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Dhaka: Water Resources and Slum Dwellers' Capabilities

Sayeed Iftekhar Ahmed

The [Bangladesh] Government's goal is to ensure that all people have access to safe water and sanitation services at an affordable cost.

Since women play a crucial role in water management and hygiene education at the household level, recognition of women's role will contribute to the overall development of the [water] sector.

Government of the People's Republic of Bangladesh
National Policy for Safe Water Supply and Sanitation 1998
(Local Government Division 1998:1, 7)

Water scarcity is a severe and growing problem in Dhaka, especially in the summers when, except for some rich areas of the city, 90 percent of the city's residents face water shortages, 60 percent of whom face acute crisis (Khan 2005, Kamal 2006, Hasan 2007c). There is no regular water supply in most of the neighbourhoods even during "normal" times, and people are also not satisfied with the quality of water. The most precarious situation is in the slum areas, where roughly 37 percent of the city's population resides. The Dhaka Water Supply and Sewerage Authority (DWASA), a public water company, is in charge of supplying water to the wide metropolitan area of over 12.51 million people (UNESCO 2003). It follows a top-down hierarchical approach in deciding who gets water. Through the lens of Amartya Sen's (1999) capability approach, this article examines whether slum dwellers in Dhaka have been able to establish personal command over the use of piped water resources distributed by DWASA.

The Capability Approach

The capability approach (Sen 1980) offers an alternative perspective to the utilitarian theory that is generally used in microeconomics. The utilitarian theory postulates that a person's well-being depends on control of personal utilities. In contrast, capability theory does not address the significance of goods in a person's life, or the pleasure a person derives from the use of those goods; instead, it addresses a person's opportunities to make use of the resources to secure well-being (Sharma 2004, 1). According to Amartya Sen, it focuses on "what they are actually able to do or to be" (Nussbaum 2000, 12). Sen uses "the notion of capability" to indicate "a space within which comparisons of quality of life (or standard of living) are most fruitfully made" (ibid.). The capability approach mainly pays attention to the opportunity rather than

the process; hence, this article focuses on the actual opportunities an individual might have to get access to water. Three indicators are used to measure the capabilities of slum dwellers to use piped water: the minimum quantity of regularly supplied piped water per person, its quality, and its price.

Slum Dwellers in Dhaka

According to Anu Muhammad (2007, 36), a Bangladeshi economist, there are six million people living in slum areas; on sidewalks, in railway stations, in garages, and inside sewer pipes in Dhaka. More than 100,000 of these people live on the street sides, sidewalks, and market verandas, in rickshaw vans, and inside market places; those who are relatively privileged live in the slums. A slum is defined as "a neighborhood [sic] or residential area with a minimum of 10 households or a mess unit with at least 25 members with four of the following five conditions prevailing within it: predominantly poor housing; very high population density and room crowding; very poor environmental services, particularly water and sanitation facilities; very low socioeconomic status for the majority of residents; lack of security of tenure" (Islam et al. 2005, 12).

A study by Islam et al. (2005, 12, 39; see also Sohel, 2007) suggests that more than 3.4 million people live in 4,966 slum clusters in Dhaka in an area of only 3,840 acres. Population density is thus very high in slum clusters—891 persons per acre—whereas the city population is 121 per acre (Islam 2005, 40). Most of these statistics are based on estimation because the slum population is highly mobile, and many residents also face eviction, by either the government or local authorities.

The slum population increased between the year 1996 and 2005 from 1.5 to 3.4 million. Massive urban migration by the rural poor is the major reason for the rapid increase of the slum population, especially after the liberation war of 1971. Roughly 37 percent of the city's population now lives in approximately 5,000 slum clusters (ibid. 20). The slums are still growing: "the rate of growth [...] and their tendency to emerge in more peripheral locations are likely to persist in the near future with continuing heavy rural to urban migration in the face of an ongoing dearth of land for cheap housing in more central locations" (ibid., 21). Over 75 percent of households in slum clusters are "single room family occupancy" and 77 percent are rented (ibid., 15, 42). On average, five persons live in one room in more than half of the clusters.

Most slum dwellers share their households with other family members and friends. They also live with non-relatives in "mess" housing; low-income people also live in "mess" housing in other parts of the city. Estimates are that 3,286,770 people live in slum households and 133,751 live in slum mess units (Islam et al. 2005, 37). Most of the households in slum clusters are women-centred, although men are the figureheads.

The major difference between slum dwellers' households and upper, middle, or lower middle-class households is that there is "very poor sanitation and inadequate water access" in the slums (Islam et al. 2005, 15). However, there are illegal and legal

electricity connections in most of the households in slum clusters.[1] Although some slum clusters consist of only 10 households, there are some with more than 1,000. Karail in Mohakhali is the "largest single slum" in the city, with more than 100,100 people. In the Kamrangirchar area, 265,000 of 300,000 people live in slum clusters, "the single largest concentration of slums." Large concentrations of slums are also located in Khilket, the Badda-Satarkul area, Hazaribagh, West Mohammadpur, and along the Narayangonj to Tongi railway line (ibid., 21).

Most women living in slum clusters are garment factory workers, domestic workers, vendors, day labourers, factory workers, and housewives. Most men work as rickshaw pullers, drivers, factory workers, day labourers, or vendors. According to casual inquiries by this author, with about 100 slum dwellers in various clusters, the daily income of both women and men is less than a dollar per day. The average income of a man is slightly higher than that of a woman because of the gender discrimination in wage distribution in most cases. The monthly income of most households in the slums is only $71 (ibid., 15). However, for slum dwellers the problem is not their low income but DWASA's decision to not supply water to the slum areas because they are living there "illegally".

Dhaka Water Supply and Sewerage Authority (DWASA)

Since its establishment in 1963 (under EP Ordinance No. XIX 1963), DWASA has been a semi-autonomous public organisation operating under the Ministry of Local Government and Rural Development. Before DWASA, the Dhaka Municipality and the Department of Public Health Engineering supplied water to the city's residents. DWASA's four main objectives were construction, operation, and maintenance of the necessary infrastructure for water supply for domestic, industrial, and commercial purposes; construction, operation, and maintenance of the sewage system; construction, operation, and maintenance of drainage facilities; and solid waste management (Ullah 2006).

Despite government mandates, the responsibility for managing solid waste has never been transferred to DWASA. Rather, since its formation in 1993, the Dhaka City Corporation (DCC) has been in charge of managing solid waste. At the beginning of the 1990s, DWASA took charge of supplying water to the Narayangang district, adjacent to Dhaka. Under the WASA Act of 1996, DWASA was restructured to set up corporate management "under which mandates for water supply, treatment and disposal of domestic and industrial sewage and storm water drainage were entrusted with DWASA" (Ullah 2006). DWASA is currently operating as a corporate organisation with three major goals: provide safe and sufficient water for drinking, industrial, and commercial uses; ensure sanitation and good hygiene conditions through proper disposal of domestic and industrial sewage; and ensure efficient storm-water drainage (Ullah 2006).

Based on this author's conversations with workers and staff, there are 420 males and only 47 females working at DWASA, organised hierarchically into first, second, third, and fourth class staff. The managing director is also the head of internal management.

DWASA's centralised system provides no plan for allocating piped water to slum households because DWASA's policy is to supply water only to legal households with DCC holding numbers. However, with the collaboration of some NGOs, DWASA does supply water to some slum areas (Mian 2002).

Capabilities of Slum Dwellers for Accessing Piped Water Resources

Quantity of Water

Although roughly 96 percent of slum residents have some access to piped water, almost none of the households have water connections, and they are also not connected to the drainage or sewage systems (Islam et al. 2005, 12). Table 1 shows the sources of drinking water in the roughly 5,000 slum clusters in Dhaka. Most slum dwellers do not obtain adequate water from these sources to meet their everyday necessities. All but 5 percent have to share their water sources with other people, and 40 percent have to share with 11 other households (ibid., 45).

Table 1: Sources of Drinking Water in Dhaka.

Municipal standpipes	92.3 percent
Tube well	6.5 percent
Other sources	1.2 percent

Source: Islam et al. 2005:45.

Seventy-five percent of households are "single room family occupancy" and on average five people live in one room (Islam et al. 2005, 15, 40). Although DWASA has set up some water connections inside slum areas, the existing connections have mostly been set up by the "owners" of the slum clusters, and in some cases by the NGOs working there.[2]

DWASA currently supplies water to an area of roughly 292 square miles in Dhaka. According to an unofficial estimation, the city requires 2,1002,500 million litres per day (mld), but from July 2005 to June 2006 DWASA was only able to supply an average of about 1,048 mld for domestic purposes (Table 2).[3] In some parts of the city, DWASA was completely unable to supply water in summer, and 60 percent of the city suffered an acute crisis of potable water (Hasan 2007c; Imam 2007). Meanwhile water demand in the city has been increasing at the rate of 100 mld per year, as a result of the 4.2 percent population growth in the city each year (Bhodro 2005).

Table 2: DWASA'S Daily Water Production during Fiscal Year 2005–2006 (million liters per day).

Year	Month	Total
2005	July	1245.3
2005	August	1220.52
2005	September	1193.95
2005	October	1224.46
2005	November	1233.62
2005	December	1227.42
2006	January	1187.75
2006	February	1165.95
2006	March	1149.49
2006	April	1203.99
2006	May	1229.51
2006	June	1290.56
Total		14,572.57

Source: DWASA 2006:2/2.

Roughly 83 percent of DWASA water comes from groundwater sources; except for regions in the hilly areas, groundwater is "the most important source of water supply" for the entire country (Rahman et al. 2001, 110). Only 17 percent comes from the nearby Shitolokkha, Buriganga, Turag, and Balu Rivers (Hasan 2007a). DWASA uses 441 deep tube wells to lift water from underground sources.[4] As a result of too much reliance on groundwater, its level has been dropping 69 feet every year, further exacerbating the problem. If DWASA continues at this rate, after five more years the water level will go down by 30 feet per year.

The major reason that DWASA cannot pump to capacity is that in the last 27 years the water level has gone down by 180210 feet in various parts of the city. The situation in adjacent places is slightly better because the water boards there do not rely as heavily on groundwater. Moreover, extreme pollution of the rivers around Dhaka has polluted the groundwater because the river water seeps through the soil into the groundwater supply (Hasan 2007b). However, despite this pollution, the major problem of DWASA is its inability to supply adequate water to most of the inhabitants of the city.[5] DWASA's wells were pumping water from 1,5501,800 feet deep before the water level went down, but the agency has recently established tube wells 3,000 feet deep in some parts of Dhaka. Such a well could produce 3,0004,000 litres of water per minute, but due to the declining water level many wells can only produce 2,0003,000 litres per minute (Imam 2007). The problem of decreasing water level thus affects the overall production of water.

In June 2006, DWASA produced on average 1,549 mld of water: 1,291 mld for domestic use and 258 mld for commercial and industrial use (DWASA 2006, 15/2). Hence, DWASA produced 103 liters water per person per day during 2005-2006, which was higher than the minimum requirement of water per person. Therefore, theoretically every person in Dhaka should have had the necessary amount of water. However, due to the absence of proper distribution policy—that is, not recognising the

needs of the slum dwellers—DWASA did not supply water equitably to all city residents. In addition, due to the high system loss—more than half—not all the water was available to consumers.[6] DWASA has nevertheless been reducing its system losses gradually from about 54 percent to about 41 percent (DWASA 2006, 17/3).

DWASA has created seven water zones in Dhaka, including the government zone, which includes the secretariat, government offices and establishments. In these seven zones, DWASA sets up water connections to the households of legal residents, government buildings, private institutions and offices, and educational and religious institutions, such as mosques, temples, churches, and seminaries. In June 2006, the total number of DWASA customers was 227,994, of which 214,316 were domestic customers. The number of customers has increased over time but has not kept pace with the number of citizens residing in the city (Table 3). There are, nevertheless, virtually no water connections to the households of 3.4 million people living in slums because they are not recognised as customers by DWASA—they do not have "holding numbers" because they are not "legal" residents in the city. The DCC provides holding numbers only to the legal owners of the land or the household.

Table 3: Numbers of DWASA Customers 2000–2006.

	7/00	7/01	7/02	7/03	7/04	7/05	6/06
Domestic	179,454	175,924	183,684	192,324	200,584	207,575	214,316
Commercial	6175	5864	6004	5916	5965	5997	6004
Industrial	1608	1641	1661	1652	1658	1661	1661
Community	1444	1104	1030	1120	1125	1129	1030
Offices	229	914	775	914	914	914	775
Total	188,911	185,448	193,155	202,592	211,380	220,439	227,994

Source: DWASA 2006:19/1-2.

Only DWASA's Zone V, which includes the posh residential areas, has a 24-hour water supply, especially in summer. One of the deputy revenue collectors of DWASA, who did not want his name to be revealed, informed this author that the reasons behind the continuous supply of water in upper-class neighbourhoods are the smaller population and the regular supply of power to that area. Moreover, special attention is paid to these areas because "important" people and diplomats and dignitaries are residing in these areas. In contrast, in the old parts of the city and in the lower middle-class neighbourhoods, even in "normal time" they do not receive water 24 hours per day, and during summer customers sometimes receive water for only 12 hours per day. Like slum dwellers, consumers in poor neighbourhoods sometimes rely on standpipes for water, especially during the summers.

Power cuts are one of the reasons for not supplying water regularly to middle-class or poor neighbourhoods. There are frequent power cuts in these areas, especially in summer, but there are few or no power cuts in the upper-class areas. Also, to operate a pump, 420 volts of electricity is needed, and in many places the electricity drops down to 380 volts during most of the summer.[7]

DWASA engineers informed me that theoretically there is 24-hour water supply in every neighbourhood in Dhaka; the problem is the water pressure. As a result of high water demand, the pressure becomes very low and it is, therefore, difficult to obtain water from a water pipe. None of the hundred-plus water consumers interviewed in Dhaka were satisfied with either the supply or the pressure of water. They have water for a maximum of 67 hours per day and the water pressure is not sufficient to lift water to the second or upper floors. Most middle and upper class consumers have built underground reservoirs to collect water from the DWASA pipes. Later, they use electric pumps to lift this water to the second or upper floor reservoirs.

To add water into their underground reservoirs, middle and upper-class customers usually use illegal pumps.[8] These middle-class water users informed me that they are aware that connecting water pumps with the main pipelines is illegal, but they also told me that there are hardly any middle or upper-class households in the city who do not have water pumps connected to the main water lines. They run these pumps during times of high pressure, usually at night or in the early morning. As a result, it is now difficult to obtain water without the pumps, and there is sometimes no water supply to the lower middle-class or poor households in the neighbourhoods who cannot afford pumps. Women, and sometimes men, from lower-middle class backgrounds also collect water from the nearby public standpipes. Besides this, especially in summer, they can collect water from the DWASA water tankers that supply water—sometimes free of charge—to the acute water shortage neighbourhoods, sometimes under the supervision of law enforcement authorities.[9]

Some slum dwellers and poor people, especially those who live in old Dhaka, rely on public standpipes for everyday water. Although standpipes were available almost everywhere in Dhaka in the past, nowadays they are mainly available in the old parts of the city and in the Narayanganj District. There are only 932 standpipes in all of Dhaka (DWASA 2006, 5). To collect water from the standpipes, women in slum areas have to walk 12 miles per day because none of the standpipes are located inside the slum areas. Usually they are placed at the corners of the main roads in old parts of the city, which are far way from the shanty areas. Most of the slum clusters are in new Dhaka, and they usually do not have public standpipes.

DWASA supplies 1,136 litres of water to every standpipe per day. The DCC is paying the bills for these standpipes; that is, the DDC pays for 1,058,752 litres water per day.[10] The Bangladesh government also has a policy of providing 92,440 litres of water per day to every religious institution, but if any such institution uses more water than the quota, they have to pay for the extra. By June 2006, 983 religious institutions received this benefit from the DCC (952 mosques, 26 temples, and 5 churches; DWASA 2006, 4); madrasahs are not included in this programme. In other words, the government has a programme for supplying water to religious institutions but no such policy for providing water to people living in poverty or "illegal" residents in the city. It is obvious that slum dwellers do not have command over piped water in terms of quantity.

Quality of Water

The water supplied by DWASA cannot be consumed without boiling. At present, DWASA is supplying odiferous and contaminated dirty water to 40 percent of the city (Hasan 2007d). City dwellers have even discovered worms in the water. Roughly a hundred DWASA consumers informed this author that even after boiling, it is sometimes difficult to use the water for cooking and drinking because of its odour as well as sediments in the water.[11] Water supplied in various slum areas was also not drinkable. People living in slums complained that sometimes the water smelled bad, but they informed me that they were used to drinking it without boiling. NGOs working in the slums sometimes supply water purifying chemicals or tablets, which they put in the community water reservoirs. For the slum dwellers, though, the main issue is not the contaminated water but the lack of water connections in their households and neighbourhoods.

According to Nazrul Islam, a Bangladeshi researcher on urban planning, the level of contamination is currently very high in Dhaka. Despite treating water in various treatment plants, it again becomes contaminated because the pipelines for both water and sewer are very old, cracked, and in need of repair (Helal 2007). The leaks in the pipelines and the cracks in the sewer lines result in the mixture of human waste with water.

Islam et al. (2005) mention that the surface water in the Buriganga, Shitolokkha, Turag, and Balu Rivers is not drinkable, even after boiling or being treated in the water plants. The chemicals that DWASA is using to treat the water are not able to remove all waste and pollutants from the severely polluted water (Helal 2007). The Buriganga River is used to dump waste materials from nearby industries, including the 243 tanneries located within two miles of the river on both sides of the bank. These tanneries "pour 7.7 million litres of untreated, highly toxic liquid waste into the river everyday" (Khan 2006). There are more than 7,000 industries just in the metropolitan areas of the city, and there are thousands of big and small industries situated around Dhaka. All of these industries dump their waste into the rivers (Alam 2007). The Buriganga is also the main recipient of untreated sewage waste; 80 percent of the sewage from Dhaka is dumped into this river untreated. Certain chemicals, such as aluminium, ammonium, chromium, cadmium, lead, and others, are present in the rivers around Dhaka in concentrations that are very dangerous for humans (Helal 2007).

DWASA regularly tests the surface water they provide; almost half the samples fail the test (DWASA 2006, 4). It is interesting to note, however, that in their June 2006 report there is no mention of the samples collected from the Saidabad Surface Water Treatment Plant, which mainly treats water collected from the Buriganga River and which is the largest of the DWASA plants.[12] Engineers and technicians for water NGOs in Dhaka have informed this author that the DWASA test results are not up to the appropriate level and are in fact biased. Their test results (conducted in private laboratories and in the National Science Laboratory) varied from those of the DWASA results and most of their samples have failed to meet the WHO standard.[13]

Price of Water

Domestic water is cheap in Dhaka; DWASA provides 1,000 litres of water for only 5.25 taka (about 7 cents) to its domestic customers. Water for commercial or industrial purposes is a little more expensive (about 25 cents). Besides metered water, there are also non-metered water connections, whose tariffs are determined by the percentage of "valuation of holdings per annum," that is, every year the DWASA staff measure the size of the holdings of the customers to determine the bills for these households (DWASA 2006, 23). DWASA vehicles also sell water relatively cheaply, especially during summer or in times of water crisis in a particular area (Table 4). However, the issue is not of price, rather one of obtaining a water connection. Obtaining a connection is both complicated and expensive due to high connection fees, bureaucratic complexity, and corruption; even DWASA officials and workers acknowledge these complexities.[14] Besides paying the regular fees, a household owner needs to pay extra money to the DWASA staff and workers as well as the representatives (ward commissioners) of the local electoral bodies. It is almost impossible to obtain a connection without offering bribes to the DWASA staff and ward commissioners. A household owner needs to give a bribe of at least $15 to the metre mechanic followed by often the same amount or more to other DWASA staff and mechanics, and roughly about $9 to $15 to a local ward commissioner, all of whom are engaged in illegal extortion.

Table 4: DWASA's Water Selling Rates for Vehicle Delivery

Quantity	Rate
2200 gallons	$ 4.00
1800 gallons	$ 3.50
1200 gallons	$ 2.85
800 gallons	$ 2.00
500 gallons	$ 1.78
250 gallons	$ 1.07

Source: DWASA 2006:26/1.

Besides bribing several persons, a household owner also needs to pay the application fee, a deposit for temporary connection, pipe connection and permission fees, a meter fee, a road-cutting fee, and the value added tax (Tables 5 and 6). Connection and metre fees depend on the size (diameter) of the pipes. Road-cutting fees also vary depending on the materials used in constructing the road. The distance of a household from the main pipeline also determines the connection fees. A longer distance means a higher connection fee, and obtaining a connection for a high-rise apartment needs special permission from DWASA and the DCC, requiring further payments to DWASA (Table 7). Instead of obtaining water connections, household owners may set up their own deep tube wells with permission from DWASA, but well fees also vary, depending on the size of the wells (Table 8).

Water is actually cheap in Dhaka, but regulatory fees are very high. It is not possible for the slum dwellers and economically marginalised population to access and take command over the piped water supply under these price structures.

Table 5: Fees For Temporary Connection and Permission for Pipe Connection (August 2004–June 2006).

Pipe Diameter	Temporary Connection Fee	Pipe Connection Fee
0.75 inch	$ 71	$ 7
1 inch	$ 143	$ 21
1.5 inch	$ 214	$ 142
2 inch	$ 286	$ 214

DWASA 2006:26/1–26/2.

Table 6: Meter Connection, Installation, and Testing Fees (August 2004–June 2006).

Meter Size	Connection	Installation	Testing
0.75 inch	$ 14	$ 7	$ 3
1 inch	$ 31	$ 14	$ 7
1.5 inch	$ 91	$ 36	$ 11
2 inch	$ 91	$ 43	$ 14

Source: DWASA 2006:26/2.

Table 7: Permission for Connecting Pipe Lines in Multi-Storied Building (February 2004–June 2006).

Cost of Clearance Form	$ 7
Floor Construction Approval Fee:	
Up to 9th floor	$ 29
10–15th floor	$ 43
Above 16th floor	$ 71

Source: DWASA 2006:26/2.

Table 8: Deep Tube Well Meter Connection Fee and Tariff.

	Up to 3 inch	4 inch	6 inch*
Meter connection fee	$ 99	$ 905	$ 1,530
Permission fee			
Domestic and community	$ 1143	$ 2000	$ 3143
Commercial and industrial	$ 2143	$ 4286	$ 5000
Yearly renewal fee			
Domestic and community	$ 7143	$ 1429	$ 1714
Commercial and industrial	$ 1071	$ 2143	$ 3143

*8 inch not permissible.
Source: DWASA 2006:26/1.

Concluding Remarks

DWASA was not able to supply the minimum requirements of water to most of the slum dwellers or poor people living in the city. They are not even successful in supplying adequate good-quality piped water to regular customers. DWASA unofficially follows an uneven policy of water distribution, and consumers living in the rich neighbourhoods are the beneficiaries. Despite paying the same amount of money for water and pipeline connection, consumers living in the middle and lower middle class areas are not receiving the same level of services as the rich consumers. Slum dwellers are not recognised as customers and their needs are ignored. They are unable to establish command over the quality, quantity, or price of water and their capabilities to access piped water are very limited.

Syeed Iftekhar Ahmed is PhD candidate in Political Science at Northern Arizona University, USA.

Endnotes

1. The owners of the slum areas provide electricity connections to the households by bringing power lines illegally from the main line. For offering this service, they charge a much higher rate than the power supply authority, which the renters have to pay because the Dhaka Electricity Supply will not connect to households without legal holding numbers. Islam et al. (2005, 12) mention that 96 percent of the households in slum areas have electricity connections.
2. DWASA sends bills to the NGOs and they collect money from the slum dwellers to pay the bills. Women in slum clusters play leading roles in collecting bills and distributing water among the slum dwellers under NGO supervision. NGOs have formed many groups in the slums, and women are the leaders of almost all of these groups. Besides collecting monthly bills, women supervise to make certain that the members of these groups collect water from the designated water sources and that no one wastes water from these sources. Female group members take turns continuously guarding the water sources.
3. None of the internal reports of DWASA acknowledge the daily needs of 2,100 mld, which was mentioned in various national newspapers. For example, see Hafiz (2006) and Imam (2007).
4. Besides DWASA, some middle and upper class households as well as some private corporations and offices (both public and private) have deep tube wells. By June 2006, there were 1,179 deep tube wells used by "other agencies" in Dhaka (DWASA 2006, ii). However, interviewed DWASA officials and workers said that unofficial estimation would be much higher than that. Use of a private deep tube well is legal in Dhaka; yet, a deep tube well should not be more than 600 feet deep and is not allowed to set up within 600 feet of a DWASA tube well location. DWASA does not have enough manpower to monitor whether this rule is properly followed.
5. According to WHO, 7 litres per person per day (Lpcd) is the "minimum survival allocation" and 1520 Lpcd is the "medium term allocation" of water (WHO 2005). NGOs working in slum areas in Dhaka accepted 2040 Lpcd as the minimal requirement of water, based on interview with Zakir Hossain, Senior Project Coordinator, Water and Sanitation Project, Dushtha Shaystha Kendra (DSK) and Mobasser Hossain Ripon, Engineer, Association for Realization of Basic Needs (ARBAN).
6. Pipeline leakage is one of the major causes for system loss in Dhaka, as well as under-billing, stealing water, and illegal connections.
7. Among the 441 deep tube wells, 233 have generators to operate during power cuts. DWASA

also has 31 portable generators, but during summer, due to acute power crises (low voltage and power cuts), DWASA has to use these portable generators to help run the wells that have no permanent generators. These portable generators should only run for 2 hours per day (60 hours per month), but in times of crisis DWASA has to run every generator 60 hours per week. The recent increase in oil price has raised DWASA's spending from $643 to $1,429 per month per generator (Imam 2007).

8. Several DWASA staff and engineers informed me that they were aware of the use of illegal water pumps in the city. However, they could not take any action against it because there are no clear guidelines regarding the use of pumps by the city dwellers; lack of staff is also a major reason. Therefore, despite their knowledge, they completely overlook the presence of illegal pumps in the city. DWASA staff and the water users told me that they never heard that the DCC or any other legal enforcement authority took any legal action against the illegal users. DCC also lacks guideline regarding the use of water pumps.
9. Each DWASA truck can carry 11551386 litres of water. A deputy revenue collector of DWASA informed me that they supply water to the households free of charge if the supply was disrupted due to the mechanical failure of DWASA. In this case, a household owner needs to inform DWASA about the problem. Most of the water users I interviewed were unaware of the service, and the handful who were indicated that after being called DWASA, usually did not coooperate.
10. Based on my conversation with a DWASA deputy revenue collector, who wanted to remain anonymous. It is interesting to note that the officers and the engineers whom I interviewed in DWASA preferred to remain anonymous. They told me that they were government officials and did not, therefore, feel comfortable being quoted in my research or any other type of publication. Workers and union leaders had no such hesitation in disclosing their names.
11. The areas where I found odiferous water were Gopibagh, Tikatuli, Hatkhola, Jatrabari, and Moahammadpur.
12. There are 615 mg of alkali in one litre of water in the river Buriganga, whereas the WHO standard is 400 mg per litre. The acceptable level of turbidity is 10, but in the Buriganaga it is 98.7. The value for ammonia is 2.5 mg in the river, whereas the acceptable value is 0.5 mg. The level of calcium is 36 mg in the river, and the acceptable level is 75200 mg per litre. The amount of oxygen is only 1.2 mg, which is much lower than the acceptable level (Rabin 2007).
13. Mobassor Hossain Ripon, an engineer in ARBAN, informed me that he collected water from different locations and took it to various laboratories in Dhaka; however, none of the test results met the WHO standard.

14. Zaber Hossain, DWAS revenue collector and other officials and mechanics working for the DWASA acknowledged the presence of bureaucratic complexity and corruption in obtaining a water connection. In addition, middle and lower-middle class city dwellers with whom I conducted interviews also mentioned the complexities and corruption associated with the connection.

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