HYDERABAD

THE WATER-WASTE PORTRAIT

Lying along the southern bank of the Musi river, Hyderabad is the fifth largest metropolis in India. The Musi has turned into the city's sewer, while the city draws water from sources over 100 km away

Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06*, Centre for Science and Environment, New Delhi
Note: See page 334 for a more detailed map of water sources

ANDHRA PRADESH

Hyderabad

The modern city of Hyderabad has a river – but few realise that it exists or remember it, given its marginal position in the city as a water source. The city was founded in 1591 on the south bank of the Musi, about 6 kilometre (km) south-east of the historic Golconda fort. Subsequently, during the early nineteenth century, it expanded north of the Musi.

Hyderabad's early water sources included its three tanks: the Hussain Sagar, Osman Sagar and Himayat Sagar, built around the river. But as is the case with all our cities, Hyderabad soon forgot its tanks and turned its back on the river. Over the years, the waterbodies became cesspools with the waste of the city, while the city's search for water took it further and further away. Today, Hyderabad draws its water from the distant Nagarjuna Sagar Dam, over 100 km away, and has to fight for it: farmers dependent on the reservoir are angry at the city for taking away what they see as theirs.

With costs of water supply increasing and sewage choking its waterways, Hyderabad is desperately searching for answers. It is a unique city where people pay high rates for the water they use. But even after maintaining these rates and recovering costs, the city authorities are worrying where to source water from next. The city just cannot seem to escape a thirsty future.

WATER

DEMAND, SUPPLY AND DISTRIBUTION

The Hyderabad Metropolitan Water Supply and Sewerage Board (HMWSSB) is in charge of the water supply and sewerage systems of the metropolitan area of Hyderabad and the 10 municipalities around the city. According to the HMWSSB, the city's water demand for its 2001 population stood at 1,300 million litre daily (MLD). But the exact quantity of water the city draws and supplies remains unclear, as different reports cite different figures ranging from 730 MLD to 1,125 MLD. This discrepancy is possibly because the HMWSSB depends on different water sources which have seasonal variations.

Water supply is divided between the municipality of Hyderabad and the surrounding new growth areas, though it is rather inequitous. In 2001, the water allocated to the municipality was about 736 MLD (for a population of 3.6 million), while the 10 neighbouring municipalities got just 200 MLD (for a population of 1.8 million).[1]

Hyderabad's *City Development Plan* says that while the network coverage is 90 per cent, roughly 70 per cent of the city's population living within the municipal limits receives piped water supply. In the surrounding municipalities which make up

THE CITY	
Municipal area	707 sq km
Total area (Hyderabad Metropolitan Area)	1,905 sq km
Population (2005)	7 million
Population (2011), as projected in 2005-06	8.2 million
THE WATER	
Demand	
Total water demand as per city agency (HMWSSB)	1,300 MLD
Per capita water demand as per HMWSSB	187 LPCD
Total water demand as per CPHEEO @ 175 LPCD	1,216 MLD
Sources and supply	
Water sources	Surface* and groundwater
Water sourced from surface sources	88%
Water sourced from groundwater	12%
Total water supplied	930 MLD
Per capita supply	134 LPCD
Leakage loss	40%
Actual supply (after deducting leakage losses)	558 MLD
Per capita supply (after leakage losses)	80 LPCD
Population served by water supply system	70%
Per capita supply in the served area	114 LPCD
Demand-supply gap (after leakage losses)	742 MLD
Treatment	
Number of WTPs	5
Total treatment capacity	967 MLD
Actual treatment	967 MLD
Future demand and supply	
Demand (2011), as projected in 2005-06	1,833 MLD
Augmentation needed to meet the demand	903 MLD
Required increase in supply	97%
THE SEWAGE	
Generation	
Sewage generated as per CPCB	605 MLD
Sewage generated as per city agency	600 MLD
Collection	
Length of sewerage network	2,400 km
Population covered by sewerage network	63%
Area covered by sewerage network	70%
Treatment	
Number of STPs	2
Total treatment capacity	133 MLD
Actual sewage treated	133 MLD
Disposal	Musi river

Source: Anon 2011, *71-City Water-Excreta Survey, 2005-06,* Centre for Science and Environment, New Delhi

Notes: *Osman Sagar, Himayat Sagar, Manjira Dam and Krishna river; HMWSSB: Hyderabad Metropolitan Water Supply and Sewerage Board

the greater Hyderabad metropolis, the network of water supply covers only 65 per cent of the area and about 40 per cent of the population. Distribution and reach, thus, is a key concern.

The pipelines which carry water from the source to the treatment plants (transmission mains) are 286 km long; from the reservoirs of the treatment plants to the city (trunk mains), another 265 km is added, while distribution within the city is an additional 1,727 km. The total distribution system of roughly 2,300 km covers 0.57 million water connections within the city's municipal limits and around. Of these, 77 per cent are domestic connections, 20 per cent are for slums, and the remaining distributed among commercial, industrial and other users (see Table: *Water users of Hyderabad*).

Water, however, is supplied only on alternate days for two hours in the municipality of Hyderabad and one hour in the surrounding areas. Around 60-70 per cent of households have metered connections, but most are non-functional.[2]

The metropolis is now working on a pilot project to implement the 24x7 scheme – to supply water to its citizens through the day – which it believes will cut inefficiency and contamination of its waterlines by sewage pipes (see Box: *24x7 in practice*). However, the pilot programme has seen water demand increase in this already water-stressed city. In 2009, the HMWSSB also launched its own brand of purified and ozonised bottled water – called Metro Water – selling it at Rs 40 for a 20-litre can.[3]

But the water scenario in the city is in a worrisome state – the city misplaces (officially) anywhere between 30-40 per cent of the water it sources through distribution losses. The gap between water demand and supply has also been increasing with each passing year. The city needs answers, and fast.

THE SOURCES

Quli Qutub Shah, the fifth sultan of the Qutub Shahi dynasty who built Hyderabad, also built its first drinking water source, the Hussain Sagar, in 1562 on a tributary of Musi. Named after the Sufi saint Hussain Shah Wali, this waterbody lies between the twin cities of Hyderabad and Secunderabad. As early as 1891, a water treatment system was set up – using slow sand filter – to supply water from the lake to the city. In 1913, the successors of Qutub Shah built the Osman Sagar and in 1927, the Himayat Sagar to control floods and provide water to the city. Over the years, many tanks were built – the Mir Alam tank on the outskirts of the city built way back in 1806, is still considered an engineering marvel, created by the first multiple-arch dam in the world (see Box: *Hyderabad's water basket*). Till 1961, the supply of 202 MLD from the Osman Sagar and Himayat Sagar reservoirs was sufficient for the city's population of 1.2 million. But then the city got impatient. It wanted more.

In 1965, a barrage was constructed across the Manjira river, a tributary of the Godavari. Manjira Phase I, as the project was called, supplied some 68 MLD of water to the city. The second phase of the project, completed in 1981, provided another 135 MLD. By 1991, the city had run out of water again. The combined capacity of Manjira I and II, Himayat Sagar and Osman Sagar was about 450 MLD, while the city was clamouring for 720 MLD.

Without devoting any thought to how the city could reduce its water need, or increase its supply from its local water tanks, its planners drew up another grandiose scheme. This time, they built another storage reservoir on the Manjira – but near Singur, upstream of the earlier barrage (see Map: *Hyderabad's water sources*). The reservoir submerged over 60 villages. But the city did not care. With money from the World Bank, its Singur barrage,

TABLE: WATER USERS OF HYDERABAD

Domestic consumers form the biggest chunk

Category	Connections	Percentage
Domestic	387,532	77.38
Slums	98,696	19.71
Commercial	13,451	2.69
Industrial	936	0.19
Others	194	0.04
Total	**500,809**	**100**

Source: Based on personal communication with V L Praveen Kumar, general manager, HMWSSB, Hyderabad, March 2006

24X7 IN PRACTICE

Meters are fixed, but water is still a scarce resource

The buzzword in water supply is 24x7 – supply of drinking water around the clock and through the week – to reduce contamination of empty water pipes from the adjoining sewage pipes. Hyderabad, being a modern city, did not want to be left behind in this experiment. It has taken up two pilot projects in Kukatpally and Adikmet, both within the municipal corporation limits. Krishna river water pumped to the city is stored in a reservoir in the pilot area and then supplied to different sub-zones. Adikmet has 4,900 water connections, the bulk being domestic. Water board documents say that while a majority of the connections are not metered, less than half the metered ones are functional. The meters are also placed some 10 feet under the ground, which makes replacement difficult. In this zone, the non-revenue water – official term for losses – is as much as 62 per cent, while bill collection amounts to only 50 per cent.

The first step has been to fix meters to all connections; the fixing and maintenance has been handed over to a private agency. The cost of a new meter is Rs 750, which is paid to the board on an instalment basis. Since October 2006, the area is being supplied water 24 hours a day for seven days a week. Water allocation has almost doubled from 9 MLD to 16 MLD.[1]

The question is, how will this system run and where will the water come from? More importantly, who will treat the sewage? As yet, there are no answers.

HYDERABAD'S WATER BASKET

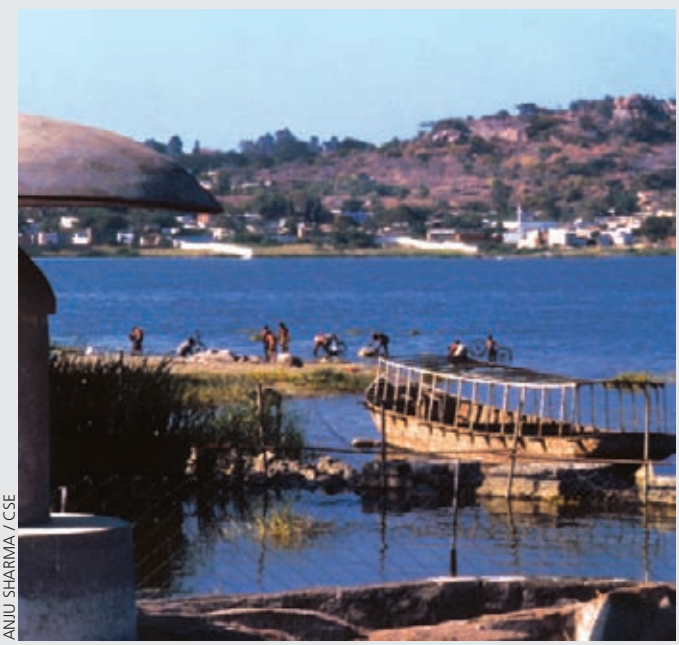
Over 50 ancient lakes built to store rainwater

The lakes and tanks of Hyderabad were its glory, chronicles a paper by C Ramachandraiah and Sheela Prasad of the Centre for Economic and Social Studies in Hyderabad. The Hussain Sagar, when built in 1562, covered an area of 21 sq km and was the water source of the city. It is said that when rainfall did not fill the tank for over four years, the city's rulers made a channel to bring water from the Musi to the lake. In 1642, the Ma Saheba tank was built to "meet the requirements of the general public".

The Mir Alam tank was another magnificent tank built by French engineers in the service of the Nizam. It consists of 21 semi-circular retaining walls with their convex side facing the water. This lake too measured 21 sq km in circumference and it was reported in the *Imperial Gazetteer* in 1909 that after these tanks were built, the incidence of cholera declined in the city. Both the Hussain Sagar and the Mir Alam were once the primary sources of drinking water.

Near the Mir Alam tank, a reservoir called Musa Mam or Husaini Nahr was also known to have been built in 1770 to supply water "when pure and sweet water was scarce in the city".

In 1624, the Saroornagar Lake was built over an area of 5 sq km in the eastern part of the city. At a distance of 24 km from the city, the Sharmirpet Lake was equally imposing. Near the now high-tech city lies the Durgam Cheruvu, known as the secret lake because it is surrounded by hills on its three sides. The study documents over 50 more lakes – all built to store rainwater. All built to meet water needs of the city and its surrounding areas. All equally neglected.[1]



ANJU SHARMA / CSE

Mir Alam tank: Built by French engineers, this tank used to be one of the primary sources of drinking water in Hyderabad

also known as Manjira Phase III and then Phase IV, provided it an additional capacity of 326 MLD. But this water travelled a long distance to reach the city: about 26 km by gravity, then pumped up a ridge for 18 km, and then another 28 km by gravity.

This water sufficiency lasted only a decade. Soon, the city was thirsty again. Drinking water became a political issue, as households went without water every alternate day. By early 2000, the city planners had found a new source. They turned now to the Krishna river some 116 km away and once again to the World Bank to fund their expensive water need.[4]

In November 2002, the construction of the Krishna Water Supply Project was initiated and its first phase brought Hyderabad some 410 MLD. The project will contribute another 1,230 MLD by 2021 – by which year the demand, at 1,934 MLD, would have again outstripped supply. By 2031, the demand-supply gap is expected to widen further – the city says it will need over 2,100 MLD and will get only 1,955 (see Table: *Widening gap*).[5] In other words, it will have come a full circle by then: the current deficit of around 30 per cent will be back to haunt the city. Hyderabad is already looking for new water, this time from the Godavari.[6]

This, when the city's calculation of its water demand could well be an underestimation, as surveys point out that large areas of the city, particularly its industrial areas, meet their water needs by pumping groundwater. A study on industrial water demand, conducted for an USAID project found that the city utility supplied less than half the water requirement. Out of the estimated 275 MLD needed by industries in this area, the board supplied 114 MLD. The rest was made up by groundwater from borewells directly or supplied by tankers.[7]

This is also when the city has no dearth of water storage in and around its vicinity. K L Vyas of the Society for Preservation of Environment and Quality of Life who has been associated with 'Save the Lakes Campaign' in Hyderabad points out that according to revenue records, there are over 678 waterbodies within a 30-km radius of the city. The combined storage of these

TABLE: **WIDENING GAP**

Demand will keep outstripping supply

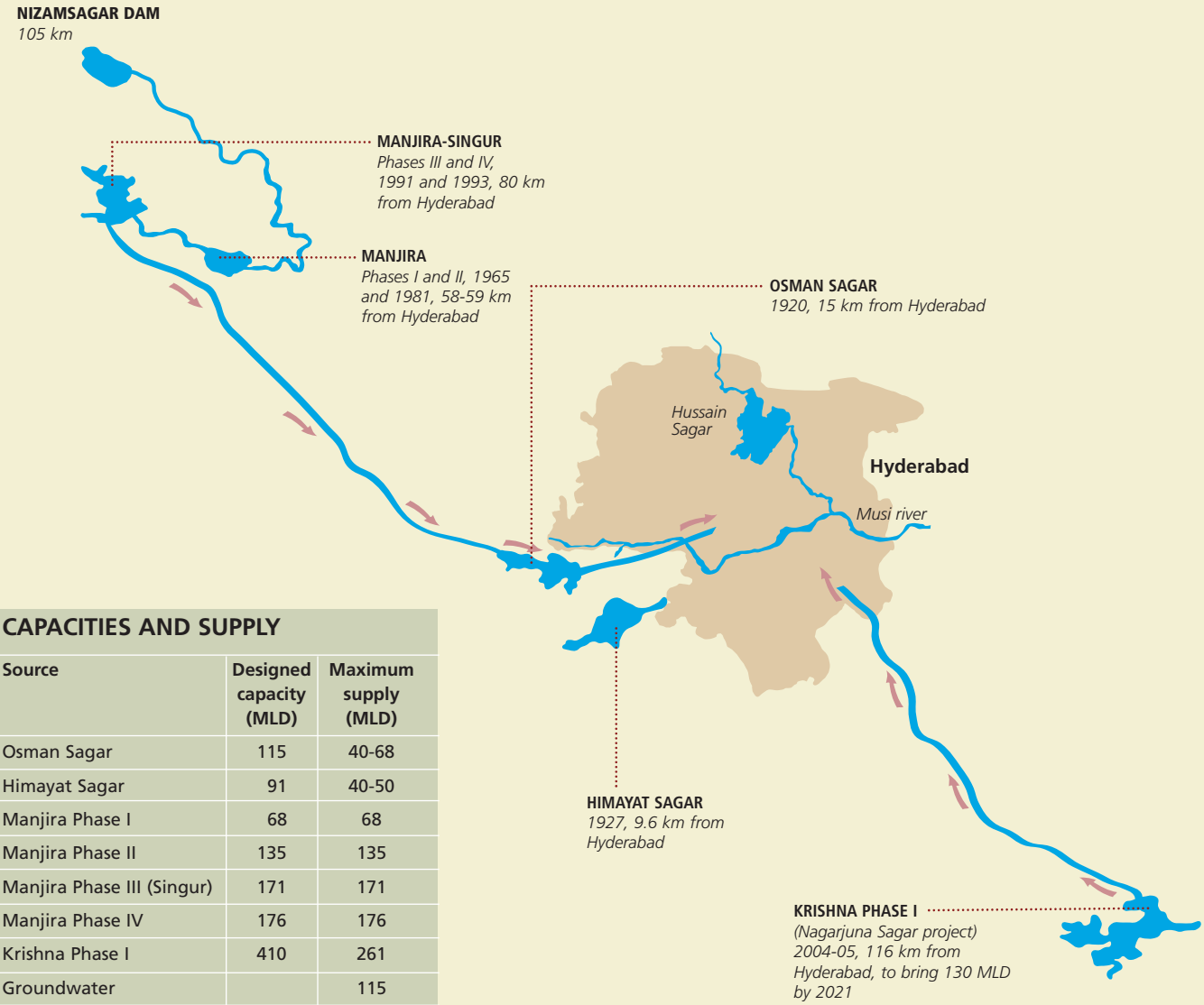
	Total demand (MLD)	Net supply (MLD)*	Deficit (MLD)	Deficit (%)
2006	1,325	931	394	30
2011	1,732	1,267	465	27
2016	1,833	1,435	398	22
2021	1,933	1,603	330	17
2031	2,188	1,955	585	27

Source: Camp Dresser and McKee International Inc 2005, *The Hyderabad Wastewater Recycling Project*, for the US Trade and Development Agency and the Hyderabad Metropolitan Water Supply and Sewerage Board, Hyderabad

Notes: *After accounting for 18 per cent leakage (technical loss); MLD: million litre daily

HYDERABAD'S WATER SOURCES

The city is travelling afar in its search for water – from 15 km to 116 km – and tapping a variety of sources



CAPACITIES AND SUPPLY

Source	Designed capacity (MLD)	Maximum supply (MLD)
Osman Sagar	115	40-68
Himayat Sagar	91	40-50
Manjira Phase I	68	68
Manjira Phase II	135	135
Manjira Phase III (Singur)	171	171
Manjira Phase IV	176	176
Krishna Phase I	410	261
Groundwater		115
Total		**1,000-1,044**

WHERE THE WATER CAME FROM OVER TIME

Source	Osman Sagar	Himayat Sagar	Manjira-I	Manjira-II	Manjira/ Singur-III	Manjira/ Singur-IV	Krishna
Year of commissioning	1920	1927	1965	1981	1991	1993	2004
River	Musi	Esi	Manjira	Manjira	Manjira	Manjira	Krishna
Reservoir	Osman Sagar	Himayat Sagar	Manjira Barrage	Manjira Barrage	Singur Dam	Singur Dam	Nagarjuna Sagar
Distance from Hyderabad (km)	15	9.6	58	59	80	80	116

Sources: Anon 2006, *Hyderabad City Development Plan*, JNNURM and Ramachandraiah Chigurupati and Vedakumar Manikonda 2007, *Hyderabad's water issues and the Musi river: Need for integrated solutions*, paper presented at the International Water Conference, Berlin, September 12-14

AGNIMIRH BASU / CSE

Hyderabad's waterbodies, like the Uppal Lake here in the picture, receive effluents from industries as well

tanks (if they are properly managed and rejuvenated), could be more than the water which is supplied from the Krishna.[8]

GROUNDWATER

Officially, Hyderabad draws only about 115 MLD of groundwater to supply to residents. But the crippling deficit in official supply means this is simply not enough to fulfill the needs of this growing and rapidly industrialising city; the rest of the water has to come from somewhere, and more groundwater fills this hole.

The Central Ground Water Board (CGWB) estimates that withdrawal is 178 MLD. The HMWSSB officials say (off the record) that private borewells extract 240 MLD. But both could be off the mark. The water need is great, and piped supply does not fulfill it.

But even as the city extracts groundwater, it has done little to improve recharge. Its lakes and water bodies, which would have been the natural recharge areas, are stressed, being encroached upon for land or simply covered up with sewage. As a result, water levels are plummeting.

Worse, as the city does not treat its sewage, excreta finds its way into drinking water (see Box: *Water stress defined*). A 2008 presentation on Hyderabad says that the incidence of gastroenteritis is several fold higher than that reported by the public health surveillance system. This was found to be true even in areas where the HWSSB supplied water.[9]

WATER STRESS DEFINED

Lost in transit, contaminated… the city's water is threatened by several ills

As much as 34-40 per cent of Hyderabad's expensive water is 'lost' in the distribution network. This city has estimated that roughly half of this is technical loss (leakages in the pipes, etc) and the rest is commercial loss – water theft. This makes the water situation in the mega-town even more stressed.

Despite its five water treatment plants, Hyderabad's water is contaminated. Experts explain this is partly because of intra-city inequity: many areas of the city – its poorer and slum areas – do not get clean water. An analysis of data from the Ronald Ross Institute of Tropical Diseases, a major referral hospital for poor people in the city, found water-borne diseases were the major cause of mortality; diarrhoea cases were increasing as well.[1]

In May 2009, in the midst of the general election fever and soaring heat, the city reported five deaths and hospitalisation of over 200 people because of polluted municipal water supply. Angry people took to the streets, demonstrating against the municipal authorities. The local legislator faced the brunt as affected residents threw bottles of contaminated water at him, demanding that he drink it. Officials suspected that the water lines were contaminated with sewage. They said that they would fix new lines, which would cost more money.[2]

THE LAKES OF GLORY

There was a time when Hyderabad had many lakes – scattered across this dryland region, these waterbodies provided water for drinking and recharge for groundwater. But over the years, the water has disappeared. The land has been usurped for buildings. A paper by C Ramachandraiah and Sheela Prasad of the Centre for Economic and Social Studies (CESS) details the growth of the city and the cost to its water bodies: the city has literally gobbled up its lakes and tanks. It is estimated that in 1973, there were 934 tanks in and around Hyderabad; the number came down to 834 in 1996. About 18 waterbodies of the size of over 10 hectare (ha) and 10 tanks below 10 ha were lost during this period of urban expansion. The study cites reports suggesting that in 1964, these waterbodies covered roughly 2.5 per cent of the geographical area. By 1990, these were down to 1.5 per cent.[10]

Another study which uses satellite imagery confirms this loss.[11] It is important to note that these studies detail the change only till 1990; since then, the city has seen massive growth. The information technology boom has probably gobbled up many more waterbodies.

For instance, the Hussain Sagar, which stopped being the city's water source in 1930, has shrunk in size. Over the years, this lake had been receiving the city's sewage and turning into a cesspool. Now a 20-MLD sewage treatment plant (STP) set up near the lake provides it some relief – some of the effluents it receives is being treated, which has improved its water quality. But the threat to Hussain Sagar from pollution and encroachment in its catchment still persists.

The city forgets that a waterbody is just as good as its catchment, which drains the water into it. The Osman Sagar, with a storage capacity of 110 million cubic metre (MCM), has a watershed area of 738 sq km; the Himayat Sagar, with its storage of 84 MCM, has a watershed of 1,311 sq km.[12] These important and cheap water sources for the city are losing their catchment areas, which is reducing inflow into the waterbodies. It is not surprising then that in early 2003, the Osman Sagar dried up and a few months later, the Himayat Sagar followed suit.

A 1998 study by Venkateswar Rao and Srinivasa Rao, which observed the rainfall and inflow patterns over a 36-year period (1961-1996) found a progressive decline in the percentage of rainfall converted into inflow into the two lakes. It found that even with rainfall levels being more or less the same, in the first 18 years studied, the Osman Sagar reached its full reservoir level 10 times, while the Himayat Sagar reached it 11 times. In comparison, in the next 18 years, the lakes filled up only five-six times. Based on this trend, the study concluded that these two reservoirs would dry up completely by 2040. If the lakes do not dry up, they would certainly get more and more polluted as their catchments are being rampantly encroached upon.[13]

A government order of 1996, which prohibits certain activities in the catchment areas of the two waterbodies, has been flouted shamelessly. The state government itself has built a brand new international airport on the catchment area of the Himayat Sagar. Clearly, drinking water is low on priority compared to air travel. The voice of environmentalists who protested against this use of the catchment was not heeded. In April 2003, a case filed in the state high court was dismissed on the ground that the "project has been cleared after considering several aspects elaborately by expert bodies at different levels".[14]

A Supreme Court judgement of December 2000 prohibiting the setting up of water-polluting industries within 10 km radius of the two waterbodies has also meant little. In this situation, city environmentalists fear that the death of these waterbodies is almost certain, which would lead to greater water insecurity for the city.

The case of other waterbodies is even more dismal. The CESS academics document the case of tank after tank in the city which have gone under the bulldozer or have simply been allowed to die. For instance, the Nandi Muslaiguda Cheruvu in the old city, an important source of water, has shrunk drastically because of encroachment, pollution and reduced inflow of water. The government permitted the construction of an electric sub-station, a school and a telecommunication building on the lakebed, even as land grabbers were filling up the lake along the road. Other waterbodies have been taken over for residential land use. In the city, the powerful real estate mafia has shown how it can easily take apart a waterbody and turn it into its own.[15]

With the waterbodies gone, the city has become more vulnerable to floods every monsoon. It has also lost its sponges – land in which to hold the rain and thereby, recharge its groundwater.

THE ECONOMICS

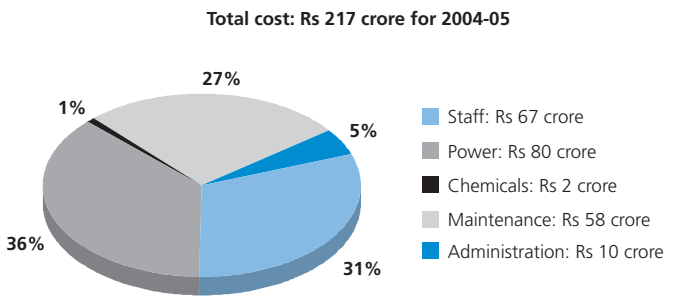
In 2004-05, as per CSE calculations, the city spent Rs 218 crore to supply 930 MLD of water. On this basis, its cost of supply was over Rs 6 per kilolitre (kl); keeping in mind the high leakage loss, the cost rose to Rs 10.68 per kl. But this estimation based on annual expenditure is lower than what the HMWSSB calculates as its cost of supply. The board computes that based on the 930 MLD of water which it says it produced in 2004-05, the cost of water production on an average is estimated at Rs 14 per kl, while Krishna water comes with a price tag of Rs 18 per kl.[16]

Hyderabad's water and sewerage board is unique: it has generated substantial revenues and also cut down its costs by increasing efficiency. It is interesting to note that even though a large number of water meters are not functional, the HMWSSB managed to collect Rs 193 crore in 2004-05 from water and sewage cess alone. Its total income in that year was Rs 271 crore against an expenditure of Rs 217 crore (see Graph: *What the city spends*).

This is when expenditure rose some 60 per cent in just five years. The major expenditure, understandable given the distances that the water is pumped from, is the cost of power. This is roughly 37 per cent of the total water and sewage costs – doubling from Rs 46 crore in 2000-01 to over Rs 80 crore in 2004-05, when the Krishna waters flowed into the city. The HMWSSB is also burdened with high interest payments – some Rs 20 crore – for the money it borrowed to implement the Krishna water project. But it scores on its human-power efficiency. It employs 5,200 qualified and experienced technical officers, staff and workers: this works out to be a little over 10 employees per 1,000 connections, which

GRAPH: **WHAT THE CITY SPENDS**

And it earns a Rs 53-crore profit riding on efficient staff management



Source: Anon 2006, *Hyderabad City Development* Plan, JNNURM, Hyderabad

is low compared to the Asian average of 12 per 1,000.

This is why on a per capita basis, its expense on water supply is less than half that of Bengaluru. Hyderabad spends Rs 313 per capita compared to Bengaluru's Rs 644 per capita.

What makes the HMWSSB different is its ability to charge higher prices for water (including revision of rates) and its efficiency in collecting payments from users (in spite of non-functional metres). The board charges on the basis of different slabs, with the cost increasing with increased water usage. The lowest slab in this city is perhaps high compared to cities like Delhi – water use of between 0-15 kl per month is charged at the rate of Rs 6 per kl; for up to 200 kl per month, the charge is Rs 25 per kl. For anything above this, consumers pay at the rate of Rs 35 per kl (see Table: *The price of water*).[17] In the surrounding municipalities, the tariff is a simple flat rate per month per household.

The tariff for commercial and industrial connections is Rs 35 per kl. Interestingly, the board differentiates between the users of water as a raw material: the charge for manufacturers of products such as mineral water, soft drinks and alcoholic beverages is Rs 60 per kl, irrespective of consumption.[18]

About 80 per cent of the board's water supply goes to domestic consumers, but only 40 per cent of its income comes from this group. This is basically due to low tariffs, incremental block tariff structures and (despite the board's best efforts) inefficient bill collection system because of non-functional meters. But the board has made important innovations to improve its collection – in case of multi-storeyed buildings and non-domestic supplies, where the monthly consumption exceeds 500 kl, the consumers are required to enter into separate agreements with the water board; they then pay a minimum monthly charge which equals 60 per cent of the agreed quantity. In 2008, a division bench of the state high court ruled in favour of the board allowing it to levy a cess of Rs 125 per month as water and sewage charge on all flat owners in the city.[19]

But even with all this done, the HMWSSB has not been able to focus on the second, and critical, part of its work – sewage. It is still working to break even in its water bills and with sources getting more distant and costs of pumping increasing, balancing the accounts is becoming very tough. In this scenario, sewage is not even on the agenda, at least not seriously.

SEWAGE

The sewage of the city and its new growth areas is a story of neglect and disrepair. While the city of Hyderabad is struggling to keep up with its sewage network and claims it now covers some 70 per cent of its area and reaches some 60 per cent of its people,

TABLE: **THE PRICE OF WATER**

The city authorities have instituted a system of high water prices and effective payment collection – which results in the profit they make

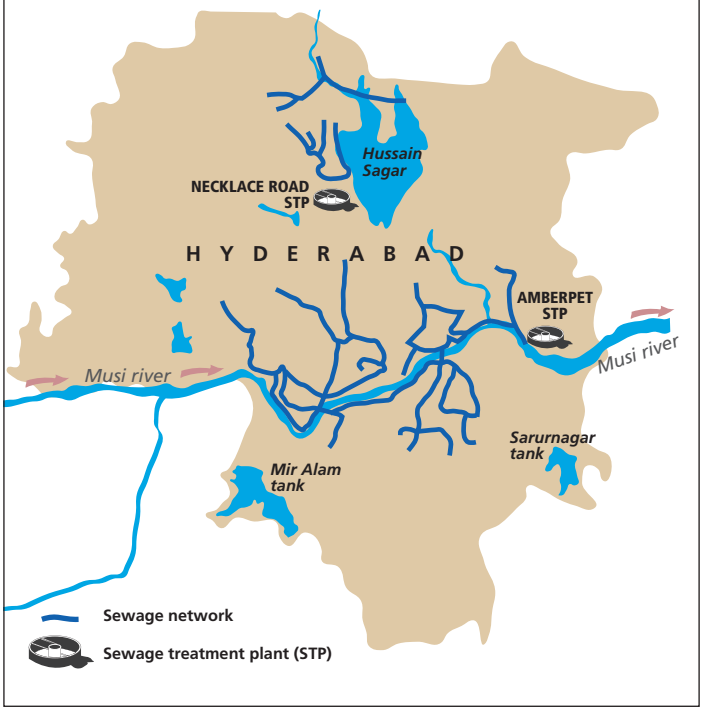
CATEGORY	Consumption of water (kl per month)	Rate (Rs per kl)
All water supply connections other than multi-storied residential apartment complexes: [a] Where monthly consumption is 500 kl or less [b] Where monthly consumption exceeds 200 kl [In cases of multi-storied residential complexes, the agreed quantity is deemed to be 15 kl multiplied by the number of residential apartments in the complex as per municipality]	0-15	6
	16-30	8
	31-50	15
	51-100	20
	101-100	25
	Entire consumption	35

Source: http://www.hyderabadwater.gov.in/wwo/UI/TariffContent.aspx, as viewed in March 2011

Notes: With respect to government-run hospitals, educational institutions and welfare hostels where monthly consumption exceeds 200 kl, a rebate of 20 per cent is applicable. In cases where the water is used as the raw material for the manufacture of end products such as mineral water, soft drinks, alcoholic beverages etc, the rate applicable is Rs 60 per kilolitre, irrespective of consumption.

MAP: THE SEWERAGE REACH

Despite a large network, coverage is inadequate



Source: Anon 2006, *Hyderabad City Development* Plan, JNNURM, Hyderabad

the surrounding municipalities with a population of 0.2 million and an area of over 370 sq km have virtually no sewage network to speak of. Officially, only one municipality and some 20 per cent of the area is covered. The area, obviously, has a long way to go in terms of coverage and treatment and disposal of its waste.[20]

The excreta story of old Hyderabad mirrors that of the rest of the country. The original sewage network was built in 1931 to serve an area of about 54 sq km and a population of about 0.4 million. The system was connected to two main intercepting sewers – on the south and north of the Musi river. In 1985, it was remodelled, say city administrators, to add five more sewers to the same system. Its network of sewers is large – spread across the sprawling metropolis over almost 2,400 km. But by the city's own admission, its coverage is completely inadequate; large parts of the city are not even reached by the sewerage network (see Map: *The sewerage reach*).

The *City Development Plan* estimates that the total sewage generated is about 600 MLD, of which only 133 MLD is treated in STPs. In other words, some 80 per cent of sewage remains untreated as it gets disposed off in drains and water bodies. But the situation could be worse.[21]

The fact is that nobody really knows how much water is used in the twin cities of Hyderabad and Secunderabad and their 10 neighbouring municipalities. There is a huge deficit between demand and supply and people use groundwater to fill this need. There is no real estimation of the quantity of groundwater used; so, there cannot be an estimation of how much sewage is really generated. It is no wonder then that Hyderabad's waterways and groundwater are suffering, and so are its people.

Computing the amount of sewage based on the water demand – 1,300 MLD in 2006 – would mean that the city generates over 1,000 MLD of sewage. A report on wastewater recycling, prepared by a US consultant for the city authorities in January 2005, puts the figure of sewage generated at 850 MLD. Whatever the estimate, the fact remains that the city has little capacity to treat its sewage. Little or none.[22]

SEWAGE TREATMENT

Hyderabad's treatment of its excreta is a bag of mostly conventional efforts with a dollop of innovation.

The city's main dumping ground for its excreta is its very own river, the Musi. The rest of the waste makes its way to the lakes and other waterbodies. What makes the excreta tale murky is that Hyderabad also neighbours the country's biggest pharmaceutical hub, Patancheru. The complex generates a huge amount of chemical waste, which researchers say, is full of antibiotics (see Box: *Swedish study finds antibiotics*). Till now, most of this waste, supposedly treated in common effluent treatment plants (CETPs), was making its way down the Manjira river, the city's water source. Now there are even bigger plans – to build pipelines

SWEDISH STUDY FINDS ANTIBIOTICS

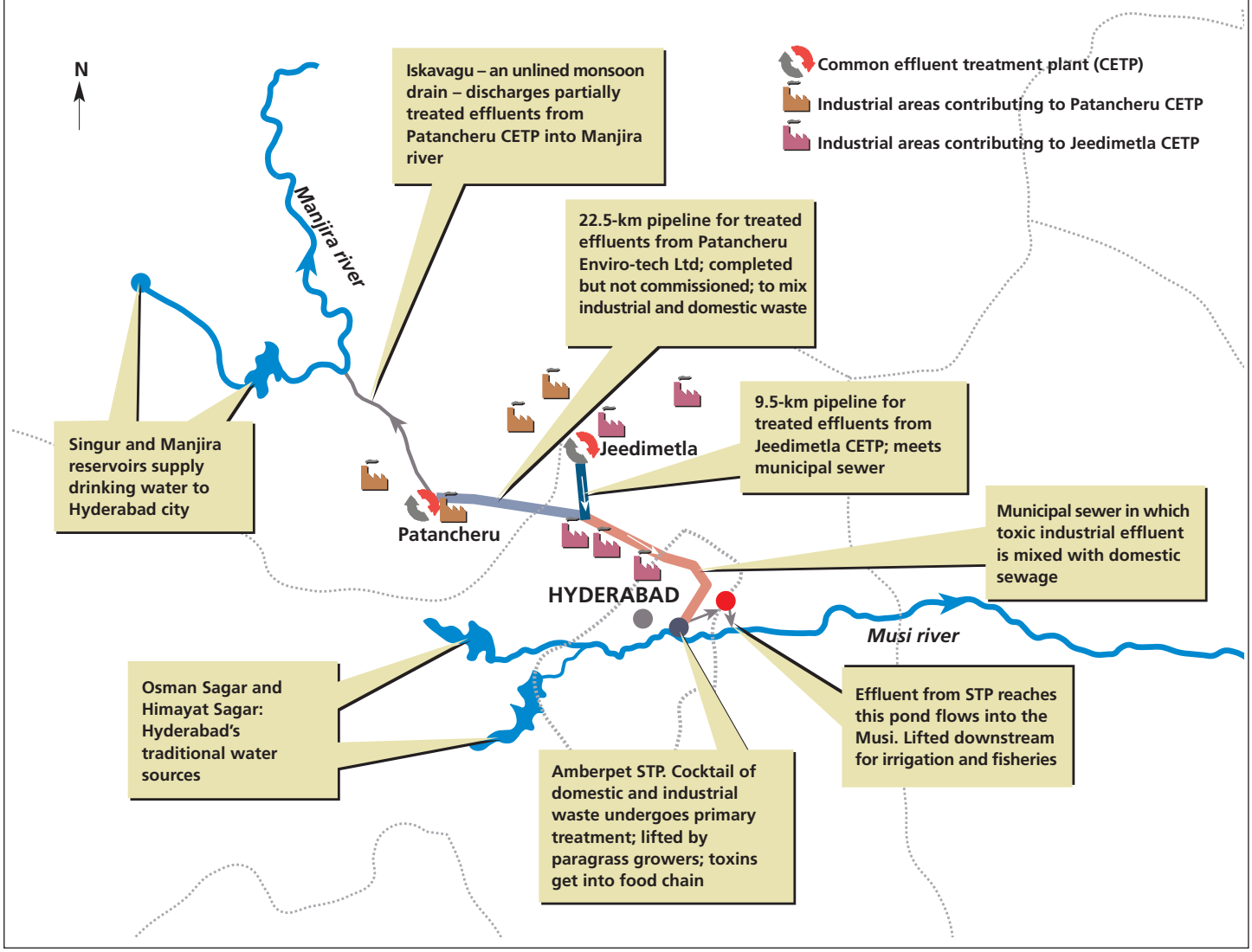
Business as usual in spite of government intervention

In a 2007 study, 'Effluent from drug manufactures contains extremely high levels of pharmaceuticals', published in the *Journal of Hazardous Materials*, Swedish researchers screened samples of effluents from a common effluent treatment plant (CETP) in Patancheru in Medak district, Andhra Pradesh, for 59 drugs. "Initial screening suggested that 21 of these were present at concentrations above 1 microgramme per litre (µg/l). An independent, quantitative analysis in our laboratory of the nine tentatively most abundant drugs and two additional antibiotics confirmed the findings…. All 11 drugs were detected at levels >100 µg/l. To the best of our knowledge, the concentrations of these 11 drugs were all above the previously highest values reported in any sewage effluent," says the paper. The maximum concentration was that of the antibiotic ciprofloxacin: 28,000-31,000 µg/l. This corresponds to approximately 45 kg of active pharmaceutical ingredients per day, the equivalent of the total amount consumed by the Swedish population (nine million) over a five-day period.[1]

In early 2009, this study headed by D G Joakim Larsson, associate professor at Goteborg University in Sweden, became 'hot' news.[2] The Indian prime minister's office, after it came across the study in international newspapers, was alarmed enough to take up the matter with the Union ministry of environment and forests. Officials of the state pollution control board ran for cover. Their response was to commission more research and more studies. The results were still awaited some six months later. It was business as usual and the business was of a 'sick industry'.

MAP: **A WASTING JOURNEY**

Hyderabad's authorities are planning to bring Patancheru's industrial grime into the city. Will it make matters worse?



Source: Kushal Pal Singh Yadav & S V Suresh Babu 2007, 'Sick industry', *Down To Earth*, Vol 16, No 18, October 31, Society for Environmental Communications, New Delhi

from the industrial estate to bring the waste to the city of Hyderabad where it will be mixed (and diluted) with municipal waste. This convoluted journey will mean that this chemical-industrial waste, after treatment, will be re-treated in the Amberpet STP, the second plant to be built in the city. The mixed waste, treated and re-treated, will then be discharged into the Musi. The farmers downstream will not just be using domestic treated waste, but will be 'gifted' with some chemicals as well (see Map: *A wasting journey*).

Currently, the city of Hyderabad treats its sewage at two places. A small 20-MLD STP at Hussain Sagar (also known as Madarsa Makta) discharges its treated effluents into the lake. This treatment plant has made a difference, for the better, for the water quality in the lake. Interestingly, the plant does not depend on closed underground sewage drains to convey the waste to it. The wastewater from open drains is diverted to a low-head diversion dam, from where dry weather flows are pumped into the sewage plant. After secondary treatment, the effluent is discharged into a holding pond and then into the Hussain Sagar. This model of treatment of sewage to generate water again is clearly an important innovation.

The 113-MLD Amberpet STP discharges its treated effluents into a canal, which after flowing for about 7 km, discharges into the Nallacheruvu Lake and from there, into a network of irrigation canals. The plant is being upgraded now, with its capacity being increased to over 339 MLD to receive the waste from the chemical industries adjoining Hyderabad. The plan is to mix the industrial waste so that it can be diluted. But engineers are not sure how it will work. The plant is not designed to treat chemical effluents. The standards for discharge are weak. The question is, whether

WASTEWATER IS WEALTH

But is irrigation water fit for human consumption?

The city's wastewater is a resource for large numbers of people living downstream of the Musi. A study by the Colombo-based International Water Management Institute (IWMI) finds that the waste of this city is a critical source of livelihood for thousands of families, who use it to irrigate their fields.[1] So, technically, this city does promote reuse of its wastewater. The problem is that this reuse happens because of poverty of the people living beyond the city and their desperation for water – even wastewater. The use is not planned: policy does not ensure that the water used for agriculture meets parameters which will make it useful for agriculture but not harmful for humans.

The study finds that two-thirds of the city's wastewater flows into the river through sewage drains/canals or directly. In addition, the treated waste from the city's sewage treatment plant is channelised through a canal to fields. It is this peri-urban area that uses the waste to grow its food. A variety of crops are grown on this wastewater – fodder for animals, vegetables, bananas, rice and coconut palms. The availability of wastewater for irrigating fodder has resulted in the growth of a dairy industry for sale of milk to the city. The study finds that wastewater-dependent households are economically better off compared to rainfall-dependent households.

The question is, what is the health fallout of using polluted water for food and fodder? More importantly, what does this use of polluted water, with high faecal coliform, do to the health of the farmers? Unfortunately, there is little empirical and epidemiological research on this issue. But what exists, suggests that this 'good' idea could well be a 'bad' idea.

In late 2008, a joint study by the London School of Hygiene and Tropical Medicine and IWMI reportedly found a significant difference in the prevalence of hookworm and other intestinal parasites in the city zone and in the regions using wastewater for irrigation.[2] Farming families were at a higher risk.

It is, however, also important to study other indicators – including heavy metal concentration in the food chain – to know how this good idea can be worked for the future. Clearly, this is the big question for Hyderabad to crack: how does it promote the reuse of wastewater in its peri-urban backyard without compromising the health of the users or the food of all?

this expensive cocktail will contaminate the fields of farmers even more than before.[23]

This is being planned in a situation when the bulk of the city's sewage is not collected in drains or treated. A portion of it (nobody knows how much exactly) flows into the Musi, from where downstream farmers use it for irrigation. Studies done by the Colombo-based International Water Management Institute (IWMI) estimate that some 40,000 ha of land is irrigated using this domestic-industrial waste concoction. It is practically the only source of water available for farmers, other than the variable monsoon rain (see Box: *Wastewater is wealth*).[24] The key concern in this case is the contamination in the food produced through this untreated waste, and whether the system can be improved – whether treated (and not untreated) waste can be used for farming.

IMPACTS

THE MANJIRA SUFFERS

The Manjira gives Hyderabad its water. But the river is bleeding today because of the mass of waste it gets from the gigantic industrial-chemical complex north of Hyderabad. This industrial complex, in Medak, was born in 1975. The pharmaceutical sector drove the boom – currently, about 40 per cent of the country's production of drugs takes place in Andhra Pradesh, and 80 per cent of this is produced in the areas surrounding Hyderabad. Over the years, as pollution grew, so has the protest against it. In 1984, the first CETP of 7.5 MLD was constructed in the area. In 1989, the 5-MLD Jeedimetla CETP was built, and in 1994, the Patancheru plant (7.5 MLD) came up.

Over the years, the plants have done little to clean up the waste from the booming industries. These plants charge their clients anywhere between Rs 78 to Rs 583 per kl for treatment, but they receive little to treat. In 2007, the plants were grossly underutilised, using only between 20-33 per cent of their installed capacity.

In 2007, listening to a case filed by local residents of this polluted area, the Supreme Court directed that the CETPs have to meet much more stringent standards. The court also asked individual industries to clean up their act so that the wastes discharged, before treatment in the plants, would meet tough, new pollution standards. But the industry remains reluctant. Meeting the new standards will be costly and hurt the competitive advantage they hold in the global pharma trade, they say.

Pollution regulators also do not have any answers to how they will improve the quality of effluents trapped for treatment in the plants. Instead, they are looking for new solutions which include mixing the treated effluents with the domestic sewage of the city of Hyderabad. In 2000, the Central Pollution Control Board had suggested a plan to build a long pipeline – over some 20-30 km – to carry the waste for this cocktail. In 2001, the Supreme Court approved the plan. The pipeline is ready, built at a cost of Rs 12.5 crore, but pollution activists have stalled its use. They say it will only transfer the problem, not solve it.[25]

In the meantime, the waste, treated, untreated or partially treated, makes its way into the Iskavagu, an unlined monsoon drain which discharges into the Manjira. Hyderabad is fortunate that its own reservoirs – Singur and Manjira – are upstream of this discharge point. But the river is not so lucky. The people who depend on it for their water are even less so.

CLEANING UP THE MUSI

The Musi, a tributary of the Krishna, is really Hyderabad's very own river. It emerges from the Anantagiri hills about 90 km

PRADIP SAHA / CSE

Untreated effluents from the common effluent treatment plant, Patancheru, drains into the Iskavagu which discharges into the Manjira

west of Hyderabad and enters the city bifurcating its old and new parts (the north and south). It runs for about 20 km within city limits and then after a journey of about 150 km, joins the Krishna in Nalgonda district. The two key reservoirs of the city, Osman Sagar and Himayat Sagar, are constructed on its tributary, the Esi.

The drainage of the Musi includes the entire municipal corporation area as well as parts of surrounding municipalities, and the Osmania University. But the river is not treated well by the city. Its quality deteriorates sharply after it enters the city limits. The problem is compounded by the fact that the river has little water – the city takes away its water and gives it sewage.

In 2001, the Union government's National River Conservation Directorate cleared a massive plan, costing some Rs 259 crore, for cleaning up the Musi. The project had big ideas. It estimated that around 850 MLD of waste, of which 75 MLD flows into the Musi, needed to be treated. By 2005, the project was expected to increase the treatment capacity to over 600 MLD and by 2011, to over 740 MLD. Interestingly, unlike other river conservation plans, the Musi action plan does not need to wait for the entire city to be sewered and connected. Instead, it proposes to intercept and divert dry weather flows from 18 stormwater drains after preliminary treatment (screening and degritting), for treatment at proposed sewage plants. After treatment, the sewage would directly reach the Musi or be used for agriculture.

The project has missed its 2005 deadline. What is important to consider is that even if it does meet its 2011 deadline, it will be of little use. By its own estimates, the total waste that needs treatment in 2011 would be close to 1,400 MLD – which points to a massive deficit. Pollution will continue to prevail, money or no money, treatment plant or no treatment plant.

SAVING THE CITY LAKES

The city's fight to save its lakes has been long and difficult. It started in 1993 over the government's order for "abandonment of the Saroornagar Lake". This was aimed at creating space for residential buildings. Citizens of the city came together in protest under the Save the Lakes Campaign. Their agitation reached a peak in 1995, when K L Vyas, convenor of the Campaign, filed a case in the Andhra Pradesh High Court. The court directed the state's Environment Protection Training and Research Institute to prepare an action plan for the protection of Saroornagar and to take steps to protect all waterbodies.[26]

In 2000, another case was filed by the Forum for a Better Hyderabad to protect the lakes. But this was not the end. Over the years, many more cases have been filed by the civil society of the city to protect the lakes from encroachment and pollution, with some success (see Box: *To save the Hussain Sagar*).

TO SAVE THE HUSSAIN SAGAR

A brief chronology of civil society's travails

1995: Petition filed by K L Vyas, convener of the Save the Lakes Campaign in the Andhra Pradesh High Court (HC), seeking protection of 170 lakes in Hyderabad. Court orders protection of all waterbodies in Andhra Pradesh.

2000: Petition filed by Forum for a Better Hyderabad to save Hussain Sagar from encroachment. In 2001, HC directs the government to stop construction of any permanent structures on or near the waterspread or catchment area. It directs that the construction of the proposed amusement park in the catchment needs clearance from the Andhra Pradesh Pollution Control Board**.**

Subsequently, Hyderabad Urban Development Authority (HUDA) introduces notification no. 3195/PR/H/2000 declaring that the entire area falling within the full tank level must be kept free from any type of construction, irrespective of the ownership or any land use or master/zonal development plans that may have been previously notified. Further, a buffer belt of 30-metre width on all sides of each lake must be kept free of any type of construction in the interest of prevention of pollution to the lake and to allow free flow of water into the waterbodies.

2003: Petition is filed by the Forum for a Better Hyderabad seeking *mandamus* against the state government for its inaction in saving Hussain Sagar and to declare the state's failure in stopping the filling up of the lake as unconstitutional. The government files an affidavit saying that the activities mentioned in the writ petition are actually intended to enhance water storage and not to fill the lake. Based on this, the court dismisses the petition saying that there is no threat to the lake. But it does ask the government to take all possible measures to protect the waterspread area of the lake from private and public authorities.

2003: The Forum files a petition against the state government and the Hyderabad Entertainment and Amusement Developers Pvt Ltd, seeking directions against them for failing to prevent further filling-up and encroachment of the waterbody and for granting permission to construct a permanent structure claiming it to be a rock garden. The court directs status quo and stay order on construction until further orders.

2004: The Forum files another petition against the state government and Viceroy Hotels, asking the court to stop illegal construction of permanent structures between the rock garden and People's Plaza and Jaladrusyam in the Hussain Sagar.

2004: A division bench of the Andhra Pradesh HC appoints a court commissioner to inspect the areas around Hussain Sagar. Based on this report, the court directs the APPCB to monitor and protect the lake from pollution and violation of Environment Protection Act, 1986 and Water Act, 1974. The court also states that stringent action would be taken against Viceroy Hotels Pvt Ltd if at any point of time they violate the rules laid down by the pollution board.

2005: Environmentalist Haragopal files a special leave petition in the Supreme Court against the construction of a railway line along the lake. In August 2005, the court issues a stay order to stop all the activities in and around the lake and constitutes a three-member committee headed by R Rajamani, former secretary of environment of the Union government, to study the issue and report to the court.

2006: Environmentalist Radha Bai files a PIL in the HC against the rise in pollution level in the lake. A division bench headed by chief justice G S Singhvi asks the state government to file an affidavit regarding the steps taken to reduce pollution in the lake caused by immersion of idols. The Bench directs that restrictions imposed by the CPCB should be implemented fully and all material immersed in the lake should be disposed off within three days. The city government looks for alternative tanks to immerse the idols.[1]

ANU SHARMA / CSE

The Buddha does not stand here anymore – as one set of citizens pushes to save the lake, another dumps statues in it

The first big victory of this public struggle came in 1996, when the state government issued an order prohibiting certain activities in the catchment area of the lakes. Based on satellite imagery, an area of 140 sq km was recognised as a 'dangerous zone'. The order prohibited industries, major hotels, residential colonies and other establishments that generate pollution to be set up within a 10-km radius of the full tank level. It mandated that residential areas would have to keep as much as 60 per cent of their area under open and green spaces. It also asked relevant government departments not to undertake building works, check dams or irrigation structures in the streams flowing into the lake.

In 1997, the high court also directed the state government to deny permission for conversion of lakes, tanks and ponds in the state for any purpose.

In 2000, this was followed up with a notification from the Hyderabad Urban Development Authority, which mandated that the entire area falling within the full tank level must be kept free from any construction. It also proposed a buffer belt of 30 metre on all sides of the lake. Later, the state government also enacted the Andhra Pradesh Water, Land and Trees Act, 2002, which empowers state agencies to take steps to protect water bodies and to prevent conversion. The act also requires measures to permanently demarcate the boundaries of the water bodies and to "evict and prevent encroachment".[27]

But in spite of all these steps, the lakes of Hyderabad are still under assault. The problem is that the city government does not see lakes and tanks as an integral part of the water and sewage treatment system. This is evident in the government's own vision for the water sector in future. In the *City Development Plan* prepared under the Jawaharlal Nehru National Urban Renewal Mission, the government cites a number of actions it wishes to take to secure Hyderabad's water future. But the plan has just a cursory mention of its lakes and tanks as providers of water security and essential for treating waste. Instead, it includes visions to augment new sources of water, the Krishna and Godavari, to tap 180 MLD.

LOOKING AHEAD

The city has big plans for its water and excreta. In the case of water, its goal is to extend coverage 100 per cent by 2016; to maintain supply at 160 litre per capita daily, but increase the duration of supply to four hours a day by 2011, eight hours a day by 2016 and achieve 24 hours of water supply by 2021. The city plans to reduce its distribution losses to 30 per cent by 2011 and 15 per cent by 2021. Its third aim is to recover the costs of operation and maintenance by 2011. In the sewerage sector, it intends to extend coverage to 80 per cent by 2011 and 95 per cent by 2021. It also plans that by 2021 (after over a decade), 95 per cent of the wastewater would be treated and 50 per cent would be recycled and reused.

To implement this action plan, the government says it needs to invest Rs 4,622.50 crore over five years in the water sector, Rs 1,706 crore in sewerage and about Rs 2,064 crore in the stormwater drainage sector. There are two big items in this Rs 8,300-crore plan – the Rs 1,082-crore Krishna drinking water project and the Rs 1,500-crore Godavari project. In comparison, the budget for the management of the Osman Sagar and Himayat Sagar catchments is a mere Rs 14 crore. In the sewerage sector, the city plan includes Rs 220 crore for building STPS, while the rest is to be spent on remodelling, rehabilitation and laying of sewer lines.[28]

Clearly, there is little in the city's plan which explains how it will overcome its current problems – too little water and massive sewage to treat. The only new element in the plan is the objective to recycle and reuse 50 per cent of the waste. It will be important to see how the city works to implement this objective, which could give it more water from waste. A 2005 report on wastewater and recycling potential in the city says there is enough wastewater to meet the water deficit in the city.

The reuse options are many – from improvements in the water quality for agricultural irrigation to reuse in industry and groundwater recharge.[29] The question now is how the city government will set about working on a plan, which can take it beyond the crisis of today and most certainly, of tomorrow.