98,880	14,000	112,880
April	97,330	16,870	114,200
Average	95,360	15,730	111,090
	(20.96MGD)	(3.46 MGD)	(24.42 MGD)

Owing to shortage against demand for water, deep tubewells are operated at an average for 21.4 hours a day ranging from 19 hours to 24 hours. Distribution valves of each deep tubewell are controlled to serve water to A district or B district so as to control the supply system with interval for limited hours. Which is shown to be an hour-restricted water supply.

Standard valve control for hour-restricted water supply from Chandnighat water work and each deep tubewells are shown in Appendix B-5.
Similarly, owing to shortage against demand for water in the area covered under service by the Chandnighat water works, an hour-restricted water supply has been in practice.

Originally, there were five over head tanks for water storage in the service area covered by the water works. However, to cover-up shortage in water supply lots of branch distribution pipes have been connected into the rising supply pipe which was installed for the purpose of conveyance water from the plant to the over head tanks. Which resulting the water pressure of the rising supply pipe dropped down to such an

extent that it can not used for the original purpose, hence the said over head tanks have been removed.

Accordingly, water supply from the Chandnighat water works is now operating using both the rising supply and town supply pipelines as shown below;

	Service hours	Total
(a) Rising Supply Pipeline	: 4:00 a.m. - 9:00 a.m.	
	2:30 p.m. - 7:00 p.m.	9.5 hrs.
(b) Town Supply Pipeline	: 9:30 a.m. - 2:00 p.m.	
	7:30 p.m. -12:00 p.m.	9.0 hrs.

Since the capacity of distribution pump in the Plant is 2.52 MGD for No.1 pump station and 2.40 MGD for No.2 pump station, total volume of water supply is calculated using above service hours as reference as below :

$$\text{Total volume of water supply} = \frac{(2.52 + 2.40)\text{MGD}}{24} \times 18.5 \text{ hrs}$$

$$= 3.79 \text{ MGD} \geqq 3.46 \text{ MGD (Refer Production capacity, Table2-2)}$$

(3) Distribution Facilities

The distribution pipe network in the area had been initially developed as centered around the Chandnighat water works and has been extended into surrounding areas covered under new developed deep tubewells. Therefore, no distribution networks have been implemented as for with basic design or any rule. Clarification, for instance, between distribution main and branch is hard to identify on the existing pipe drawings.

Existing distribution main network in the Project area is shown with water sources and over head tanks in Fig. 2-4.

As it can be seen in the Fig. 2-4, the distribution main network consists of pipe size mainly ϕ200 mm and max. ϕ450 mm in the area. These

main pipe is installed 2 lines at the some part of the road. Especially main network for the Chandnighat water works for water supply service is a mostly complex mechanism of pipes in most of the area.

Materials of pipe installed in this area are of cast iron, steel, asbestos - cement and PVC, in which cast iron pipe is mainly used for distribution main and PVC for house connection.

According to the result of the questionnaire survey executed in this study, 73 % out of interviewees are served water by house connection, and 23 % out of water consumers are received water with meter system.

Fig. 2-5 shows the planned distribution main under the DWASA Emeregency Water Supply Project (EWASP) in which connection pipe between the said main and Chandnighat water work is given.

Fig. 2-4 Plan for Existing Distribution Mains

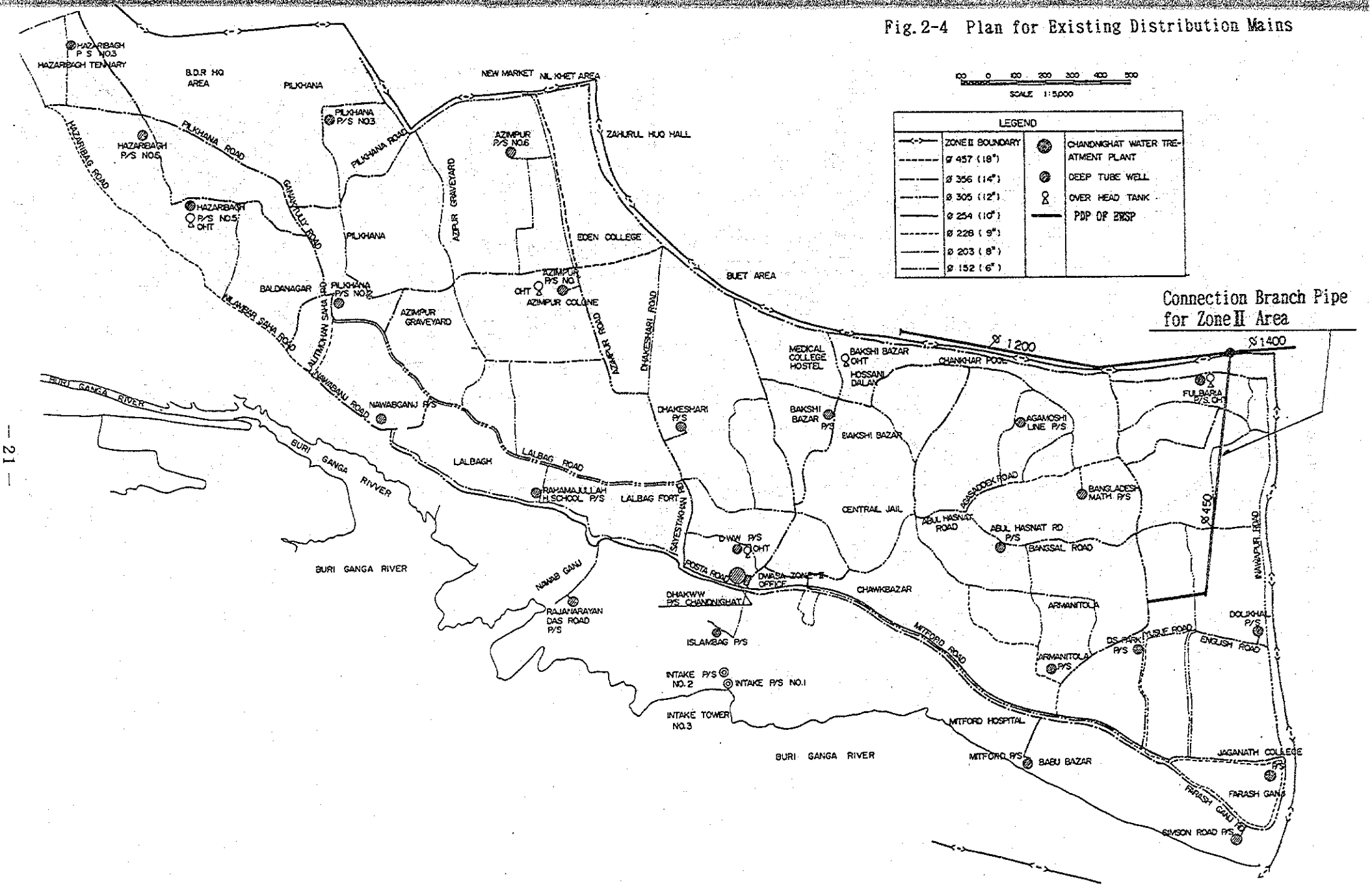
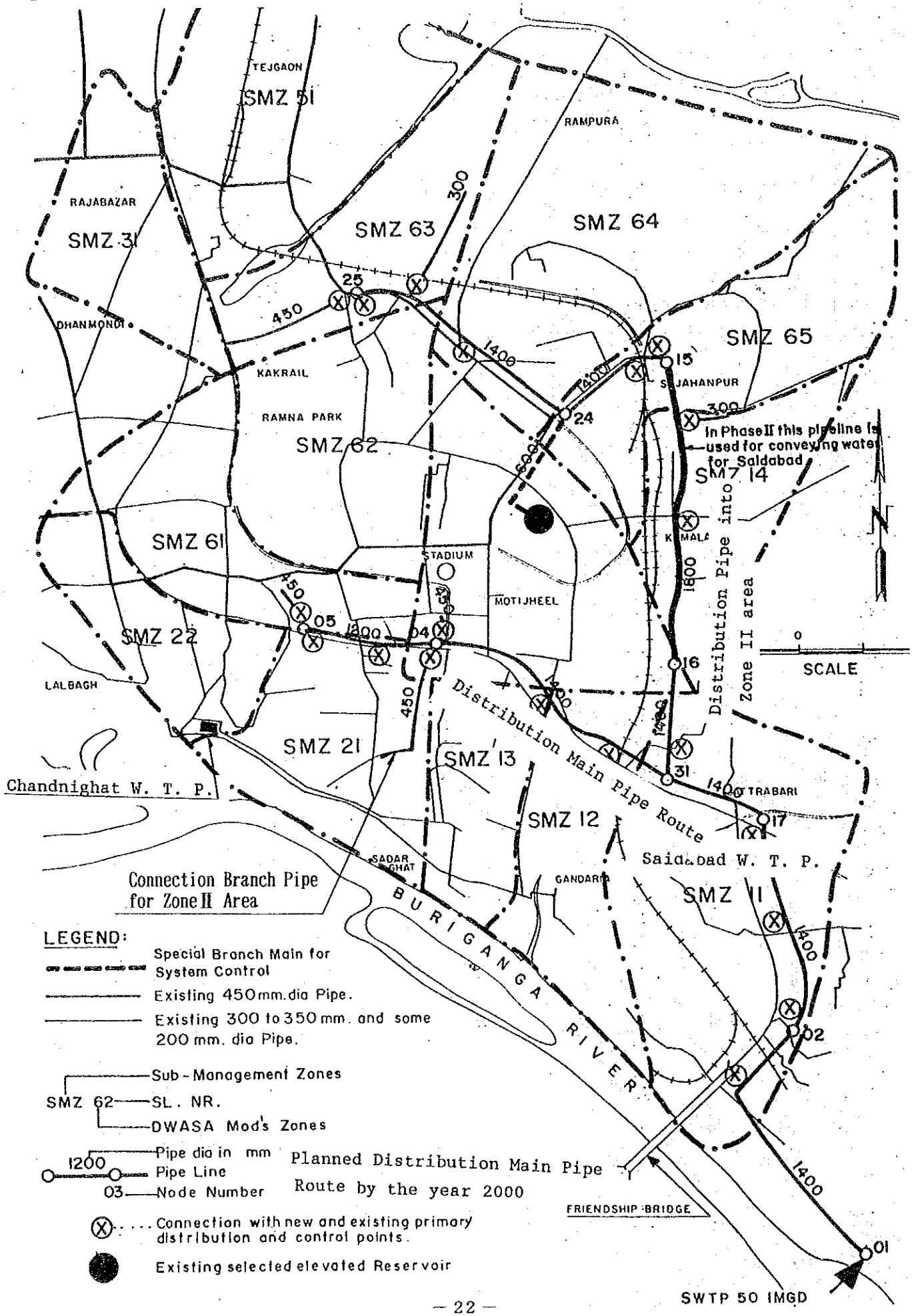


Fig. 2-5 Distribution Mains for Saidabad Water Works



LEGEND:

- Special Branch Main for System Control
- Existing 450mm.dia Pipe.
- Existing 300 to 350 mm. and some 200 mm. dia Pipe.
- Sub-Management Zones
- SMZ 62 — SL. NR.
- DWASA Mod's Zones
- 1200 — Pipe dia in mm
- Pipe Line
- 03 — Node Number
- Planned Distribution Main Pipe Route by the year 2000
- ⊗ .... Connection with new and existing primary distribution and control points.
- Existing selected elevated Reservoir

2.3.2 Present Conditions of the Water Supply

(1) Questionnaire Survey

In order to grasp the present status on the water supply in Zone II area, the study team conducted a questionnaire survey for the people living in the Project area. The survey consisted of an interview survey that was executed to visit local inhabitants and get answers from the people, while a questionnaire survey that was felt out a questionnaire by the DWASA's personnel in Zone II.

Collected data were 27 for interview survey, 13 for questionnaire survey and the total sum was 40.

The detail of the survey is presented in Appendix B-4 and its summary is shown below.

1) Classification of Water Service

Water service is classified as follows:

a) House connection with meter	8
b) House connection without meter	21
c) Common house connection with meter	1
d) Common house connection without meter	4
e) Public faucet	3
f) Hand pump installed illegally by user due to low water pressure	2
g) Others	1
Total	40

2) Time of Water Service

Serviced hours a day in which consumer can obtain water supply are as follows:

2 hours a day	1	
3 hours a day	3	5
4 hours a day	1	
5 hours a day	3	
6 hours a day	6	11
7 hours a day	2	
8 hours a day	1	
9 hours a day	2	3
10 hours a day	-	
11 hours a day	2	
12 hours a day	2	5
13 hours a day	1	
Total	24	24

The said number of 24 is excluded unknown number of 11 such as due to reciving and storing water into a private water tank and number of 5 who are likely convinced that anytime get service when water source is operating.

From a result of the survey, it was observed that water service is approximately 5 to 7 hours a day in the area.

3) Request to DWASA

In the survey request of inhabitant to DWASA in relation to water supply was questioned, resulting as follows:

a) No request	17
b) yes	19
Total	36

Break-down of b) above is as below:

- Shortage of water 14
- Low pressure of water supply 12
- Hour-restricted water supply 7
- Others 2

(2) Present Status of the Water Supply

On the basis of the collected data and the results of the questionnaire survey referring an opinion of DWASA's engineers, the most serious water shortage areas inside Zone II are selected. The said areas are shown in Fig. 2-6.

In these areas of the end of water supply networks, it was observed that a hand pump was directly installed into distribution pipe so as to get water supply because they can not obtain a water from house connection or public faucet due to limited water pressure of the main pipe.

It is reported that there are more than one hundred of hand pumps installed for the said purpose in Zone II area, which shows acute shortage of water in the area.

The operational valve control for each deep tubewell and Chandnighat water works for hour-restricted water supply is showns in Appendix B-5.

2.3.3 Demand for Water

The demand for water in MODS Zone II has been compiled and estimated on the basis of the data incorporated in DWASA's report on EWSP, also from the result of discussion with DWASA.

Although there are some areas where water produced in Zone II area is servicing to outside or a water is receiving from the outside of Zone II area, in principle, water produced inside Zone II must be assumed to have been consumed within the area itself. Accordingly, the estimation of demand for water is calculated considering total area covered under Zone II only.

The results of the estimation are presented below in Table 2-3. Whereas, detailed conditions and break down are described hereinafter.

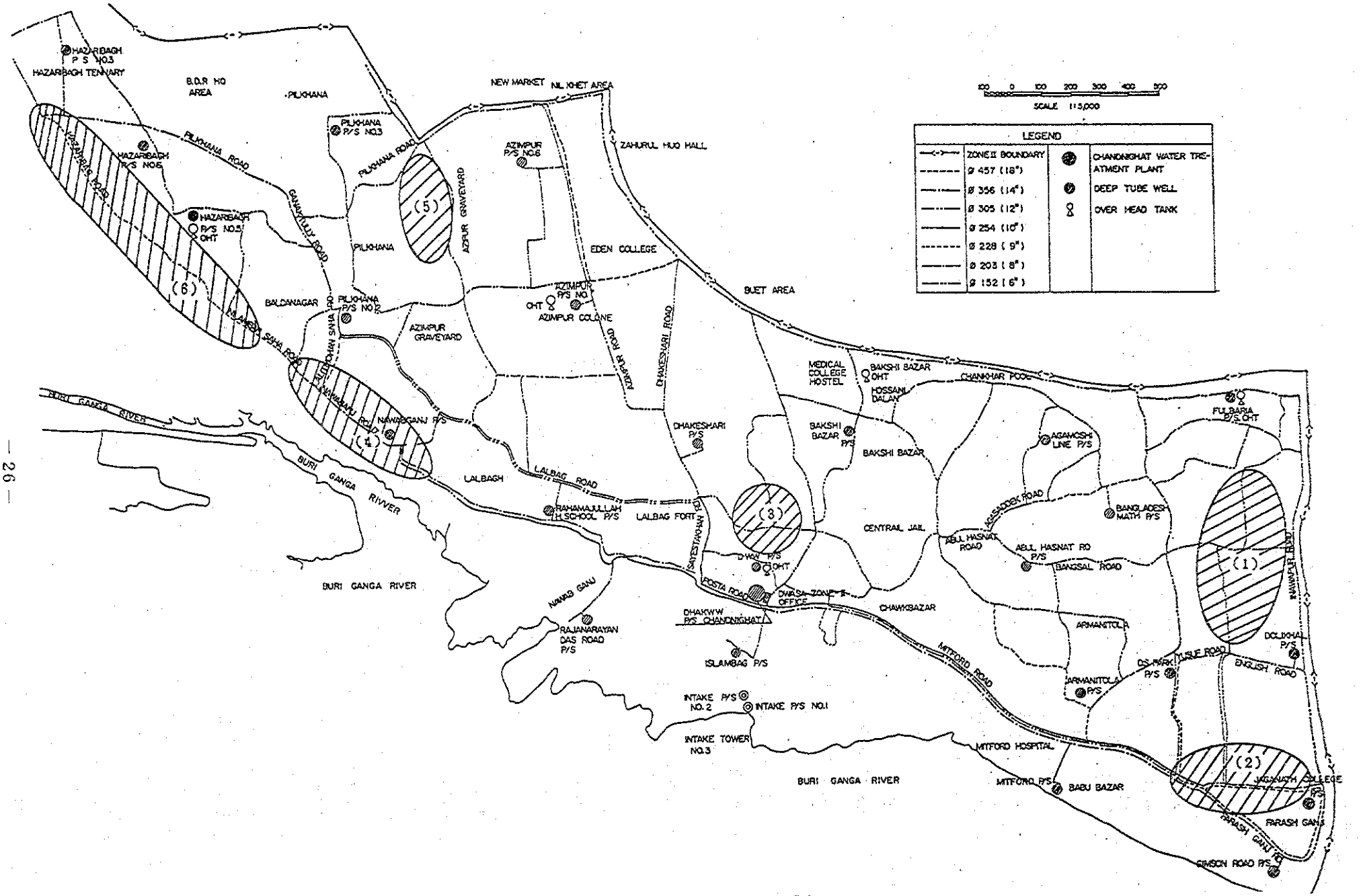


Fig. 2-6 Most Serious Water Shortage Area in Zone II

Table 2-3 Estimation of Water Demand in Zone II

Year	Population (A)	Demand for Water(B)	Gap Between Production Capacity(C)	Shortage (D=C/B)
				(%)
1991	597,448	34.60	10.18	29.4
1995	635,876	35.25	10.83	30.7
2000	678,417	36,62	12.20	33.3

Note : Present Production Capacity = 24.42 MGD.
(Refer to Table 2-2)

Under the following conditions water demand in MODS Zone II is estimated:

1) Population in 1991 is based on the report from National Population Census (1991).

2) Population in 1995 and 2000 is estimated based on the calculation of population growth rate shown in DWASA's report on EWSP.

3) Population of non-permanent resident of the Project area is estimated based on number of floating people. The said population in 1991 is assumed five(5) times of number of floating people in National Census of 1981. Average growth rate of population in Dhaka city of 3.8% is used for estimation of the same for the year 1995 and 2000.

4) Daily water demand per capita is qouted from DWASA's report on EWSP, which is 158 litters in 1991 and 159 in 1995 and 2000 for LALABGH AREA and 145 litters in 1991, 146 in 1995 and 147 in 2000 for KOTWALI AREA.

5) Daily water demand per capita for non-permanent resident is assumed to be 80 litters till the year 2000.

6) Ratio of water supply physical loss is referred as 35%, 31% and 28% for the years 1991, 1995 and 2000, respectively which are derived from DWASA's report on EWSP. On the other hand, the present physical loss of

25% is indicated in DWASA's report of LDWPR as the result of the survey undertaken for system losses in the pilot areas. However, the ratio is likely to be little small for this particular Project area, because the said ratio is used for estimation of the system losses of whole of Dhaka City. The report suggests that the water pressure in the main pipe and the service connection in the survey is as 5 to 8 meter and lower than 2 m to 3 m, respectively. Which shows likely a little low pressure for the Project area.

In the report, therefore, water supply physical loss is assumed to be the same with the ratio shown in EWSP report.

Water demand in MODS Zone II is summed up by the outcome of the demand in Lalbagh area and Kotwali area, because the daily water demand between Lalbagh and Kotwali area is different.

Table 2-4 Estimation of Water Demand in Lalbagh Thana

Particulars	Year		
	1991	1995	2000
1. Population (in million)	405,024	433,254	464,448
2. Daily Water Consumption per capita (lt/c.d.)	158	159	159
3. Water Consumption above (MGD)	14.06	15.14	16.23
4. No. of Non-permanent Residents (Persons)	49,900	57,900	69,800
5. Daily Water Consumption per capita above (lt/c.d.)	80	80	80
6. Water Consumption above (MGD)	0.88	1.02	1.22
7. Total Water Consumption (MGD)	14.94	16.16	17.45
8. Total Supply Loss (%)	35	31	28
9. Water Demand (MGD)	22.98	23.42	24.24

Table 2-5 Estimation of Water Demand in Kotwali Thana

Particulars	Year		
	1991	1995	2000
1. Population (in million)	192,424	202,622	213,969
2. Daily Water Consumption per capita (lt/c.d.)	145	146	147
3. Water Consumption above (MGD)	6.13	6.50	6.91
4. No. of Non-permanent Residents (Persons)	81,300	94,500	113,800
5. Daily Water Consumption per capita above (lt/c.d.)	80	80	80
6. Water Consumption above (MGD)	1.42	1.66	2.00
7. Total Water Consumption (MGD)	7.55	8.16	87.91
8. Total Supply Loss (%)	35	31	28
9. Water Demand (MGD)	11.62	11.83	12.38

CHAPTER 3 OUTLINE OF THE PROJECT

Chapter 3. OUTLINE OF THE PROJECT

3.1 Objective of the Project

3.1.1 Objectives

The Chandnighat Water Treatment Plant was constructed initially to supply water to the old city of Dhaka in 1874. With growth of population in the city, underground water has been developed for potable water.

Groundwater reserve has been an important source of water supply in the city for centuries. Deep tubewells drilled by DWASA are providing water for domestic and industrial consumers on commercial basis.

But, rapid urbanization of the city has caused serious shortage of water, and programmes by DWASA to supplying additional water from ground water reserve could not sufficiently meet the increasing demand for water.

However, to resolve the current problems of water supply in the city, DWASA has undertaken several positive steps, such as:

1) Crash Programme for DTW's (Deep tubewells)
2) DWASA III Project
3) DWASA IV Project

Among these, DWASA IV Project initiated under the World Bank assistance and Dhaka City Emergency Water Supply Project (EWSP) under French - Bangladesh protocol are on going. These progressing projects are now in feasibility study stage and still in need for detailed engineering design for water treatment plant and main supply pipelines for water distribution system. On the other hand, implementation process of these projects are slow and with long period plan, also schedule for these will only be decided after agreement with the donors.

In the projects of Crash Programme for DTW's and DWASA III a total of 90 deep tubewells are developing and expected to supply water around 79

MGD. However, report from World Bank is against development of further deep tubewells, as becuase, heavy pumping from confirmed aquifers has caused the lowering of piezometris head and thereby producing excessive sand. Consequently, existing wells with a small capacity are too much costly to operate and maintain.

Considering the above, DWASA has planned for implementation of the rehabilitation and expansion of Chandnighat Water Treatment Plant at an emergency basis.

Chandnighat Water Treatment Plant plays a vital role in water supply, being the only existing water treatment plant in the city of Dhaka. However, its facilities and equipment have superannuated and are likely to be difficult to operate properly even after small scale rehabilitations.

Moreover, the present condition of the existing facilities does not allow for operation with the design capacity and water quality.

With this background, the Government of Bangladesh has requested for grant aid cooperation on the Project to undertake rehabilitation works of the Chandnighat Water Treatment Plant including main water distribution pipes.

The objective of the Project is to expand the existing treatment capacity of the facilities of the Plant and to rehabilitate its superannuated facilities and equipment, and thereby contribute to the improvement of the water supply service in the project area by means of water quality and quantity.

3.1.2 Significance of the Project

From the survey of April 1992, it was found there are 24 nos. deep tubewells and one (1) water treatment plant in the project area.

Reference to previous Fig. 2-3 which shows location of these wells and water works. It can be seen from the figure that the distance between wells from each other is in average around 500 m which is limited dis-

tance to keep one well operational water level from interference with the adjacent wells. It means scope for new well development in that area is not viable and difficult for future plan.

The original Chandnighat Plant has been constructed in 1874 and rehabilitated in 1947 and 1970 in the latest for limited facilities such as pump and electrical equipment. However, since 1970, major replacement/ rehabilitation have not been carried out. Owing to which, the facilities of the Plant are superannuated and its equipment are insufficient. Despite the fact that demand for water is rising gradually in the area in keeping with the growth rate of population and town activity, the water supply remains unable to meet the increasing demand.

With this shortage of supply water, it is reported that there are more than one hundred pitcher pumps directly connected into distribution pipe line. In habitants living in the lowest water pressure area under the Zone II has been doing this to get water from the distribution line. Attention should be given to discourage such activities, because such manners are not allowed for water works, it has very dangerous risk of water pollution from the waste water of surrounding area to get mixed into the water supply pipe.

The progressing water treatment plant projects such as EWSP initiated under French Government grant aid is now in feasibility study stage. If the programme is carried out on the original schedule prepared in the EWSP report, connection of main water distribution pipe into the project area is estimated to be done by 2000.

The Project is significant as water supply project for the following reasons:

1) The aim of the Project is to improve the quality and quantity of water supply service, which is the primary requirement and beneficial to the people living in the project area.

2) The Project will be helpful to reduce high incidence of water bourne diseases such as diarrhea, dysentery, typhoid and worm infection, which are reported to be very high among the people living in this area.

The above mentioned factors are the most important significance of this Project, because since long time the citizens of the project area do not get satisfactory services on both water supply and of the sanitation facilities, which is due to inadequency of water.

Moreover, implementation of this Project will work as a stepping-stone for DWASA towards accomplishment of targeted water supply for Dhaka City at its future course.

3.2 Examination on the Contents of the Request

3.2.1 Examination of Propriety of the Project

Purpose of this section is to establish the status of the present water supply system of DWASA and look at perspective the role of the Chandnighat Plant, besides to ensure no overlap between this Project and related projects which are ongoing and preparing.

Listed below are few related projects, under preparation by DWASA, in connection to the above:

1) DWASA IV Project
2) Dhaka City Emergency Water Supply Project (EWSP)
3) Leakage Detection Control Programme (LDCP)

(1) DWASA IV Project

More than 95% of water supplied to Dhaka Metropolitan area are groundwater. However, the World Bank recommended in the feasibility study report that surface water should be used as the main source for bulk water in future instead of groundwater, because the following circumstances;

i) In certain areas it is found that the water level of the deep tubewells has fallen down and wells are producing excessive sand. Moreover, existing wells are small in capacity but to much costly to operate and should be either redeveloped or abandoned.

ii) It was found out that the increased ratio of the population is quite bigger than their expectation, therefore, construction of the bulk water supply system utilizing surface water would be more practical and economical.

iii) Quality of well water being contaminated regularly from random disposal of untreated sewage in and around the city.

iv) Over-extraction of water by deep tubewells caused heavy subsidance of ground level. Considering the relation with the flood situation in Dhaka city area, which size and frequency is alarming new installation for more deep tubewell is not at all justified.

In the above study, new water treatment plant with initial capacity of 100 MGD adaptable to 200 MGD in continuous phase at Saidabad was planned to carry out along with other works under DWASA IV Project.

(2) Dhaka City Emergency Water Supply Project (EWSP)

Study for this project commenced from February, 1991 is under French Grant Aid assistance in response to the request of the Government of Bangladesh. The study area covers the DWASA service area.

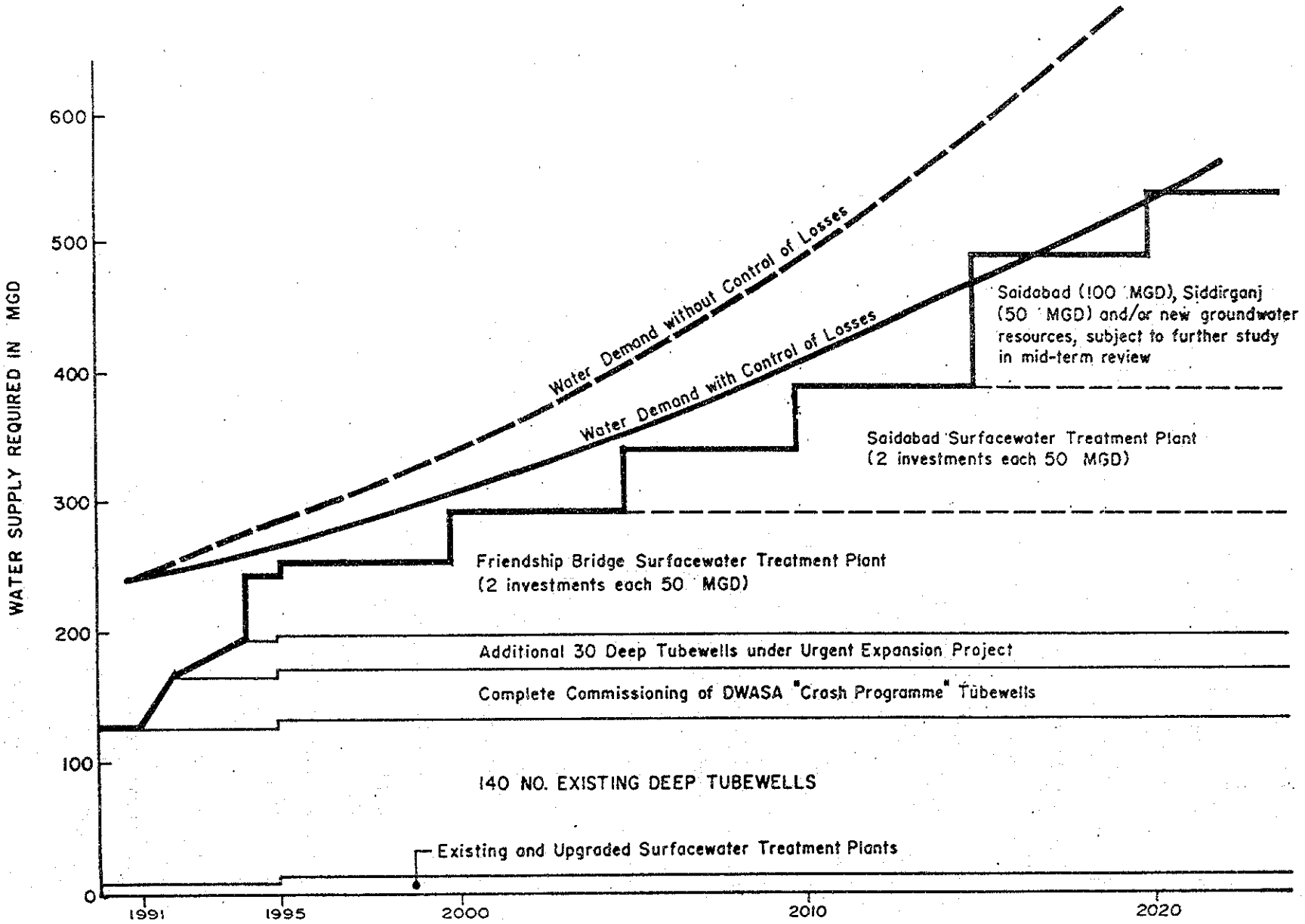
An interim report of the study as pre-feasibility study was submitted to DWASA in September, 1991. The study aims at formulation a master plan for establishment of water supply system of DWASA in which this Project is already involved to be expanded the capacity up to 10 MGD as shown in Fig. 3-1.

According to the study report, a surface water treatment plant having a capacity of 50 MGD is planned at China-Bangladesh friendship bridge which stands by the Buriganga river, which is adaptable to 100 MGD in continuous phase.

(3) Leakage Detection Control Programme (LDCP)

DWASA incurs considerable amount of financial losses through uncounted

Fig. 3-1 Water Demand and
Water Supply Plan for Dhaka city



for water by leakage and other technical faults in the distribution system and by water supplies to the consumers.

To cope with such situation, DWASA executed a study on the investigation into the actual condition of the system loss with the World Bank's cooperation. The study report was submitted to DWASA by a World Bank consultant in September of 1991,

The study is prepared based on investigations and measurement programmes in two pilot areas in the city of Dhaka and from review and analysis of DWASA records.

The study aims at achieving the following objectives:

1) To identify sources of unaccounted-for water and estimate the quantity of such losses.

2) To formulate a plan for establishment of leakage control and thereby reduction of unaccounted-for water.

3) To formulate a plan for improvement of commercial loss control and thereby reduction of unaccounted-for water.

According to the survey report, an estimation of unbilled water quantity for the city of Dhaka is analyzed as shown hereunder.

Table 3-1 Summary of Water Losses in the City of Dhaka

1) Total production according to DWASA records	517,000 m^3/d	100.00%
2) Total billing according to DWASA records	227,500 m^3/d	44.00%
3) Technical losses according to Consultants analysis		
Pipe leaks	82,550 m^3/d	15.97%
Service connection	44,140 m^3/d	8.54%
Miscellaneous losses	2,240 m^3/d	0.43%
Total technical losses	128,930 m^3/d	24.94%
4) Commercial unaccounted-for water according to Consultants analysis		
Un-metered connections	38,690 m^3/d	7.48%
Illegal connection	14,500 m^3/d	2.80%
tampered, illegible, defect meters	35,200 m^3/d	6.81%
Inaccurate meters	3,750 m^3/d	0.73%
Faulty reading & billing	68,250 m^3/d	13.20%
Miscellaneous	180 m^3/d	0.04%
Total commercial losses	160,570 m^3/d	31.06%
5) Total unaccounted-for water (3+4)	289,500 m^3/d	56.00%

Source: Leak Detection and Waste Prevention Programme prepared GKW consultant; August 1991.

As the preceding table shows, the technical loss or leakage from distribution pipes and service connections is 24.9% of total production for water, which can be said to be unexpectedly low.

In the distribution system of water supply for a large part in the city, the pressure of water inside the pipeline is kept very low to limit substantial amount of physical losses. In addition to the planned pressure of supply water, water shortage is assumed due to low pressure in the pipeline. In this connection the study report described during the survey it was found that water pressure in the supply pipeline was 5 m

to 8 m and less than 2 m to 3 m in service connection pipes. It is expected that increase on the ratio of technical losses will vary from 25% to 40% up to 45% when the water supply system is improved without any measurement for technical loss control.

Accordingly in the report, the leakage detection control programme is summarized as follows:

Programme for Control of Technical Water Loss

- Maping of all pipes of Nominal Diameter(DN)=> 200 mm up to 1994	270 km	TK	54,000,000
- Mapping of all distribution pipes of DN < 200 mm up to 1996	900 km	TK	104,000,000
- Employment of 2 specialized loss control experts for 5 years from 1992 to 1996 for training of DWASA staff, implementation of long term loss control measures and coordination and supervision of the following activities		TK	110,000,000
- Separation of MODS zones		Tk	2,400,000
- Separation of sub-zones		TK	66,464,000
- SC meter installation	40,000 units	TK	60,000,000
- SC meter repair	18,200 units	TK	27,400,000
- Replacement of old steel pipes (5 years)	45.5 km	TK	60,480,000

Total cost for this technical loss reduction drive sum up TK 50.7 crore, which is equivalent to approx. Us$ 14.1 million dollar.

It is estimated to improve a technical losses control drive to reduce system losses to the 18% target level with performance of the mentioned above control programme.

Programme for Control of Commercial Unaccounted-for Water

- Assignment of an experienced commercial adviser for 2.5 years starting in 3rd quarter 1991 throughout 24 months and periodical follow up missions thereafter.

Jobs to be undertaken;

* to streamline the billing procedures with special respect to computer supported billing
* to implement tight control procedures for billing procedures
* to further improve billing software and hardware
* to perform training for DWASA's billing key personnel
* to establish a sound basis for efficient long term operations

- Employment of specialized expert for above jobs for 2.5 years:	TK	25,000,000
- Enhancement of billing software budgeted in 1991:	TK	500,000
- Cost estimate for further enhancement:	TK	750,000
- Purchase of computer hardware budgeted in 1991:	TK	8,500,000
- Cost estimate for upgrading:	TK	5,000,000

It is estimated that by adequate commercial operations and performance commercial unaccounted-for water can be reduced from 31% to 11% of water production.

Total additional cost for the design and implementation of a sound billing system to reduce commercial unaccounted-for water from the actual 31% level to 11% and to start long term procedures for maintaining this level thus sum up to Tk 3.1 crore equivalent to approx. US$ 0.9 million dollar.

With the recommendation of the World Bank study, DWASA decided to execute the LDC programme and accordingly its actual activities has commenced as of June of 1992. Initially, preparation of customer data base by means of the questionnaire survey is being undertaken.