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Waste Water Management - A Study

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ABSTRACT

Water use across various sectors in India is on the rise. Various estimates and projections indicate an increasing trend in water demand for agriculture, industrial and domestic uses in the coming decades. Non-domestic use of water is much higher (95%) than domestic use (5%). It is projected that India may move into the category of water stressed nation by 2020. Comprehensive planning, therefore, is needed to meet the ever increasing demand of water. Wastewater has been an untapped resource in India till now. As per the latest estimate 38,255 mld of wastewater is generated in the country. This waste water can be reused for non-domestic purposes. Recycling of wastewater may help to reduce pollution of land and water bodies, reduce fresh water demand and also reduce the need for developing new sources of water supply. The National Urban Sanitation Policy (NUSP) formulated in 2008 by Ministry of Urban Development (MoUD), Government of India (GoI) addresses reuse of wastewater. Bangalore started reuse of water in 1990s, which is first in the country in the municipal sector. Efforts have also been made by Gujarat Urban Development Corporation in this direction and it has signed a memorandum of understanding with Doshion Ltd, a water management service company to build wastewater recycling plants in the state. Surat Municipal Corporation (SMC) has also taken the initiative for waste water recycle. In this paper, we will examine the efforts made by the SMC in managing waste water.

Keywords: Surat Municipal Corporation, Urban Local Bodies, Public Private Partnership, Waste Water, Recycling of Waste Water

INTRODUCTION

The term 'wastewater' means any water that is no longer wanted as no further benefits can be derived out of it. About 99 per cent of wastewater is water and only 1% is solid wastes and 'reuse' of wastewater is to utilize it in its present form without making many alterations. The collected wastewater must be treated to adjust its quality to any of the following end-users uses: (i) irrigation, (ii) artificial recharge, (iii) potable water supply, (iv) toilet flushing and (v) industrial water supply. Reuse of wastewater has been practiced in many areas worldwide for thousands of years. NUSP formulated in 2008 by MoUD, GoI, addresses reuse of wastewater as

an important factor helping to meet the environmental outcomes of the city while the National Water Policy (NWP) addresses it as one of the potential source for meeting water demands and reducing pollutions. NUSP recommends the Service Level Benchmarks defined by MoUD and recommends a minimum of 20% reuse of wastewater in every city. Other than NUSP and NWP, Jawaharlal Nehru National Urban Reforms has included the reuse of wastewater as one of the optional reforms.[1]There is a paradigm shift with respect to sewage management that is from sewage treatment to sewage reuse and recycling.[2]

In the era of economic growth water is seen as a scarce resource as water use across the various sectors like drinking water, energy, commercial agriculture, industrial development is on the rise. Beside this Pollution and contamination of water resources have resulted into newer crises.[3] In view of the increasing population demand of freshwater for all uses will become unmanageable. Comprehensive planning, therefore, is needed to meet the ever increasing demand of water. Wastewater has been an untapped resource in India till now. After proper treatment waste water can be reused like in Israel. 70% of waste water after treatment is used for drinking purposes. Wastewater can be recycled for irrigation purposes or for usage in industry/thermal power stations as utility water (cooling towers/boilers) pisciculture, forestry and horticulture.[4] In this paper, we will examine the efforts made by the SMC in managing waste water.

SCENARIO OF WASTE WATER

It is estimated that about 38,255 mld/day of wastewater is generated in urban centres comprising Class I cities and Class II towns having a population of more than 50,000 (accounting for more than 70% of the total urban population). The municipal wastewater treatment capacity developed so far is about 11,788 mld, that is about 30% of wastewater generation in these two classes of urban centres. Maharashtra, Delhi, Uttar Pradesh, West Bengal and Gujarat are the major contributors of wastewater (63%; Central Pollution Control Board [CPCB], 2007).

	Class 1	**Class II city**	**Total**
Wastewater generated (mld)	35,558	2,697	38,255
Waste treatment capacity (mld)	11,554	234	11,788
Missing capacity (mld)	24,004	2,463	26,467
Untreated (%)	68	92	70

Source: CPCB 2009, status of water supply, wastewater generation and treatment

It is estimated that the projected wastewater from urban centres may cross 1,20,000 mld by 2051 and that rural India will also generate not less than 50,000 mld in view of water supply designs for community supplies in rural areas. The volume of wastewater generated

by domestic, industrial and commercial sources has increased with population, urbanization, improved living conditions and economic development.[5]This waste water can be reused.

WASTE WATER MANAGEMENT IN SURAT CITY

The drainage department of the SMC provides the necessary infrastructure to carry the sewerage from domestic and industrial establishments of the city to the treatment plants, treating it and then disposing it appropriately. The functions of the Department include Planning, designing, estimating, tendering, executing and operating as well as maintaining the sewerage systems which consists of sewerage network, sewage pumping stations, sewage pumping mains, sewage treatment and effluent disposal works etc.

SMC has comprehensive sewerage system (more than 1425 Km of sewers and 9 sewage treatment works) to serve not only the domestic and commercial but also the industrial developments. Wastewater generated from all this developments is collected by a network of underground sewers and pumping stations and conveyed to sewage treatment works for physical and biological treatment to meet the parameters prescribed by the Gujarat Pollution Control Board before discharge into the nearest water course.

Until 2006, out of the total city area of 112.27 km^2, 92.19% area and 97.10% of the population was covered with sewerage systems. In 2006, with the increase in the SMC limits from 112.274 km^2 to 326.515 km^2 the coverage of sewerage has gone down from 92% to 47%. However, due to lesser population in the extended city area, 75% population was being served by underground sewerage system, at the time of city limit extension.

SCENARIO OF DRAINAGE

The overall area of SMC is divided into following six drainage zones: West Drainage Zone, South East Drainage Zone, North Drainage Zone, East Drainage Zone, South Drainage Zone, South West Drainage Zone.

SEWAGE WASTE MANAGEMENT IN SURAT

The Important Constituents of the Sewage Waste Management at SMC are:

1. Sewage Pumping Station
2. Sewage Treatment Plant
3. Sewage Gas Based Power Plant
4. Tertiary Treatment Plant
5. Common Effluent Treatment Plant
6. SCADA

		2012-13	2014
a.	Coverage	149.00 km² 74.00%	204 km²
b.	Population catered	3.85 million i.e., 91.0 % (As per census 2001) Estimate present population catered is 4.40 million	100% of present habitable area
c.	Length of sewer network	1425 km	1600 km
d.	Existing sewage pumping stations	34 No.	58 No. (1949.98 MLD)
e.	Existing sewage treatment plants	9 No.	12 No. (992.50 MLD)

Source: http://www.Icrier.org/pdf/surat_water.pdf

1. Sewage Pumping Station

Waste water is brought through the following Sewage Pumping Stations to the treatment plants. For pumping High efficiency Sewage Submersible pumps are used.

S. No.	Sewage pumping station (under execution)	Capacity in MLD
1.	Variav sewage pumping station	37.00
2.	Variav sewage treatment plant	49.00
3.	Utran sewage pumping station	37.00
4.	Motavarachha sewage pumping station	11.00
5.	Motavarachha G.E.B. sewage pumping station	28.00
6.	Sarthana sewage pumping station	9.00
7.	Puna sewage pumping station	32.00
8.	Magob sewage pumping station	56.00
9.	Parvat sewage pumping station	4.50
10.	Godadara sewage pumping station	27.00
11.	Dindoli sewage pumping station	31.00
12.	BamroliGamtal sewage pumping station	27.00
13.	Vadod-Jiav sewage pumping station	31.00
14.	Sonari sewage pumping station	27.00
15.	Unn-Sonari sewage pumping station	4.50
	Total	411.00

Source: http://www.suratmunicipal.gov.in/drainage/drainage_main.aspx?SrNo=005005305406505405

S. No.	Name of sewage pumping station (existing)	Capacity in MLD
1.	Salabatpura pumping station	65.00
2.	Nanpura pumping station	98.00
3.	Athwa pumping station	21.00
4.	Umra North pumping station	18.50
5.	Umra South pumping station	19.50
6.	Piplod pumping station	9.00
7.	New Anjana pumping station	12.00
8.	Navagam pumping station	55.00
9.	Shantiniketan pumping station	1.00
10.	Katargam new G.I.D.C pumping station	52.00
11.	AshwanikumarPatelnagar pumping station	2.00
12.	Rander pumping station	30.00
13.	Pal pumping station	15.00
14.	Adajan pumping station	15.00
15.	Umarwada pumping station	14.50
16.	Althan pumping station	19.00
17.	Jahangirabad pumping station	32.78
18.	New Khatodara pumping station	50.00
19.	Pandesara G.I.D.C. pumping station	140.00
20.	Modimohollo pumping station	3.00
21.	Limbayat pumping station	41.00
22.	Kantreshwar sewage pumping station	69.00
23.	DabholiSinganpore pumping station	62.00
24.	Karanj pumping station	93.00
25.	BamaroliVadod pumping station	180.00
26.	New Khatodara G.I.D.C. pumping station	18.50
27.	Paras pumping station	52.00
28.	JahangirpuraPisad pumping station	26.00
29.	Vesu main pumping station	51.00
30.	VesuIntermidiate pumping station	21.00
31.	Palanpore pumping station	31.00
32.	Chhaparabhatha sewage pumping station	25.00
33.	Kosad sewage pumping station	83.00
34.	Kosad railway sewage pumping station	57.00
	Total	1481.78

Sewage Treatment Plants and Waste Water Treatment Technologies

STP location	Year of commission	Capacity (MLD)		Process
		Design	Utilizing	
1. Anjana	1995	82.5	85	Conventional activated sludge
2. Bhesan	1995	100	70	Conventional activated sludge
3. Bhatar	1999	120+42	108	Conventional activated sludge + sequential batch reactor tech
4. Karanj	1999	100	98	Conventional activated sludge
5. Singanpore	2003	100+55	100	Conventional activated sludge + SBR tech
6. Bamroli	2002	100	65	Up flow anaerobic sludge blanket + extended aeration
7. Asharma	2009	15	8	Moving bed bio reactor
8. Khajod	2009	25	15	Moving bed bio reactor
9. Variav-Kosad	2012	84	35	UASB + moving bed bio reactor
10. Dindoli under execution		66	-	Conventional activated sludge
Total		726.5+163	584	

Proposed STP projects	
Bhatar (extention) sewage treatment plant	120.00 MLD capacity
Karanj (extention) sewage treatment plant	80.00 MLD capacity
Singanpore (extention) sewage treatment plant	100.00 MLD capacity
Bamroli-Vadod (extention) sewage treatment plant	60 LD capacity

Source:
http://www.suratmunicipal.gov.in/drainage/drainage_main.aspx?srno=005005305406505405, http://www.icrier.org/pdf/surat_water.pdf

2. Sewage Treatment Plants

Total Existing Sewage Treatment Plants 9 no.
Total Existing Capacity: 726.5 MLD
STP Under Construction-1 No., 66 MLD, STP Under Augmentation -3 Nos., 150 MLD
STP Under Planning - 2 no., 53 MLD

Everyday about 750 mld of waste water is treated in the 9 treatment plants. Different technologies are being used. The technology to be used is decided on the basis of climate,

land and Capital and energy availability. Different technologies being used by SMC to treat waste water are: Conventional Activate Sludge (CAS), Sequencing batch reactor (SBR), Up-flow anaerobic sludge blanket (UASB) and Moving Bed Reactor technology and Biological Nutrient Removal, Integrated Fix Film Technology. CAS technology is used the most. SBR technology is latest but it is 2.5 times costly but the quality of water treated is good. UASB is the best technology to treat the waste water as treatment cost to be incurred is minimal. The operation and maintenance of all the sewage treatment plants is carried out by private agencies. SMC has given the contract for desilting of manholes and drainage lines in the different parts of the city to the private agencies.[6]

Process of Waste Water Treatment

Wastewater can be treated using different technologies depending on the quality required. As the quality goes up, so does the costs and there is a decrease in the risk. Wastewater is treated through three levels, which are discussed below.

Primary Treatment

It consists of screen chamber and grit chamber. Screen chamber removes inorganic materials like paper, pouch, other floating particles etc. Grit Chamber removes particles of sand, ash, clinkers, egg shells, bone chips and inert materials etc. Treatment involving sedimentation (sometimes preceded by screening and grit removal) to remove gross and settle able solids. The remaining settled solids, referred to as sludge, are removed and treated separately.

Secondary Treatment

It consists of biological process, which is the heart of the sewage treatment plant. By this treatment Biological Oxygen Demand (BOD), COD and TSS are removed. It removes 85% of BOD and suspended solids via biological or chemical treatment processes. Secondary treated reclaimed water usually has a BOD of <20 mg/L and suspended solids of <30 mg/L, but this may increase to >100 mg/L due to algal solids in lagoon systems.

Disinfection Treatment

It consists of chlorination, UV Treatment for disinfection purpose. This normally implies the removal of a high percentage of suspended solids and/or nutrients, followed by disinfection. It may include processes such as coagulation, flocculation and filtration. The treated water is discharged in the creeks from where the water drains into the Arabian Sea.

Sludge Disposal Unit

It consists of either conventional sludge drying beds or mechanical unit. It does dewatering

from sludge (sludge is a by-product of treated waste water).[7,8]

3. Sewage Gas Based Power Plant

Sludge is used for generating electricity. Total 8000 m^3 sludge is generated every day. The total electricity generated till Dec 2012 from sewage gas is 3.87 Crore units, worth Rs. 17.96 Crore

- The First Sewage Gas to Electricity Generation Plant was set up at Anjana Sewage Treatment in 2003 with a capacity of 0.5 MWe.
- In 2008 another Sewage Gas based power plants each of 1 MWe capacity was commissioned.
- Additional two sewage gas based power plants each of 0.55 MWe and 0.75 MWe are installed and on verge of commissioning.

4. Tertiary Treatment Plant

This plant has been set up to treat waste water and supply the treated water to industries in Surat. This project is first of its kind in India in scale and quantum. 80 mld of waste water is transferred to tertiary plant from Bamroli plant after primary and secondary treatment. Ultra-Filtration/Reverse Osmosis technology is used to treat the waste water at tertiary plant. The rejection rate of this treatment is about 50%. The treatment cost of water is about Rs 12-15/ litre which. This treated water will be sold to industries at the rate of Rs. 22/litre. Total cost of the project is 160 crore. At first stage of planning it was thought to create a tertiary plant on PPP basis but the standing committee later on decided to reject the proposal as cost was on higher side and wants the whole project to be done by SMC. 40 MLD Industrial Grade Tertiary Treated Water will be supplied to Industries at Pandesara GIDC from Bamroli STP which is under execution. Commissioning of this project will help to reduce the load on drinking water resources in years to come.

5. Common Effluent Treatment Plant (CETP)

A common Effluent Treatment Plant has been set up under PPP mode for treating industrial waste water. It was commissioned in January 2011. The arrangement under the PPP mode is - Expenditure for Wastewater Collection Network, Pumping Station and Conveyance line will be borne by SMC. Operational and Maintenance expenditure for CETP will be borne by Pandesara Industries. The details of the project are as under.

1. Estimated Cost : Rs. 119.00 Crore
2. Project Components
   Wastewater Collection Network - 21 km
   Pumping Station - 140 MLD

Conveyance Line - 3.5 km
CETP - 100 MLD

6. Supervisory Control and Data Acquisition (SCADA)

For monitoring and controlling the network of sewage system SCADA is in place. Project cost is Rs. 33 crore. SCADA helps in

- On line Data Monitoring and Controlling
- Advance Planning for preventive maintenance and reduced break down period
- Online electrical data to be used to improve energy efficiency and energy audit.[9]

Advantage of Waste Water Management

1. It protects Environment
2. Protects aquatic life
3. Helps to meet the Scarcity of Water Resource
4. Helps in generation of energy.

Problem in treatment and reuse of water

1. Non availability of the suitable treatment technology
2. Land requirement for establishment of Plant
3. Capital Expenditure for development of treatment plant
4. Recurring (O & M) expenditure on treatment of sewage (including electricity consumption for plant operation)
5. Post treatment uses of treated waste water[10]
6. Sometimes lack of sewage leads to underutilization of treatment plant
7. Pure sewage is not received for treatment (gunny, plastic bags, carcass, POP etc., dumped in drainage line), it increases the cost of treatment
8. Storm Water and Sewage Water lines get mixed
9. Industrial Waste gets mixed with sewage waste which is harmful to microorganism
10. Lack of manpower skills and capacity in managing treatment plants and monitoring it
11. Lack of systematic urban planning
12. Political influence in technology selection for treatment of waste water
13. Lack of accountability leads to wastage of resource-underutilization of treatment plants, selection of technology, lack of monitoring, lack of skilled manpower etc.

RECOMMENDATIONS

1. Commissioning of plants should be done in a phased manner
2. Discharge norms should be flexible taking into account the receiving body where sewage

is discharged

3. Technology selection should be based on topography of the area and availability of land, capital, energy etc.
4. Dual power supply should be available in case of failure of one power system as continuous power supply is required to treat waste water
5. Urban planning should be done on the basis of future requirement
6. Adequate skilled manpower should be recruited
7. Effective monitoring system should to be set up
8. Creation of awareness amongst citizens about disposal of pure sewage water.

REFERENCES

1. Panchal, Kinnari (2012). "Policy incentives & disincentives for wastewater reuse − A case of Gujarat State, India", Working Paper for India Water Week, Available https://www.indiawaterweek.water.tallyfox.com/filefield-private/files/.../. Last accessed date 20th Dec 2013
2. Kamyotra, J.S. and Bhardwaj, R.M. "Municipal Wastewater Management in India, India Infrastructure Report 2011". Ch. 20. Available: http://www.idfc.com/.../report/2011/Chp-20-Municipal-Wastewater-Management. Last accessed date 20 th Dec 2013
3. Gaon, Kandbari. "India's Water Crises: Developments, Debates and Discourses, A capacity building workshop",Sambhaavnaa Institute of Public Policy and Politics, February 26 – March 01, 2013. Available: http://www.sambhaavnaa.org/indias-water-crises-developments-debates-and-di...
4. Opcit. Available: http://www.idfc.com/.../report/2011/Chp-20-Municipal-Wastewater-Management.
5. Opcit. Available: http://www.idfc.com/.../report/2011/Chp-20-Municipal-Wastewater-Management.
6. Available:http://www.suratmunicipal.gov.in/Drainage/Drainage_Main.aspx?SrNo=005005305406505405. Last accessed date 25th Dec 2013
7. Gayathri, Devi, Mekala., Brian, Davidson., Madar, Samad. and Anne-Maree, Boland. "Wastewater Reuse and Recycling Systems: A Perspective into India and Australia", Working Paper 128International Water Management Institute. Available: http://www.iwmi.cgiar.org/Publications/Working_Papers/working/WOR128.pdf.
8. Shah Shwetal. "Initial Proposal - Technological Solution for Sewage Waste Treatment and Reuse." Available: http://www.gujaratcmfellowship.org/document/Fellows/Initial-Proposal-for-Sewage-Treatment_Shwetal-Shah_25Jan2011.pdf.
9. Jatin Shah. "Service delivery of water and sanitation - Challenges faced by metropolitan cities (Surat City). Icrier's Program on Capacity Building & Knowledge Dissemination on Urbanization in India", Preparing for the Urban Challenges of the 21st Century February 06, 2013. Available: http://Www.Icrier.Org/Pdf/Surat_Water.Pdf.
10. Ibid. Available: http://Www.Icrier.Org/Pdf/Surat_Water.Pdf.