



Alternate water supply arrangements in peri-urban localities: *awami* (people's) tanks in Orangi township, Karachi

Noman Ahmed and Muhammad Sohail

Noman Ahmed is associate professor in the Department of Architecture and Planning at NED University of Engineering and Technology, Karachi, Pakistan.

Address: Department of Architecture and Planning, NED University of Engineering and Technology, University Road, Karachi-75270, Pakistan; e-mail: nahmed@neduet.edu.pk

Dr Muhammad Sohail is senior research manager at the Water, Engineering and Development Centre (WEDC) of the University of Loughborough, United Kingdom.

Address: WEDC, Loughborough University of Technology, Leicestershire LE11 3TU, UK; e-mail: M.Sohail@lboro.ac.uk

SUMMARY: This paper describes the serious water shortages that have been a feature of life in Karachi in recent years, and how community-managed public tanks (*awami* tanks) have been used in Orangi, Karachi's largest informal settlement, to cope with the situation. These tanks are an example of a water supply service developed as a cooperative arrangement between informally developed community organizations and public sector agencies. The paper explores the partnerships between service providers, recipients of the service and other related stakeholders.

I. INTRODUCTION

MUNICIPAL WATER SUPPLY in Karachi has become grossly inadequate with regard to users' needs and expectations. Residential communities suffer from poor levels of service, and peri-urban locations, especially low-income settlements, have very limited access to municipal water supplies. One approach to coping with this problem has been the use of community-managed public tanks (*awami* tanks). This paper is based on information on 22 *awami* tanks in different locations in Orangi township in Karachi, including Ghaziabad, Gulshan-e-Zia, Mansoor Nagar, Gulshan-e-Bihar and Raees Amrohvi Colony. Information was collected from various stakeholders, including tanker operators and owners, Karachi Water and Sewerage Board (KWSB) staff, staff from the Pakistan Rangers (a paramilitary force usually deployed for border security) and municipal representatives. In addition, focus group meetings were held with tanker operators and area residents, and interviews held with KWSB staff, Rangers, elected councillors and political activists, all of whom shared their views anonymously.

II. WATER SUPPLY IN KARACHI - A BACKGROUND

IN PAKISTAN OVER the years, various organizational changes have been implemented in the utility agencies by federal or provincial governments, or under the advice of related international finance institutions. In the case of water supply and distribution in Karachi, in the past this has been handled by various combinations of different civic agencies. The Karachi Joint Water Board, constituted in 1953, was the first entity assigned the task of executing the first major expansion of Karachi's water supply system from the Indus River. Project execution was later entrusted to the Karachi

Development Authority (KDA), when it was established in 1957. Distribution and retailing of treated water remained the responsibility of Karachi Metropolitan Corporation (KMC), some 22 independent agencies and bulk users. Over the years, the division of responsibility for production and distribution proved increasingly difficult to integrate and manage. It was subsequently decided to form a new authority to operate the entire water supply system. Thus, in 1981, the Karachi Water Management Board (KWMB) was created to take responsibility for water distribution throughout the metropolitan area, and it was given enhanced powers that included distribution throughout the metropolitan area, as well as cost recovery. The operations of the KWMB never became a viable proposition, as the Board did not have a revenue base of its own and relied on the KMC for collection of the water rate, although the tariff doubled during its existence – all this while responsibility for maintenance of sewerage services remained with the KMC.⁽¹⁾

Appreciating the need for the creation of a unified institution to handle water supply and sewerage services, the government enacted the Sindh Local Government (Amendment) Ordinance of February 1983, which led to the creation of the Karachi Water and Sewerage Board (KWSB) within the KMC. This organizational restructuring was done on the advice of the World Bank, and the new KWSB also enjoyed powers of revenue collection. Although it functioned as a totally autonomous body under the government of Sindh Province, its policy-making function remained with its board of directors, headed by the mayor or administrator of Karachi. In 1996, a new Act was promulgated by the provincial assembly (the Karachi Water and Sewerage Board Act 1996), under which the KWSB was separated from the KMC. The authority to approve its annual budget was transferred to the provincial government.⁽²⁾ Under the devolution plan currently being implemented, the Karachi City district government is responsible for controlling and managing water and sanitation services. Thus, in early 2003, the KWSB became an organ of the city government and was renamed the Water and Sanitation Department (WSD). Further administrative changes are still taking place.⁽³⁾

The KWSB is the key water supply agency for the city. It arranges the production of water and supplies it to the taps of consumers; 263 million gallons per day (mgd) of water are supplied from the Indus-Kalri, located 80 miles from the city, and this supply is facilitated through a comprehensive network of conduits and pumping stations. Karachi receives 20 mgd from Lake Haleji, 5 mgd from Dumlottee wells and 100 mgd from the Hub River, and all are peri-urban sources. The Hub source, a seasonal stream, depends entirely upon rainfall and, in dry periods, supply normally stops, as is the case today. According to a 1998 estimate, total water demand is 665 mgd, compared to a supply of 388 mgd. In the past, when the water supply from the Hub River has dried up, it has caused a great deal of hardship to the citizens in the western areas of city, including Orangi township. The KWSB has several projects planned to reduce the gap between supply and demand. The expected cumulative demand for water by 2002–03 was estimated at 820 mgd, against a projected supply of 605 mgd (Box 1). There are various reasons for the continuing water shortages and poor levels of service. The KWSB system experiences leakage and thefts from its network, amounting to 30–35 per cent of the total supply. Leakage is the result of inappropriate management and poor maintenance of the system, incongruent external development of roads/streets in the city that cause damage to the network, sub-standard quality of construction, and even deficiencies

1. KWSB (2000), *Karachi Water and Sewerage Board: Basic Facts – 2000*, KWSB, Karachi; also KWSB (1997), *Karachi – Water Supply and Sewerage: Basic Facts*, KWSB, Karachi.

2. Government of Sindh (2001), *Sindh Local Government Ordinance*, Government of Sindh, Karachi.

3. See reference 2.

Box 1: Profile of water supply in Karachi in 2001

Bulk water supply (1998): 388 million gallons per day
 Bulk water demand (1998): 665 million gallons per day

Bulk water supply (2002) projected: 605 million gallons per day
 Bulk water demand (2002) projected: 820 million gallons per day

Water demand (1998): low-income communities: 63 litres/capita/day
 middle-income communities: 132 litres/capita/day
 high-income localities: 335.5 litres/capita/day

Inventory of services

Bulk water supply

1. Indus	263 million gallons/day
2. Haleji	20 million gallons/day
3. Dumlottee	5 million gallons/day
4. Hub*	100 million gallons/day
Total:	388 million gallons/day

Retail water supply

1. Water mains and distribution lines	3,360 miles
2. Pumping station and boosting	131
3. Community taps	3,378
4. Hydrants (for tanker supply)	10
5. Water tankers	28
6. Reservoirs	8

Sources

1. Dumlottee wells	7
2. Dumlottee conduit	25 miles
3. Haleji conduit	60 miles
4. Indus system	80 miles
5. Hub system	35 miles
6. Major pumping station	10
7. Filter plants	
Gharo	2
COD Hill	2
Pipri and Gharo	2
Northeast Karachi	1
8. Tunnel	2.5 miles

Sewerage services

1. Trunk sewers	113 miles
2. Sub-mains and lateral sewers	2,700 miles
3. Rising mains	44 miles
4. Treatment plants**	2
5. Pumping stations	24
6. Automatic sewer cleaning machines	12
7. Mains/sub-mains sewers	272 miles
8. Ejector	11

* Hub river source is fast drying up.

** These treat 20 million gallons per day. A third treatment plant is being built at Mauripur, Karachi West.

SOURCE: KWSB (2001), *Basic Facts, Departmental Report*, Karachi Water and Sewerage Board, Karachi.

in pipe design. There has been no effective leakage repair project implemented despite the fact that one has been planned and lying pending for several years. Also, people break open the existing system of pipes to steal water either for their own consumption or to sell commercially in a variety of ways. This happens along the main conduits and the primary and distribution lines, often in connivance with KWSB staff.

At the same time, haphazard city growth and densification have contributed to a rise in water demand. New neighbourhoods are being added to the cityscape without a corresponding increase in the water supply. Inner-city areas have increased in density, giving rise to acute water shortages. Squatter settlements have sprung up in peri-urban areas, thus increasing the cost of a piped supply because of their distance from existing water mains. Settlements located at the end of the network receive a very low level of service, since a large amount of the water allocation has already been removed, legally or illegally. The pumping procedure also falls short in supplying water effectively to the ends of the network. It is mostly the urban poor who reside at the peripheries who suffer from this situation.

a. Alternative water sources

The acute water shortages and frequent breakdowns in supply have led to the development of various, mostly informal, alternatives. Privately developed water hydrants are common, and draw water from informally developed boreholes. These are evident in almost all areas of the city. A borehole generates water of inferior quality, usually unfit for drinking. However, since there is no monitoring of water quality and the operation of these hydrants takes place in connivance with the concerned government officials, the practice continues unabated. Water is pumped into tankers, which then supply designated locations – including low-income localities within the peri-urban belt of the city – also other locations where water is in short supply, and factories and construction sites. It is estimated that this mode of supply accounts for about 10 per cent of the total water needs of the city.⁽⁴⁾

Supplying water from such informally developed sources has repercussions. First, it does not provide water fit for domestic consumption, yet people are forced to use it because they have no alternative. Second, tanker movements damage roads and streets which were not developed for these kinds of vehicles. However, the price of water from these tankers is relatively low compared to that of fresh-water supplies from KWSB hydrants.

There are about 5,000 commercial tankers supplying water to areas lacking other supplies. In addition to acquiring water from illegal hydrants, water is also obtained from KWSB hydrants under the control of Pakistan Rangers. In the peak summer season, the tankers do a thriving business, which is even greater when KWSB piped services break down. According to officially prescribed rates, a 1,200-gallon tanker can charge Rs 250 (around US\$ 4.20), a 2,400-gallon tanker Rs 350 (US\$ 5.90) and a 3,600-gallon tanker Rs. 500 (US\$ 8.40). These rates are reported to double during water supply crises and breakdowns. It is also reported that tanker operators create artificial crises in association with KWSB officials, in order to expand their business potential. Occasionally, commercial tankers are made to supply water free of charge to low-income settlements, and the cost of such trips is borne by the government. Other modes of vending water supply include pushcart vendors, manual water carriers and large underground-tank owners in the communities; also donkey carts, which operate in areas where small-scale supplies are required, and where the water comes from leakage points and illegal hydrants. Most of these operations are locality-based and serve an internal clientele.⁽⁵⁾

It is obvious that the overall scale of operation and level of service of the KWSB is well below the desired level.⁽⁶⁾ There are many reasons for this, including low tariff levels, poor recovery of dues, political interference, obsolete technologies, and overstaffing.⁽⁷⁾ Despite the loans and technical assistance received from donor agencies, the situation has not improved. The government has tried various options to address this emerging problem. One of the possibilities was to engage the private sector in contractual agreements for the provision of services. The options considered included management contracts, leasing contracts, operating concessions, BOT (build–operate–transfer), BOO (build–own–operate), BOOT (build–own–operate–transfer) and full privatization.⁽⁸⁾

While the city-scale operations of the KWSB remain problematic and await improvement, at the local level some solutions have evolved for the provision of services through cooperative arrangements among various

4. Interview with the president of the Karachi Water Tanker Association.

5. According to discussion with tanker operators.

6. For more details, see Ahmed, N and M Sohail (2000), *Privatization of KWSB – An Analysis*, City Press, Karachi.

7. For details in this respect, see reference 6.

8. See reference 4.

9. Ahmed, N and M Sohail (2001), "Public-private partnerships in the water and sanitation sector for the urban poor – the case of Karachi, Pakistan", unpublished report, WEDC, UK. It also refers to the process of illegal subdivision of land for developing informal settlements. For more details, see Hasan, Arif (1990), "Community groups and non-government organizations in the urban field in Pakistan", *Environment and Urbanization* Vol 2, No 1, pages 74–86.

10. KDA–MPECD (1990), *Karachi Development Plan – 2000*, final draft report, Karachi Development Authority, Karachi. After the enforcement of the devolution plan on 14 August 2002, the city of Karachi was re-designated as one district. The previous spatial divisions of East, West, Central and Malir districts have ceased to exist.

11. Cited by local KWSB staff.

12. KWSB (2001), *Karachi Water and Sewerage Board: Basic Facts*, KWSB, Karachi. The plan to build the stipulated 50 tanks of 10,000 gallons each could not materialize. The KWSB/Rangers did construct a few tanks in different locations, which differed in volume. The phenomenon of *awami* tanks discussed in this paper is somewhat different. Rather than a conscious and programmed input to resolve a standing issue, the *awami* tanks were built as a quick solution to address the immediate need of water supply. Table 1 provides details about the evolution, ownership and management of the tanks.

stakeholders. One example is the *awami* (people's) tanks, which developed in response to acute water shortages in the remote locations in Orangi township, Karachi.

III. AWAMI TANKS IN ORANGI TOWNSHIP

a. The water situation in Orangi

ORANGI TOWNSHIP IS situated in the Orangi hills in the western part of Karachi. It is the city's largest *katchi abadi*, or "squatter" settlement, and covers an area of more than 3,240 hectares (8,000 acres). It has a population of about 900,000 living in 94,122 houses, which people have constructed themselves with help from the informal sector. For the most part, the township was created by middlemen through the illegal occupation and subdivision of state land.⁽⁹⁾

Although Orangi township was initiated primarily as a planned settlement, and later became a *katchi abadi* in 1965, a piped water supply was provided only in 1984. Orangi lies in District West, which is linked to the Hub River supply system. This rainfed stream has been used as a water source since 1982, primarily for the areas of District West.⁽¹⁰⁾ The supply project was completed in three phases and finally became fully operational in 1995. Between 1982 and 1995, the supply was largely adequate and was a major reason for the rapid expansion of the settlements in Orangi. However, due to poor rainfall in the past three years, the Hub's water level has fallen and has virtually dried up, and the areas of District West in general, and Orangi in particular, have been severely hit. While there are no exact figures available for Orangi's water needs, they are thought to be around 60 million gallons per day (mgd).⁽¹¹⁾

Two measures have been taken by the KWSB and the city administration to tackle the shortages, namely using tankers – linking the service with various forms of water provision – and upgrading/modifying pumping facilities from the Indus River supply system. Upgrading the northeast Karachi pump house increased pumping capacity from 25 mgd to 50 mgd, and other measures have included the construction of a new 25-mgd pump house at Khawaja Ajmer Nagri (of direct benefit to Orangi) and the connection of 48-inch and 36-inch diameter pipes to link Karachi's western localities with the Indus supply network. The installation of new valves, the sinking of 12 tubewells in Orangi, Baldia, Manghopir and Surjani townships, and the construction of 50 water storage tanks of 10,000 gallons each in Orangi and Baldia⁽¹²⁾ were also proposed.

Tertiary distribution pipes have been laid in Orangi under the auspices of various programmes. During the initial period of elected local government (1979–1992), pipelines were laid by the area councillors with development funds from the Karachi Metropolitan Corporation (KMC). As a result, sizeable areas of Orangi had a piped water network, even in some of the remote locations such as Ghaziabad, Gulshan-e-Zia and Gulshan-e-Bihar, in the period when the water supply situation was satisfactory. The shortages that occurred after the Hub dried up became severe in the 1990s, and the pressing need for a daily water supply had to be treated as an emergency. The city and provincial administration decided to use tankers to extend the water supply to water-scarce areas in Orangi. Initially, this responsibility was entrusted to the KWSB and, in 1997–98, it was advised to supply water through its own fleet of tankers as well as through its

contractors. However, the KWSB was unable to do this because of a lack of initiative, local political influences, and differences with commercial operators on supply rates, among other reasons. As the situation became tense, almost leading to water riots, the administration decided to entrust this responsibility to Pakistan Rangers, who were also called in to help the civil administration restore law and order in the city.

The Rangers carried out a survey of the affected areas, and one of their conclusions was that the water supply could be facilitated effectively if nodal points were developed where the water supplied by the tankers could be stored and distributed. It was also found that political influence on supply routines needed to be curbed, something which the Rangers were able to achieve due to their military clout. The study also revealed the few locations where small-scale community tanks existed, and other areas where mosques and churches had pre-existing underground tanks. Mosque or church committees agreed to allow the use of their underground tanks as communal water supply reservoirs and, in addition to this, new tanks were built, either by the people themselves through self-help or by the Rangers¹³ (Table 1).

b. The *awami* tanks

Most *awami* tanks (people's tanks) are underground (although a few are at ground level), and are used to store and distribute water to local community members. They exist in several formats. Underground tanks constructed by neighbourhood mosques or churches have been used as *awami* tanks and were one of the earlier options of community-based water storage and distribution in times of shortage or ruptures in supply. Other public locations, such as graveyards and communal neighbourhood open spaces, have also been used as sites for purpose-built tanks. In some cases, residents have allowed the use of their house tanks as *awami* tanks for the benefit of other community residents, but this has been possible only where the tanks are large enough to store 1–2 tankerloads of water – approximately 6,000 gallons. In addition to these examples, built by the people through their own resources, the Rangers have constructed *awami* tanks on public open spaces, and these have been developed in Orangi township in Ghaziabad, Gulshan-e-Zia, Gulshan-e-Bihar, Mansoor Nagar, Yaqoobabad, Chisti Nagar, Raees Amrohvi Colony and adjoining areas. Recently, it was reported that *awami* tanks have also been developed in Baldia and Surjani townships in Karachi. The total number of *awami* tanks is not known or mentioned in any specific records of the Rangers/KWSB.

Water is supplied to *awami* tanks by commercial water contractors enlisted by KWSB/Pakistan Rangers. The contractors fill the tankers from authorized hydrants and deliver the water to designated *awami* tanks according to a schedule decided by the Rangers. Water and transportation charges for this supply are reportedly paid for by the Rangers. After delivery, people use canisters and other vessels to carry the water manually from the *awami* tanks to their homes. Each *awami* tank is meant to serve its own, informally defined, area residents.

There were several reasons why *awami* tanks were needed. First, supply from the piped network could not be facilitated because of overall water shortages. Second, even in areas where some piped supplies were available, the volume of water was grossly inadequate to meet domestic needs; and, in some cases, the piped supplies were reported to be

13. Interview with Rangers officers in charge of water supply in Orangi, 2001.

Table 1: Awami tanks: evolution, ownership and management

No.	Location	Built by	Management	Ownership
1	Gulshan-e-Zia	Built in 1989 by the Rangers (with contributions from the people/mosque)	Managed by a community elder and an Imam (prayer leader)	The Madrassah (local seminary) and the mosque
2	Gulshan-e-Zia	Built in 1990 by the people through self-help	A community elder manages it on behalf of the community; Rangers monitor supply through the tankers	The people/ graveyard committee
3	Gulshan-e-Zia	Built in 1982 by the people	Managed on a self-help basis by the people of the area	The people
4	Gulshan-e-Zia	Built 10 years ago with the help of Thalawala (local building component manufacturer)	Thalawala (local building component manufacturer)	Thalawala
5	Gulshan-e-Zia	Built 11 years ago by Mohalla (sub-neighbourhood) committee, from contributions	Mohalla committee	Mohalla committee
6	Gulshan-e-Zia	Built 10 years ago by the mosque committee	Mosque committee	Mosque committee
7	Gulshan-e-Zia	Built 12 years ago by the block maker	Mohalla committee	Mohalla committee
8	Gulshan-e-Zia	Built 2 years ago by the mosque committee	Mosque committee	Mosque committee
9	Ghaziabad	Built 10 years ago by the mosque committee	Mosque committee	Mosque committee
10	Muslim Maywati Colony, Ghaziabad	Built 1.5 years ago by the mosque committee	Mosque committee	Mosque committee
11	Ghaziabad	Built 1 year ago by the mosque committee	Mosque committee	Mosque committee
12	Ghaziabad	Built 1 year ago	Shopkeeper	Shopkeeper
13	Christian Colony, Ghaziabad	Built 1 year ago by a local philanthropist	Local philanthropist with two helpers	Local philanthropist
14	Christian Colony, Ghaziabad	Built 10 years ago by a local philanthropist	Local philanthropist	Local philanthropist
15	Muslim Colony, Ghaziabad	Built 8 years ago by the government	Mosque committee	Mosque committee
16	Yaqoobabad	Built 1 year ago with community contributions	Community elders	Community elders
17	Yaqoobabad	Established 4 months ago by a few community elders	Community elders	Community elders
18	Mansoor Nagar	Established 6 months ago by Rangers	Mohalla committee	Mohalla committee
19	Mansoor Nagar	Built 7 years ago with the help of Orangi Pilot Project	Local philanthropist	Local philanthropist
20	Mansoor Nagar	Built by Mohalla committee in 1983	Mohalla committee	Mohalla committee
21	Mansoor Nagar	Built in 1990 by a community philanthropist	Community philanthropist	Community philanthropist (allows his house tanks to be used for community benefit)
22	Mansoor Nagar	Built 14 years ago by Hakim Khan, for the mosque	Mosque committee	Mosque committee

SOURCE: This table concerns the 22 *awami* tanks included in the study undertaken by the authors in 2000. See Ahmed, N and M Sohail (2001), "Public-private partnerships in the water and sanitation sector for the urban poor – the case of Karachi, Pakistan", unpublished report, WEDC, UK.

contaminated as a result of sewerage water mixing with normal water. Third, in areas where piped supplies did not function for some time, water pipes were either stolen or vandalized. Pipes were also damaged when some residents made illegal connections or broke open the joints in a bid to obtain more water than was sanctioned for each house. This further reduced the chances of resuming a piped supply, as this was only possible after appropriate repairs. Fourth, in order to meet their daily needs, a sizeable number of households acquired water from commercial tankers that drew from illegal hydrants. This water was not fit for drinking, although it was used for other domestic chores such as washing clothes, bathing, washing utensils or for the toilet. Thus, there remained a pressing need for a supply of drinking water.

c. Management and operation

As part of managing and monitoring tanker supply from designated KWSB hydrants to *awami* tanks, Rangers personnel maintain a list of all the tankers that operate on different routes. They also prepare route maps, issue payments to the tanker operators on the basis of actual supply, respond to emergency situations regarding supply and attend to any complaints lodged by area residents.

The management of supply from the *awami* tanks to the residents is undertaken by mosque committees, neighbourhood committees, or groups of area elders, who are given the task with the consent of area residents. These committees or groups maintain records of tanker supply, including frequency and quantities, and also manage distribution, organize maintenance or repairs, and liaise with Rangers when complaints are lodged or for other related matters. Area residents have to raise small funds jointly to undertake any repairs that may arise.

Awami tanks receive water according to different schedules and in varying quantities. In some cases, water is supplied twice a week, in others once a week or even once a fortnight. Usually, at least one tanker-load of 1,200 gallons is delivered although, during acute shortages, one tanker-load of water is divided between two or three *awami* tanks. *Awami* tanks are rarely supplied during the day, and delivery normally takes place in the evening or at night. The water is distributed once the tanker has made a delivery, and usually is either lifted manually using a rope and bucket or comes from a tap; in some mosques, water is drawn using motorized pumps. In a very few cases, the water is rationed by the management group. Usually, people take water for only their drinking needs, as the limited quantities available from *awami* tanks cannot fulfil other requirements.

d. Problems and challenges

In view of Orangi's hilly terrain, getting a smooth piped water supply is a difficult task and will require a technical review for determining the various pumping options. At present, vending or similar improvised solutions such as *awami* tanks are the only available options because of anticipated high infrastructure costs. Most of the underground water pipes have been found to be damaged and will require massive repairs before they can be used further. Thus, even if adequate water becomes available, it cannot be piped before repairs are undertaken, and people will still have to rely on *awami* tanks or water-vending alternatives.

However, there are a number of challenges related to the reliance on *awami* tanks. The use of water hydrants has come under a great deal of political pressure. The Rangers have been able to organize supply to the mutual benefit of all the communities concerned, as they supply the water at no charge (the cost is borne by the government), and the majority of the people who use the *awami* tanks are satisfied. However, people fear that when the Rangers pull out, the existing system of water supply through *awami* tanks will be directly affected. This is based on the assumption that once the Rangers have gone, local political groups will be able to exercise their influence and supply water only to their areas of choice, thus leaving the general public unserved.

Awami tanks are normally supplied at night, when tanker movement is easier because there is less traffic, but supply also depends on the supply cycle from city sources to the hydrants. Night supply causes problems to those families who do not have a male in the house capable of carrying water from the *awami* tanks to the house. It also causes general inconvenience to residents, who are forced to stay awake long into the night waiting for the tankers to arrive. It is especially a problem for those veil-observing women, who find it physically difficult to carry containers full of water to their homes at night. It was found that the frequency of supply has little connection with the need for water, as bulk supply to the hydrant is greatly dependent on the overall water supply situation in the city; thus, scarcity at the city level affects the supply to *awami* tanks. People whose houses are far from *awami* tanks have many complaints regarding the immense physical effort needed to carry water.

Ownership of the tanks by the people usually leads to appropriate maintenance and upkeep. When people build with their own resources, they make sure that the infrastructure is properly looked after. In contrast, government-built tanks are poorly managed because the people do not own them, and they often become subject to vandalism because people do not tend to safeguard them. However, the study revealed that many tanks were poorly constructed, built of cement blocks without any plastering or waterproofing. This causes water loss although, in several cases, the length of storage did not exceed one day.

Private tankers also operate in these areas. Because the supply of water from the Rangers' tankers and the *awami* tanks is often limited, people are forced to purchase water from private operators as well, usually at high prices. The water obtained from illegally developed hydrants/boreholes is unfit for drinking, although it is supplied to consumers without constraint. It becomes a source of disease and a hazard to public health. *Awami* tanks even become a necessity in some areas where piped water supply is relatively good. Often, water pipes lie next to sewerage pipes and, as a result of seepage, the water is contaminated. In such areas, therefore, the poor quality of the water forces people to purchase/obtain at least their drinking water from some external source.

Awami tanks are perceived as a cooperative arrangement by the people, not a commercial solution; and as the quantities of water supplied are a bare minimum, not even sufficient for basic human needs, people want a better-quality service. The piped water supply is commonly perceived as the only sustainable solution; *awami* tanks, a near-pilot initiative, are seen as only a temporary measure.

IV. CONCLUSIONS AND RECOMMENDATIONS

THE STUDY OF *awami* tanks shows that communities, with support from government agencies, can generate cooperative action to address their basic needs. It is significant that in Orangi township, despite acute water shortages, the low economic status of its households and an overall feeling of desperation, there has been no communal conflict in the routine operation of *awami* tanks. However, the relatively infrequent supply of water to the tanks has adversely affected their expansion, and communities are concerned about the lack of water from the source itself. Besides, the assumption that there will soon be a piped water supply often puts off extending *awami* tank operations. Judging by the overall water supply situation in the city in general, and in Orangi in particular, it is clear that the piped water supply for Orangi will remain grossly inadequate in the near future. Appropriate solutions, with optimum capacity to deliver, have to be tried, tested and replicated. It is also obvious that government alone cannot deliver the services, due to its limited capacity to address the problems. It will have to rely on a mechanism of partnership that evolves from the people's initiative and then moves towards permanence. *Awami* tanks are an important example of a water supply option that has been developed and sustained in low-income communities and that could be greatly improved by taking some appropriate measures. For example, the design and construction of *awami* tanks needs to be improved in order to prevent water loss due to seepage. Low-cost techniques for constructing stable tanks are possible. Also, water should be delivered daily or every other day and the quantities should be adequate to meet daily needs. By using motors or simple manual pumps, the efficiency of supply could be greatly improved. Plastic or rubber pipes could be used where taps/motors are available to supply water directly to houses. The communities could negotiate with the KWSB for a more regular supply of water in return for payment, which obviously would be much less than to the commercial tankers. These measures alone would considerably enhance the performance of *awami* tanks. But in addition to this, the reality of the situation concerning the lack of performance of the piped water supply needs to be clearly communicated to the people of Orangi so that they can consider other options. Unfortunately, the authorities and elected representatives have been unwilling to do this as they are concerned with maintaining their political and administrative hold on the communities.