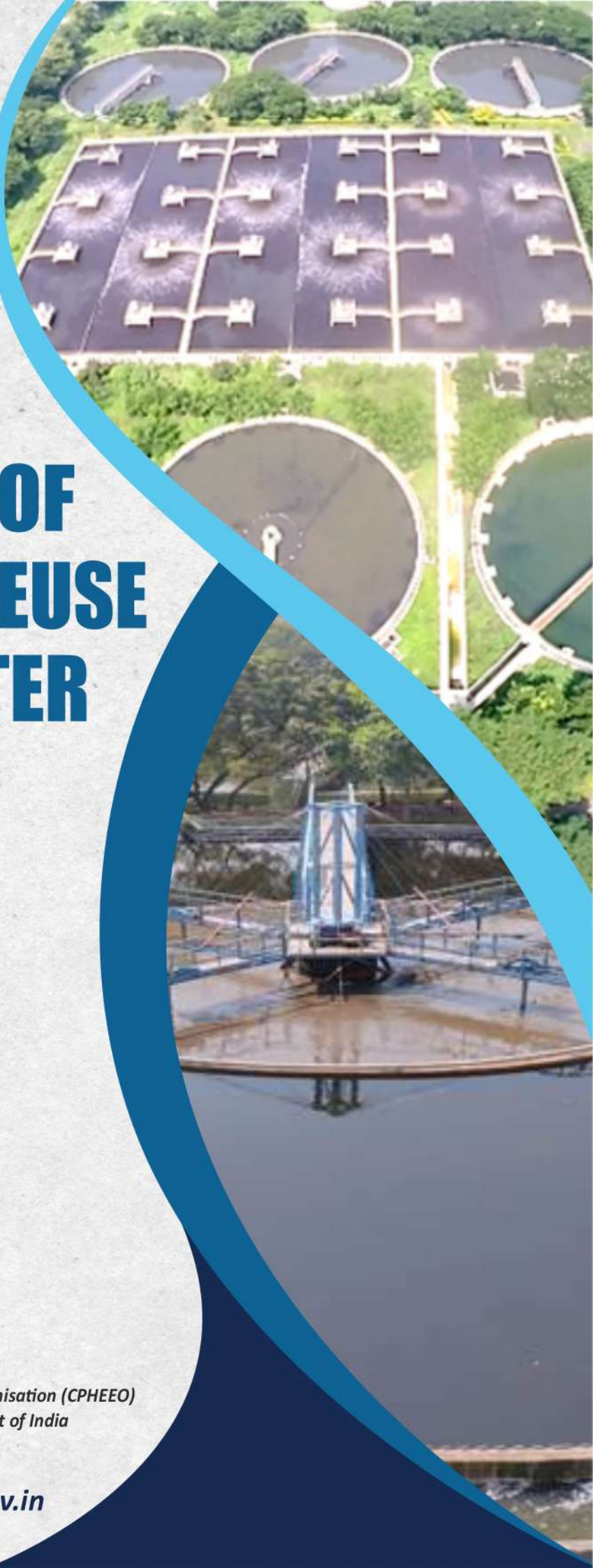
Azadi Ka Amrit Mahotsav

Ministry of Housing and Urban Affairs
Government of India

स्वच्छ भारत
एक कदम स्वच्छता की ओर



COMPENDIUM OF RECYCLE AND REUSE OF WASTEWATER

in 54 Million Plus Cities

Central Public Health and Environmental Engineering Organisation (CPHEEO)
Ministry of Housing and Urban Affairs, Government of India

September 2021

mohua.gov.in | cpheeo.gov.in

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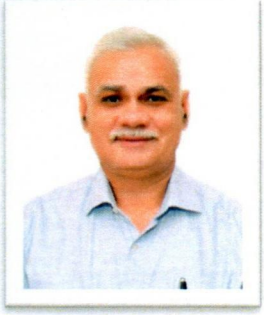
Disclaimer

The information contained herein has been obtained from ULBs and data was collected over a period of 6-9 months. Ministry shall have no liability for errors, omissions or inadequacies in the information contained herein or for interpretation thereof. Keeping in view of the latest developments, this compendium may be updated from time to time.

दुर्गा शंकर मिश्र
सचिव
Durga Shanker Mishra
Secretary



आज़ादी का अमृत महोत्सव

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

भारत सरकार
आवासन और शहरी कार्य मंत्रालय
निर्माण भवन, नई दिल्ली–110011
Government of India
Ministry of Housing and Urban Affairs
Nirman Bhawan, New Delhi-110011

FOREWORD

India accounts for 16% of the world's population and 4% of the world's freshwater resources. Due to rapid economic and demographic change, the water demand in all the sectors are increasing exponentially and use of recycled wastewater should be an alternative option to meet the non-potable water demand. When treated wastewater is reused for various non potable applications, fresh water is conserved and will boost circular economy in water sector.

Today with the advancement of technology, there are good examples of countries like Israel, South Africa, Australia, USA, Europe etc. who have ventured into recycle and reuse of wastewater and they are not only using the treated wastewater for industrial & agricultural purposes but also for indirect potable applications.

The practice of using treated or untreated wastewater for agriculture has also been historically prevalent in India, however there is a need to understand the economic, environmental, social and health implication of use of untreated wastewater and mitigating any deleterious effects from the use of the same. Many cities in India also encourage wastewater reuse to conserve fresh water sources and generate revenue from the sale of treated wastewater for industries. A utility derives the following benefits from recycle & reuse of treated wastewater for various non-potable applications,

- Recycled wastewater and its sale to industrial customers and other needs, frees up fresh water hitherto used, which could be used to augment and meet the ever increasing water needs.
- This option is less expensive as compared to other options to augment existing water supplies from distant water sources or expensive treatment such as desalination.
- Revenue from sale of secondary treated wastewater can cover operation and maintenance costs of STPs.

Recently, Govt. of India announced Jal Jeevan Mission for urban areas with one of the objectives to make cities, water secure by promoting circular economy in water sector. Since, recycle and reuse of wastewater enhances water security, sustainability and resilience in the water sector across the country, it is the need of the hour to strictly adhere to at least 20% recycling and reuse of wastewater by all the cities as per Service Level Benchmarking published by the Ministry. A compendium of recycle and reuse has been prepared by CPHEEO, collating various exemplary recycle and reuse projects being practiced in 54 Million plus cities across the country.

I encourage all the cities to adopt recycle and reuse of treated wastewater and wish that this compendium will be useful for all State Governments/ ULBs/ PHEDs/ Jal Nigam etc., for scaling-up their wastewater recycling facilities in order to aid Circular Economy & achieve Sustainable Development Goals.

I congratulate Dr. M. Dhinadhayalan, Adviser (PHEE) and his team in CPHEEO who were involved in the preparation of this Compendium.

(Durga Shanker Mishra)

New Delhi
21st September, 2021

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भारत सरकार
आवासन और शहरी कार्य मंत्रालय

GOVERNMENT OF INDIA
MINISTRY OF HOUSING AND URBAN AFFAIRS

अमृत
Atal Mission for Rejuvenation and Urban Transformation

PREFACE

Due to alarming population explosion coupled with rapid urbanization and industrialization, catering to good quality potable water and also the treatment of wastewater have become a major challenge. With decreasing availability of freshwater and increasing costs for delivering acceptable water quality and quantity due to long distant sources, cities are facing numerous challenges in achieving efficient service delivery. Due to vagaries in rainfall pattern and dwindling of groundwater resources, different parts of the country are not getting adequate and reliable water resources for various purposes, pushing the nation's water systems to the brink and forced to think about alternatives. In this context, recycle and reuse of wastewater will be an alternative to resolve the water crisis and achieve sustainable water future by conserving fresh water, thus makingthe cities, water secure & resilient.

Many cities are implementing recycling and reuse projects under various Missions of the Ministry as well as under State Programmes. However, no information is available with the Ministry on these projects. CPHEEO has attempted to collect and compile the details of recycling and reuse of wastewater projects practiced in all 54 Million plus cities with an objective to share the information on various best practices and also the technologies adopted for recycle and reuse of wastewater.

As per CPCB report on "National Inventory of Sewage Treatment Plants" published in March, 2021, the sewage generation from all the urban centres is estimated as 72,368 MLD and there are 1,093 operational STPs with a total capacity of 26,869 MLD (37.10%). As per the information collected by CPHEEO from 54 Million plus cities, there are 32 cities which have adopted recycle and reuse projects and 22 cities have not implemented recycle and reuse projects. The total wastewater generation from all the 54 Million plus cities is 23,512 MLD, quantity of wastewater treated is 13,157 MLD including 4,177 MLD which is recycled and reused.

This compendium provides exemplary cases of our cities and bridge the knowledge gap so as to encourage cities to promote circular economy in the water sector. It is desirable that cities should promote recycle & reuse of wastewater for various non-potable applications, by making this practice as mandatory through changes in State / local regulations. It is envisioned to make water secure cities by promoting circular economy under the proposed Jal Jeevan Mission – Urban.

I express my best wishes and hope that the 'Compendium of Recycle and Reuse of Wastewater in 54 Million plus Cities will be helpful for urban areas in transition to circular water economy. I take this opportunity to appreciate efforts of Dr. M. Dhinadhayalan, Adviser (PHEE) and his team in drafting the Compendium. I also acknowledge and appreciate the valuable contribution of Commissioners and Engineers of respective Municipal Corporations, PHEDs, Water and Sewerage Boards in sharing their best recycle & reuse practices.

(**D Thara**)

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MINISTRY OF HOUSING AND URBAN AFFAIRS
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New Delhi-110011, dated the 20

EXECUTIVE SUMMARY

Population of urban India is increasing at an alarming rate, creating huge stress on the exiting natural resources including water. As per report of World Resource Institute, 2015, 54% of India's total area is facing high to extremely high water stress, almost 600 million people are at higher risk of surface water supply disruptions. 54% of India's groundwater wells are decreasing. The onus is on authorities to not only deal with solving water crises but also to efficiently treat the wastewater generated and explore other means and modes to recycle & reuse the treated wastewater for various non-potable applications like industries, agriculture, horticulture, farm forestry, toilet flushing, groundwater recharge, augmenting primary water sources, fish culture, commercial uses etc. so as to reduce the burden on fresh water.

In order to assess the extent of recycle and reuse of treated wastewater in 54 Million plus cities across the country, an exercise was undertaken by CPHEEO to collect and compile the data with respect to their population, wastewater generation, STP capacity and extent of recycle & reuse of wastewater. The details in respect of technologies adopted, capital cost, O & M cost and PPP arrangement are also captured in the compendium.

Out of 54 Million plus cities, 32 cities have success stories of recycle and reuse of wastewater for industries, irrigation & agricultural purposes, and remaining 22 cities have not implemented any recycle and reuse projects. 11 cities that are practicing recycle and reuse of wastewater are generating revenue from sale of wastewater. The total sewage generation from all 54 Million plus cities is 23512 MLD and the total number of operational STPs are 345 nos. with a capacity of 19266 MLD (81.7%). The quantity of wastewater treated is 13157 MLD, of which 4177 MLD is recycled and reused which accounts for 17.71% of the total wastewater generated. It was observed that 18 cities out of 54 cities have achieved more than 20% of recycle and reuse, which is highly appreciable. Gwalior and Nashik have achieved 100% recycle and reuse of wastewater by discharging secondary treated wastewater in rivers and diverting it for irrigation purpose. 14 cities also have tertiary treatment plants with Ultra Filtration, Disk filtration, RO etc.

The best practice case studies of 32 cities practicing recycle and reuse of treated wastewater are compiled and presented in Part I of the Compendium. Though specific information regarding all the STPs that are treating wastewater for recycle and reuse applications from different cities are collected, the details of only few STPs are described in the Compendium and have been endorsed by respective city. The details of wastewater generation and treatment capacity in respect of 22 cities that are not practicing recycling and reuse of wastewater are also presented in the Part II of the compendium with a view to assess the reuse potential for various industrial applications. The details of all 54 Million plus cities, population, wastewater generation, STP capacity, wastewater treated, extent of recycle & reuse, revenue generation, treatment technologies are depicted in Part III of the Compendium in a tabular format.

The details of wastewater generation, treatment capacity and extent of recycle and reuse of wastewater from all the 54 million plus cities are extracted and given in the following table.

Sl. No	Cities	Population (As Per 2011 census)	Current Wastewater Generation (MLD)	Quantity of wastewater treated (MLD)	Total No. of STPs	Capacity of STPs (MLD)	Quantity of treated wastewater reused (MLD)	% of treated wastewater reused
1	Agra	1844000	285	165	9	221	100	35.04
2	Ahmedabad	7100000	1080	878	12	990	512	47.41
3	Amritsar	1321000	210	190	3	218	3	1.43
4	Asansol	1156387	144	0	2 (defunct)	0	0	0.00
5	Aurangabad	1175116	85	127	4	211	75	88.76
6	Bengaluru	8450000	1440	920	32	1183	460	31.94
7	Bhilai	625000	57	23	1	30	22	38.45
8	Bhopal	1790000	301	80	13	144	23	7.64
9	Chandigarh	1055000	227	227	6	244	27	11.92
10	Chennai	7438000	1199	530	13	745	52	4.34
11	Coimbatore	1620000	133	30	3	170	21	16.00
12	Delhi	11000000	3268	2383	40	3058	340	10.40
13	Dhanbad	1162470	94	0	1	0	0	0.00
14	Faridabad	1438855	197	30	4	165	8	4.06
15	Ghaziabad	1648643	300	300	8	483	80	26.67
16	Greater Mumbai	12440000	2190	349	8	2721	49	2.23
17	Gwalior	1159032	169	169	5	223	169	100.00
18	Hyderabad	7499587	1975	772	21	772	70	3.54
19	Indore	1990000	312	312	10	413	102	32.53
20	Jabalpur	1054336	146	17	3	51	17	11.61
21	Jaipur	3046000	180	121	4	183	0	0.00
22	Jamshedpur	631364	158	55	4	64	40	25.32
23	Jodhpur	2050000	110	85	3	120	85	77.27
24	Kannur	232634	31	0	0	0	0	0.00
25	Kanpur	2765358	410	355	7	472	338	82.44
26	Kochi	602046	75	5	2	5	0	0.00
27	Kolkata	4580582	1400	179	5	179	0	0.00
28	Kollam	367107	42	0	0	0	0	0.00
29	Kota	457540	87	20	2	26	0	0.00
30	Kozhikode	613255	60	0	0	0	0	0.00
31	Lucknow	2817105	434	401	3	401	0	0.00
32	Ludhiana	1900000	625	418	5	466	0	0.00
33	Madurai	1468000	61	38	2	171	38	62.00
34	Malappuram	77136	8	0	1	0	0	0.00
35	Meerut	1305429	316	72	1	72	0	0.00
36	Nagpur	2405000	520	340	4	340	314	60.29

37	Nashik	2000000	320	331	10	361	320	100.00
38	Navi Mumbai	1120547	215	215	7	454	65	30.23
39	Patna	1683000	258	43	3	140	0	0.00
40	Prayagraj	1536518	366	268	7	268	40	10.94
41	Pune	3100000	750	535	10	567	400	53.33
42	Raipur	1048120	167	0	0	0	0	0.00
43	Rajkot	1969000	220	120	6	317	0	0.00
44	Ranchi	1073427	94	9	7	11	7	7.66
45	Srinagar	1202000	147	49	7	59	0	0.00
46	Surat	6500000	956	928	11	1373	319	33.37
47	Thiruvanantha puram	955494	140	60	1	107	0	0.00
48	Thrissur	315957	25	0	0	0	0	0.00
49	Trichy	1045436	115	58	1	88	0	0.00
50	Vadodara	1740000	409	273	7	277	3	0.78
51	Varanasi	1197051	302	265	5	362	0	0.00
52	Vasai Virar	1222000	259	18	1	30	0	0.00
53	Vijayawada	1034358	149	130	7	150	0	0.00
54	Visakhapatnam	1890000	290	265	16	166	79	27.26
Total		**128918890**	**23512**	**13157**	**345**	**19266**	**4177**	**17.77%**

Since recycle and reuse of wastewater involves multi stakeholder approach involving government authorities, industries and also public, Public Private Partnership shall also be explored to make it as successful working models. The compendium gives an idea of different treatment technologies adopted by the cities, capital cost, operating and maintenance cost, challenges faced, lessons learnt etc.

It is hoped that this compendium will help cities dealing with scarcity of fresh water and struggling to cater to the problems concerning excess wastewater generation and treatment to incorporate recycle and reuse projects. Also, motivate other cities to upscale recycle and reuse of the treated wastewater projects.

I congratulate Ms. Chaitra Devoor, Asst. Adviser (PHEE) and Ms. Rojna Sharma, Consultant in collecting and compiling the details of recycle and reuse projects in the Compendium.

(Dr. M.Dhinadhayalan)

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PART III: OVERVIEW OF RECYCLE AND REUSE OF WASTEWATER PRACTICES IN 54 MILLION PLUS CITIES

Abbreviations and Acronyms

ACF	Activated Carbon Filtration
ADA	Agra Development Authority
AMC	Ahmedabad Municipal Corporation
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
ASP	Activated Sludge Process
BDL	Below Detection Limit
BEL	Bharat Electronic Limited
BNR	Biological Nutrient Removal
BOD	Biochemical Oxygen Demand
BSP	Bhilai Steel Plant
BWSSB	Bangalore Water Supply and Sewerage Board
CEPT	Centre for Environmental Planning and Technology
CGWB	Central Ground Water Board
CMWSSB	Chennai Metro Water Supply and Sewerage Board
COD	Chemical Oxygen Demand
CPHEEO	Central Public Health and Environmental Engineering Organization
DJB	Delhi Jal Board
DPR	Detailed Project Report
FC	Faecal Coliform
GHMC	Greater Hyderabad Municipal Corporation
GIDC	Gujarat Industrial Development Corporation
GoI	Government of India
GoTN	Government of Tamil Nadu
GVMC	Greater Visakhapatnam Municipal Corporation
HMDA	Hyderabad Metropolitan Development Authority
HMWSSB	Hyderabad Metropolitan Water Supply and Sewerage Board
HPCL	Hindustan Petroleum Corporation Limited
IAF	Indian Air Force
IEC	Information, Education & Communication
IOCL	Indian Oil Corporation Limited
JICA	Japan International Cooperation Agency
JNNURM	Jawaharlal Nehru National Urban Renewal Mission
KIADB	Karnataka Industrial Area Development Board
KIAL	Kannur International Airport Limited
KPCL	Karnataka Power Corporation Limited
KSPCB	Karnataka State Pollution Control Board
MAHAGENCO	Maharashtra State Power Generation Company
MBBR	Moving Bed Biofilm Reactor
MCGM	Municipal Corporation of Greater Mumbai
MHADA	Maharashtra Housing and Development Authority
MLD	Million Litre Per Day
MoHUA	Ministry of Housing and Urban Affairs
MoU	Memorandum of Understanding
MPN	Most Probable Number
MSW	Municipal Solid Waste

NMC	Nagpur Municipal Corporation
NMMC	Navi Mumbai Municipal Corporation
NWWMPL	Nagpur Waste Water Management Pvt. Ltd.
O&M	Operation and Maintenance
PMC	Pune Municipal Corporation
PPCL	Pragati Power Corporation Limited
PPP	Public Private Partnership
RIL	Reliance Industries Limited
RINL	Rashtriya Ispat Nigam Ltd.
RMBR	Rotating Media Bioreactor
RO	Reverse Osmosis
SAIL	Steel Authority of India Limited
SBR	Sequential Batch Reactor
SMC	Surat Municipal Corporation
SPV	Special Purpose Vehicle
STP	Sewage Treatment Plant
SVPIMSR	Sardar Vallabhbhai Patel Institute of Medical Sciences and Research
TDS	Total Dissolved Solids
TTRO	Tertiary Treatment Reverse Osmosis
UASB	Up-Flow Anaerobic Sludge Blanket
UF	Ultra Filtration
UGD	Underground Drainage
ULB	Urban Local Body
UT	Union Territory
UV	Ultraviolet
VEL	Vishwaraj Environment Pvt. Ltd.
VMC	Vadodara Municipal Corporation
VPT	Visakhapatnam Port Trust
WSP	Waste Stabilization Pond

PART I: CITIES PRACTICING RECYCLE AND REUSE OF WASTEWATER

RECYCLE AND REUSE OF WASTEWATER IN AGRA

Agra is one of the major cities of Uttar Pradesh and has population of 18.44 Lakhs (as per 2011 census) living in 244.14 Sq. km of Agra municipal corporation area. The city generates 285.39 MLD of wastewater. Agra Municipal Corporation and Agra Development Authority (ADA) provides water supply and sewerage services to the city. There are 9 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 220.75 MLD. 7 STPs of 180.25 MLD and 2 STPs of 40.5 MLD are operated by Agra Municipal Corporation and Agra Development Authority respectively. Wastewater is treated through various treatment technologies like Up-flow Anaerobic Sludge Blanket Reactor (UASB), Waste Stabilization Pond (WSP), Extended Aeration, etc. Approximately 100 MLD of treated wastewater is being reused for Irrigation and horticultural purposes.

Sewage Treatment Plant of 78 MLD at Dhandhupura and 14 MLD in Jaganpur Dayalbagh are presented as successful recycle and reuse of wastewater projects in Agra.

Name/Location of the Sewage Treatment Plant	Dhandhupura STP	Jaganpur Dayalbagh
Capacity	78MLD	14MLD
Year of commissioning	2001	2011
Implemented by	Yamuna pollution control Unit, UP Jal Nigam, Agra	UP Jal Nigam
Total Capital cost	Rs. 22.71 Crore	Rs. 7.51 Crore
Technology adopted	Up-flow Anaerobic Sludge Blanket Reactor (UASB)	Up-flow Anaerobic Sludge Blanket Reactor (UASB)
Quantity of wastewater received and treated	70MLD	12MLD
Area/Purpose of Reuse	For Horticulture uses only	For Horticulture uses only
Agency responsible for O & M	Va Tech Wabag Ltd.	Va Tech Wabag Ltd.
Operation and Maintenance cost	Rs. 154.44 Lakh per month (Inclusive of consumable and cost of manpower)	Rs. 27.72 Lakh per month (Inclusive of consumable and cost of manpower)
Energy Cost	Rs. 432.73 Lakh per year	Rs. 77.66 Lakh per year
Sludge Generation	65 MT/month	55 MT/month
Mode of treatment and disposal of Sludge	Sludge Drying Bed/used as manure in agriculture	Sludge Drying Bed/used as manure in agriculture

Treated wastewater is passed through effluent channel of approximately 7 km in length to river Yamuna. Approximately 100 MLD wastewater is being reused for irrigation and horticultural purposes from this channel. Currently, no revenue is generated from the reuse of wastewater, however, the reuse of treated wastewater has dual benefit of saving the fresh water consumption for irrigation and the cost incurred it.

Performance of Treatment Plant

1. 78 MLD plant in Dhandhupura

Parameters	**Sewage Inflow[1]**	**Design value[2]**	**After Treatment[3]**
Biological Oxygen Demand (mg/l)	160	150-250	< 30
Chemical Oxygen Demand (mg/l)	400	250-500	< 250
Total Suspended Solids (mg/l)	230	200-600	< 50
Total Nitrogen (mg/l)	-	-	-
Total Phosphorous (mg/l)	-	-	-
Fecal Coliform (MPN/100mL)	-	-	-

2. 14 MLD plant in Jaganpur Dayalbagh

Parameters	**Sewage Inflow[1]**	**Design value[2]**	**After Treatment[3]**
Biological Oxygen Demand (mg/l)	160	150-250	< 30
Chemical Oxygen Demand (mg/l)	500	250-500	< 250
Total Suspended Solids (mg/l)	250	200-600	< 50
Total Nitrogen (mg/l)	-	-	-
Total Phosphorous (mg/l)	-	-	-
Fecal Coliform (MPN/100mL)	10^6	>1000	850

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STPs

78 MLD STP at Dhandhupura

14 MLD STP at Jaganpur Dayalbagh

RECYCLE AND REUSE OF WASTEWATER IN AHMEDABAD

Ahmedabad is one of the mega cities of Gujarat and has a population of about 71 lakhs (as per 2011 census) living in 488 Sq. km of municipal area. The city generates 1080 MLD of wastewater. Ahmedabad Municipal Corporation (AMC) provides water supply and sewerage services to the city. AMC has so far established 12 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 990 MLD treated through secondary treatment process like Activated Sludge Process. Out of 990MLD, around 512 MLD is reused mainly for irrigation and agriculture purposes and 2 MLD is being supplied for industrial purposes.

Vinzol STP of 70 MLD capacity has been presented as successful recycle and reuse of wastewater project in Ahmedabad.

Name/ Location of the Sewage Treatment Plant	Vinzol STP
Capacity of STP	70MLD
Year of Commissioning	2011
Implemented by	AMC (the responsible Urban Local Body (ULB)) Under JnNURM ULB Share: 50% Central govt. share: 35% State govt. share: 15%
Total Capital cost	Rs. 30.3 Cr from ULB
Technology adopted	Activated Sludge Process
Quantity of wastewater received	70 MLD
Quantity of wastewater treated	70 MLD through Secondary treatment
Quantity of wastewater reused	2 MLD - Vatva CETP (Green Environment Services Co-Op. Society Ltd.)
Agency responsible for O&M	M/S. Rajkamal Builders Private Limited
Total O&M cost	Rs. 4.50 lakh per month (excluding energy cost)
Energy cost	Rs. 4.80 lakh per month
Consumables/repairs	O&M cost is inclusive of Consumables/repairs Cost (approx. Rs. 2 lakh per month)
Manpower (Skilled & Unskilled personnel)	O&M cost is inclusive of manpower (approx. Rs. 2.5 lakh per month)
Sludge generation	60-65 m^3/month
Mode of treatment & disposal of sludge	Sludge dewatering and irradiation of sludge at sludge hygienisation plant.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	200 – 250	<20	20 - 25
2	Chemical Oxygen Demand (mg/l)	450 – 500	<100	80 - 100
3	Total Suspended Solids (mg/l)	300 – 350	<30	30 - 40
4	Total Nitrogen (mg/l)	25 – 30	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	1000 - 10000	-

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

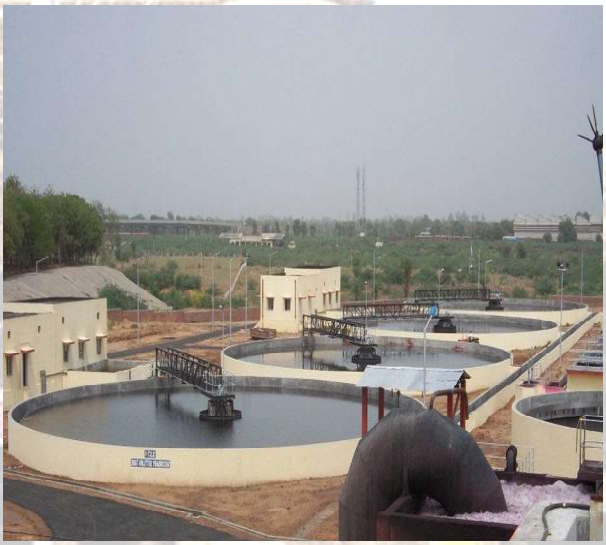
In Vinzol STP, the treated wastewater is being used for Industrial purpose by Vatva CETP (Green Environment Services Co-Op. Society ltd.) thereby saving the fresh water to the tune of 2 MLD. The sale of treated water has generated an income of Rs. 407.42 Lakh since May 2014 till March 2021 for the ULB. Treated sludge is being used as fertiliser in agriculture/horticulture development thereby saving an approximate amount of Rs. 2 Lakh per month on fertiliser/manure. Treatment of industrial effluent which gets infiltrated, shock loads in terms of higher COD and acidic pH is a key challenge faced by AMC.

The following table depicts the details of existing recycle and reuse of wastewater projects in Ahmedabad

Present Installed Plant Capacity (in MLD)		Existing Reuse recycling capacity (MLD)	Treated Sewage Reuse
Vasna	240	240	Irrigation to agricultural land through Fatewadi canal by Irrigation department of Govt. of Gujarat.
Vasna	126	126	
Vasna	35	35	
Vasna	48	48	
Jalvihar	60	60	
Vastrapur Lake	0.50	0.5	Gardening, central verge plantations and nuisance tanker filling and mission million tree watering.
Rasala	1	1	Law garden and Parimal garden, zone level plantations and nuisance tanker filling and mission million tree watering.
V.S. Hospital	1	1	Gardening and flushing purposes by dual plumbing installation at new SVPIMSR hospital.
Vinzol	70	2	2 MLD treated sewage is being supplied to Vatva CETP for their reuse purpose.

Nikol	0.50	0.5	Gardening, central verge plantations and nuisance tanker filling and mission million Tree Watering.
Total existing reuse recycling capacity		514	

Photos of STP



70 MLD Vinzol STP

RECYCLE AND REUSE OF WASTEWATER IN AMRITSAR

Amritsar is one of the major cities in Punjab and has population of about 13.21 Lakhs (as per census 2011) living in 139 Sq. km of municipal area. The city generates 210 MLD of wastewater. Amritsar Municipal Corporation is responsible for providing water supply and sewerage services to the city. The Municipal Corporation has so far established 3 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 217.5 MLD of which 190 MLD of wastewater is treated through secondary treatment technology like Activated Sludge Process (ASP) and Sequential Batch Reactor (SBR). 3 MLD of wastewater is currently reused inside STP premises for gardening and horticulture purposes.

Sewage treatment plant of 95 MLD located in Basarke Bhaini and Wadala Bhittewad are presented as successful recycle and reuse of wastewater projects in Amritsar.

Name/Location of the Sewage Treatment Plant	Basarke Bhaini, Khapper Kheri Pind, South - Zone	Wadala Bhittewad, Ghausabad Pind, North - Zone
Capacity	95 MLD	95 MLD
Year of commissioning	2019	2019
Total Capital cost	Rs. 80.30 Cr	Rs. 84.70 Cr
Technology adopted	Activated Sludge Process (ASP)	Activated Sludge Process (ASP)
Quantity of wastewater received & treated	95 MLD	88 MLD
Quantity of wastewater reused	1.5 MLD	1.5 MLD
Area/ Purpose of reuse	Reused inside STP premises for gardening	Reused inside STP premises for gardening
Agency responsible for O & M	M/s. Shapoorji Pallonji & Co. Pvt. Ltd.	M/s. Shapoorji Pallonji & Co. Pvt. Ltd.
Operation and Maintenance cost	Rs. 9.63 Crore for 5 Years	Rs. 10.16 Crore for 5 Years
Energy cost	Rs. 9 Lakh per month	Rs. 9 Lakh per month
Consumables/Repairs	Rs. 14.45 Lakh per month included in O&M bill	Rs.15.24 Lakh per month included in O&M bill
Cost of production of Per KLD (Secondary Treatment)	Rs. 10.52/KL	Rs. 11.72/KL
Sludge generation	7800 m^3/day	7000 m^3/day

Performance of Treatment Plant

1. 95 MLD Plant in Basarke Bhaini, Khapper Kheri Pind, South - Zone

Sl. No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	216	180 - 225	17
2	Chemical Oxygen Demand (mg/l)	360	400 - 550	60
3	Total Suspended Solids (mg/l)	290	400 - 500	21
4	Total Nitrogen (mg/l)	25	40 - 45	38
5	Total Phosphorous (mg/l)	0.9	5	BDL
6	Faecal Coliform (MPN/100ml)	-	BDL	300

2. 95 MLD Plant in Wadala Bhittewad, Ghausabad Pind, North - Zone

Sl. No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	170	180 - 225	18
2	Chemical Oxygen Demand (mg/l)	420	400 - 550	70
3	Total Suspended Solids (mg/l)	270	400 - 500	33
4	Total Nitrogen (mg/l)	21	10	32
5	Total Phosphorous (mg/l)	1	5	2.0
6	Faecal Coliform (MPN/100ml)	-	BDL	280

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

3 MLD treated wastewater from the both the above mentioned STPs are reused inside STP premises for gardening and horticulture purposes thereby saving fresh water.

Photos of STPs

Digester & Equipment Building Of 95 MLD STP at Basarke Bhaini, Khapper Kheri Pind, South - Zone

Main Pumping Station Of 95 MLD STP at Wadala Bhittewad, Ghausabad Pind, North Zone

RECYCLE AND REUSE OF WASTEWATER IN AURANGABAD

Aurangabad is one of the major cities of Maharashtra and has a population of 11.75 Lakh (as per 2011 census) residing in 176.13 Sq. km of municipal corporation area. The city generates 84.50 MLD of wastewater. Aurangabad Municipal Corporation is responsible for providing water supply and sewerage services to the city. It has so far established 4 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 211 MLD. Wastewater is treated through secondary treatment process by adopting technologies like Activated Sludge Process (ASP), Sequential Batch Reactor (SBR), etc. Approximately 75 MLD of treated wastewater is reused for industrial and horticultural purposes in the city.

Sewage Treatment Plant of 161 MLD capacity located at Kanchnawadi has been presented as successful recycle and reuse of wastewater project in Aurangabad.

Name/Location of the Sewage Treatment Plant	Kanchnawadi
Capacity	161 MLD
Year of commissioning	2017
Implemented by	Aurangabad Municipal Corporation
Total Capital cost	Rs.108.35 Cr
Quantity of wastewater received & treated	60-65 MLD
Technology adopted	Sequential Batch Reactor (SBR)
Quantity of wastewater reused	Approximately 15 MLD
Agency responsible for O & M	Khilari Infrastructure Pvt.Ltd.
Operation and Maintenance cost	Rs. 64.33 Cr for ten years (inclusive of consumables and repairs)
Energy cost	Approximately Rs. 25 Lakh per month (electricity bill)
Cost of manpower (Skilled and Unskilled)	Rs. 13. 50 Lakh per month
Sludge generation	Approximately 3195 MT per month
Mode of treatment & disposal of sludge	Sludge is dried in drying bed and disposed to landfill.

Treated wastewater is reused for construction of Maharashtra Smarudhi Mahamarg expressway. It is also used by Aurangabad Municipal Corporation for the purpose of firefighting and for watering road divider plants. Currently, no revenue is generated from the reuse of wastewater, however, the reuse of treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	250	<10	<10
2	Chemical Oxygen Demand (mg/l)	400	<10	<40
3	Total Suspended Solids (mg/l)	250	<100	<10
4	Total Nitrogen (mg/l)	45	<5	<5
5	Total Phosphorous (mg/l)	5	<1	<1
6	Faecal Coliform	--	<1000	<1000

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photo of STP

161 MLD STP at Kanchnawadi

RECYCLE AND REUSE OF WASTEWATER IN BENGALURU

Bengaluru is the capital city of Karnataka and has a population of 84.5 Lakh residing in 800 Sq. km of municipal area and generating 1440 MLD of wastewater. Bangalore Water Supply and Sewerage Board (BWSSB) provides water supply and sewerage services to the city. BWSSB has so far established 32 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 1182.5 MLD with an actual capacity of utilization of 920 MLD. The wastewater is treated through various secondary and tertiary treatment technologies like Activated Sludge Process, Extended Aeration, Membrane Bio Reactor Technology, UV technology etc. Out of 920 MLD of the total treated wastewater, around 460 MLD is reused for minor irrigation, commercial, industrial, horticultural, landscape etc.

The STPs of Cubbon park, Lalbagh and Yelahanka have been presented as successful reuse of wastewater projects in Bengaluru. The wastewater treatment is being carried out by ASP, Extended aeration, Membrane Bio Reactor Technology, F-Type Rapid Gravity Sand Filters and UV technology. The treated wastewater is reused for commercial, industrial and horticultural purposes. The sludge generated from the above mentioned STPs are used as fertiliser in Gardens or Horticulture Department.

Name/Location of the Sewage Treatment Plant	Cubbon Park STP	Lalbagh STP	Yelahanka New Town STP
Capacity	4 MLD	1.5 MLD	10 MLD
Year of commissioning	Stream A– 2005 Stream B - 2018	2005	2003
Total Capital cost	Stream A- Rs.8.0 Cr Stream B- Rs.20.90 Cr	Rs. 8.0 Cr	Rs. 20.00 Cr
Technology adopted	Membrane Bio Reactor Technology followed by chlorination	Extended Aeration followed by Conventional and UV technology	Activated Sludge Process followed by F-Type Rapid Gravity sand Filters
Quantity of recycle and reuse	4 MLD	1.5 MLD	6 MLD
Area/ Purpose of reuse	1.5 MLD – Cubbon Park Horticulture, 1.0 MLD – Construction activities like tunnelling /connecting, 1.5 MLD – For Public Office gardening, walking, fountain, etc.	1.5 MLD -horticulture and landscaping	Commercial – 4 MLD Industrial – 2 MLD
Revenue from sale of treated wastewater	Rs. 13.75 Lakh/month	Rs. 8.5 Lakh/month	Rs. 36.98 Lakh/month

Agency responsible for O & M	M/s. SUEZ India Pvt. Ltd.	M/s. SUEZ India Pvt. Ltd.	M/S Nruthya Ganapathi Engineers, Bangalore
Operation and Maintenance cost	Rs. 18.99 Lakh/month	Rs. 7.89 Lakh/month	Rs. 17.8 Lakh/month
Energy cost	Rs. 7.32 Lakh/month	Rs. 1.35 Lakh/month	Rs. 9.10 Lakh/month
Consumables/repairs	Rs. 6.53 Lakh/month	Rs. 2.97 Lakh/month	Rs. 3.20 Lakh/month
Cost of Manpower (Skilled and Unskilled)	Rs. 5.14 Lakh/month	Rs. 3.57 Lakh/month	Rs. 5.50 Lakh/month
Cost of production of Per KLD	Rs.25 per KL	Rs.25 per KL	Rs.25 per KL
Sludge generation	600 kg/day	300 kg/day	2000 kg/day
Mode of treatment & disposal of sludge	Sludge is dried in sludge drying beds and used as Fertilizer by Horticulture Dept./Garden	Sludge is dried in sludge drying beds and used as Fertilizer by Horticulture Dept./Garden	Sludge is dried in sludge drying beds and used as Fertilizer by Horticulture Dept./Garden
Major issues faced/scope for further improvement	Nil	Nil	More silt content and in residential area
Quality control	As per KSPCB Norms	As per KSPCB Norms	As per KSPCB Norms

Cubbon Park is a large botanical garden located in the heart of Bengaluru city covering about 300 acres. 4 MLD treated water from the STP is used for the horticultural needs of the cubbon park by saving fresh water which otherwise would be used for landscaping purposes. Lalbagh Botanical Garden is spread over 240 acres and uses 1.5 MLD of treated water from the STP located in Lalbagh, saving the fresh water needs for horticultural purpose. The use of treated water for horticulture purpose in two gardens has saved the consumption of fresh water to the tune of 5.5 MLD saving approximately Rs.2.2 Lakh/day. 6MLD wastewater from the Yelahanka New Town STP is reused for commercial and industrial purposes.

The details of existing recycle and reuse of wastewater projects in Bengaluru are as follows;

- Tertiary treated water from 40 MLD TTP at Devanahalli is being supplied to Karnataka Industrial Area Development Board (KIADB) Industrial area.
- Tertiary treated water from 10 MLD TTP at Yelahanka is being supplied to KIAL, IAF, BEL, Rail Wheel Factory, ITC etc.
- Tertiary treated water from 4 MLD TTP at Cubbon park is being supplied to Raj Bhavan, Vidhana Soudha, High Court, Golf Course, Cubbon park etc.
- Tertiary treated water from 1.5 MLD TTP at Lal Bagh is being supplied to Lal Bagh.
- Tertiary treated water from 15 MLD TTP at Jakkur is being supplied to KPCL gas based power plant at Yelahanka.

- From 298 MLD STP at K&C Valley and 90 MLD STP at Bellandur, about 370 MLD of Secondary Treated Water is being supplied to Minor irrigation for filling the lakes/tanks of Kolar District.
- From 60 MLD STP at Raja Canal and 20 MLD STP at Horamavu, about 80 MLD of Secondary Treated Water is being supplied to Minor irrigation for filling the lakes/tanks of Chikaballapur District.

Performance of Treatment Plant

1. Yelahanka New Town STP

Parameters	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
Biological Oxygen Demand (mg/l)	200-250mg/l	380mg/l	< 5mg/l
Chemical Oxygen Demand (mg/l)	400-500mg/l	800mg/l	<50mg/l
Total Suspended Solids (mg/l)	300-400mg/l	400mg/l	< 5mg/l
Total Nitrogen (mg/l)	-	-	-
Total Phosphorous (mg/l)	-	-	-
Faecal Coliform (MPN/100ml)	-	<25 FC MPN/100ML	<25 FC MPN/100ML

2. Lalbagh STP

Parameters	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
Biological Oxygen Demand (mg/l)	223	<5	1.6
Chemical Oxygen Demand (mg/l)	400.5	<50	16.5
Total Suspended Solids (mg/l)	182.32	<5	<1
Total Nitrogen (mg/l)	39	<10	<1
Total Phosphorous (mg/l)	2.29	-	0.98
Faecal Coliform (MPN/100ml)	BDL	BDL	BDL

3. Cubbon Park STP

Parameters	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
Biological Oxygen Demand (mg/l)	240.17	<4	1.73
Chemical Oxygen Demand (mg/l)	483.49	<50	17.03
Total Suspended Solids (mg/l)	235.62	<3	<1
Total Nitrogen (mg/l)	40	<10	<1
Total Phosphorous (mg/l)	2.466	-	1.191
Faecal Coliform (MPN/100ml)	BDL	BDL	BDL

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STPs

4 MLD STP at Cubbon Park

1.5 MLD STP at Lalbagh

10 MLD STP at Yelahanka New Town

RECYCLE AND REUSE OF WASTEWATER IN BHILAI

Bhilai is one of the major cities of Chhatisgarh and has a population of 6.25 Lakh (as per 2011 census) residing in a municipal area of 72.20 Sq. km. There is one STP in the city with a treatment capacity of 30 MLD, which is being operated and maintained by Bhilai Steel Plant. Bhilai Steel Plant township area has a population of 1.34 Lakh residing in 21.77 Sq. km of township area. Bhilai Steel Plant is a PSU, a unit of Steel Authority of India (SAIL). The township area covers 18 ward of Bhilai Municipal Corporation area and 7 ward of Risali Municipal Corporation area. Until 2020, Risali was a part of Bhilai Municipal Corporation area. The total population of Bhilai in census 2011 was 6.25 Lakh including Risali. After the partition of Risali Municipal Corporation area, the current population of Bhilai is 5.6 Lakh residing in municipal area of 72.20 Sq. km.

The city generates 56.83 MLD of wastewater. The wastewater is treated through secondary treatment technology by adopting Activated sludge process technology and 22.57MLD is treated through tertiary technology. Out of which, 21.85 MLD of treated wastewater is reused for industrial purposes.

The 30 MLD STP located at Sector 5, Ward 53 has been presented as successful reuse of wastewater project in Bhilai.

Name/Location of the Sewage Treatment Plant	30 MLD STP, Sector 5, Ward 53
Capacity	30 MLD
Year of commissioning	2008
Implemented by	Bhilai Municipal Corporation
Total Capital cost	Rs. 28.2 Cr
Quantity of wastewater received & treated	22.57 MLD by Secondary and Tertiary treatment
Technology adopted	Treated by Activated Sludge Process having flash mixer and reactor clarifier, chlorination tank, gravity sand filter, followed by nitrification and denitrification of effluent.
Quantity of wastewater reused	21.85 MLD by BSP Plant
Agency responsible for O & M	Bhilai Steel Plant
Operation and Maintenance cost of STP	Rs. 13.80 Lakh/month
Operation and Maintenance cost of underground sewer network	Rs. 32.63 Lakh/month

Energy cost	BSP has its own power generation plant, hence cost is not available. Energy consumption is 118520 Kw-hr for August 2020 and 105720 Kw-hr for September 2020.
Sludge generation	4.5 ton/month
Mode of treatment & disposal of sludge	Utilized for green belt maintained by Bhilai Steel Plant
Mode of treated water supply/sale/disposal	Self-utilized for industrial cooling purpose by Bhilai Steel Plant
Revenue generation by sale of treated wastewater	None but the savings on fresh water is achieved

The 30 MLD STP at sector 5 is operated by Bhilai Steel Plant itself and municipal corporation has no direct control on its O&M. From this STP, the treated wastewater to the tune of 21.85 MLD is supplied to SAIL plant. At present, there is no revenue generated from the sale of treated water, but the cost incurred towards the use of fresh water is saved by BSP.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	22.2	-	1.73
2	Chemical Oxygen Demand (mg/l)	-	-	-
3	Total Suspended Solids (mg/l)	18.0	-	1.2
4	Total Nitrogen (mg/l)	3.0	-	0.27
5	Total Phosphorous (mg/l)	0.26	-	0.07
6	Faecal Coliform (MPN/100ml)	-	-	-

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STP

30 MLD STP at Sector 5

RECYCLE AND REUSE OF WASTEWATER IN BHOPAL

Bhopal is the capital city of Madhya Pradesh and has a population of 17.9 Lakh (as per 2011 census) residing in 413 Sq. km of municipal corporation area. The city generates 301 MLD of wastewater. Bhopal Municipal Corporation is responsible for providing water supply and sewerage services to the city. It has so far established 13 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 144 MLD. Wastewater is treated through secondary treatment process by adopting technologies like Sequential Batch Reactor (SBR), Activated Sludge Process (ASP), Trickling Filter, Waste Stabilisation Ponds(WSP) etc. Approximately 20 to 25 MLD of treated wastewater is reused for fisheries, horticulture, construction activities etc.

Sewage Treatment Plant of 35 MLD capacity located at Mohali Dhamkheda has been presented as successful recycle and reuse of wastewater project in Bhopal.

Name/Location of the Sewage Treatment Plant	Mohali Dhamkheda
Capacity	35 MLD
Year of commissioning	2019
Total Capital cost	Rs. 42.77 Cr
Quantity of wastewater received & treated	25 MLD
Technology adopted	Sequential Batch Reactor (SBR)
Quantity of wastewater reused	Approximately 20 MLD
Agency responsible for O & M	Ankita Construction
Operation and Maintenance cost	Rs. 50 Lakh per year (all inclusive)
Energy cost	Rs. 35 Lakh per year
Cost of manpower (Skilled and Unskilled)	Rs. 15 Lakh per year
Sludge generation	0.5 m^3/day
Mode of treatment & disposal of sludge	The sludge produced during the treatment of sewage is dried and co treated with green waste. The compost obtained is used for horticulture purposes by the Municipal Corporation.

Currently, no revenue is generated from the reuse of wastewater, however, the reuse of treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	64	220	9
2	Chemical Oxygen Demand (mg/l)	180	500	30
3	Total Suspended Solids (mg/l)	115	220	10
4	Total Nitrogen (mg/l)	32	40	7.4
5	Total Phosphorous (mg/l)	3.2	8	1.4
6	Faecal Coliform (MPN/100ml)	250	2500	86

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photo of STP

35 MLD STP at Mohali Dhamkheda

RECYCLE AND REUSE OF WASTEWATER IN CHANDIGARH

Chandigarh is a city of Punjab and has a population of 10.55 lakh (as per 2011 census) residing in 114 Sq. km of municipal corporation area. The city generates 226.57 MLD of wastewater. Chandigarh Municipal Corporation is responsible for providing water supply and sewerage services to the city. It has so far established 6 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 243.63 MLD. The treatment is carried out by adopting various secondary treatment technologies like Sequential Batch Reactor (SBR), Activated Sludge process (ASP) etc. Out of this, 90 MLD is treated by tertiary treatment technology by Rapid Sand Filtration. The treated wastewater to the tune of 226.57 MLD is reused for different purposes like horticulture purposes for development of green belts, parks, lawns etc.

Sewage Treatment Plant of 136 MLD capacity located at Mohali has been presented as successful recycle and reuse of wastewater project in Chandigarh.

Name/Location of the Sewage Treatment Plant	Mohali
Capacity	136 MLD
Year of commissioning	2010
Total Capital cost	Rs. 29 Cr
Quantity of wastewater received & treated	100MLD
Technology adopted	Secondary Treatment -Moving Bed Biofilm Reactor (MBBR) Tertiary treatment - Rapid sand filtration.
Quantity of wastewater reused	27 MLD
Agency responsible for O & M	Toshiba Water Solutions Pvt. Limited, Gurgaon + ULB
Operation and Maintenance cost	Rs. 2.79 Crore per year excluding Manpower and Energy cost
Energy cost	Rs. 6.00 Crore per year
Cost of manpower (Skilled and Unskilled)	Rs. 1.28 Crore per year
Cost of production of Per KLD treated wastewater **Secondary treatment-** **Tertiary treatment -**	 Rs. 2.07 per KLD Rs. 2.76 per KLD
Sludge generation	1142.6 m^3/day
Mode of treatment & disposal of sludge	Centrifuge process using decanters and given to farmers free of cost.

Chandigarh Municipal Corporation has made it mandatory for residential area bigger than 500 sq. yard to take tertiary treated water for using horticultural purposes. Amount of Rs. 50 per month per 500 sq. yard is collected from the residential area and total revenue of Rs. 42.3 Lakh was collected in last fiscal year from the sale of tertiary treated water.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	285	<30	20-22
2	Chemical Oxygen Demand (mg/l)	510	<150	80-85
3	Total Suspended Solids (mg/l)	330	<100	60-70
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	-

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STP

136 MLD STP at Mohali

RECYCLE AND REUSE OF WASTEWATER IN CHENNAI

Chennai is the capital city of Tamil Nadu and has population of about 74.38 Lakhs (as per 2011 census) living in 426 Sq. km of corporation area. The city generates 1199 MLD of wastewater. Chennai Metro Water Supply and Sewerage Board (CMWSSB) is responsible to provide water supply and sewerage services to the city. CMWSSB has so far established 13 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 745 MLD. However, 530 MLD of wastewater is actually being treated. From the 530 MLD treated wastewater, 22 MLD of secondary treated wastewater and 30 MLD of tertiary treated wastewater is reused for industrial purposes, landscaping, gardening etc.

Treated water from STPs of Kodungaiyur, Koyambedu and Perungudi have been presented as successful recycle and reuse of wastewater projects in Chennai.

Name/Location of Sewage Treatment Plant	Kodungaiyur	Koyambedu	Perungudi
Capacity of STP (MLD) secondary Treatment	270	214	126
Capacity of Tertiary Treatment Plant (MLD)	45	45	10 (under construction)
Total Quantity reused (MLD)	21.79 MLD - Secondary treated 20 MLD (Avg.) – Tertiary treated	10 MLD - Tertiary treated	0.21 MLD – Secondary treated
Places of reuse	52 MLD treated wastewater is recycled and reused at various industries and horticulture purpose.		
Year of Commissioning, Tertiary Treatment Plant	2019	2019	2021
Capital Cost, Tertiary Plant	Rs. 348 Cr	Rs. 396.50 Cr	Rs. 43.36 Cr
Technology for Secondary level treatment	Activated Sludge Process	Activated Sludge Process	Sequential Batch Reactor
Technology For Tertiary/advanced level treatment	Reverse Osmosis	Reverse Osmosis	Ultra filtration
Agency responsible for O&M	M/s P&C Projects Pvt. Ltd.		
O&M Cost (per annum)	Rs. 26.76 Cr	Rs. 21.20 Cr	Rs. 12.48 Cr
Energy cost (per annum)	Rs. 11.56 Cr	Rs. 9.16 Cr	Rs. 5.39 Cr
Consumables/repairs (per annum)	Rs. 5.32 Cr	Rs. 4.21 Cr	Rs. 2.48 Cr
Cost of manpower (Skilled and Unskilled) (per annum)	Rs. 9.88 Cr	Rs. 7.83 Cr	Rs. 4.61 Cr
Total treated sludge generated	173.95 m^3/day	137.87 m^3/day	81.17m^3/day

Mode of treatment & disposal of sludge	Treated in a radial flow type sludge thickener. The thickened sludge will undergo anaerobic decomposition in the absence of air in the closed dome type digesters, producing biogas.
Mode of treated water supply/sale/disposal:	Through lorries for horticulture purposes, through pipeline for industrial usage and disposal.

52 MLD of treated wastewater is reused in different industries from the above mentioned STPs. Some of the industries are mentioned below;

i. CETEX Petrochemicals
ii. Chennai Petroleum Corporation Ltd.
iii. Manali Fertilizers Ltd.
iv. Manali Petrochemicals Ltd. (Plant 1 & 2)
v. Tamil Nadu Petro products Ltd.
vi. Indian additives Ltd.
vii. North Chennai Thermal Power Station
viii. Tamil Nadu Energy Company Ltd. (NTPC - JV)
ix. L&T ship building
x. Kothari petrochemicals Limited
xi. Greater Chennai Corporation

The STPs are implemented, operated and maintained by CMWSSB. The total capital cost of these 3 STPs is Rs. 458 Cr which were constructed in different phases and was funded by GoTN and CMWSSB. The capital cost of the tertiary treatment plants area is Rs. 787.86 Cr. By recycling and reusing of 52 MLD treated wastewater, there is a savings of 52 MLD of fresh water available for public water supply for CMWSSB. By buying recycled water, in place of fresh water, industries save an amount of Rs. 33.80 per day. The sale of treated wastewater has also generated an income of Rs. 5.46 Cr on an average for the ULB since last 20 years and currently with the supply of TTRO water, CMWSSB yields an increased revenue of Rs.8.22 Cr per month.

Performance of Secondary Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	250	460	<20
2	Chemical Oxygen Demand (mg/l)	780	1570	<250
3	Total Suspended Solids (mg/l)	430	690	<30
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	$2.5x10^6$	-	<10000

Performance of Tertiary Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	250-350	350	<3
2	Chemical Oxygen Demand (mg/l)	325-450	450	<10
3	Total Suspended Solids (mg/l)	300-500	430	<1
4	Total Nitrogen (mg/l)	40-60	50	10
5	Total Phosphorous (mg/l)	5-8	8	2
6	Faecal Coliform (MPN/100ml)	2.5x106	-	<1

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) has commissioned 8 biogas plants at various STPs which helps in huge cost savings to the tune of 61.84 Crores (as on October 2018) on energy by producing power through biogas generation. At present the biogas energy plants in the STPs are under rehabilitation and are expected to be completed by 2022. Till October, 2018 more than 90% of the in house energy requirements were being taken care of by the production of electricity by biogas. The details are as follows.

Details of Biogas generation and location of STPs

Sl. No.	Location of STP	STP Capacity	Capacity of Biogas Engine (KW)	Biogas Engine Commissioned On	Total power generated up to October-2018 (KWH)	TNEB power savings Cost up to October-2018 Rs in Lakhs
1	Kodungaiyur	110 MLD	1064	6-Nov	5,03,85,520	2,285.00
2	Koyambedu	60 MLD	625	5-Oct	1,53,30,310	648.59
3	Koyambedu	120 MLD	2 x 836	15-Aug	71,62,000	454.79
4	Nesapakkam	40 MLD	469	6-May	1,55,08,776	656.26
5	Nesapakkam	54 MLD	1064	13-Nov	13,53,690	68.65
6	Perungudi	54 MLD	1064	6-Aug	3,48,45,700	1,411.62
7	Perungudi	60 MLD	1064	12-Jan	99,48,360	658.76
	TOTAL		7022 KW		13,45,34,356	6,183.67
					Say	61.84 Crore

Some of the main challenges faced by CMWSSB are, to create public awareness and make people understand the advantages of recycle and reuse of treated wastewater. IEC is also considered as an important and integral component of reuse of treated wastewater. CMWSSB also believes that the

production and availability of the technological equipment in India could pave way for much more improvements in operations of the STPs and biogas plants which will be more cost effective.

Details of all the STP in the city are given below.

Location of STP	Total Capacity	Phase wise development - STP Capacity	Year of commissioning	Mode of Treatment	Compliance Status of STP
Kodungaiyur STP	270	80	1989	Activated Sludge Process	Complied <u>Parameters</u> <u>Range</u> pH – 6.5 to 8.5 BOD - < 20 mg/l COD – <u>≤</u> 250 mg/l TSS - < 30 mg/l Faecal Coliform – 10000MPN/100 ml
		80	1991		
		110	2006		
Koyambedu STP	214	34	1978		
		60	2005		
		120	2015		
Nesapakkam STP Zone - IV	117	23	1974		
		40	2006		
		54	2014		
Perungudi STP Zone – V	126	60	2012		
		54	2006		
		12	2011		
Sholinganallur STP *(Under Trial Operations)*	18	18	2021	Sequential Batch Reactor	

Photos of STP:

270 MLD STP at Kodungaiyur

214 MLD STP at Koyambedu

126 MLD STP at Perungudi

RECYCLE AND REUSE OF WASTEWATER IN COIMBATORE

Coimbatore is one of the major cities of Tamil Nadu State and has a population of 16.2 Lakh (as per 2011 census) residing in 257 Sq. km of municipal corporation area. The city generates 132.84 MLD of wastewater. Coimbatore Municipal Corporation (CMC) is responsible for providing water supply and sewerage services to the city. CMC has so far established 3 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 170 MLD. STP of 70 MLD capacity located at Ukkadam is operational and STP of 60 MLD capacity located at Ondipudur is on trial run. Another STP of 40 MLD capacity located at Nanjundapuram is under progress. However, of the present treatment capacity, 30 MLD of wastewater is being treated through secondary treatment technology by adopting sequential batch reactor (SBR) at Ukkadam STP. Of this, 21.25 MLD of treated wastewater is reused for different commercial and agricultural purposes in the city.

The STP located at Ukkadam has been presented as successful recycle and reuse of wastewater project in Coimbatore.

Name/Location of the Sewage Treatment Plant	Ukkadam
Capacity	70 MLD
Year of commissioning	2012
Implemented by	Coimbatore Municipal Corporation
Total Capital cost	Rs. 55 Cr from ULB
Quantity of wastewater received and treated	30 MLD
Technology adopted	Secondary treatment by Sequential Batch Reactor(SBR)
Quantity of treated wastewater reused	M/s Coimbatore Golf Club, Coimbatore = 0.30 MLD M/s L&T Defence = 0.25 MLD M/s SNMV college = 0.20 MLD M/s Shanmugavadivel Holdings = 0.25 MLD **Total = 21.25 MLD**
Agency responsible for O & M	M/s JS Associates Development India (P)Ltd.
Operation and Maintenance cost	Rs. 2.81 Crores per annum
Energy cost	Rs. 2.76 Crore per annum
Cost of manpower (Skilled and Unskilled)	Rs. 93 Lakh per annum
Sludge generation	7 Ton per day
Mode of treatment & disposal of sludge	Treated Sludge is dumped into dumping yard

Mode of treated water supply/sale/disposal	Treated water is let into 20 Lakh litre sump and from which it is being pumped by means of 2 nos. of 100 HP centrifugal pumpsets to vellalore dumping yard lagoon/sump.
Revenue generation by sale of treated wastewater	Rs. 35 Lakh/year

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	200 - 300 mg/l	<10 mg/l	≤10mg/l
2	Chemical Oxygen Demand (mg/l)	400 - 500 mg/l	<100 mg/l	≤100 mg/l
3	Total Suspended Solids (mg/l)	200 – 400 mg/l	<10 mg/l	<10 mg/l
4	Total Nitrogen (mg/l)	15 mg/l	<2 mg/l	<2 mg/l
5	Total Phosphorous (mg/l)	5 mg/l	<2 mg/l	<2 mg/l
6	Faecal Coliform (MPN/100ml)	10^6	≤200	≤200

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

From the Ukkadam STP, the treated wastewater to the tune of 0.30 MLD is supplied to Golf Club and 0.95 MLD is being supplied to group of companies and 20 MLD is used for irrigation and agricultural purposes. The treated water is let into 5km stretch of Nalla before using for irrigation, agriculture and plantation. This saves huge quantity of fresh water. The sale of treated wastewater has generated an income of Rs. 35 Lakh per year to the ULB. Coimbatore Municipal Corporation believes that better IEC activities and conducting awareness programme among general public and commercial services will improve the use of treated water and sludge.

Photo of STP

70 MLD Ukkadam STP

RECYCLE AND REUSE OF WASTEWATER IN DELHI

Delhi is the National Capital and has an urban population of 11 million (as per 2011 census) living in 1486 Sq. km of municipal corporation area. It is one of the major and fastest urbanising cities in the country, generating 3268 MLD of wastewater. Delhi Jal Board (DJB) is responsible to provide water supply and sewerage services to the city. DJB has so far established 40 Sewage Treatment Plants (STPs) out of which 35 are operational, 03 are under rehabilitation and 02 have been closed. The total capacity of these STPs is 3058 MLD, of which the operational capacity is 2383 MLD. The wastewater is treated through Activated Sludge Process, Biofilm etc. Out of 2383 MLD of total treated wastewater around 340 MLD is reused for various purposes like horticulture, industrial reuse etc.

Three STPs located at Rithala, Phase II, Delhi Gate Nalla I and Dr. Sen Nursing Home Nallah have been presented as successful recycle and reuse of wastewater projects in Delhi. The total capacity of these 3 STPs are 202MLD, of which 44MLD is being recycled and reused. The wastewater treatment is being carried out using secondary treatment technologies like ASP, MBBR etc. The treated wastewater is reused for horticulture and power plant. The sludge generated from the above mentioned STPs are dewatered by using Solar drying beds and belt filter press. The treated sludge is used as fertiliser in agriculture/horticulture development.

Name/Location of the Sewage Treatment Plant	Rithala, Phase II	Delhi Gate Nalla I	Dr. Sen Nursing Home Nallah
Capacity	182 MLD	10 MLD	10 MLD
Year of commissioning	2001	1999	1998
Total Capital cost	Rs. 80 Crore	Rs. 6.31 Crore	Rs. 5.4 Crore
Technology adopted	Activated Sludge Process and bio film	Densadeg and Biofor technology	Densadeg and Biofor technology
Quantity of recycle and Reuse	24 MLD	10 MLD	10 MLD
Area/ Purpose of reuse	23 MLD for power plant 1 MLD for Horticulture	10 MLD for power plant	10 MLD for power plant
Agency responsible for O & M	Suez India Pvt. Ltd.	Suez India Pvt. Ltd.	Suez India Pvt. Ltd.
Operation and Maintenance cost	Rs. 960 lakh per annum	Rs. 190 lakh per annum	Rs. 190 lakh per annum
Energy Cost	Rs. 40 Lakh per annum	Rs. 60 Lakh per annum	Rs. 60 Lakh per annum
Cost of production of Per KLD	Rs. 2.20 per KL	Rs. 7.60 per KL	Rs. 7.50 per KL

Sludge generation	28-30 MT/day	7-8 m^3/day	7-8 m^3/day
Mode of treatment & disposal of sludge	Solar drying beds & disposed to farmers	Belt Filter Press used for dewatering of sludge. The sludge is transported to other DJB sites for further used by farmers etc.	Belt Filter Press used for dewatering of sludge. The sludge is transported to other DJB sites for further use by farmers etc.
Major issues faced/scope for further improvement	Quality of inflow sewage Extended Peak Flow (especially during rainy seasons)	Nil	Nil
Quality control	Within prescribed limit	Within prescribed limit	Within prescribed limit

The operation and maintenance charges for Delhi gate Nala I STP and Dr. Sen Nursing Home Nallah STP is borne by Pragati Power Corporation Limited (PPCL) and that for Rithala, Phase-II STP is borne by Delhi Jal Board. However, PPCL bears the O & M charges for Effluent Pumping Station (EPS) in Rithala, Phase-II STP. Out of 24 MLD of recycled water in Rithala, Phase II, 23 MLD is supplied to power plant and 1 MLD is supplied for horticulture purposes. It is also to be mentioned that PPCL (Power plant) on an average makes Rs. 27.6 Lakh per month excluding the operation and maintenance cost.

10MLD of recycled water generated from both Delhi Gate Nalla 1 and Dr. Sen Nursing Home Nallah are used for power plant.

The sale of treated water has reduced the consumption of fresh water. The amount spent on fresh water is saved and the sale of treated wastewater also generate income for the ULBS. The sludge is used as manure for agriculture/horticulture, which saves the fertiliser cost.

Note: All the expenditure for operation & maintenance of STP plant including electricity charges are being borne by PPCL for Delhi gate Nala I STP and Dr. Sen Nursing Home Nallah. STP as per MOU with DJB. DJB is not incurring any expenditure for O&M on these plants. The expenditure borne by PPCL is saving to DJB.

Performance of Treatment Plants

1. Rithala, Phase-II

Parameters	Sewage Inflow[1]	Design value[2]	After Treatment[3]
Biological Oxygen Demand (mg/l)	130	270	5
Chemical Oxygen Demand (mg/l)	310	632	22
Total Suspended Solids (mg/l)	135	539	6
Total Nitrogen (mg/l)	NA	-	-
Total Phosphorus (mg/l)	NA	-	-
Faecal Coliform (MPN/100mL)	NA	-	-

2. Delhi Gate Nalla I

Parameters	Sewage Inflow[1]	Design value[2]	After Treatment[3]
Biological Oxygen Demand (mg/l)	138	270	5
Chemical Oxygen Demand (mg/l)	335	632	20
Total Suspended Solids (mg/l)	150	539	7
Total Nitrogen (mg/l)	NA	NA	NA
Total Phosphorus (mg/l)	NA	NA	NA
Faecal Coliform (MPN/100mL)	NA	NA	NA

3. Dr. Sen Nursing Home Nallah

Parameters	Sewage Inflow[1]	Design value[2]	After Treatment[3]
Biological Oxygen Demand (mg/l)	160	200	15
Chemical Oxygen Demand (mg/l)	350	500-700	45
Total Suspended Solids (mg/l)	280	410	20
Total Nitrogen (mg/l)	-	NA	-
Total Phosphorus (mg/l)	-	NA	<1
Faecal Coliform (MPN/100mL)	-	-	-

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs


182 MLD STP at Rithala, Phase II


10 MLD STP at Dr. Sen Nursing Home Nallah


10 MLD STP at Delhi Gate Nalla I

RECYCLE AND REUSE OF WASTEWATER IN FARIDABAD

Faridabad is the largest city of Haryana having a population of 14.38 Lakhs (as per 2011 census) residing in 208 Sq. km of municipal corporation area. The city generates 197 MLD of wastewater. Faridabad Municipal Corporation is responsible for providing water supply and sewerage services to the city. They have so far established 4 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 165 MLD, of which only one plant of 45 MLD capacity located in Badshahpur is in operation. In this STP, 30 MLD of wastewater is received and treated through secondary treatment technology like Sequential Batch Reactor (SBR). Out of this, 8 MLD of treated wastewater is reused for agricultural purposes in the city.

Sewage Treatment Plant of 45 MLD capacity located at Badshahpur has been presented as successful recycle and reuse of wastewater project in Faridabad.

Name/Location of the Sewage Treatment Plant	Badshahpur
Capacity	45 MLD
Year of commissioning	2011
Implemented by	Faridabad Municipal Corporation
Total Capital cost	Rs. 45 Cr
Contribution by ULB and private agency	This STP was constructed under JnNURM scheme and constructed by M/s. Hydroair Tectonics PCD Ltd. as per terms & Conditions of DPR the executing agency shall maintain this STP upto 5 years. The work has been further extended 10 years. Now the O&M work of this STP has been allotted to another agency i.e. M/s. Enviro Solution after tender procedure.
Quantity of wastewater received & treated	30 MLD
Technology adopted	Sequential Batch Reactor (SBR)
Quantity of wastewater reused	8 MLD for agricultural purpose
Agency responsible for O & M	M/s Enviro solutions
Operation and Maintenance cost	Rs. 7.50 Lakh per month (inclusive of consumable, repairs and cost of manpower)
Energy cost	Rs. 13 Lakh per month
O&M cost per KLD treated wastewater	Rs. 1.48 per KLD
Sludge generation	600 kg/day
Mode of treatment & disposal of sludge	Sun drying and used for fertiliser in agriculture land

Treated wastewater to the tune of 8 MLD is reused for agricultural purposes and currently no revenue is generated from the sale of treated wastewater.

The work for construction of new STPs of 100 MLD at Pratapgarh and 80 MLD at Mirzapur is under progress. The total agreement amount of this work is Rs.248.33 crore. The construction work of these STPs have already been started w.e.f. 02.11.2020 and completion date is 30.11.2022. At present 16% work at Mirzapur and 22% work at Partapgarh has been completed.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	276 mg/l	30mg/l	30 mg/l
2	Chemical Oxygen Demand (mg/l)	520 mg/l	250 mg/l	135 mg/l
3	Total Suspended Solids (mg/l)	134 mg/l	100mg/l	86 mg/l
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	1.6 mg/l
6	Faecal Coliform (MPN/100ml)	-	-	480000

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STP

45 MLD STP in Badshahpur

RECYCLE AND REUSE OF WASTEWATER IN GHAZIABAD

Ghaziabad is a city in Uttar Pradesh and has a population of 16.48 Lakhs (as per 2011 census) residing in 220 Sq. km of municipal corporation area. The city generates 300 MLD of wastewater. Ghaziabad Municipal Corporation(GMC) is responsible for providing water supply and sewerage services to the city. They have so far established 8 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 483 MLD. 300 MLD of wastewater is being treated through secondary treatment process by adopting technologies like Up-flow Anaerobic Sludge Blanket Reactor (UASB), Activated Sludge Process(ASP), etc. Out of the treated 300 MLD, 80MLD of treated wastewater is reused for construction, industrial, horticulture and agricultural purposes in the city.

Sewage Treatment Plant of 73 MLD located at Dundahera has been presented as successful reuse of wastewater project in Ghaziabad.

Name/Location of the Sewage Treatment Plant	Dundahera
Capacity	73 MLD
Year of commissioning	2000
Implemented by	UP Jal Nigam
Total Capital cost	Rs. 18.81 Cr
Quantity of water received	71.62 MLD
Quantity of water treated	69.47 MLD
Technology adopted	Up-flow Anaerobic Sludge Blanket Reactor (UASB)
Quantity of wastewater reused	17 MLD approx. (average per month) for construction purpose
Agency responsible for O & M	VA Tech Wabag Limited
Operation and Maintenance cost	Rs. 1.2 Cr per month (including consumables and repairs cost + cost of manpower (Skilled and Unskilled))
Energy cost	Approximately Rs. 12 lakhs per month
Sludge generation	800 kg/day approximately
Mode of treatment & disposal of sludge	By centrifugal process and then taken to drying Bed. The treated sludge is given to farmers to be used as fertilisers.

There are four industrial areas in Ghaziabad namely; Bulandshahr Road Industrial area, Meerut road Industrial area, Shahibabad Industrial area and Loni road site 4 Industrial area. 5 MLD of treated wastewater is sent to these industrial areas as per the requirement. 18 MLD is reused for agricultural purposes, 12 MLD for horticultural purposes, 26 MLD for construction purpose and in highway

construction, and 19 MLD is reused for other purposes like spraying on the roads, watering trees and plants alongside the roads etc., totalling to 80 MLD. The reuse of treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill. It also has potential to generate income for the ULB by sale of treated wastewater.

In the 73 MLD Dundahera STP, Ghaziabad Municipal Corporation faces challenges of huge collection of grit into grit chamber. GMC has mentioned that a mechanical grit chamber instead of existing manual grit chamber for removing stones and sand will be better to solve this issue. Trespassers and animals are also seen entering into the plant premises, therefore, a secure compound wall is required on all the sides of the STP.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	208	220-250	19
2	Chemical Oxygen Demand (mg/l)	411	400-500	53
3	Total Suspended Solids (mg/l)	378	350-500	28
4	Total Nitrogen (mg/l)	NA	NA	NA
5	Total Phosphorous (mg/l)	NA	NA	NA
6	Faecal Coliform (MPN/100ml)	NA	4.5×10^7	NA

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STP

73 MLD Dundahera STP

RECYCLE AND REUSE OF WASTEWATER IN GREATER MUMBAI

Greater Mumbai is one of the major cities in Mumbai State has urban population of about 124.4 Lakh (as per census 2011) living in 480.24 Sq. km of municipal area. The city generates 2190 MLD of wastewater. Municipal Corporation of Greater Mumbai (MCGM) is responsible for providing water supply and sewerage services to the city. MCGM has laid 2015 km of sewer lines across the city for collection of wastewater. The wastewater collected through sewerage network is treated and disposed through 8 Sewerage treatment plants / Waste Water Treatment Facilities (WWTF)'s at Colaba, Worli, Bandra, Versova, Malad, Bhandup, Ghatkopar and Charkop. The total installed capacity of these 8 STP's is 2721 MLD. Out of these 8 Sewage treatment plants, STP at Colaba & Charkop are provided with tertiary treatment facilities. Apart from these 8 treatment plants, MCGM has constructed small decentralised STPs of small capacities at Banganga (1.5 MLD), Dadar (0.3 MLD), SBT plant at Worli (3 MLD), STP at Bandra (1 MLD) with planning of use of treated wastewater at local level. The total capacity of STP's in MCGM, treating for recycle and reuse is 48.8 MLD. Treated wastewater from these plants are reused for various horticultural purposes.

Sewage Treatment Plant at Banganga, Charcop and Colaba are presented as successful recycle and reuse of wastewater projects in Greater Mumbai.

Name/Location of the Sewage Treatment Plant	Banganga	Charkop	Colaba
Capacity	1.5 MLD	6MLD	37 MLD
Year of commissioning	2014	Constructed in 1992 by MHADA & Handed over to MCGM in 2010 (Technology upgradation in 2017 to RMBR)	2020
Total Capital cost	Rs. 2.50 Cr.	Rs. 6.67 Cr.	Rs. 137 Cr.
Technology adopted	Secondary Treatment-Rotating Media Bio Reactors. Tertiary Treatment-Dual Media Filters/Activated Carbon Filters/ Disinfection by Ozonization and sodium hypochlorite dosing.	Secondary Treatment-RMBR technology Tertiary Treatment-Dual Media Sand Filters. Disinfection by Ozonization	Secondary Treatment-Sequential batch reactor Tertiary Treatment-Disk Filter. Disinfection by Chlorination

Quantity of wastewater received and treated	1.5 MLD	4.8 MLD	24 MLD
Quantity of recycle and Reuse	Approximately 0.3 MLD treated water utilized for gardening	Approx. 0.10 MLD	Approx. 1MLD
Area/ Purpose of reuse	Plantation & gardening purpose	Landfill / horticulture	Gardening
Agency responsible for O & M	M/s Naik Environmental Engineers Private Limited.	M/s. Naik Environmental Engineers Private Limited.	M/S. Suez India Private Limited.
Operation and Maintenance cost	Rs. 0.29 Cr. per year	Rs. 2.01 Cr (for 8 years)	Rs. 141 Cr (for 15 years)
Energy cost	Approximately 11.75 Lakhs/ year (As per 2020's energy consumption)	Approximately 29.2 Lakhs/ year	Approximately 2.5 Cr/year
Consumables/Repairs	Included in O &M cost	Included in O &M cost	Included in O &M cost
Cost of Manpower (Skilled and Unskilled)	Included in O &M cost	Included in O &M cost	Included in O &M cost
Cost of production of Per KLD (Secondary Treatment)	O&M cost approx. Rs.9.50/ KL (inclusive of energy cost) + Rs. 5.02 (amortization cost incl. of capital cost of Plant Installation) =Rs.14.52/KL	O&M cost approx. Rs.3.15/ KL (inclusive of Energy cost & O&M Cost)	O&M cost approx. Rs.19.40/ KL (inclusive of energy cost)
Sludge generation	10-15 kg/day	30-40 kg/day	2-3 MT/month
Mode of treatment & disposal of sludge	Biologically digested dried sludge is used as manure in the Garden	Biologically digested dried sludge is used as manure in the Gardens	After stabilization of sludge at site, it is disposed at land fill site in Navi Mumbai

The treated sewage water at Banganga STP is being supplied at the rate of Rs. 3.27 per KL to Raj Bhavan, Honorable Governor's house where it is used for gardening purpose.

Treated sewage water at Charkop STP is being supplied to scientifically closed Gorai dumping ground for gardening purpose and it is used for fire-fighting purpose in local area, as and when required. The plant at Dadar supplies treated sewage water to Pramod Mahajan Garden located in Dadar for

gardening purpose. These initiatives of reuse of treated wastewater for non-potable purposes saves and replaces precious drinking water and has the capacity to generate revenue for MCGM.

Colaba STP is recently commissioned in April 2020 and proposal for supply of treated wastewater to military area in Colaba is in pipeline which will generate revenue for MCGM.

Performance of Treatment Plant

1. **Banganga STP**

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	100-200	100-200	Upto 5
2	Chemical Oxygen Demand (mg/l)	200-400	200-400	Up to 30
3	Total Suspended Solids (mg/l)	100-200	100-200	Up to 10
4	Total Nitrogen (mg/l)	10-14	≤10	≤10
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	≤200 Nos/100ml	≤200 Nos/100ml

2. **Charcop STP**

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	100-200	<5	<5
2	Chemical Oxygen Demand (mg/l)	200-300	<50	<50
3	Total Suspended Solids (mg/l)	100-200	<5	<5
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	≤200 Nos/100ml	≤200 Nos/100ml

3. **Colaba STP**

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	198-250	250	10
2	Chemical Oxygen Demand (mg/l)	378-500	500	50
3	Total Suspended Solids (mg/l)	227.300	500	5
4	Total Nitrogen (mg/l)	13.5-20	620	<1
5	Total Phosphorous (mg/l)	3.9-6	6	<1
6	Faecal Coliform (MPN/100ml)	-	≤200 Nos/100ml	Below detectable limit

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STPs

1.5 MLD STP at Banganga

6 MLD STP at Charcop

37 MLD STP at Colaba

RECYCLE AND REUSE OF WASTEWATER IN GWALIOR

Gwalior is one of the City of Madhya Pradesh and has a population of 11.59 Lakhs (as per 2011 census) residing in 423.35 Sq. km of municipal corporation area. The city generates 169 MLD of wastewater. Gwalior Municipal Corporation is responsible for providing water supply and sewerage services to the city. It has so far established 5 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 223 MLD. 169 MLD of wastewater is treated through secondary treatment technologies by adopting Activated Sludge Process (ASP) technology and Sequential Batch Reactor(SBR). The treated wastewater is realised into the canal and as per the agreement with irrigation department, it gets utilised for various irrigation and agricultural purpose as and when required.

Sewage treatment plant of 65 MLD located at Laltipara and 145 MLD located at Jalalpur have been presented as successful recycle and reuse of wastewater projects in Gwalior.

Name/Location of the Sewage Treatment Plant	Laltipara	Jalalpur
Capacity	65 MLD	145 MLD
Year of commissioning	2020	2020
Implemented by	Gwalior Municipal Corporation	Gwalior Municipal Corporation
Total Capital cost	Rs. 207.96 Cr	Rs. 173.326 Cr
Quantity of wastewater received & treated	38.29 MLD	84 MLD
Technology adopted	Sequential Batch Reactor (SBR)	Sequential Batch Reactor (SBR)
Quantity of treated wastewater Reused	32 MLD (25 MLD for agriculture 4 MLD for horticulture 3 MLD for firefighting)	60 MLD for agriculture
Agency responsible for O & M	M/s Jayanti super construction Pvt. Ltd. Mehsana, Gujarat	M/s Envirad Project Pvt. Ltd. Kanpur (U.P)
Operation and Maintenance cost	Rs. 40.70 Cr For 10 Years (including cost of laying sewer line)	Rs. 26.68 Cr For 10 Years (including cost of laying sewer line)
Consumables and repairs	Included in O & M	Included in O & M
Energy cost	Rs. 29.5 Cr For 10 Years	Rs. 69.7 Cr For 10 Years
Cost of manpower (Skilled and Unskilled)	Included in O & M	Included in O & M

O & M cost /KL (treated wastewater) for secondary treatment	Rs.1.74 / KL at full capacity	Rs.0.511/ KL at full capacity
Cost of production of Per KLD treated wastewater	Rs. 3 per KLD	Rs. 13.44 per KLD
Sludge generation	15 m^3/day	30 m^3/day
Mode of treatment & disposal of sludge	Thickened sludge is pumped to centrifuge unit for dewatering. By centrifuging 80 % water is removed from sludge which is redirected to inlet unit. Wet cake generated is taken by contractor to sell it.	Thickened sludge is pumped to centrifuge unit for dewatering. By centrifuging 80 % water is removed from sludge which is redirected to inlet unit. Wet cake generated is taken by contractor to sell it.

Performance of Treatment Plant

1. 65 MLD STP in Laltipara

Sl.No.	**Parameters**	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
1	Biological Oxygen Demand (mg/l)	180 mg/l	230 mg/l	10 mg/l
2	Chemical Oxygen Demand (mg/l)	464 mg/l	500 mg/l	50 mg/l
3	Total Suspended Solids (mg/l)	250 mg/l	223 mg/l	10 mg/l
4	Total Nitrogen (mg/l)	37 mg/l	40 mg/l	10 mg/l
5	Total Phosphorous (mg/l)	8 mg/l	8 mg/l	2 mg/l
6	Faecal Coliform (MPN/100ml)	46000MPN /100mL	10^7/100 mL	100 MPN/100mL

2. 145 MLD STP in Jalalpur

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	153.5 mg/l	230.40 mg/l	10 mg/l
2	Chemical Oxygen Demand (mg/l)	393 mg/l	500.00 mg/l	50 mg/l
3	Total Suspended Solids (mg/l)	291 mg/l	223.30 mg/l	10 mg/l
4	Total Nitrogen (mg/l)	38 mg/l	40.00 mg/l	10 mg/l
5	Total Phosphorous (mg/l)	3.68 mg/l	8 mg/l	2 mg/l
6	Faecal Coliform (MPN/100ml)	9.7^7/100mL	10^7/100mL	100 MPN/100mL

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs

65 MLD STP at Laltipara

145 MLD STP at Jalalpur

RECYCLE AND REUSE OF WASTEWATER IN HYDERABAD

Hyderabad is the capital city of Telangana and has a population of 74.9 Lakhs (as per 2011 census) residing in 1451.91 Sq. km of municipal corporation area. The city generates 1975.44 MLD of wastewater. Greater Hyderabad Municipal Corporation (GHMC) and Hyderabad Metropolitan Development authority (HMDA) is responsible for providing water supply and sewerage services to the city. They have so far established 21 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 772.30 MLD. Out of the present treatment capacity, 772.3 MLD of wastewater is being treated through secondary treatment process by adopting technology like sequential batch reactor (SBR), Activated Sludge process, etc. and of this 60 MLD is treated by tertiary treatment technology like ultrafiltration. 70 MLD of treated wastewater is reused for different purposes like horticulture, landscaping and for the purpose of lake balancing.

The STP located at Balkapur nala and Khajaguda have been presented as successful recycle and reuse of wastewater projects in Hyderabad.

Name/Location of the Sewage Treatment Plant	Balkapur nala, Khairatabad	Khajaguda
Capacity	20 MLD	7 MLD
Year of commissioning	2012	2017
Implemented by	HMDA (Hyderabad Metropolitan Development Authority)	HMWSSB (Hyderabad Metropolitan Water Supply and Sewerage board)
Total Capital cost	Approximately Rs.28 Cr	Approximately Rs.7.85 Cr
Contribution by ULB and private agency	ODA loan from Japan (JICA)	JNURM
Quantity of wastewater received and treated	20 MLD	7 MLD
Technology adopted	Secondary treatment –Biological Nutrient Removal (BNR) Tertiary treatment – Ultrafiltration using membranes	Secondary treatment –MBBR Moving Bed Bio Reactor
Quantity of wastewater reused	Horticulture = 2 MLD Landscaping = 2.5 MLD Lake balancing of Hussain Sagar = 15.5 MLD Total = 20 MLD	Landscaping = 250 KLD Lake balancing of Khajaguda = 6.75 MLD Total = 7 MLD
Agency responsible for O & M	Aquatech Systems Asia Pvt. Ltd.	M/S Ramky Infrastructures Pvt. Ltd.
Operation and Maintenance cost	Rs. 12.42 Lakhs Per month (excluding energy cost)	Rs. 3.90 Lakhs Per month (excluding energy cost)
Energy cost	Approximately Rs. 19 Lakhs per month	Approximately Rs. 2.70 Lakhs per month

Consumables and repairs	Rs. 5.46 Lakhs per month	Rs. 1.88 Lakhs per month
Cost of manpower (skilled and unskilled)	Rs. 6.66 Lakhs per month	Rs. 2.02 Lakhs per month
O&M cost per KLD treated wastewater	Secondary treatment – Rs. 3.96/KLD Tertiary treatment – Rs. 5.24/KLD	Secondary treatment – Rs. 3.29/KLD
Cost or production per KLD treated wastewater	Secondary treatment – Rs. 3.96/KLD Tertiary treatment – Rs. 5.24/KLD	Secondary treatment – Rs. 3.29/KLD
Sludge generation	4 m^3/day	0.2 m^3/day
Mode of treatment & disposal of sludge	Centrifuge process using decanters	Centrifuge process

Out of 20 MLD wastewater reused from the STP at Balkapurnala, 2 MLD is used for Horticulture, 2.5 MLD is used for Landscaping and 15.5 MLD is used for lake balancing in Hussainsagar.

Out of 7 MLD wastewater reused from the STP at Khajaguda, 250 KLD is used for Landscaping and 6.75 MLD is used for lake balancing of Khajaguda. The reuse of treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill. It also has potential to generate income for the ULB by sale of treated wastewater.

Performance of Treatment Plant

1. Balkapur nala STP

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	290 mg/l	150-300 mg/l	<2mg/l
2	Chemical Oxygen Demand (mg/l)	574 mg/l	200-650 mg/l	<50 mg/l
3	Total Suspended Solids (mg/l)	131 mg/l	200-300mg/l	<1 mg/l
4	Total Nitrogen (mg/l)	56 mg/l	35-70 mg/l	5.4 mg/l
5	Total Phosphorous (mg/l)	7.2 mg/l	6-10 mg/l	0.19 mg/l
6	Faecal Coliform (MPN/100ml)	900	-	<100 MPN/100ml

2. Khajaguda STP

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	290 mg/l	250-350 mg/l	< 20 mg/l
2	Chemical Oxygen Demand (mg/l)	574 mg/l	300-500 mg/l	<100 mg/l
3	Total Suspended Solids (mg/l)	131 mg/l	300-500mg/l	<30 mg/l
4	Total Phosphates	2.92 mg/l	-	0.75 mg/l
5	Total kjeldahl nitrogen as N	18 mg/l	-	0.26 mg/l
6	Faecal Coliform (MPN/100ml)	900	5.0 X 10^7MPN/100 ml	<1000MPN/ 100 ml

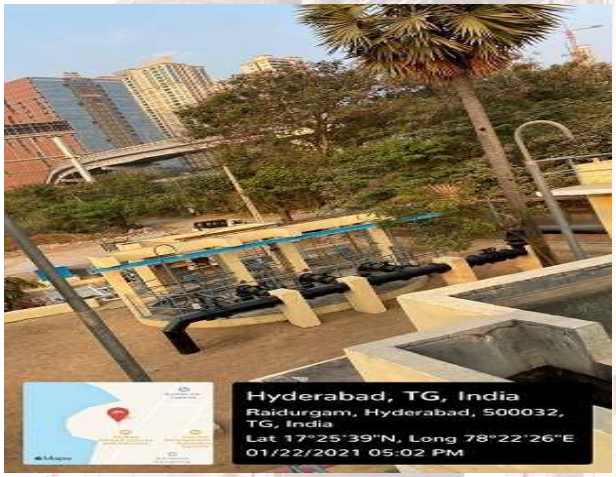
[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs

20 MLD STP at Balkapur Nala



7 MLD STP at Khajaguda

RECYCLE AND REUSE OF WASTEWATER IN INDORE

Indore is one of the major cities of Madhya Pradesh and has population of 19.9 lakh (As per census 2011) living in 267 Sq. km of municipal corporation area. The city generates 312 MLD of wastewater. Indore Municipal Corporation (IMC) provides water supply and sewerage services to the city. IMC has so far established 10 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 412.5 MLD based on secondary treatment technologies like Activated Sludge Process, Sequential Batch Reactor etc. Out of the 412.5 MLD, 101.5 MLD of wastewater is reused for different purposes like horticulture, landscaping, irrigation, construction, vehicle washing in IMC, urinal washing, fountains, divider washing, footpath cleaning, etc.

Sewage Treatment Plant of 245 MLD capacity in kabitkhedi has been presented as successful recycle and reuse of wastewater project in Indore.

Name/Location of the Sewage treatment Plant	kabitkhedi
Capacity	245 MLD
Year of commissioning	2016
Implemented by	Indore Municipal Corporation
Total Capital cost	Rs. 194 Cr.
Technology adopted	Sequential Batch Reactor (SBR)
Quantity of wastewater reused	91 MLD
Area of reuse	Horticulture, landscaping, irrigation and construction
Agency responsible for O & M	M/S Toshiba Water solutions.
Operation and Maintenance cost	Rs. 1.36 Cr per month (all inclusive)
Energy cost	Rs. 1.05 Cr per month
Consumables/Repairs	Rs. 0.11 Cr per month
Cost of manpower (Skilled & Unskilled personnel) (Rs)	Rs. 0.20 Cr per month
Sludge generation	7.95 m^3/day
Mode of treatment & disposal of sludge	Sludge is collected from all the STPs and is sent to the landfill site of the city where it is get mixed with wet waste and is treated further for the making of compost.

91 MLD from 245 MLD plant in Kabitkhedi and 10.5 MLD from other STPs is reused for various purposes. Reuse of wastewater from Kabitkhedi 245 MLD plant is done through pipe line network of

around 34 km and overhead tank of 3ML located at meghdoot garden. Treated wastewater is supplied through overhead tank to 101 gardens and fountains via pipeline network and 38 hydrants which are installed within the city to supply treated water to tankers for horticulture, landscaping, construction purpose etc. Reuse sump is constructed for supply of treated water by pumping to nearby 6 villages covering the area of around 5000 hectares.

Sale of treated water has generated an income of Rs.89.4 Lakhs in 2020-2021 for Indore Municipal Corporation by selling treated water to the contractors, farmers and other organisations and IMC has saved Rs.1.09 Cr in monitory value in the last fiscal year by utilisation of treated wastewater in place of fresh water. Treated sludge is used as fertiliser thereby saving an amount of Rs.3.6 lakh per month (including wet waste) as it is mixed with wet waste at compost plant to produce compost.

Some of the benefits of recycle and reuse are, IMC has reduced its expenditure for horticulture purpose like maintenance of bore well and minimising travel time for tankers by supplying treated water through pipelines and installation of hydrants. Considering the huge scope of reuse for industrial purposes in Sanwer Road Industrial area, IMC envisions to build tertiary treatment plant in the future to cater to this demand.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2] (At inlet)	After treatment[3]
1	Biological Oxygen Demand (mg/l)	80	225	8
2	Chemical Oxygen Demand (mg/l)	197	500	39
3	Total Suspended Solids (mg/l)	34	400	9
4	Total Nitrogen (mg/l)	38	45	2
5	Total Phosphorous (mg/l)	6	7	2
6	Faecal Coliform (MPN/100ml)	-	10^6	-

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STP:

245 MLD STP at Kabitkhedi

Overhead tank of 3 ML capacity at Meghdoot garden used for storing and supplying treated wastewater

Tanker getting filled by treated wastewater from hydrant

RECYCLE AND REUSE OF WASTEWATER IN JABALPUR

Jabalpur is one of the major cities of Madhya Pradesh and has a population of 10.54 Lakhs (as per 2011 census) residing in 264 Sq. km of municipal corporation area. The city generates 146 MLD of wastewater. Jabalpur Municipal Corporation (JMC) is responsible for providing water supply and sewerage services to the city. JMC has so far established 3 Sewage Treatment Plants (STPs) with a total treatment capacity of 51.05 MLD. However, only 16.95 MLD is received at these STPs for treatment. There are 15 STPs of total 176.55 MLD Capacity that are under process. Out of the received 16.95 MLD wastewater, 16 MLD of wastewater is treated by Waste Stabilization Pond (WSP) technology and 0.95 MLD is treated through Activated Sludge Process (ASP) followed by tertiary treatment like Chlorination & UV. The amount of wastewater received and treated to the tune of 16.95 MLD is entirely reused for various purposes in the city like agriculture, horticulture, landscape and constructional purposes.

Sewage Treatment Plant of 50 MLD capacity located in Zone no. 1 Kathonda is presented as successful recycle and reuse of wastewater project in Jabalpur.

Name/Location of the Sewage Treatment Plant	Zone no. 1 Kathonda
Capacity	50 MLD
Year of commissioning	2010 (but started in 2018 after the centralised sewer network system was inaugurated)
Implemented by	Jabalpur Municipal Corporation
Total Capital cost	Rs. 9.2 cr.
Quantity of wastewater received & treated	16 MLD
Technology adopted	Secondary Treatment – Waste Stabilization pond
Quantity of wastewater reused	16 MLD - Agricultural purpose.
Agency responsible for O & M	Jabalpur Municipal Corporation
Operation and Maintenance cost	Rs. 7.20 Lakh per annum (all inclusive)
Consumables and repairs	Rs. 80 thousand -1.2 Lakh per Year
Energy cost	Rs. 1.8-3 Lakh per year
Cost of manpower(Skilled and Unskilled)	Rs. 3 Lakh per year
Sludge generation & mode of treatment & disposal of sludge	NA (Sludge collected in the pond is well stabilized and needs to be withdrawn after two years)
Revenue generation by sale of treated wastewater	NIL

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	108-184	200	≤30
2	Chemical Oxygen Demand (mg/l)	250-400	500-1000	…
3	Total Suspended Solids (mg/l)	120-160	150-200	≤100
4	Total Nitrogen (mg/l)	06-11	20-100	….
5	Total Phosphorous (mg/l)	04-05	6	….
6	Faecal Coliform (MPN/100ml)	10^6 - 10^8	10^6 - 10^8	≤1000

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater (as per environment protection rule 1986*)

Treated wastewater to the tune of16 MLD from 50 MLD STP located at Zone no. 1 Kathonda (waste stabilising pond) is reused for irrigation/agricultural purpose only. 0.95 MLD of treated wastewater from 0.55MLD and 0.5MLD capacity STPs located at Gwarighat and Gulaua Talab respectively are reused for horticulture, landscape and constructional purposes.

Since land area required for Waste Stabilization Pond is large compared to other process, it is generally constructed outside of the main residential/ commercial area. Also, Jabalpur City has underground Sewer Network designed based on Centralized Sewer Network system and plans to connect more than 40% of the house sewers to this centralised Sewer Network by June 2022. However, JMC finds it challenging to plan an economic system for wastewater treatment and its recycling/reuse. A decentralized sewerage system has to planned by dividing whole city into small zones to minimize the cost of wastewater treatment &its recycling/reuse process.

Photos of STP

50 MLD Waste stabilizing pond at Zone no. 1 Kathonda

RECYCLE AND REUSE OF WASTEWATER IN JAMSHEDPUR

Jamshedpur or Tatanagar is one of the major industrial cities of India and of Jharkhand State having a population of 6.31 lakh (as per 2011 census) residing in 64 Sq. km of municipal corporation area. The city generates 158 MLD of wastewater. At present, four party agreement exists between State government, Jamshedpur Notified Area Committee (JNAC) - ULB, Tata Steel and JUSCO (which is a subsidiary of Tata Steel) who are collectively working towards providing water supply in Jamshedpur. There are 4 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 63.5 MLD. Wastewater is treated through Secondary treatment technology like Activated Sludge Process and through tertiary treatment technology like ultrafiltration. Approximately 40 MLD of treated wastewater is reused for industrial purpose by Tata Steel.

Sewage Treatment Plant of 45 MLD capacity located at Bara has been presented as successful recycle and reuse of wastewater project in Jamshedpur.

Name/Location of the Sewage Treatment Plant	Bara
Capacity	45 MLD
Year of commissioning	2016
Implemented by	JUSCO
Total Capital cost	Rs.58 Cr (for 45 MLD plant in Bara and 16 MLD Plant in Kharkai)
Quantity of wastewater received	44 MLD
Quantity of wastewater treated	44 MLD - Secondary Treated 30 MLD - Tertiary Treated
Technology adopted	Activated Sludge process (Secondary Treatment) Ultra Filtration (Tertiary Treatment)
Quantity of treated wastewater reused	40 MLD
Agency responsible for O & M	Jamshedpur Utility Services Company Limited (JUSCO)
Operation and Maintenance cost	Rs. 7. 43 Cr per annum (all inclusive)
Energy cost	Rs. 3.05 Cr per annum
Consumables/repairs	Rs. 1.6 Cr per annum
Cost of manpower (Skilled and Unskilled)	Rs. 2.7 Cr per annum
Cost of Production per KLD of treated wastewater	Rs. 4/KLD (Secondary Treatment) Rs. 5/KLD (Tertiary Treatment)
Sludge generation	2 m^3/day
Mode of treatment & disposal of sludge	Sludge is sent Bio Digester and is used for horticulture purpose

Treated wastewater from 45 MLD STP plant at Bara is sent to pumping station and Tata steel reuses about 40 MLD of the treated wastewater. Since this plant is running under CSR (Corporate Social Responsibility), Tata Steel is not liable to pay any amount for reusing the treated wastewater. Therefore, no revenue is generated from the reuse of wastewater, however, the reuse of treated wastewater has benefits of saving the fresh water consumption and also the cost incurred on the water bill.

Public Private Partnership (PPP) Model is existing for supplying drinking water from Moharda water scheme in Jamshedpur. The major terms & conditions of PPP Agreement are as follows,

- Drinking Water and Sanitation Department (DWSD), a department of government of Jharkhand and Jamshedpur Notified Area Committee (JNAC), are responsible for supplying drinking water though the existing facility to approximately 6000 consumers residing in Service Area. As they were desirous of diverting this function of supplying drinking water in the Service Area, they approached Tata Steel Limited (TSL) for this purpose.
- TSL agreed to take on the responsibility of supplying drinking water to the Consumers in the Services Area on the terms and conditions mutually agreed among all the parties.
- With concurrence and nomination (as opposed to inviting tenders from other parties) of JNAC, TSL has engaged its subsidiary JUSCO (expert at water management having its operations at Jamshedpur and having successfully implemented prestigious projects in other parts of the country) for performing work relating to treatment and distribution of drinking water in the service Area.
- JNAC has agreed to cooperate and provide all assistance required by JUSCO in order to ensure drinking water is successfully supplied to Consumers in the Service Area.

Performance of Treatment Plant

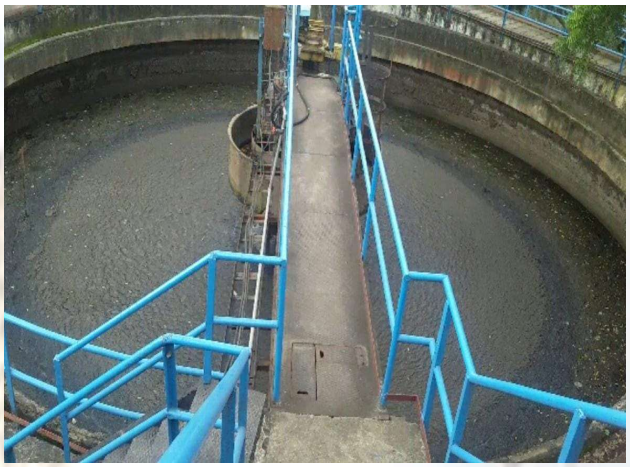
Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	96	-	11.5
2	Chemical Oxygen Demand (mg/l)	163	-	<50
3	Total Suspended Solids (mg/l)	184	-	17
4	Total Nitrogen (mg/l)	0	-	0.5
5	Total Phosphorous (mg/l)	1.9	-	0.8
6	Faecal Coliform (MPN/100ml)	-	-	-

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs



45 MLD Plant in Bara

RECYCLE AND REUSE OF WASTEWATER IN JODHPUR

Jodhpur is a city in Rajasthan and has a population of 20.5 lakh residing in 232 Sq. km of municipal area. At present, the city generates 110 MLD of wastewater. Jodhpur Municipal Corporation (JMC) is the responsible agency that provides water supply and sewerage services to the city. JMC has so far established 3 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 120 MLD. The wastewater is treated through various secondary treatment technologies like Activated Sludge Process and Waste stabilisation ponds. Out of the total treated wastewater, 85 MLD is reused for agriculture and horticulture.

Sewage Treatment Plant located in Nandari, Salawas (Phase I) and Salawas (Phase II) have been presented as successful recycle and reuse of wastewater projects in Jodhpur.

Name/Location of the Sewage Treatment Plant	Nandari	Salawas (Phase I)	Salawas (Phase II)
Capacity	20 MLD	50 MLD	50 MLD
Year of commissioning	2004	2011	2018
Total Capital cost	Rs. 3 Cr	Rs. 34.1 Cr	Rs. 29.85 Cr
Technology adopted	Waste Stabilisation pond (WSP)	Activated Sludge Process (ASP)	Activated Sludge Process (ASP)
Quantity of recycle and Reuse	20 MLD	30 MLD	35 MLD
Area/ Purpose of reuse	Agriculture	Agriculture	Agriculture
Revenue from sale of treated wastewater	Rs. 18 lakhs per annum	Rs. 12 lakhs per annum	Rs. 12 Lakhs per annum
Agency responsible for O & M	M/s D J Enterprises	M/s Vatech Wabag	M/s Geo Miller & O. Pvt. Ltd.
Operation and Maintenance cost	Rs. 1.35 lakhs per month	Rs. 10.5 lakhs per month	Rs. 4.25 lakhs per month
Energy cost	Rs. 0.50 lakhs per month	Rs. 10.0 Lakhs per month	Rs. 10.0 Lakhs per month
Consumables/repairs and Cost of Manpower (Skilled and Unskilled)	Included in O & M Rate	Included in O & M Rate	Included in O & M Rate
Cost of production of Per KLD	Rs. 0.31/KL	Rs. 2.27/ KL	Rs. 1.35/KL
Sludge generation	In WSP, sludge generated settle at the bottom and is cleaned periodically.	15 Ton/day	13 Ton/day

Mode of treatment & disposal of sludge	Aerobic and anaerobic digestion in Tanks	Anaerobic digestion , centrifuge and used as manure	Anaerobic digestion, centrifuge and used as manure
Major issues faced/scope for further improvement	Industrial wastewater mixed with raw sewage	Industrial wastewater mixed with raw sewage	Industrial wastewater mixed with raw sewage

Performance of Treatment Plant

1. Nandari

Parameters	**Sewage inflow[1]**	**Design value[2] For outlet**	**After treatment[3]**
Biological Oxygen Demand (mg/l)	170-250mg/l	30 mg/l	35-40 mg/l
Chemical Oxygen Demand (mg/l)	450-550mg/l	200mg/l	180-220 mg/l
Total Suspended Solids (mg/l)	300-400mg/l	30mg/l	30-45 mg/l
Total Nitrogen (mg/l)	30-50	-	--
Total Phosphorous (mg/l)	10-12	-	--
Faecal Coliform (MPN/100ml)	-	-	--

2. Salawas (Phase I)

Parameters	**Sewage inflow[1]**	**Design value[2] For outlet**	**After treatment[3]**
Biological Oxygen Demand (mg/l)	160-250 mg/l	20 mg/l	15-22 mg/l
Chemical Oxygen Demand (mg/l)	400-600 mg/l	200 mg/l	50-80 mg/l
Total Suspended Solids (mg/l)	250-450 mg/l	30 mg/l	12-30 mg/l
Total Nitrogen (mg/l)	40-45 mg/l	--	2-8 mg/l
Total Phosphorous (mg/l)	10-15	--	1-2 mg/l
Faecal Coliform (MPN/100ml)	--	--	--

3. Salawas (Phase II)

Parameters	**Sewage inflow[1]**	**Design value[2] For outlet**	**After treatment[3]**
Biological Oxygen Demand (mg/l)	160-250 mg/l	20 mg/l	17-26 mg/l
Chemical Oxygen Demand (mg/l)	385-600 mg/l	200 mg/l	70-100 mg/l
Total Suspended Solids (mg/l)	300-450 mg/l	30 mg/l	14-30 mg/l
Total Nitrogen (mg/l)	40-45 mg/l	--	3-8 mg/l
Total Phosphorous (mg/l)	10-15	--	1-2 mg/l
Faecal Coliform (MPN/100ml)	--	--	--

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs

Nandari 20 MLD STP

Salaswa 50 MLD STP Phase I

Salaswa 50 MLD STP Phase II

RECYCLE AND REUSE OF WASTEWATER IN KANPUR

Kanpur is one of the major cities in Uttar Pradesh and has a population of 27.65 Lakhs (as per 2011 census) residing in 258.10. Sq. km of municipal corporation area. The city generates 410 MLD of wastewater. Kanpur Municipal Corporation is responsible for providing water supply and sewerage services to the city. They have so far established 7 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 472 MLD which is treated through secondary treatment process by adopting technologies like Activated Sludge Process (ASP), Up-flow Anaerobic Sludge Blanket (UASB) etc. Approximately 338 MLD of treated wastewater is reused for agricultural purposes in the city. The treated wastewater is released into the channel which is utilised for agricultural purposes as and when required.

Sewage treatment plant of 210 MLD and 43 MLD located at Bingawan and Jajmau are presented as successful recycle and reuse of wastewater projects in Kanpur.

Name/Location of the Sewage Treatment Plant	Bingawan	Jajmau
Capacity	210 MLD	43 MLD
Year of commissioning	2015	2020
Total Capital cost	Rs. 141.96 Cr	Rs. 19.67 Cr
Quantity of wastewater received & treated	135 MLD	43 MLD
Technology adopted	Up-flow Anaerobic Sludge Blanket (UASB)	Activated Sludge Process (ASP)
Agency responsible for O & M	U.P. Jal Nigam	U.P. Jal Nigam
Operation and Maintenance cost	Rs. 2.30 Cr per annum (All inclusive)	Rs.7.47 Cr per annum (All inclusive)
Energy cost	Rs. 1.22 Cr per annum	Rs. 4.30 Cr per annum
Consumables and repairs	Rs. 1.05 Cr per annum	Rs. 1.85 Cr per annum
Cost of manpower (Skilled and Unskilled)	Rs. 0.20 Cr per annum	Rs. 0.92 Cr Per annum
O & M cost/KL (treated wastewater)	Rs. 4.60/KL	Rs. 4.89/KL
Cost of production per KL of Secondary treated wastewater	Rs. 4.60/KL	Rs. 4.89/KL
Sludge generation	405 m^3/day	129 m^3/day
Mode of treatment & disposal of sludge	Belt Filter Press	Centrifuge

Performance of Treatment Plant

1. 210 MLD plant in Bhingawan

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	176	<30	29
2	Chemical Oxygen Demand (mg/l)	628	<100	98
3	Total Suspended Solids (mg/l)	524	<50	49
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	-

2. 43 MLD Plant in Jajmau

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	235	<30	25
2	Chemical Oxygen Demand (mg/l)	574	<100	80
3	Total Suspended Solids (mg/l)	507	<50	31
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	-

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs

210 MLD STP at Bingawan

43 MLD STP at Jajmau

RECYCLE AND REUSE OF WASTEWATER IN MADURAI

Madurai is a city in Tamil Nadu and has a population of 14.68 Lakh (as per 2011 census) residing in 147.9 Sq. km of municipal corporation area. The city generates 61.29 MLD of wastewater. Madurai City Municipal Corporation (MCMC) is responsible for providing water supply and sewerage services to the city. It has so far established 2 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 170.70 MLD. Wastewater is treated through secondary treatment process by Sequential Batch Reactor (SBR) technology. 38 MLD of treated wastewater is reused for grass farming.

Sewage Treatment Plant of 125 MLD capacity located at Avaniyapuram has been presented as successful recycle and reuse of wastewater projects in Madurai.

Name/Location of the Sewage Treatment Plant	Avaniyapuram
Capacity	125 MLD
Year of commissioning	2011
Total Capital cost	Rs. 72.60 Crore
Quantity of wastewater received & treated	20 MLD
Technology adopted	Sequential Batch Reactor (SBR)
Quantity of wastewater reused	20MLD
Agency responsible for O & M	M/s. AMR Engineering And Construction Technology
Operation and Maintenance cost	Rs. 80.7 Lakh per year
Energy cost	Rs. 1.64 Crore per year
Consumables and repairs	Rs. 16.7 Lakh per year
Cost of manpower (Skilled and Unskilled)	Rs. 71.46 Lakh per year
O&M cost/KL (treated wastewater) Secondary treatment-	Rs. 3.50/KL
Sludge generation	1.5 MT/day
Mode of treatment & disposal of sludge	Sludge is dried in drying bed and is given to farmers for using as fertiliser. It is also used in the nursery in the STP premises.

Treated wastewater to the tune of 20 MLD is reused from for the purpose of grass farming. Currently, no revenue is generated from the reuse of wastewater, however, the reuse of treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	270	200-300	13
2	Chemical Oxygen Demand (mg/l)	472	400-500	64
3	Total Suspended Solids (mg/l)	383	200-400	12
4	Total Nitrogen (mg/l)	25	25-30	6.72
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	60	100/100ml	10

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photo of STP

125 MLD plant at Avaniyapuram

RECYCLE AND REUSE OF WASTEWATER IN NAGPUR

Nagpur is one of the major cities of Maharashtra and has a population of 24.05 Lakhs (as per 2011 census) living in 227 Sq. km of municipal corporation area. The city generates 520 MLD of wastewater. Nagpur Municipal Corporation (NMC) is responsible to provide water supply and sewerage services to the city. NMC has so far established 4 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 340 MLD out of which 313.5 MLD is reused in thermal power plant in the city.

NMC has two major centralized STPs of 200 MLD & 130 MLD at Bhandewadi. Small Decentralised STPs are constructed by NMC at Mokshadham, Ghat Road with capacity of 5 MLD and Mankapur Square with capacity of 5 MLD. Treated wastewater from two centralized STPs of 200 MLD & 130 MLD at Bhandewadi have been presented as successful recycle and reuse of wastewater projects in Nagpur.

Name/ Location of the Sewage Treatment Plant	Bhandewadi STP	Bhandewadi STP
Capacity	130 MLD	Upgraded to 200 MLD from 100 MLD
Year of commissioning	July 2016	July 2018
Implemented by	Nagpur Municipal Corporation	Nagpur Municipal Corporation
Total Capital cost	Rs. 195 Cr	Rs. 261.72 Cr
Contribution by ULB and Private Agency	ULB share borne by MAHAGENCO	Complete funding by VEL (Vishwaraj Environment Pvt. Ltd.) NMC – To provide land and sewage
Technology adopted	Secondary treatment by sequential batch reactor Tertiary treatment by Sand bed filter	Secondary treatment by sequential batch reactor Tertiary treatment by fiber Disc Filter
Quantity of wastewater reused	123.5 MLD	190 MLD
Area of reuse	123.5 MLD reused in thermal power station	190 MLD reused in thermal power station
Agency responsible for O & M	M/s SMS envocare	Vishwaraj Environment Pvt. Ltd.
Operation and Maintenance cost	Rs. 24 lakh per annum	Rs. 60 Cr for 30 years
Energy cost	Rs. 12 Cr per annum	
Cost of Manpower (Skilled and Unskilled)	Rs. 91.2 lakh per annum	

Consumables/Repairs	Rs. 99 lakh per annum	
Cost of production of Per KLD	Rs. 11	Rs. 2.03
Revenue generated from reuse of wastewater	Rs. 15 Cr. per annum	Rs. 40 Cr. per annum
Sludge generation	10 m^3/day	5 MT – Total quantity accumulated till March 2021
Mode of treatment & disposal of sludge	Sludge is treated by centrifuge and disposed in landfill sites	

Treated wastewater to the tune of 123.5 MLD is successfully reused from Bhandewadi 130 MLD STP which is supplied to thermal power plant. The sale of this treated wastewater generates income of Rs. 15 Cr per annum.

Public-Private Partnership (PPP) Model for 200 MLD STP

NMC has augmented their existing 100 MLD STP at Bhandewadi to 200 MLD to treat the raw sewage flowing in the Pioli river (75 MLD), Pohra River (75 MLD) and Hiwari Nagar old pumping station on trunk main (50 MLD). For this, a concession agreement was signed between NMC and NWWMPL. Nagpur Waste Water Management Private Limited (NWWMPL) was formed by Vishwaraj Environment Pvt. Ltd. as a special purpose vehicle and is responsible for Capital Investment, Construction and O&M of entire scheme for said period with committed quantity & quality. As per the concession agreement, the concessioning authority (NMC) shall be providing land and sewage and concessionaire (NWWMPL) has right to sell the treated effluent. As a part of Agreement, NMC has given rights over treated sewage to the Concessionaire to encourage the reuse of treated sewage and a part of the revenue is shared with NMC as a part of royalty.

The 200 MLD Sewage Treatment Plant was commissioned in July 2018 and is under operation in full capacity from date of commissioning. Further, a Tripartite Agreement has been signed between NMC – MAHAGENCO-NWWMPL for the use of 190 MLD treated wastewater by Mahagenco in their Koradi and Khaperkheda Thermal Power Plant for cooling purpose.

According to Terms of Agreement, following are the major responsibilities of each parties.

1. Nagpur Municipal Corporation (NMC) - Shall be responsible for supply of raw sewage
2. Nagpur Waste Water Management Private Limited (NWWMPL) – Shall be responsible for Capital Investment, Construction and O&M of entire scheme for said period with committed quantity & quality.
3. MAHAGENCO – Shall be responsible for payments during agreement period as per contract terms.

It is a successful PPP model in which all the stakeholders are benefitted. The sale of treated wastewater from 200 MLD plant is generating income of Rs. 40 Cr per annum.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	250 mg/l	<5 mg/l	3.5mg/l
2	Chemical Oxygen Demand (mg/l)	500 mg/l	<30 mg/l	12 mg/l
3	Total Suspended Solids (mg/l)	300 mg/l	<5 mg/l	3 mg/l
4	Total Nitrogen (mg/l)	45 mg/l	<10 mg/l	2.8 mg/l
5	Total Phosphorous (mg/l)	8 mg/l	<0.5 mg/l	0.35mg/l
6	Faecal Coliform (MPN/100ml)	1600000	<2	<1

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STPs

Bhandewadi 130 MLD STP


Bhandewadi 200 MLD STP

RECYCLE AND REUSE OF WASTEWATER IN NASHIK

Nashik is one of the major cities of Maharashtra and has population of 20 Lakhs (as per census 2011) living in 267.48 Sq. km of municipal corporation area. The city generates 320 MLD of wastewater. Nasik Municipal Corporation (NMC) provides water supply and sewerage services to the city. NMC has so far established 10 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 360.50 MLD and a new one of 32 MLD capacity is under construction. All the treated wastewater is reused in the city for agricultural purposes and other reuse for downstream area as deemed fit. The wastewater is treated by various secondary treatment technologies like Activated sludge process, Sequential Batch Reactor etc. As per Sanctioned Letter No. 2959/2009 dtd. 24/07/2009 for Water Reservation to NMC, from Water Resource Department, Govt. of Maharashtra, the treated sewage water is being released in the river for Agriculture and other reuse for downstream area as deemed fit.

Treated wastewater from 3 STPs (Topovan II, Panchak III, Gangapur Goan) has been presented as successful recycle and reuse of wastewater projects in Nashik city.

Name/Location of the Sewage Treatment Plant	Topovan II	Panchak III	Gangapur Goan
Capacity	52 MLD	32 MLD	18 MLD
Year of commissioning	2010	2016	2019
Total Capital cost	Rs. 14.41 Cr	Rs. 22 Cr	Rs. 31 Cr
Technology adopted	Unaerobic Sludge Blanket Reactor	Unaerobic Sludge Blanket Reactor + Moving Bed Biofilm Reactor	Sequential Batch Reactor
Quantity of wastewater received & treated	1593 ML per month (53 MLD)	646 ML per month (21.53MLD)	547 ML per month (18 MLD)
Quantity of recycle and Reuse	1593 ML per month	646 ML per month	547 ML per month
Area/ Purpose of reuse	As per Agreement with Water Resource Department, Govt. of Maharashtra, treated wastewater is required to be released in the river for agriculture and further reuse.		
Agency responsible for O & M	M/s Mahajan Brothers, Nashik	M/s Badgujar and Company, Nashik	M/s Gondwana Engineers Ltd., Nagpur
Operation and Maintenance cost including Cost of Manpower	Rs. 4.58 Lakh per month	Rs. 5.11 Lakh per month	Rs. 3 Lakh per month
Energy cost (as per March 2021 bill)	Rs. 3.09 Lakh per month	Rs. 1.82 Lakh per month	Rs. 5.95 Lakh per month

Consumables/Repairs	Rs. 0.81 Lakh per month	Rs. 1.34 Lakh per month	Rs. 2.65 Lakh per month
Cost of production of Per KLD (Secondary Treatment)	Rs. 0.53 per KLD	Rs. 1.28 per KLD	Rs. 2.12 per KLD
Sludge generation	236 m^3 per month	95 m^3 per month	83 m^3 per month
Mode of treatment & disposal of sludge	Sludge Drying bed	Centrifuge	Centrifuge
	Dry sludge is used as manure for Agriculture purpose		

Performance of Treatment Plant

1. Topovan II

Sl.No.	**Parameters**	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
1	Biological Oxygen Demand (mg/l)	94	20	15
2	Chemical Oxygen Demand (mg/l)	286	-	49
3	Total Suspended Solids (mg/l)	165	30	21
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml) # Common Outlet of Tapovan 52+78 MLD	$18X10^5$	-	36

2. Panchak III

Sl.No.	**Parameters**	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
1	Biological Oxygen Demand (mg/l)	88	20	15
2	Chemical Oxygen Demand (mg/l)	266	-	47
3	Total Suspended Solids (mg/l)	141	30	22
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	$60X10^4$	-	12

3. Gangapur Goan

Sl.No.	**Parameters**	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
1	Biological Oxygen Demand (mg/l)	86	5	5
2	Chemical Oxygen Demand (mg/l)	349	50	38
3	Total Suspended Solids (mg/l)	152	10	9
4	Total Nitrogen (mg/l)	29	$\leq$ 10	8
5	Total Phosphorous (mg/l)	3.25	$\leq$ 2	1.25
6	Faecal Coliform (MPN/100ml)	725	$\leq$ 230	145

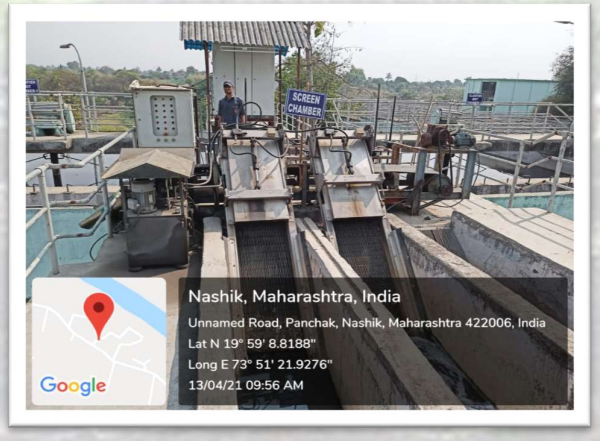
[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STPs

52 MLD Topovan II STP



32 MLD Panchak III STP

18 MLD Gangapur Gaon STP

RECYCLE AND REUSE OF WASTEWATER IN NAVI MUMBAI

Navi Mumbai is one of the major cities in Maharashtra and has urban population of about 11.2 Lakhs (as per census 2011) living in 109.59 Sq.km of municipal area. The city generates 215 MLD of wastewater. Navi Mumbai Municipal Corporation (NMMC) is responsible for providing water supply and sewerage services to the city. NMMC has so far established 7 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 454 MLD. Wastewater received is treated through secondary treatment process by adopting Sequential Batch Reactor(SBR) technology. Out of treated 215MLD, 65 MLD is reused in the city for different purposes like horticulture, construction and washing of MSW Machines and vehicles.

The 87.5 MLD STP located at Koparkhairane has been presented as recycle and reuse of wastewater project in Navi Mumbai.

Name/Location of the Sewage Treatment Plant	Koparkhairane
Capacity	87.50 MLD
Year of commissioning	2012
Total Capital cost	Rs. 92.79 Cr.
Quantity of wastewater received & treated	48 MLD
Quantity of wastewater reused	14.5 MLD
Technology adopted	Secondary Treatment - Sequential Batch Reactor (SBR) Tertiary Treatment - Ultra Filtration Membrane & Ultra violet Technology (UF + UV) (ongoing work under AMRUT Scheme)
Quantity of wastewater reused	14.5 MLD
Agency responsible for O & M	Eagle Infra Private limited
Operation and Maintenance cost	Rs. 2.15. Cr. per annum (inclusive of manpower and Consumables)
Energy cost	Rs. 3.66 Cr per annum
Sludge generation	2.75 m^3/day
Mode of treatment & disposal of sludge	Centrifugation method is used. Digested sludge sent to landfill
Cost of production of Per KLD treated wastewater (Rs)	Secondary treatment – Rs.2.74 Tertiary treatment – Rs.6.42

Out of 14.5MLD wastewater reused, 11.38 MLD is used for Horticulture, 0.48 MLD is used for Construction and 2.67 MLD is used for other purposes like washing of Municipal Solid Waste (MSW) collection and transportation vehicles and machineries at the MSW management site. The reuse of

treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill. It also has potential to generate income for the ULB by sale of treated wastewater to various industries. There are 6 STPs in the city where recycle and reuse of treated wastewater is being implemented which saves huge quantity of fresh water to the tune of 65 MLD.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	140	<5	4
2	Chemical Oxygen Demand (mg/l)	272	<100	29
3	Total Suspended Solids (mg/l)	162	<10	9
4	Total Nitrogen (mg/l)	-	<10	-
5	Total Phosphorous (mg/l)	-	<2	-
6	Faecal Coliform (MPN/100ml)	<100	<100	<100

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photo of STP

87.5 MLD Koparkhairane STP

RECYCLE AND REUSE OF WASTEWATER IN PRAYAGRAJ

Prayagraj is one of the oldest and major cities in Uttar Pradesh and has a population of 15.36 Lakh (as per 2011 census) residing in 365.70 Sq. km of municipal corporation area. The city generates 365.51 MLD of wastewater. Prayagraj Municipal Corporation is responsible for providing water supply and sewerage services to the city. They have so far established 7 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 268 MLD. It is treated through secondary treatment process by adopting technologies like Sequential Batch Reactor (SBR), Activated Sludge Process (ASP), Bio Tower (Modified Trickling Filter) etc. Out of this, 14 MLD is treated by Sequential Batch Reactor(SBR) and effluent parameters comply the latest NGT guidelines for tertiary treated wastewater. Out of the treated 268 MLD, approximately 40 MLD of treated wastewater is reused for agricultural purposes in the city.

Sewage Treatment Plant of 80 MLD capacity located at Naini has been presented as successful reuse of wastewater project in Prayagraj.

Name/Location of the Sewage Treatment Plant	Naini
Capacity	80 MLD
Year of commissioning	1999
Implemented by	Ganga Pollution Control Unit, UPJN, Prayagraj
Total Capital cost	Rs. 62 Cr
Quantity of wastewater received and treated	75 MLD (Average)
Technology adopted	Secondary Treatment – Activated Sludge Process (ASP)
Quantity of wastewater reused	Approximately 40 MLD used for agricultural
Agency responsible for O & M	M/s Prayagraj Water Private Limited (Concessionaire)
Operation and Maintenance cost	Rs. 102.38 Cr for 15 years
Energy cost	Rs. 66.34 Cr for 15 years
Consumables and repairs	Rs. 14.76 Cr for 15 years
Cost of manpower (Skilled and Unskilled)	Rs. 21.28 Cr for 15 years
Sludge generation	30 m^3/day
Mode of treatment & disposal of sludge	Sludge is dried in drying bed and disposed to landfill.

At present approximately 40 MLD of treated wastewater from Naini STP is reused for agricultural purposes. The reuse of treated wastewater has dual benefit of saving the fresh water consumption

and also the cost incurred on the water bill. It has a potential to generate income for the ULB by sale of treated wastewater. An additional 42 MLD STP is under construction at Naini and there is a proposal under preparation for the reuse of treated wastewater to the tune of 80 MLD which will be supplied to NTPC Meja Thermal Power Station.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	137 mg/l	30 mg/l	26 mg/l
2	Chemical Oxygen Demand (mg/l)	343 mg/l	50 mg/l	43 mg/l
3	Total Suspended Solids (mg/l)	305 mg/l	50mg/l	46 mg/l
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	1000 MPN	500

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photos of STP

80 MLD STP in Naini

Channel used for agricultural purpose

RECYCLE AND REUSE OF WASTEWATER IN PUNE

Pune is one of the major cities of Maharashtra with urban population of 31 Lakhs (as per 2011 census) living in 243.96 Sq. km of municipal corporation area. The city generates 750 MLD of wastewater. Pune Municipal Corporation (PMC) is responsible to provide water supply and sewerage services to the city. PMC has so far established 10 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 567 MLD. However, 535 MLD of wastewater is actually being treated through secondary treatment technologies like Activated sludge process, modified activated sludge process, sequential batch reactor etc. Out of 535 MLD of the total treated wastewater, around 400 MLD is reused for irrigation purposes as per requirement from irrigation department. Wastewater is also reused for various other purposes like construction, road cleaning etc. wherein tankers are sent to different STPs in the city to facilitate the water requirements.

New Naidu STP, Bopodi STP and Erandawane STP have been presented as successful recycle and reuse of wastewater projects in Pune.

Name/Location of the Sewage Treatment Plant	**Bopodi STP**	**Erandawane STP**	**New Naidu STP**
Capacity	18 MLD	50 MLD	115 MLD
Year of commissioning	2003	2004	2010
Total Capital cost	Rs. 5.36 Cr	Rs. 11.61 Cr	Rs. 40.15 Cr
Technology adopted	Modified Activated Sludge Process	Extended Activated Sludge Process	Activated Sludge Process
Quantity of wastewater treated (2019 – 2020)	16.48 MLD	48.3 MLD	101 MLD
Total treated sludge generated	3 Ton/day	6 Ton/day	10 Ton/day
Agency responsible for O & M	M/s J.D Khandeshi	M/s Toshiba Water Solution Pvt. Ltd.	M/s Vishvaraj Environment Pvt. Ltd.
Operation and Maintenance cost (Including consumables+ cost of manpower ClO_2+Lab testing)	Rs. 4.06 crore for 5 years	Rs. 6.87 crore for 5 years	Rs. 7.71 crore for 5 years
Energy cost	Rs. 64 Lakh per annum	Rs. 178 Lakh per annum (including energy cost of pumping station)	Rs. 163 lakh per annum

Treated wastewater from all the 10 STPs in the city are released to Mula and Mutha river which confluence to form Mula-mutha river. Pumping stations are constructed at the downstream to pump the water into irrigation canals. This was done in 2015 to meet the water demand for irrigation. As per requirement from Irrigation Department, around 400 MLD of treated wastewater is supplied for agricultural purposes thereby saving the fresh water. The generated sludge is used as fertiliser in Agriculture/horticulture department.

Huge quantity of garbage material from drains disturb the screening process, which is often the main challenge in operation and maintenance of STP. The life of present STPs in the city have exceeded 15 years therefore, by installing new types of screens, grit removal arrangement, blowers, centrifuge etc. treatment can be further improved in these STPs.

Performance of Treatment Plant

1. Bopodi STP

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	150-180	250	8-10
2	Chemical Oxygen Demand (mg/l)	200-300	350	15-25
3	Total Suspended Solids (mg/l)	160-200	300	10-15
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	<100

2. Erandawane STP

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	140-160	250	7-10
2	Chemical Oxygen Demand (mg/l)	250-300	350	20-30
3	Total Suspended Solids (mg/l)	180-210	300	10-15
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	<100

3. New Naidu STP

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	170-180	250	8-10
2	Chemical Oxygen Demand (mg/l)	300-330	350	20-30
3	Total Suspended Solids (mg/l)	160-180	300	5-15
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	<100

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STPs

18 MLD Bopodi STP

50 MLD Erandawane STP

115 MLD New Naidu STP

RECYCLE AND REUSE OF WASTEWATER IN RANCHI

Ranchi is the capital city of Jharkhand State and has a population of 10.7 Lakh (as per 2011 census) residing in 175.12 Sq. km of municipal corporation area. The city generates 94 MLD of wastewater. Ranchi Municipal corporation is responsible for providing water supply and sewerage services in the city. There are 7 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 10.5 MLD. All the wastewater is treated by Phytorid Bed Technology. Approximately 7.2 MLD of treated wastewater is reused for agriculture, horticulture, landscaping and washing of vehicles.

Sewage Treatment Plant of 2 MLD capacity located at Kadru has been presented for successful recycle and reuse of wastewater Ranchi.

Name/Location of the Sewage Treatment Plant	Near baddisson blue, Kadru
Capacity	2 MLD
Year of commissioning	2018
Total Capital cost	Rs.2.83 Cr
Quantity of wastewater received and treated	2 MLD
Technology adopted	Phytorid Bed Technology
Quantity of wastewater reused	1.6 MLD
Agency responsible for O & M	Eagle Infra India Ltd.
Operation and Maintenance cost	Approx. Rs.1 lakh per month (all inclusive)
Sludge generation	$3m^3$/month
Mode of treatment & disposal of sludge	Sludge is dumped in dumping yard.

Treated wastewater to the tune of 1.6 MLD is reused for agriculture, horticulture, landscaping and washing of vehicles from Kadru 2 MLD STP in Kadru. Currently, no revenue is generated from the reuse of wastewater, however, the reuse of treated wastewater has dual benefit of saving the fresh water consumption and the cost incurred on the water bill. It also has potential to generate income for the ULB by sale of treated wastewater.

Performance of Treatment Plant

Sl.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	322	-	29.4
2	Chemical Oxygen Demand (mg/l)	603	-	244
3	Total Suspended Solids (mg/l)	82	-	64
4	Total Nitrogen (mg/l)	-	-	-
5	Total Phosphorous (mg/l)	-	-	-
6	Faecal Coliform (MPN/100ml)	-	-	-

[1] Influent refers to inflow of sewage

[2] Design value refers to system handling capacity

[3] Effluent refers to treated wastewater

Photo of STP

2 MLD Plant in Kadru

RECYCLE AND REUSE OF WASTEWATER IN SURAT

Surat is one of the major cities in Gujarat and has a population of 65 Lakhs residing in 462.15 Sq. km of municipal area. At present, the city generates about 956 MLD of wastewater. Surat Municipal Corporation (SMC) provides water supply and sewerage services to the city. SMC has so far established 11 Sewage Treatment Plants (STPs) in the city having a total treatment capacity of 1373 MLD and wastewater is treated through secondary treatment process. Out of 956 MLD, 115 MLD is treated up to tertiary level treatment. Out of the total treated wastewater about 319 MLD is being reused for different purposes in the city. Treated water is being reused for various industrial and horticultural purposes.

STP of 100 MLD capacity located in Bamroli has been presented as successful recycle and reuse of wastewater project which was established in the year 2014. It has UASB + Extended Aeration technology followed by sand filtration, activated carbon filtration, reverse osmosis and ultra- filtration. Out of 99 MLD wastewater received & treated, 57MLD tertiary treated wastewater is reused for various non-potable uses. The details of Bamroli STP are as follows.

Name / Location of the Sewage Treatment Plant	Bamroli
Capacity	100 MLD
Year of commissioning	2014
Implemented by	Surat Municipal Corporation Contractor : Enviro Control Associates (I) Pvt. Ltd.
Total Capital cost	Rs. 112.16 Cr (Sewage Treatment Plant) Rs. 85.10 Cr (Tertiary Treatment plant)
Contribution by ULB and Private Agency	100 % (Grant from State Government)
Technology adopted	Secondary treatment - Up-flow Anaerobic Sludge Blanket Process + Integrated Fixed Film Activated Sludge process + Extended Aeration. Tertiary treatment - Sand Filtration / Disc Filtration + Ultra Filtration (UF) +Reverse Osmosis (RO) + Activated Carbon Filtration (ACF)
Quantity of wastewater received & treated	99 MLD
Quantity of wastewater treated by tertiary treatment	57 MLD
Quantity of wastewater reused	40 MLD net output

Area of reuse	Non potable water in various industrial clusters, gardening purposes at STPs & Road Dividers, sprinkling at MSW disposal site, Sewer Jetting Machines in Surat.
Agency responsible for O & M	SSG Infratech Pvt. Ltd., Surat
Operation and Maintenance cost (including consumables and repairs and cost of Manpower)	Rs. 123.76 Lakhs per month (July 2021) - TTP Rs. 30.28 Lakhs per month (July 2021) - STP
Energy cost	Rs. 37.74 Lakhs per month (July 2021) - TTP Rs. 44.18 Lakhs per month(July 2021) - STP
O & M cost /KL (treated wastewater	Rs. 2.66 per KL (Secondary Treatment) Rs. 23.10 per KL (Tertiary Treatment)
Cost of production of Per KLD	Rs. 25.76 per KL
Revenue generated from reuse of wastewater	About Rs. 233 Cr till July 2021
Sludge generation	15 - 18 Tonne/Day
Mode of treatment & disposal of sludge	Mechanical filter press. Sold as manure & remaining disposed in landfill sites.

Treated water is reused for various non-potable uses in various industrial clusters, for gardening purposes at STPs & road dividers, for sprinkling at MSW disposal site and in sewer jetting machines.

In 2014, the city of Surat began supplying treated wastewater to industries in the Pandesara cluster at a price of Rs 18.20 per KL. This has gradually gone up to Rs 28.58 per KL till present (July 2021). At present, 57 MLD secondary treated wastewater (40 MLD net output - tertiary treated wastewater) is used for various industrial purposes (dyeing and printing) at Pandesara GIDC Area, 2 MLD is used for landscaping and 1 MLD is used internally in STP for chlorination system, sludge dewatering system etc.

After this success and due to additional demand from Pandesara Industries, an additional 40 MLD TTP has been set up similarly at Dindoli STP by Surat Municipal Corporation. This plant is operational & supplies 40 MLD of tertiary treated wastewater to Pandesara Industries. Therefore, the current non potable water demand of 80 MLD at Pandesara Industrial area is being sufficed through SMC's 40 MLD Tertiary Treatment Plant at Bamroli and 40 MLD Tertiary Treatment Plant at Dindoli.

Further, Sachin GIDC Industrial setup, adjacent to the city has come forward to buy 35 MLD treated wastewater from newly constructed 35 MLD capacity Tertiary Treatment Plant at Bamroli STP since November 2020. Till July 2021, Rs. 233 Cr has been generated from the sale of treated wastewater.

Some of the challenges faced by Surat Municipal Corporation with respect to sewage inflow, O & M etc. are listed below,

- Variation / fluctuation in quality and quantity of sewage, particularly in ensuring that there are no industrial waste mixed into the sewage has been a huge challenge for SMC.
- Buffer tank which is required to ensure consistent supply to the tertiary treatment plant.
- Uninterruptible power supply for continuous functioning of the plant.
- Proper treatment of reject water after Tertiary Treatment shall be planned.
- The secondary sewage treatment plant should be so operated that the outlet parameters of secondary treated water match with the acceptable inlet parameters of Tertiary Treatment Plant and for that comprehensive Operation & Maintenance upto Tertiary Treatment Plant should be given to single agency.
- Staff training is must as on site components like UF/RO are imported from other countries. So as to avoid dependency and in-house capacity building should be undertaken.

Performance of Treatment Plant

S.No.	Parameters	Sewage inflow[1]	Design value[2]	After treatment[3]
1	Biological Oxygen Demand (mg/l)	370 mg/l	<10 mg/l	<8 mg/l
2	Chemical Oxygen Demand (mg/l)	700 mg/l	<50 mg/l	<40 mg/l
3	Total Suspended Solids (mg/l)	350 mg/l	<20 mg/l	<15.8 mg/l
4	Total Nitrogen (mg/l)	32 mg/l	<10 mg/l	<10 mg/l
5	Total Phosphorous (mg/l)	7 mg/l	≤2 (as dissolved phosphorous)	≤2 (as dissolved phosphorous)
6	Faecal Coliform (MPN/100ml)	1×10^5 MPN/100 ml	<100 MPN/100 ml	<100 MPN/100 ml

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photos of STP

Bamroli STP – Secondary Treatment Plant

Bamroli STP – Tertiary Treatment Plant

Aerial view of 100 MLD STP at Bamroli

RECYCLE AND REUSE OF WASTEWATER IN VADODARA

Vadodara is one of the major cities of Gujarat and has population of 17.4 Lakhs (as per 2011 census) living in 220.33 Sq.km of Vadodara municipal corporation area. The city generates 409 MLD of wastewater. Vadodara Municipal Corporation (VMC) is responsible to provide water supply and sewerage services to the city. VMC has so far established 7 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 276.5 MLD. However, 273 MLD of wastewater is being treated through secondary treatment process out of which 32 MLD is treated through tertiary treatment process (UV and media filtration). Out of 273 MLD treated, 3.2 MLD is reused in the city.

VMC has provided 78 MLD STP at Rajivnagar as successful recycle and reuse of wastewater project in Vadodara. The wastewater is treated by SBR technology followed by media filtration and UV. Of the 2MLD which is reused, 1.5 MLD is used for horticultural purposes and 0.5 MLD is reused in the sewer cleaning machine in the city, thereby saving fresh water of 2 MLD. Sale of treated water has the potential to generate an income for the ULBs. VMC have MoU with Ceres Biotech Pvt. Ltd. for collecting sludge from STP and they use it to make Fertilizer.

Name/Location of the Sewage Treatment Plant	Rajivnagar
Capacity	78 MLD
Year of commissioning	2018
Implemented by	Vadodara Municipal Corporation
Total Capital cost	Rs. 88.50 Crore
Technology adopted	Secondary treatment - Sequential Batch Reactor (SBR)
Quantity of wastewater reused	2 MLD
Area of reuse	1.5 MLD for horticulture and 0.5 MLD in sewer cleaning machine
Agency responsible for O & M	Rajkamal Builders Infrastructure Pvt. Ltd.
Operation and Maintenance cost	Rs. 30.91 Lakh per month (All inclusive)
Energy cost	Rs. 18 Lakhs per month
Consumables/Repairs	Rs. 8 Lakhs per month
Cost of manpower (Skilled & Unskilled personnel)	Rs. 4.83 lakhs per month
O & M cost /KL (treated wastewater for tertiary treatment	Rs. 2.58/kL
Sludge generation	576000 kg per annum
Mode of treatment & disposal of sludge	Ceres Biotech Pvt. Ltd. collects Sludge in dry back form and use it as fertilizer.

Performance of Treatment Plant

Parameters	Sewage Inflow[1]	Design value[2]	After Treatment[3]
Biological Oxygen Demand (mg/l)	218	<5	<5
Chemical Oxygen Demand (mg/l)	480	<50	<50
Total Suspended Solids (mg/l)	280	<5	<5
Total Nitrogen (mg/l)	40	<10	<10
Total Phosphorous (mg/l)	8	≤1	≤1
Fecal Coliform (MPN/100mL)	$2X10^7$	≤100	≤100

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

New STP of 60 MLD is under progress which is planned to be commissioned by 2023, out of which 35 MLD is proposed to be sold to M/S RIL and M/S IOCL for reuse purposes. Revenue will be generated after this plant is commissioned.

Photo of STP

78 MLD Rajivnagar STP

RECYCLE AND REUSE OF WASTEWATER IN VARANASI

Varanasi is one of the major cities of Uttar Pradesh and has population of 12 Lakhs (as per 2011 census) living in 82 Sq.km of Varanasi Municipal Corporation area. The city generates 302 MLD of wastewater. Varanasi Municipal Corporation is responsible for providing water supply and sewerage services to the city. It has so far established 5 Sewage Treatment Plants (STPs) in the city with a total treatment capacity of 411.8 MLD. Around 265 MLD of wastewater is being treated through secondary treatment process by adopting technologies like Activated Sludge Process (ASP), Sequential Batch Reactor (SBR) etc., and by tertiary treatment technologies like Chlorination and UV technology. Approximately 50 MLD of treated wastewater is being reused for irrigation, landscaping and horticultural purposes in the city.

Sewage treatment plant of 140 MLD capacity located at Dinapur, Varanasi has been presented as successful recycle and reuse of wastewater project in Varanasi.

Name/Location of the Sewage Treatment Plant	Dinapur, Varanasi
Capacity	140 MLD
Year of commissioning	2018
Total Capital cost	Rs. 170 Crore
Technology adopted	Activated Sludge Process with chlorine disinfection
Quantity of wastewater received and treated	90 MLD
Agency responsible for O & M	Va Tech Wabag Ltd.
Operation and Maintenance cost	Rs. 3.48 Cr for 1 year (excluding power charges)
Energy cost	Rs. 40 Lakhs per month, Out of which around Rs. 25 Lakhs worth power is being generated form Biogas produced in the STP.
Consumables/Repairs	Rs. 20 Lakhs per month
Cost of manpower (Skilled & Unskilled personnel)	Rs. 9 Lakhs per month
O & M cost /KL for secondary treated wastewater	Rs. 70/KL
Cost of production per KLD of secondary treated wastewater	Rs. 70/KL
Sludge generation	960 m^3/month

Mode of treatment & disposal of sludge	Sludge Drying Bed and sold to farmers as bio fertiliser

Out of total 50 MLD reused wastewater, around 40 MLD is being discharged in the irrigation canal (Sharada Sahayak Canal) from 120 MLD STP at Goithaha. Around 6.0 MLD treated wastewater is being utilized for irrigation, landscaping and horticultural purposes from Bhagwanpur 9.8 MLD STP, Dinapur 80 MLD STP & 140 MLD STP. Around 4.0 MLD treated wastewater is used for internal horticulture, golf course etc. in Banaras Locomotive Work (BLW). Recently, Municipal Corporation, Varanasi has started use of treated wastewater from Goithaha STP for sprinkling on road for dust control. Feasibility of usage of treated wastewater for cleaning of Rail Coaches/ Wagons are also being explored.

Performance of Treatment Plant

Parameters	**Sewage Inflow[1]**	**Design value[2]**	**After Treatment[3]**
Biological Oxygen Demand (mg/l)	116	20	14
Chemical Oxygen Demand (mg/l)	225	36	21
Total Suspended Solids (mg/l)	230	30	26
Total Nitrogen (mg/l)	-	-	-
Total Phosphorous (mg/l)	-	-	-
Fecal Coliform (MPN/100mL)	-	-	-

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photo of STP

140 MLD STP in Dinapur Varanasi

RECYCLE AD REUSE OF WASTEWATER IN VISAKHAPATNAM

Visakhapatnam is one of the major cities of Andhra Pradesh and has population of about 18.9 Lakhs (as per 2011 census) living in 682 Sq. km of municipal corporation area. The city generates 289.80 MLD of wastewater. Greater Visakhapatnam Municipal Corporation (GVMC) is responsible to provide water supply and sewerage services to the city. GVMC has so far established 5 Sewage Treatment Plants (STPs) and 11 Mini STPs in the city with a total treatment capacity of 165.50 MLD. At present 102.05MLD is being collected and treated by secondary treatment process. Of this, 12MLD is reused for commercial and industrial uses by Visakhapatnam Port Trust (VPT), ESSAR Industry and Vizag Golf Course.

GVMC has provided 54MLD STP at Narava which is getting upgraded to 108MLD as a successful recycle and reuse of wastewater project in Visakhapatnam. This STP was funded under JnNURM and started operating from 2016. At present, 20MLD wastewater is received at the plant and treated by Activated Sludge Process with diffused aeration system technology.

Name/Location of the Sewage Treatment Plant	Narava
Capacity	54 MLD upgrading to 108MLD (Upgrading work is in progress)
Year of commissioning	2016
Implemented by	GVMC
Total capital cost upto Secondary Treatment only.	Rs. 48.6 Crores under Jawaharlal Nehru National Urban Renewal Mission (JnNURM)
Contribution by ULB and Private Agency	30% by ULB
Technology adopted	Secondary treatment –Activated Sludge Process with diffused aeration system Proposed tertiary treatment – Ultra filtration (UV) and Reverse Osmosis (RO)
Quantity of wastewater received and treated by secondary treatment at present	20 MLD
Agency responsible for O & M	Tata Projects Limited
Operation and Maintenance cost	Rs. 32.51 Crores Per annum (after upgradation to 108 MLD)
Energy cost	Rs. 21.15 Crores Per annum
Consumables/Repairs	Rs. 11.36 Crores Per annum
O & M cost /KL (treated wastewater	Rs. 11.28 Per KL including Energy Charges

Secondary treatment **Tertiary treatment**	Rs.3.34 Per KL (present) Rs.7.94Per KL (proposed)
Cost of production of Per KLD	Rs. 3.34 per KL for secondary treatment process Rs. 7.94 per KL for tertiary treatment process (proposed)
Sludge generation	At present generation is 2 tons (one truck)/day for 20MLD sewage.
Mode of treatment & disposal of sludge	Converting into sludge cakes by centrifuge and is used for horticulture purposes

GVMC has taken up Recycle and Reuse Project under Smart City Project duly Augmenting the existing capacity providing necessary infrastructure and giving UGD house service connections in Pendurthi and Gajuwaka and Malkapuram areas of Visakhapatnam and upgrading the existing 54MLD STP to 108MLD, of which, a tertiary Treatment plant of 79MLD capacity with UF and RO system is planned to facilitate the supply of treated water to Industries like HPCL(Hindustan Petroleum Corporation Limited) and RINL (RashtriyaIspat Nigam Ltd.) also known as Vizag Steel. Rs.57/KL will be received from HPCL and Rs.33/KL will be received from RINL thereby generating income of Rs. 127.43 Crores per annum for GVMC**.** The above project enables GVMC to not only save fresh water but also generate income.

Performance of Treatment Plant

Sl.No.	**Parameters**	**Sewage inflow[1]**	**Design value[2]**	**After treatment[3]**
1	Biological Oxygen Demand (mg/l)	102 - 235 mg/l	20 mg/l	<2.5mg/l
2	Chemical Oxygen Demand (mg/l)	90 - 500 mg/l	250 mg/l	<10 mg/l
3	Total Suspended Solids (mg/l)	53.3 – 258 mg/l	-	<2 mg/l
4	Total Nitrogen (mg/l)	18.7-29.9 mg/l	NS	<20 mg/l
5	Total Phosphorous (mg/l)	-	-	-
6	FaecalColiform (MPN/100ml)	$24X10^3$ -$76x10^3$	-	Nil

[1] Influent refers to inflow of sewage
[2] Design value refers to system handling capacity
[3] Effluent refers to treated wastewater

Photo of STP

Narava, 108 MLD STP

PART II: CITIES NOT PRACTICING RECYCLE AND REUSE OF WASTEWATER

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Asansol
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Asansol Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	326.48
4.	Population (2011 Census)	:	1156387
5.	Projected Population		
	Present, 2020	:	1335422
	Intermediate, 2035	:	1695985
	Ultimate, 2050	:	2184429
6.	Wastewater generation (MLD)		
	Present, 2020	:	144.22 MLD
	Intermediate, 2035	:	180.31 MLD
	Ultimate, 2050	:	235.91 MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	2 (Defunct)
	Total capacity	:	NIL
	Capacity of STPs which are in operation	:	NIL
	Capacity of STPs which are not in operation	:	NIL
	Actual capacity of utilization:	:	NIL
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NIL
	Actual capacity of utilization	:	NIL
	Capacity of Proposed STP	:	110.40 MLD
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (NIL) Reused (NIL)
	Tertiary treatment	:	NIL

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Dhanbad
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Dhanbad Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	275
4.	Population (2011 Census)	:	1162470
5.	Projected Population		
	Present, 2020	:	1333720
	Intermediate, 2035	:	1667150
	Ultimate, 2050	:	2500072
6.	Wastewater generation (MLD)		
	Present, 2020	:	NA
	Intermediate, 2035	:	NA
	Ultimate, 2050	:	NA
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	1
	Total capacity	:	250 KLD
	Capacity of STPs which are in operation	:	250 KLD
	Capacity of STPs which are not in operation	:	NA
	Actual capacity of utilization:	:	250 KLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	250 KLD
	Actual capacity of utilization	:	250 KLD
	Capacity of Proposed STP	:	250 KLD
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (250 KLD) Reused (NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Jaipur
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Nagar Nigam Jaipur Greater And Heritage
3.	Area under Municipality/Corporation, Sq km	:	431
4.	Population (2011 Census)	:	30.46 lakhs
5.	Projected Population		
	Present, 2020	:	40.67 lakhs
	Intermediate, 2035	:	55.00 lakhs
	Ultimate, 2050	:	60.00 lakhs
6.	Wastewater generation (MLD)		
	Present, 2020	:	180
	Intermediate, 2035	:	250
	Ultimate, 2050	:	315
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	4
	Total capacity	:	183 MLD
	Capacity of STPs which are in operation	:	120.5 MLD
	Capacity of STPs which are not in operation	:	62.5 MLD (Unit under upgradation)
	Actual capacity of utilization:	:	66%
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	8
	Actual capacity of utilization	:	8
	Capacity of Proposed STP	:	215
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (120.5) Reused (NIL)
	Tertiary treatment	:	-

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Kannur
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Kannur Municipal corporation
3.	Area under Municipality/Corporation, Sq km	:	73 Sq. Km
4.	Population (2011 Census)	:	232634
5.	Projected Population		
	Present, 2020	:	246500
	Intermediate, 2035	:	272000
	Ultimate, 2050	:	293000
6.	Wastewater generation (MLD)		
	Present, 2020	:	31.41 MLD
	Intermediate, 2035	:	38 MLD
	Ultimate, 2050	:	45 MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	Nil
	Total capacity	:	-
	Capacity of STPs which are in operation	:	-
	Capacity of STPs which are not in operation	:	-
	Actual capacity of utilization:	:	-
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	-
	Actual capacity of utilization	:	-
	Capacity of Proposed STP	:	-
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (NIL) Reused (NIL)
	Tertiary treatment	:	-

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Kochi
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Kochi Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	98
4.	Population (2011 Census)	:	602046
5.	Projected Population		
	Present, 2020	:	656618
	Intermediate, 2035	:	709056
	Ultimate, 2050	:	761493
6.	Wastewater generation (MLD)		
	Present, 2020	:	75MLD
	Intermediate, 2035	:	86MLD
	Ultimate, 2050	:	93MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	2
	Total capacity	:	5MLD
	Capacity of STPs which are in operation	:	5MLD
	Capacity of STPs which are not in operation	:	NIL
	Actual capacity of utilization:	:	
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NIL
	Actual capacity of utilization	:	NIL
	Capacity of Proposed STP	:	41.5MLD
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (5MLD) Reused (NIL)
	Tertiary treatment	:	NIL

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Kolkata
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Kolkata Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	206.25
4.	Population (2011 Census)	:	45,80,582
5.	Projected Population		
	Present, 2020	:	Data not available
	Intermediate, 2035	:	Data not available
	Ultimate, 2050	:	Data not available
6.	Wastewater generation (MLD)		
	Present, 2020	:	1400
	Intermediate, 2035	:	Not yet assessed
	Ultimate, 2050	:	Not yet assessed
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	5
	Total capacity	:	179
	Capacity of STPs which are in operation	:	107
	Capacity of STPs which are not in operation	:	72
	Actual capacity of utilization:	:	About 80%
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	Nil
	Actual capacity of utilization	:	N/A
	Capacity of Proposed STP	:	287.06
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (107 MLD) Reused (NIL)
	Tertiary treatment	:	Nil

N.B: The majority of the sewage from the core inner city area - about 910 MLD in magnitude receives no formal treatment and is discharged via the DWF canal 36 km distant to the Kulti River. Before discharging to the Kulti River the sewage receives natural treatment as it passes through the East Kolkata Wetlands - an extensive fishery to the east of the city.

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Kollam
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Kollam Municipal Corporation
3.	Area under Municipality/Corporation,	:	73.03 Sq Km
4.	Population (2011 Census)	:	367107
5.	Projected Population		
	Present, 2020	:	392804
	Intermediate, 2035	:	420300
	Ultimate, 2050	:	475292
6.	Wastewater generation (MLD)		
	Present, 2020	:	42.422
	Intermediate, 2035	:	45.392
	Ultimate, 2050	:	51.331
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	Nil
	Total capacity	:	
	Capacity of STPs which are in operation	:	Nil
	Capacity of STPs which are not in operation	:	12 MLD (work just started)
	Actual capacity of utilization:	:	12 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	Nil
	Actual capacity of utilization	:	
	Capacity of Proposed STP	:	
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (NIL) Reused (NIL)
	Tertiary treatment	:	Nil

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Kota
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Municipal corporation Kota North
3.	Area under Municipality/Corporation, Sq km	:	258.82
4.	Population (2011 Census)	:	457540
5.	Projected Population		
	Present, 2020	:	767903
	Intermediate, 2035	:	1143462
	Ultimate, 2050	:	1673184
6.	Wastewater generation (MLD)		
	Present, 2020	:	87.08
	Intermediate, 2035	:	129.67
	Ultimate, 2050	:	189.74
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	2
	Total capacity	:	26
	Capacity of STPs which are in operation	:	20
	Capacity of STPs which are not in operation	:	6
	Actual capacity of utilization:	:	NA
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NA
	Actual capacity of utilization	:	NA
	Capacity of Proposed STP	:	NA
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated(20 MLD) Reused (NIL)
	Tertiary treatment	:	NA

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Kozhikode
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Kozhikode Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	118.59 Sq.Kms
4.	Population (2011 Census)	:	613255
5.	Projected Population		
	Present, 2020	:	613255
	Intermediate, 2035	:	690763
	Ultimate, 2050	:	791587
6.	Wastewater generation (MLD)		
	Present, 2020	:	66.23
	Intermediate, 2035	:	71.36
	Ultimate, 2050	:	85.49
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	NIL
	Total capacity	:	N.A
	Capacity of STPs which are in operation	:	N.A
	Capacity of STPs which are not in operation	:	N.A
	Actual capacity of utilization:	:	N.A
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	-
	Actual capacity of utilization	:	-
	Capacity of Proposed STP	:	-
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (NIL) Reused (NIL)
	Tertiary treatment	:	-

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Lucknow
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Lucknow Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	590.361
4.	Population (2011 Census)	:	2817205
5.	Projected Population		
	Present, 2020	:	3615612
	Intermediate, 2035	:	5598995
	Ultimate, 2050	:	7489706
6.	Wastewater generation (MLD)		
	Present, 2020	:	434
	Intermediate, 2035	:	627
	Ultimate, 2050	:	899
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	3
	Total capacity	:	401
	Capacity of STPs which are in operation	:	401
	Capacity of STPs which are not in operation	:	0
	Actual capacity of utilization:	:	401
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NA
	Actual capacity of utilization	:	NA
	Capacity of Proposed STP	:	347 (120+1+39+80+22+85)
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (401 MLD) Reused (NIL)
	Tertiary treatment	:	-

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Ludhiana
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Municipal Corporation Ludhiana
3.	Area under Municipality/Corporation, Sq km	:	
4.	Population (2011 Census)	:	16.2 Lac
5.	Projected Population		
	Present, 2020	:	19 Lac (approx.)
	Intermediate, 2035	:	23 Lac (approx.)
	Ultimate, 2050	:	28 Lac (approx.)
6.	Wastewater generation (MLD)		
	Present, 2020	:	625 MLD
	Intermediate, 2035	:	693 MLD
	Ultimate, 2050	:	750 MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	5
	Total capacity	:	466 MLD
	Capacity of STPs which are in operation	:	418 MLD
	Capacity of STPs which are not in operation	:	48 MLD
	Actual capacity of utilization:	:	418 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NA
	Actual capacity of utilization	:	NA
	Capacity of Proposed STP	:	NA
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (418 MLD) Reused (NIL)
	Tertiary treatment	:	0

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Malappuram
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Malappuram Municipality
3.	Area under Municipality/Corporation, Sq km	:	33.61 Sq.km
4.	Population (2011 Census)	:	68088
5.	Projected Population		
	Present, 2020	:	77136
	Intermediate, 2035	:	81636
	Ultimate, 2050	:	88830
6.	Wastewater generation (MLD)		
	Present, 2020	:	
	Intermediate, 2035	:	
	Ultimate, 2050	:	
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	1
	Total capacity	:	0.03 MLD
	Capacity of STPs which are in operation	:	-
	Capacity of STPs which are not in operation	:	-
	Actual capacity of utilization:	:	0.03 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	0.03 MLD
	Actual capacity of utilization	:	0.03 MLD
	Capacity of Proposed STP	:	NA
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated(0.03 MLD) Reused(NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Meerut
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Nagar Nigam Meerut
3.	Area under Municipality/Corporation, Sq km	:	450 Sq.km
4.	Population (2011 Census)	:	1305429
5.	Projected Population		
	Present, 2020	:	1913854
	Intermediate, 2035	:	3269840
	Ultimate, 2050	:	5804430
6.	Wastewater generation (MLD)		
	Present, 2020	:	
	Intermediate, 2035	:	
	Ultimate, 2050	:	
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	01
	Total capacity	:	72 MLD
	Capacity of STPs which are in operation	:	72 MLD
	Capacity of STPs which are not in operation	:	NA
	Actual capacity of utilization:	:	72 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	-
	Actual capacity of utilization	:	
	Capacity of Proposed STP	:	
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (72 MLD) Reused (NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Patna Town
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	
3.	Area under Municipality/Corporation, Sq km	:	100
4.	Population (2011 Census)	:	1683000
5.	Projected Population		
	Present, 2020	:	2181805
	Intermediate, 2035	:	2995087
	Ultimate, 2050	:	4257029
6.	Wastewater generation (MLD)		
	Present, 2020	:	257.96
	Intermediate, 2035	:	379.00
	Ultimate, 2050	:	518.01
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	3 commissioned(140 MLD), 3 under construction (210 MLD)
	Total capacity	:	350 MLD
	Capacity of STPs which are in operation	:	140 MLD
	Capacity of STPs which are not in operation	:	210 MLD (Under construction)
	Actual capacity of utilization:	:	40-45 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	-
	Actual capacity of utilization	:	-
	Capacity of Proposed STP	:	-
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (40-45 MLD) Reused (NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Raipur
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Raipur Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	226 Sq Km
4.	Population (2011 Census)	:	1048120
5.	Projected Population		
	Present, 2020	:	1266644
	Intermediate, 2035	:	1915271
	Ultimate, 2050	:	2990401
6.	Wastewater generation (MLD)		
	Present, 2020	:	167.47
	Intermediate, 2035	:	313.8
	Ultimate, 2050	:	485.33
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	4 Nos (Under construction)
	Total capacity	:	206 MLD
	Capacity of STPs which are in operation	:	Nil
	Capacity of STPs which are not in operation	:	4 Nos (Under construction)
	Actual capacity of utilization:	:	Nil
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	Nil
	Actual capacity of utilization	:	Nil
	Capacity of Proposed STP	:	Nil
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (NIL) Reused (NIL)
	Tertiary treatment	:	Nil

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Rajkot
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Rajkot Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	161.86 Sq km
4.	Population (2011 Census)	:	1286678
5.	Projected Population		
	Present, 2020	:	1969000
	Intermediate, 2035	:	3303000
	Ultimate, 2050	:	4636000
6.	Wastewater generation (MLD)		
	Present, 2020	:	220 MLD
	Intermediate, 2035	:	396 MLD
	Ultimate, 2050	:	556 MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	6
	Total capacity	:	316.50
	Capacity of STPs which are in operation	:	120.00
	Capacity of STPs which are not in operation	:	196.50
	Actual capacity of utilization:	:	120.00
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	0
	Actual capacity of utilization	:	0
	Capacity of Proposed STP	:	8 MLD
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (120 MLD) Reused (NIL)
	Tertiary treatment	:	--

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Srinagar
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Urban Environmental Engineering Department (UEED)/Lakes and waterway Development Authority (LAWDA)
3.	Area under Municipality/Corporation, Sq km	:	294 sq. km
4.	Population (2011 Census)	:	12.02 lakhs
5.	Projected Population		
	Present, 2020	:	13.59 lakh
	Intermediate, 2035	:	16.22 lakh
	Ultimate, 2050	:	18.84 lakh
6.	Wastewater generation (MLD)		
	Present, 2020	:	146.77 MLD
	Intermediate, 2035	:	175.17 MLD
	Ultimate, 2050	:	203.47 MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	07
	Total capacity	:	58.80 MLD
	Capacity of STPs which are in operation	:	53.80
	Capacity of STPs which are not in operation	:	5.0 MLD (Under the Control of Badami Bagh Cantonment Board.)
	Actual capacity of utilization:	:	48.90 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NIL
	Actual capacity of utilization	:	NIL
	Capacity of Proposed STP	:	NIL
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (48.90 MLD) Reused (NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Thiruvananthapuram
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Thiruvananthapuram Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	214.86 Sq.km
4.	Population (2011 Census)	:	955494
5.	Projected Population		
	Present, 2020	:	1164000
	Intermediate, 2035	:	1338000
	Ultimate, 2050	:	1740000
6.	Wastewater generation (MLD)		
	Present, 2020	:	140 MLD
	Intermediate, 2035	:	160 MLD
	Ultimate, 2050	:	210 MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	1
	Total capacity	:	107 MLD
	Capacity of STPs which are in operation	:	107 MLD
	Capacity of STPs which are not in operation	:	NA
	Actual capacity of utilization:	:	60 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	
	Actual capacity of utilization	:	
	Capacity of Proposed STP	:	
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (60 MLD) Reused (NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Thrissur
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Thrissur Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	101.68km^2
4.	Population (2011 Census)	:	315957
5.	Projected Population		
	Present, 2020	:	317546
	Intermediate, 2035	:	355037
	Ultimate, 2050	:	381438
6.	Wastewater generation (MLD)		
	Present, 2020	:	25.40MLD
	Intermediate, 2035	:	28.40MLD
	Ultimate, 2050	:	30.52MLD
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	Nil
	Total capacity	:	
	Capacity of STPs which are in operation	:	Nil
	Capacity of STPs which are not in operation	:	Nil
	Actual capacity of utilization:	:	Nil
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	Nil
	Actual capacity of utilization	:	Nil
	Capacity of Proposed STP	:	10KLD(septage treatment plant at Mattampuram),100KLD(septage treatment plant at Ramavarmapuram),360KLD(sewage treatment plant at Govt.Dist.Hospital Thrissur),2.5MLD(sewage treatment plant at Kokkala)
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (NIL) Reused (NIL)
	Tertiary treatment	:	

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Tiruchirappalli
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Tiruchirappalli
3.	Area under Municipality/Corporation, Sq km	:	167.23
4.	Population (2011 Census)	:	915569
5.	Projected Population		
	Present, 2020	:	1045436
	Intermediate, 2035	:	1238954
	Ultimate, 2050	:	1432472
6.	Wastewater generation (MLD)		
	Present, 2020	:	114.99
	Intermediate, 2035	:	136.28
	Ultimate, 2050	:	157.57
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	1
	Total capacity	:	88 MLD
	Capacity of STPs which are in operation	:	58 MLD
	Capacity of STPs which are not in operation	:	30 MLD (Renovation under AMRUT phase ii)
	Actual capacity of utilization:	:	
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	NA
	Actual capacity of utilization	:	NA
	Capacity of Proposed STP	:	37 MLD (In construction under AMRUT phase ii)
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (58 MLD) Reused (NIL)
	Tertiary treatment	:	NIL

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Virar
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Vasai - Virar City Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	311.00 Sq.Km.
4.	Population (2011 Census)	:	12.22 lakh
5.	Projected Population		
	Present, 2020	:	Approx. 24 Lakh
	Intermediate, 2035	:	Approx. 35 Lakh
	Ultimate, 2050	:	Approx. 47 Lakh
6.	Wastewater generation (MLD)		
	Present, 2020	:	Approx. 259.20 MLD
	Intermediate, 2035	:	Approx. 367.20 MLD
	Ultimate, 2050	:	Approx. 507.60 MLD
7.	Existing capacity of STPs (Secondary level) (MLD) : 30 MLD		
	No. of STPs	:	01
	Total capacity	:	30 MLD
	Capacity of STPs which are in operation	:	30 MLD
	Capacity of STPs which are not in operation	:	Nill
	Actual capacity of utilization:	:	18 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	Nill
	Actual capacity of utilization	:	Nill
	Capacity of Proposed STP	:	Nill
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (18 MLD) Reused (NIL)
	Tertiary treatment	:	-

PROFORMA FOR COLLECTION OF DATA ON RECYCLE AND REUSE OF WASTEWATER PROJECT

I. General (City Specific)

1.	Name of the city	:	Vijayawada
2.	Name of Urban Local Body(ULB)/Water Supply and Sewerage Board/PHED etc., (As applicable)	:	Vijayawada Municipal Corporation
3.	Area under Municipality/Corporation, Sq km	:	61.88
4.	Population (2011 Census)	:	1034358
5.	Projected Population		
	Present, 2020	:	120000
	Intermediate, 2035	:	1472770 (2033)
	Ultimate, 2050	:	1838436 (2048)
6.	Wastewater generation (MLD)		
	Present, 2020	:	148.8 MLD
	Intermediate, 2035	:	191.140 (2033)
	Ultimate, 2050	:	235.590 (2048)
7.	Existing capacity of STPs (Secondary level) (MLD)		
	No. of STPs	:	7
	Total capacity	:	150 MLD
	Capacity of STPs which are in operation	:	130 MLD
	Capacity of STPs which are not in operation	:	20 MLD
	Actual capacity of utilization:	:	130 MLD
8.	Existing capacity of STPs (tertiary level/Advanced) (MLD)		
	Total capacity	:	-
	Actual capacity of utilization	:	-
	Capacity of Proposed STP	:	
9.	Total quantity of wastewater treated and reused (MLD)		
	Secondary treatment	:	Treated (130 MLD) Reused (NIL)
	Tertiary treatment	:	

PART III: OVERVIEW OF RECYCLE AND REUSE OF WASTEWATER PRACTICES IN 54 MILLION PLUS CITIES

Sl. No	Cities	Recycle and Reuse Practice	Population (As per 2011 census)	Water Demand (MLD)	Current Wastewater Generation (MLD)	Quantity of wastewater treated (MLD)	Quantity of treated wastewater reused(MLD)	Total No. of STPs	Capacity of STPs (MLD)	Treatment Technology		Revenue Details
										Secondary Treatment	Tertiary Treatment	
1	Agra	Present	1844000	248.94	285.39	165.00	100.00	9	220.75	UASB, WSP,Extended Aeration	-	No revenue generated
2	Ahmedabad	Present	7100000	958.50	1080.00	878.00	512.00	12	990.00	ASP	-	Revenue generated
3	Amritsar	Present	1321000	178.34	210.00	190.00	3.00	3	217.50	ASP,SBR	-	No revenue generated
4	Asansol	Absent	1156387	156.11	144.22	0.00	0.00	2 (Defunct)	0.00	NA	-	NA
5	Aurangabad	Present	1175116	158.64	84.50	126.60	75.00	4	211.00	SBR,ASP	-	No revenue generated
6	Bengaluru	Present	8450000	1140.75	1440.00	920.00	460.00	32	1182.50	MBBR, ASP, Extended Aeration	Chlorination,UV, F-Type Rapid Gravity sand Filters	Revenue generated
7	Bhilai	Present	625000	84.38	56.83	22.57	21.85	1	30.00	ASP	Chlorination + Gravity Sand Filter	No revenue generated
8	Bhopal	Present	1790000	241.65	301.00	80.00	23.00	13	144.00	SBR,ASP,Trickling Fillter,WSP	-	No revenue generated

Sl. No	Cities	Recycle and Reuse Practice	Population (As per 2011 census)	Water Demand (MLD)	Current Wastewater Generation (MLD)	Quantity of wastewater treated (MLD)	Quantity of treated wastewater reused(MLD)	Total No. of STPs	Capacity of STPs (MLD)	Treatment Technology		Revenue Details
										Secondary Treatment	Tertiary Treatment	
9	Chandigarh	Present	1055000	142.43	226.57	226.57	27.00	6	243.63	MBBR,SBR, ASP	Rapid Sand Filtration	Revenue generated
10	Chennai	Present	7438000	1004.13	1199.00	530.00	52.00	13	745.00	SBR,ASP	UV, RO	Revenue generated
11	Coimbatore	Present	1620000	218.70	132.84	30.00	21.25	3	170.00	SBR	-	Revenue generated
12	Delhi	Present	11000000	1485.00	3268.00	2383.00	340.00	40	3058.00	ASP+Biofilm, Densadeg and Biofor Technology	-	Revenue generated
13	Dhanbad	Absent	1162470	156.93	93.54	0.25	0.00	1	0.25	MBBR	UV	NA
14	Faridabad	Present	1438855	194.25	197.00	30.00	8.00	4	165.00	SBR	-	No revenue generated
15	Ghaziabad	Present	1648643	222.57	300.00	300.00	80.00	8	483.00	UASB,ASP	-	No revenue generated
16	Greater Mumbai	Present	12440000	1679.40	2190.00	349.49	48.80	8	2721.00	RMBR, SBR	Dual Media Sand Filters, Disk Filters, Chlorination	Revenue generated
17	Gwalior	Present	1159032	156.47	169.00	169.00	169.00	5	223.00	SBR,ASP	-	No revenue generated
18	Hyderabad	Present	7499587	1012.44	1975.44	772.30	70.00	21	772.30	MBBR, BNR,SBR,ASP	UF using Membranes	No revenue generated

Sl. No	Cities	Recycle and Reuse Practice	Population (As per 2011 census)	Water Demand (MLD)	Current Wastewater Generation (MLD)	Quantity of wastewater treated (MLD)	Quantity of treated wastewater reused(MLD)	Total No. of STPs	Capacity of STPs (MLD)	Treatment Technology		Revenue Details
										Secondary Treatment	Tertiary Treatment	
19	Indore	Present	1990000	268.65	312.00	312.00	101.50	10	412.50	SBR,ASP	-	Revenue generated
20	Jabalpur	Present	1054336	142.34	146.00	16.95	16.95	3	51.05	WSP, ASP	Chlorination + UV	No revenue generated
21	Jaipur	Absent	3046000	411.21	180.00	120.50	0.00	4	183.00	ASP, SBR	-	NA
22	Jamshedpur	Present	631364	85.23	158.00	55.00	40.00	4	63.50	ASP	UF	No revenue generated
23	Jodhpur	Present	2050000	276.75	110.00	85.00	85.00	3	120.00	ASP,WSP	-	Revenue generated
24	Kannur	Absent	232634	31.41	31.41	0.00	0.00	0	0.00	NA	-	NA
25	Kanpur	Present	2765358	373.32	410.00	355.00	338.00	7	472.00	ASP,UASB	-	No revenue generated
26	Kochi	Absent	602046	81.28	75.00	5.00	0.00	2	5.00	ASP	-	NA
27	Kolkata	Absent	4580582	618.38	1400.00	179.00	0.00	5	179.00	ASP,WSP, Aerated Lagoon, Oxidation Pond	-	NA
28	Kollam	Absent	367107	49.56	42.42	0.00	0.00	0	0.00	NA	-	NA
29	Kota	Absent	457540	61.77	87.08	20.00	0.00	2	26.00	ASP	-	NA
30	Kozhikode	Absent	613255	82.79	60.23	0.00	0.00	0	0.00	NA	-	NA
31	Lucknow	Absent	2817105	380.31	434.00	401.00	0.00	3	401.00	UASB, Fluidized Aerobic Bed	-	NA
32	Ludhiana	Absent	1900000	256.50	625.00	418.00	0.00	5	466.00	UASB, SBR	-	NA

Sl. No	Cities	Recycle and Reuse Practice	Population (As per 2011 census)	Water Demand (MLD)	Current Wastewater Generation (MLD)	Quantity of wastewater treated (MLD)	Quantity of treated wastewater reused(MLD)	Total No. of STPs	Capacity of STPs (MLD)	Treatment Technology		Revenue Details
										Secondary Treatment	Tertiary Treatment	
33	Madurai	Present	1468000	198.18	61.29	38.00	38.00	2	170.70	SBR	-	No revenue generated
34	Malappuram	Absent	77136	10.41	8.33	0.03	0.00	1	0.03	Biomembrane Technology	-	NA
35	Meerut	Absent	1305429	176.23	316.00	72.00	0.00	1	72.00	SBR	-	NA
36	Nagpur	Present	2405000	324.68	520.00	340.00	313.50	4	340.00	SBR	Fiber Disk Filter,Sand Bed filter	Revenue generated
37	Nashik	Present	2000000	270.00	320.00	331.00	320.00	10	360.50	USBR+MBBR, SBR,ASP	-	No revenue generated
38	Navi Mumbai	Present	1120547	151.27	215.00	215.00	65.00	7	454.00	SBR	UF+UV	No revenue generated
39	Patna	Absent	1683000	227.21	257.96	43.00	0.00	3	140.00	SBR	-	NA
40	Prayagraj	Present	1536518	207.43	365.51	268.00	40.00	7	268.00	ASP,SBR, Biotower	-	No revenue generated
41	Pune	Present	3100000	418.50	750.00	535.00	400.00	10	567.00	Modified ASP,Extended ASP,SBR	-	No revenue generated
42	Raipur	Absent	1048120	141.50	167.47	0.00	0.00	0	0.00	NA	-	NA
43	Rajkot	Absent	1969000	265.82	220.00	120.00	0.00	6	316.50	SBR	-	NA
44	Ranchi	Present	1073427	144.91	94.00	9.00	7.20	7	10.50	Phytorid Bed Technology	-	No revenue generated
45	Srinagar	Absent	1202000	162.27	146.77	48.90	0.00	7	58.80	ASP, SBR, MBBR	-	NA

Sl. No	Cities	Recycle and Reuse Practice	Population (As per 2011 census)	Water Demand (MLD)	Current Wastewater Generation (MLD)	Quantity of wastewater treated (MLD)	Quantity of treated wastewater reused(MLD)	Total No. of STPs	Capacity of STPs (MLD)	Treatment Technology		Revenue Details
										Secondary Treatment	Tertiary Treatment	
46	Surat	Present	6500000	877.50	956.00	927.90	319.00	11	1373.00	UFASB+ Integrated Fixed Film ASP + Extended Aeration	Disk Filtration+ UF+RO+ ACF	Revenue generated
47	Thiruvananthapuram	Absent	955494	128.99	140.00	60.00	0.00	1	107.00	ASP+Extended Aeration	-	NA
48	Thrissur	Absent	315957	42.65	25.40	0.00	0.00	0	0.00	NA	-	NA
49	Trichy	Absent	1045436	141.13	114.99	58.00	0.00	1	88.00	WSP	-	NA
50	Vadodara	Present	1740000	234.90	409.00	273.00	3.20	7	276.50	SBR	UV+ Media Filtration	No revenue generated
51	Varanasi	Present	1197051	161.60	302.00	265.00	0.00	5	361.80	SBR, ASP	UV, Chlorination	No revenue generated
52	Vasai Virar	Absent	1222000	164.97	259.20	18.00	0.00	1	30.00	MBBR	-	NA
53	Vijayawada	Absent	1034358	139.64	148.80	130.00	0.00	7	150.00	Extended Aeration,UASB,MBBR	-	NA
54	Visakhapatnam	Present	1890000	255.15	289.80	265.00	79.00	16	165.50	ST -ASP + Diffused Aeration	UV+RO	No revenue generated
Total			**128918890**	**17404.05**	**23511.99**	**13157.06**	**4177.25**	**345**	**19265.81**			

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