ISSN 1605-2021

লোক-প্রশাসন সাময়িকী, সংখ্যা ৬৪
চৈত্র ১৪২১-জ্যৈষ্ঠ ১৪২২/এপ্রিল-জুন ২০১৫

Rajshahi Water Supply and Sewerage Authority: Achievements and Challenges

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Abstract: *The present study was conducted to assess the achievements of Rajshahi WASA using secondary data in March 2012. Collected information reveals that water supply and related services were improved in last 15 years. Water coverage was 33% in 1995 which increased to 67% in 2010. Per capita per day water production and consumption were 95 liter and 41 liter in 1995 which increased by 10% and 58%(105 liter and 65 liter respectively) in 2010. Services regarding water supply like number of population served, number of house connection, area of water distribution and amount of water sold were increased by 210%, 197%, 524% and 384% respectively from 1995 to 2011. On the other hand, non-revenue water was decreased from 56% (in 1995) to 38% in 2011. All these improvements indicate that management efficiency of Rajshahi WASA was increased considerably in last 16 years. Some challenges were also identified during the research. These were: poor tariff structure, lack of sufficient investment, higher non-revenue water, excess extraction of ground water, unplanned city, lack of necessary manpower and water contamination. Improvement of billing structure, arranging sufficient fund from donor agencies, reduction of non-revenue water, optimum use of surface water, planned city, appointment of necessary manpower and improvement of water quality by reducing contamination were the suggestions to face the challenges.*

1. Introduction

1.1 Prelude

Rajshahi City is one of the seven divisional headquarters located in the north-western part of Bangladesh with 787180 people in the total area of 93.47 square kilometers. Population growth rate is about 1.10%. With the increase of population the demand for water and sanitation is increasing day by day. To meet water supply and sanitation needs of the citizens, Rajshahi Water Supply & Sewerage Authority (Rajshahi WASA) was established in 1st August 2010 to provide safe and sufficient water for drinking, industrial and commercial purposes. Before that it was under Rajshahi City Corporation as Water Supply Section. Another objective was to establish improved sewerage system in the city area. But still now it is working only on supply of water to the consumers. There is no any central sewerage system maintained by the government or by any other authority in Rajshahi city. After getting its new entity Rajshahi WASA is maintaining its continuity regarding water supply as water supply section

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performed earlier. With the advancement of time performances of this organization has been improved no doubt. But no intensive research was carried out on this fissue. The present research is an attempt to assess the achievements of Rajshahi WASA over years.

1.2 Historical Development of Rajshahi WASA

The history of Rajshahi city is quite old. There are different opinions about the nomenclature of this district. According to historian Akshoy Kumar Maytreo, Rajshahi was named by the Jaminder of Natore Rani Bhabani. It is assumed that Rajshahi town was developed by the union of two villages namely- Rampur and Boalia. Primarily it was called Rampur-Boalia but the name Rajshahi became more popular later on[2]. There is another opinion that in 15th century Raja Khan who was popularly known as Raja Gyanesh conquered this area defeating the Sultan of Gaur and took the title Raja Shah. It is generally believed that the name of this city might have been derived from that name-Raja Shah.[3]

Once upon a time the district headquarter of Rajshahi was at Natore up-to 1825. After that district headquarters was shifted to Rampur-Boalia considering Natore as an unhygienic city due to excess water logging[4]. After 51 years in April 1876 Rajshahi Municipality was established during Lieutenant General Sir Richard Tempol (1874-1876). Total population of Rajshahi city was 15000 only. Water supply for drinking and other domestic purposes was one of the major services delivered by the municipality. As Rajshahi city is situated on the bank of river Padma, citizens of Rajshahi city used river water for their daily necessities. On the other hand, there was good number of ponds, ring well and hand tube wells in city area. The then Jamindar maintained these water sources for their raiyot. But due to overgrowth of population of the city, modernization in water supply system became very urgent. Moreover, due to use of unhygienic and untreated water of those open sources citizens were attacked by various water bourne diseases. In 1936 Rajshahi municipality became under electric supply. As a result, water supply

2 Deputy Commissioner's Office, Rajshahi, 2011(www.dcRajshahi.gov.bd(accessed on 20 April, 2012).

3 Bangladesh Bureau of Statistics(BBS), Bangladesh Population Census Report 2001: Community Series: Zila Rajshahi (Dhaka: Reproduction, Documentation and Publishing Wing, BBS, Planning Division, Ministry of Planning, Government of the People's Republic of Bangladesh, 2001), pp.1-4.

4 Ibid

through pipeline was started under the project "Maharani Hemanta Kumari Water Works" in 1937. Maharani Hamanta Kumari was the then Jamindar of Puthia.

Rajshahi municipality started supply of safe drinking water through pipe line in 1937 when D. N. Dasgupta was municipal chairman (1934-1939). A water supply project was taken costing Tk. 257285 out of which Tk. 65000 was paid by the then Jamindar of Puthia Maharani Hemanta Kumari. In the honor of the then Puthia Jamindar the project was named "Maharani Hemanta Kumari[5] Water Works". Under that project a central water treatment plant was constructed at Hatemkhan area of Rajshahi city (Photo 1). The system had more than 100 street water reservoirs (Dhopkal), each with a capacity of 1779 liters. The street reservoirs were connected to a centrally built iron and hardness removal plant, with a capacity of 700m3 water/day and an elevated service reservoir through reticulated distribution pipes. People collected water from that street reservoir. More than 400 people collected water from one Dhopkal. The mechanism of central reservoir and Dhopkal was very scientific. The project was implemented by the Department of Public Health Engineering, Rajshahi. But with the advance of time, due to population increase and hence expansion of city area, the Dhopkals was destroyed for the construction of roads and buildings. As a result, the central reservoir became abundant in 1965.

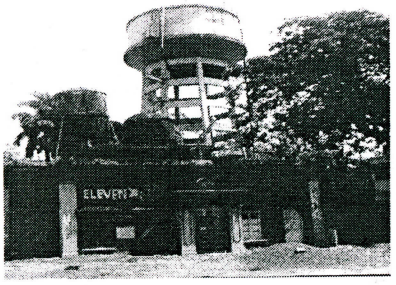

Photo 1: Iron and hardness removal plant

Photo 2: Street water reservoir (Local name Dhopkal)

The Ministry of Works, Calcutta, India started ground water supply system in Rajshahi city. After treating ground water by physico-chemical process water was supplied through pipe lines to the houses. Department

5 আনারুল হক আনা, রাজশাহী মহানগরীর কথা, ২য় সংস্করণ, আলীগড় লাইব্রেরী, ঢাকা/রাজশাহী, ২০০৭। পৃ.-১১৭।

Supply and Sewerage Authority (Rajshahi WASA) was established in 1st August 2010 as an autonomous body under the Ministry of Local Government, Rural Development and Cooperatives of the People's Republic of Bangladesh. The mission of Rajshahi WASA is to provide safe and sufficient water for drinking, industrial and commercial use. The main responsibility of Rajshahi WASA is:

- Construction, operation and maintenance of the necessary infrastructure for collecting, treating, preserving and supplying water to household, industries and commercial concerns,
- Construction, operation, improvement and maintenance of the necessary infrastructure for collecting, treating and disposing domestic sewerage and other sewerage and
- Construction, operation, improvement and maintenance of the necessary infrastructures for storm water drainage facilities of the city.

1.3 Objectives of the study

The study was conducted with the following objectives:

1) To assess the achievements of Rajshahi WASA over years

2) To identify the challenges faced by Rajshahi WASA and

3) To make some suggestions to solve those challenges

2. Methodology

The data of the present study were mainly collected from various official documents of Rajshahi WASA and other government offices as secondary sources through content analysis method. Data were also collected from concerned government documents, related literatures, books, journals, news papers, articles, theses, and web sites. Face to face interviews were conducted with structured questionnaire with Managing Director and other officials of Rajshahi WASA for necessary information. Descriptive statistics such as mean, percentage etc. were used to describe the variables/indicators of the study. After analysis of data results were presented in various tables and graphs.

3. Achievements of Rajshahi WASA

3.1 Water coverage of Rajshahi WASA

The water coverage of Rajshahi WASA is shown in Table 1 and Figure 1. From Table 1 it is seen that water coverage through household connection and public water points were 32% and 1% respectively in 1995 which increased to 62% and 5% respectively in 2011. The increment in water connections and public water points were 94% and 400% respectively. The total water coverage was 33% in 1995 which increased to almost double (67%) in 2011(Figure 1).

Table 1: Water coverage of Rajshahi WASA

Coverage through (%)	1995	2000	2005	2011	% change from 1995 to 2011
1.Household connection	32	41	59	62	94
2. Public Water points	1	2	3	5	400
3. Total coverage	33	43	62	67	103

Source: Official documents of Rajshahi WASA

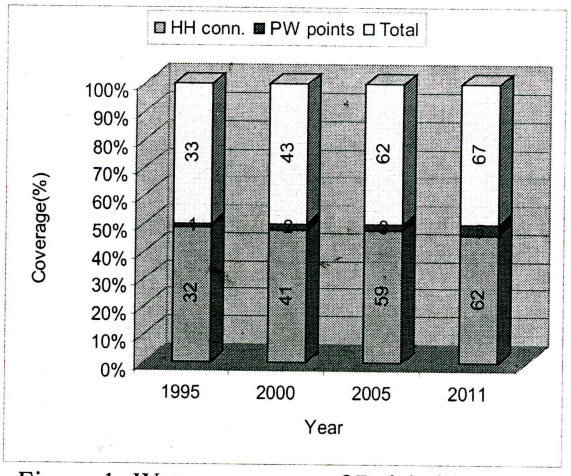

Figure 1: Water coverage of Rajshahi WASA
Note: HH=Household, PW= Public Water

3.2 Water production and consumption

Table 2 shows the water production and consumption of Rajshahi WASA. The data contained in Table 2 indicate that total water production was 16188 cubic meter per day in 1995 which increased to 55440 cubic meter per day in 2011. The growth in water production was 242%. The per capita production and consumption of water was 95 liter and 41 liter

respectively in 1995 which increased to 105 liter and 65 liter respectively in 2011(Figure 2). The rate of increment was 10% and 58% respectively. Due to increase in the number of population of the city over years, both production and consumption of water have been increased.

Table 2: Water production and consumption

Parameters	1995	2000	2005	2011	% change from 1995 to 2011
1.Water production(lpcd)	95	81	87	105	10
2. Water consumption (lpcd)	41	42	50	65	58
3. Total water production (m^3/day)	16188	20160	32640	55440	242

Source: Official documents of Rajshahi WASA

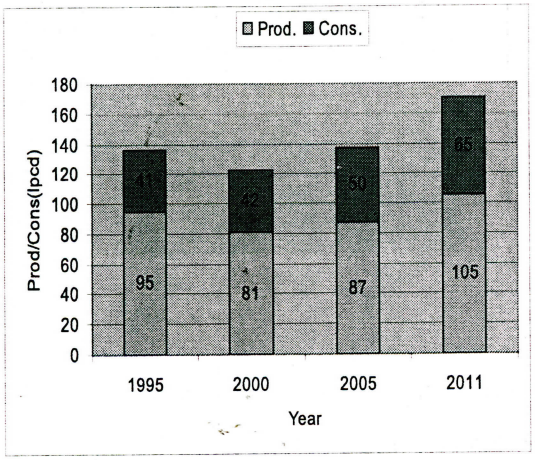

Figure 2: Production and consumption of water
Note: Prod.=Production, Cons.=Consumption

3.3 Non-revenue water (NRW)

The information regarding non-revenue water is presented in Table 3 and Figure 3. From the data furnished in Table 3, it is illustrated that non-revenue water of Rajshahi WASA is decreasing gradually. In 1995 the amount of non-revenue water was 56% which decreased to 38% in 2011(Figure 3). Non-revenue water through pipe line and individual house connection were 111 m3 meter per kilometer per day and 0.90 m3 meter per connection respectively in 1995 which decreased to 42 m3 meters per kilometer per day and 0.71 m3 per connection respectively in 2011. The rate of decrease was 62% and 27% respectively. The overall decrease in non-revenue water was mainly due to improved management efficiency. Rajshahi WASA has fixed a target to reduce it from 38% to

23% (International standard).

Table 3: Non-revenue water (%)

Type of non-revenue water	1995	2000	2005	2011	% change from 1995 to 2011
1. Non-revenue water (%)	56	49	42	38	-32
2.Non-revenue water (m^3/km/d)	111	49	40	42	-62
3. Non-revenue water(m^3/conn/d)	0.90	0.67	0.63	0.71	-27

Source: Official documents of Rajshahi WASA

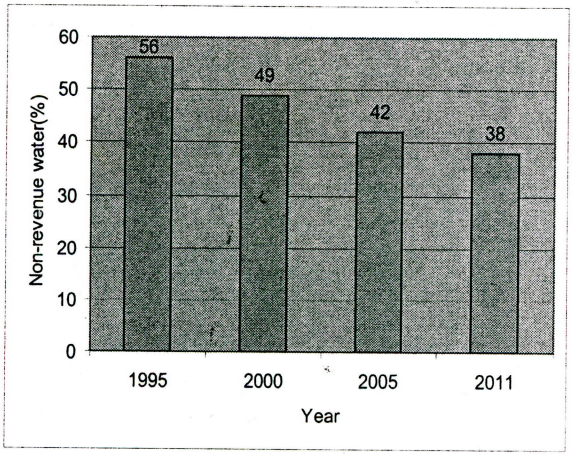

Figure 3: Non-revenue water of Rajshahi WASA

3.4 Water services of Rajshahi WASA

Water services of Rajshahi WASA are shown in Table 4 and Figure 4. From the table, it is observed that population served by water connection, number of water connection, length of water distribution and total water sold in 1995 were 170000, 10090, 82 km and 7063 m3 per day respectively. After 16 years these services were tremendously increased to 528000, 30000, 512 km and 34200 m3 per day respectively in 2011. The increments were 210%, 197%, 524% and 384% respectively. Increment of different parameters of water services of Rajshahi WASA were mainly due to good management.

Table 4: Water services of Rajshahi WASA

Type of water services	1995	2000	2005	2011	% change from 1995 to 2011
1.Population served by connection	170000	239000	374000	528000	210
2.House connection(no.)	10090	14610	21690	30000	197
3. Length of water distribution(km)	82	198	348	512	524
4. Total water sold(m^3/year)	7063	10373	18870	34200	384
5. Total water production (m^3/day)	16188	20160	32640	55440	242

Source: Official documents of Rajshahi WASA

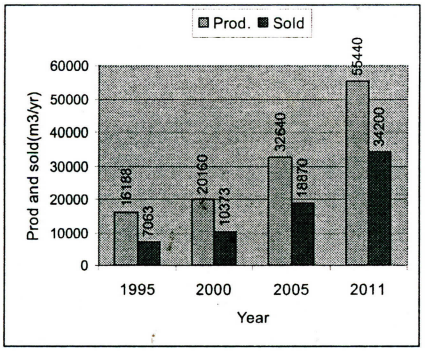

Figure 4: Production vs sold water of Rajshahi WASA

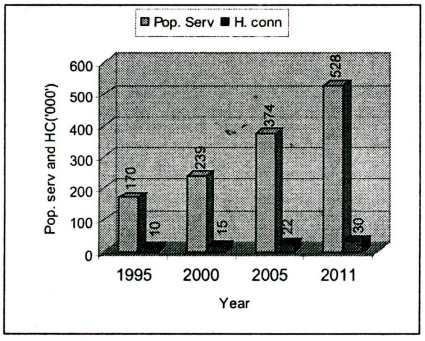

Figure 5: Population served and house connection of Rajshahi WASA

3.5 Quality of service provided by Rajshahi WASA

Table 5 shows the quality of services provided by Rajshahi WASA to the citizens. Duration of water supply was 8 hours/day in 1995 which increased to 12 hours/day in 2011. The duration of water supply through pump machine operation was increased by 50% in last 16 years. As a results number of complaints by the citizens was reduced to a considerable number. The number of complaints alleged by the citizens

was 3650 in 1995 which reduced to 2555 in 2011. The rate of decrease was 30%. Increased duration of water supply ensures water production satisfies customers that reduces complaints.

Table 5: Quality of service provided by Rajshahi WASA

Parameters	1995	2000	2005	2011	% change from 1995 to 2011
1. Duration of service(hrs/d)	8	9	10	12	50
2. Number of complaints	3650	2920	2785	2555	-30

Source: Official documents of Rajshahi WASA

3.6 Total water operational cost

Various operational costs are shown in Table 6 and Figure 6. The labor cost, electricity cost and other cost were Tk. 92 lac, Tk. 68 lac and Tk. 38 lac respectively in 1995. After 16 years these costs were increased to Tk. 259 lac, Tk. 252 lac and Tk. 122 lac respectively in 2011. The rate of increments was 182%, 268% and 223% respectively. Increase in all types of costs was reflected in total cost of water production. In 1995 total cost was Tk. 198 lac which increased to Tk. 633 lac in 2011(Figure 6). Due to inflation of price of different items, the total cost of production was increased.

Table 6: Total water operational cost

Type of cost	1995	2000	2005	2011	% change from 1995 to 2011
1. Labor cost/yr (Lac Tk.)	92	156	158	259	182
2. Electricity cost/yr (Lac Tk.)	68	86	144	252	268
3. Other cost/yr (Lac Tk.)	38	55	89	122	223
4. Total cost/yr (Lac Tk.)	198	297	391	633	220

Source: Official documents of Rajshahi WASA

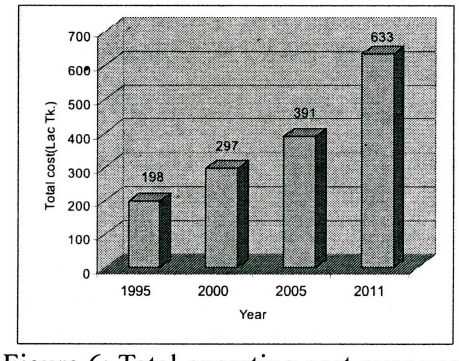

Figure 6: Total operating cost over year

3.7 Revenue earning from water

Revenues earned by Rajshahi WASA from water are presented in Table 7 and Figure 7. The data presented in the table indicate that average tarrif and connection charges in 1995 were Tk. 40 per month per connection and Tk. 912 per connection respectively which increased to Tk. 125 per month and Tk. 2653 per connection respectively in 2011. The increments were 212% and 191% from 1995 to 2011. The total revenue earning was Tk. 53 lac in 1995 which increased to Tk. 482 lac in 2011(Figure 7). A significant change in revenue earning was found in last 16 years and it was 809%. The collection efficiency was also increased to considerable amount. In 1995 collection efficiency was 41% which after 16 years (2011) increased to 54%. Increased manpower and their efficiency have increased collection efficiency.

Table 7: Water operating revenue

Type of revenue	1995	2000	2005	2011	% change from 1995 to 2011
1. Average water tariff (Tk./month/conn.)	40	60	90	125	
2. Average number of house conn./month	45	60	75	100	
3. Connection charges/house(Tk.)	912	1638	1905	2653	
4. Total yearly revenue (Lac Tk.)	53	117	251	482	
5. Collection efficiency (%)	41	43	47	54	

Source: Official documents of Rajshahi WASA

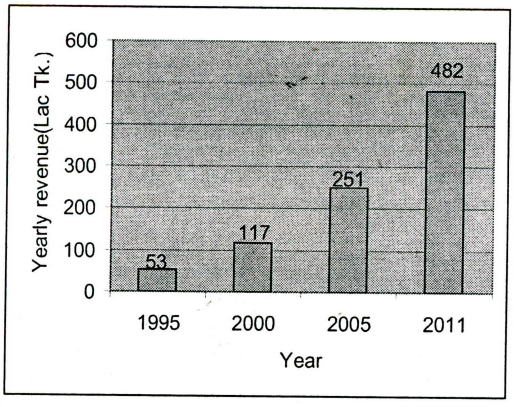

Figure 7: Yearly revenue of Rajshahi WASA

3.8. Key Performance Indicator (KPI)

Rajshahi WASA has already practiced the Benchmarking and Performance Improvement Program (PIP) by using the International Benchmarking Network (IB-Net) format and the Key results of benchmarking data and PIP of Rajshahi WASA are following.

Table 8: Key Performance Indicator (KPI) of Rajshahi WASA

Name of performance indicators	Rajshahi WASA status	Developing countries' standard
1. Population coverage by water supply	67 %	100 %
2. Continuity of water supply	12 hrs/day	24 hrs/day
3. Consumption of water	65 lpcd(liter per capita per day)	145 lpcd(liter per capita per day)
4. Operating ratio	1.30	0.70
5. Collection efficiency	54 %	90 %
6. Non revenue water	38 %	23 %
7. Staff / 1000 connections	7.87	5.00
8. Water quality	Hardness : 300-400 mg/L Iron : 3.5-2.4 mg/L Manganese : 2.0-1.0 mg/L Arsenic : <0.01 mg/L Faecal coli form : 10-12 /100ml	Hardness : 200-500 mg/L Iron : 0.3-1.0 mg/L Manganese : 0.1 mg/L Arsenic : 0.05 mg/L Faecal coli form : Zero

Source: Official documents of Rajshahi WASA

3.9 Targets of Rajshahi WASA:

Table 9: Targets of Rajshahi WASA

Area of performance improvement	Proposed components
Increase water coverage (Form 67% to 100%)	1.Installation of various pipe lines 2. Procurement of water tanker
Increase consumption of water (form 65 lpcd to 145 lpcd)	1. Installation of Production tube-well and water treatment plants 2. Procurement of regeneration unit & water flow meter for each PTW
Decrease operating ratio (form 1.3 to 0.70)	1. Procurement of O&M equipment. 2. Procurement of submersible pump motor for replacing old turbine pump. 3. Installing water flow meter at house connection.
Increase collection efficiency (Form 54% to 90%)	1. Customized software & preparation of computerized Billing System.
Decrease non-revenue water (Form 38% to 23%)	1. Preparation of GIS based pipe line network map. 2. Installing water meter at each house connection.
Improved water quality	1. Procurement of water test lab equipment 2. Installation of washout.

4. Challenges/Problems Faced by Rajshahi WASA

4.1 Poor tariff structure: The problems of tariff structures are: a) Poor billing and collection system (manual billing system). b) Comparatively lower water tariff (3.86 Tk. /m3). c) Lack of tax paying habit of the citizens (About Tk. 80 million water tax is unpaid). d) Comparatively high intensity of non-revenue water (38%) and e) Lower operation ratio (1.30). At the moment Rajshahi WASA provides the cheapest water in the world. The price of 1 cubic meter (1000 liter) of water is only Tk. 3.86(0.04 USD). Provision of water at low cost to the city dwellers is listed as one of the achievements of Rajshahi WASA. Rajshahi WASA is trying to reduce the operating ratio from 0.79 to 0.70 by the end of this year.

The major concern faced by the Rajshahi WASA due to low tariff results less revenue than the cost of supplying water. In 2010-11 financial years the total cost of production was Tk. 633 lac while the total revenue was Tk. 482 lac. Full cost recovery is essential for successful management of water supply. The appropriate water tariff is very much required for Rajshahi WASA to balance the benefits and costs of water usage and to ensure sufficient revenue for the long-term financial sustainability of the water supply business. However low revenues limit the utility's to make a higher contribution to investments.

4.2 Large Investment: Lack of sufficient fund for taking development projects is another challenge for Rajshahi WASA. As a new organization Rajshahi WASA is yet to manage development fund. But it needs massive investment for both production and treatment surface water in order to replace extraction of ground water as it is becoming no more viable. Treating surface water requires huge investment and this is a great challenge for Rajshahi WASA. At present Rajshahi WASA is running one large surface water treatment plant with the help of the government. There is also a great need for more investments in establishing more treatment plants in order to meet the fast-growing water demand in Rajshahi city.

4.3 Non-revenue water: After establishment of Rajshahi WASA, it is trying to reduce uncounted for water losses and poor performance in revenue collection. In Rajshahi, there is substantial portion of Non-revenue water (NRW) (38%) and system loss which is not billed and this is due to leakage and illegal connections. The reduction of NRW is one of the major challenges for Rajshahi WASA. The rehabilitation and

optimization of Rajshahi WASA's water distribution network is required to minimize losses and to enable 24-pressurized water supply. Rajshahi WASA also needs provision of water quality assurance and control measures to address this challenge.

4.4 Switching to surface water from ground water extraction: Rajshahi WASA has 67% water coverage and water demand in Rajshahi city is 118.07 million liter per day (MLD) which more than double to its supply. At present 99% of the supplied water is from ground water abstraction from Rajshahi WASA's 70 production tube wells. The remaining 1% water come surface water treatments. Ground water depletion is occurring at an alarming rate. In most places the layer of ground water has been decreasing by 2-3 meters each year due to lifting of ground water. Rajshahi WASA has to change its focus to using surface water instead of underground water because abstracting ground water is no longer ecologically viable. The ground water aquifer inevitably and urgently needs to be recharged through rain water harvesting. But in Rajshahi region rainfall is comparatively lower than that of other regions of Bangladesh. Moreover, source of surface water near Rajshahi city is very limited. The Padma river and other wetlands are gradually silted and dried up. Points of Padma river in which water is available throughout the year are of long distance (15-30km) from Rajshahi.

However, treating surface water is much more technically complex and expensive than using ground water. Treating surface water became a great challenge for Rajshahi WASA because the large rivers nearest to Rajshahi city are also quite polluted due to indiscriminate discharge of domestic waste water and some industrial effluent. The water quality situation would further deteriorate if no pollution control measures in Rajshahi watershed are undertaken. Continuous falling of ground water layer due to excess use of underground water for irrigation in Rajshahi region. But natural sources of water (river, ponds, beels, haors etc.) for irrigation have been silted up and becoming dried. As a result, farmers have to use underground water for irrigation. Especially in summer season use of underground water is increased due excess need of crops.

4.5 Unplanned City Development and Growth: The rapid growth of Rajshahi city also causes high demand for water along with housing, electricity and gas. Due to tremendous geographical expansion and population growth over the last two decades , the city was developed in a very unplanned manner and as such the planning for the Rajshahi WASA activities is modified time to time to meet fast-growing demand of

Rajshahi city for water and still this is one of the challenges for Rajshahi WASA.

4.6 Lack of efficient manpower: As a new organization Rajshahi WASA is suffering from shortage of efficient manpower. Before establishing Rajshahi WASA water supply section of Rajshahi City Corporation (RCC) looked after the water supply service. After the formation of Rajshahi WASA 62 officers and staffs of water supply section of RCC have been absorbed into Rajshahi WASA. They are only the permanent staffs of Rajshahi WASA. There are some temporary staffs also. But with these limited number of staffs' activities of WASA has become very tough. The organogram of Rajshahi WASA have not yet been approved by competent authority. Without approved organogram Rajshahi WASA could not appoint sufficient manpower for its operation and maintenance activities. So, this is a very vital problem for Rajshahi WASA.

4.7 Contamination of drinking water: During production water is almost safe for drinking and other purposes. But when it is supplied through pipe line became contaminated by biological and chemical means. The chemical contaminants are: excess hardness (300-400 mg/L), iron (2.4-3.5 mg/L) and manganese (1-2 mg/L). On the other hand, biological contaminant is presence of Coliform bacteria (10-12/100ml water) in pipeline.

5. How to Overcome the Challenges

5.1 To Improve Tariff Structure: Probable suggestions are

- Initiation of computerized billing system
- Payment of water tax through banking channel
- Water tariff should be rationalized
- Rajshahi WASA staffs should be trained by experienced Dhaka WASA officials
- Motivation through media (Newspaper, Television etc.) to pay tax regularly.

5.2 Arrangement of sufficient fund

- Timely submission of development project to the government
- Fruitful communication with donor agencies for development fund
- Rajshahi WASA should be financially solvent gradually by revenue earning

5.3 Reduction of Non-revenue Water (from 38% to 23%)

- Reduce water leakage
- Disconnection of illegal water users
- Preparation of GIS pipe line network system

5.4 Optimum Use of Surface Water

- Establishing surface water treatment plant
- Water may be carried out from those points by pipe line.

5.5 Planned city

Rajshahi Development Authority should work for a "Planned Rajshahi City" in coordination with Rajshahi City Corporation, Rajshahi WASA and other related agencies to make Rajshahi as a planned city.

5.6 Appointment of Sufficient Manpower

- The government should approve the Rajshahi WASA organogram for smooth functioning
- After getting the approval of organogram, Rajshahi WASA should appoint necessary manpower to run water supply activities smoothly.

5.7 Reduction of water contamination

- Installation of water test laboratory
- Installation of sufficient water treatment plant
- Installation of washout.

6. Future Development Plan of Rajshahi WASA

Future urbanization, rapid population growth and water demand Rajshahi WASA has taken four development projects for long-term achievements. These are as follows:

1. Development of Water Supply System in Rajshahi City.
2. Feasibility Study for Water Supply in Rajshahi City.
3. Development of Sewerage System in Rajshahi City

7. Conclusions

Though Rajshahi WASA is a very new organization, it is working hard to supply safe water for drinking and other purposes as per requirement of the citizens. Since Rajshahi city is growing rapidly in area and population. So, it is a great challenge for Rajshahi WASA to ensure water of adequate quantity and quality round the year. The ground water table is rapidly declining due to excess abstraction. Therefore, ground water is no longer a viable option. Rajshahi WASA needs sufficient funds for establishing more production tube well, surface water treatment plants and rehabilitation of water pipe lines as well as 100% metering. As new organizations existence of problems in the water supply system of Rajshahi WASA is very much natural. It is also true that challenges/problems faced by Rajshahi WASA are complex in nature but not impossible to solve. Some suggestions have been made to solve those challenges regarding water supply and sewerage system in Rajshahi city. If the government and donor agencies extend their hands of cooperation in this regard then Rajshahi WASA will be able to overcome those challenges and serve the people of Rajshahi city by supplying safe water for drinking and other purposes.

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