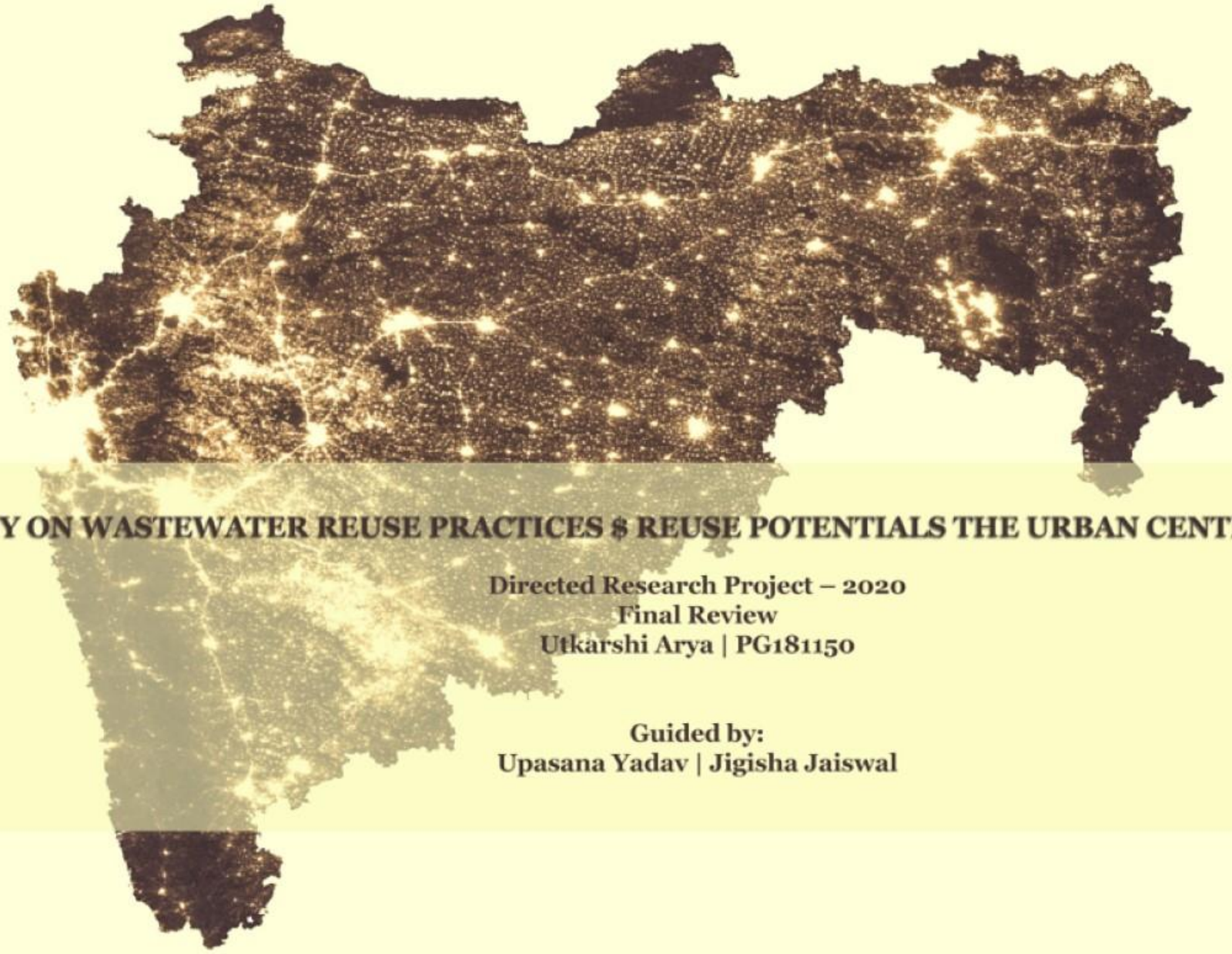


A STUDY ON WASTEWATER REUSE PRACTICES $ REUSE POTENTIALS THE URBAN CENTRES OF MAHARAHTRA

Directed Research Project – 2020
Final Review

Utkarshi Arya | PG181150

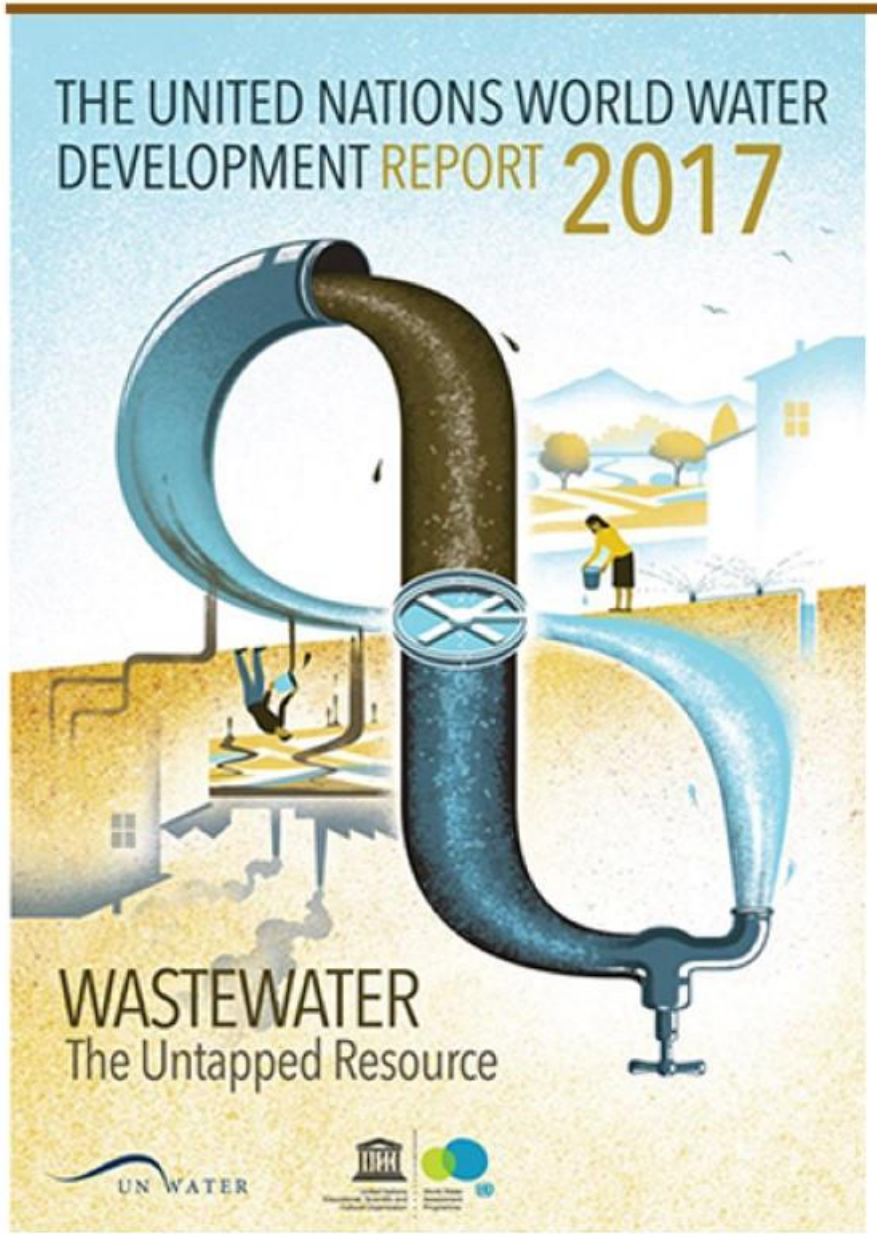
Guided by:
Upasana Yadav | Jigisha Jaiswal

This Directed Research Project (DRP) on "**A Study on Wastewater Reuse Potential & Practices in Urban Areas of Maharashtra - Pilot case of developing wastewater reuse plan for Kolhapur City"** was supported by the Center for Water and Sanitation. Guidance was provided by the CWAS team at CEPT Research and Development Foundation, CEPT University.

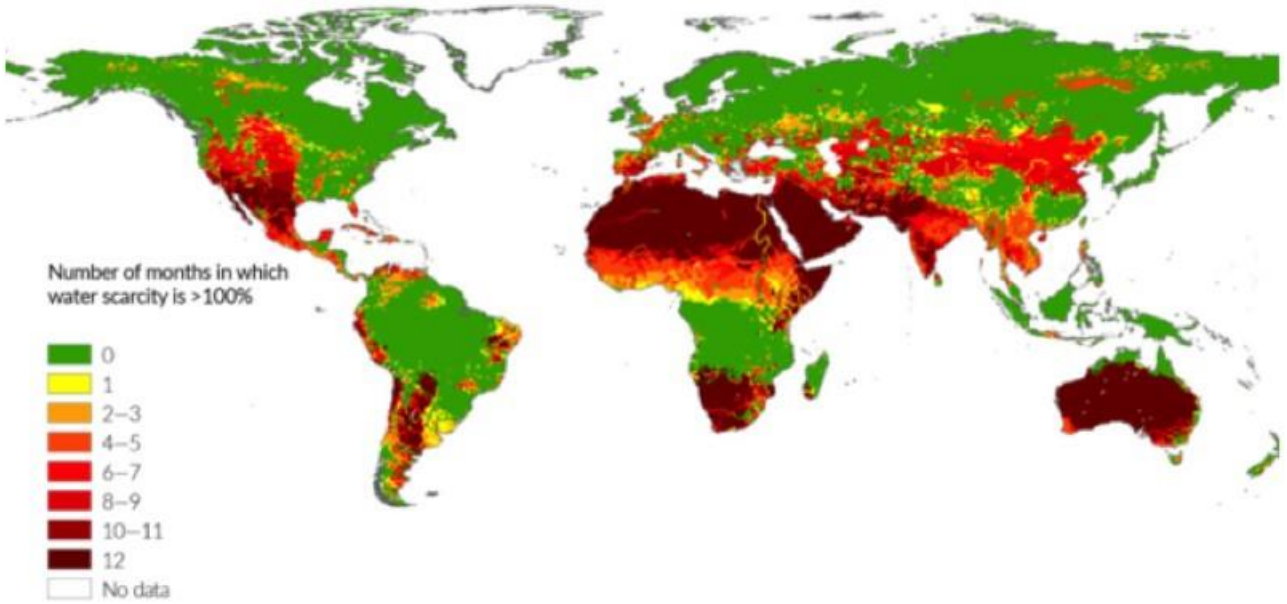
It was carried out towards partial fulfilment of the requirements for the award of a Master's Degree at the Faculty of Planning, CEPT University, Ahmedabad, India.

CWAS CENTER FOR WATER AND SANITATION | CRDF CEPT RESEARCH AND DEVELOPMENT FOUNDATION | CEPT UNIVERSITY

FP FACULTY OF PLANNING CEPT UNIVERSITY

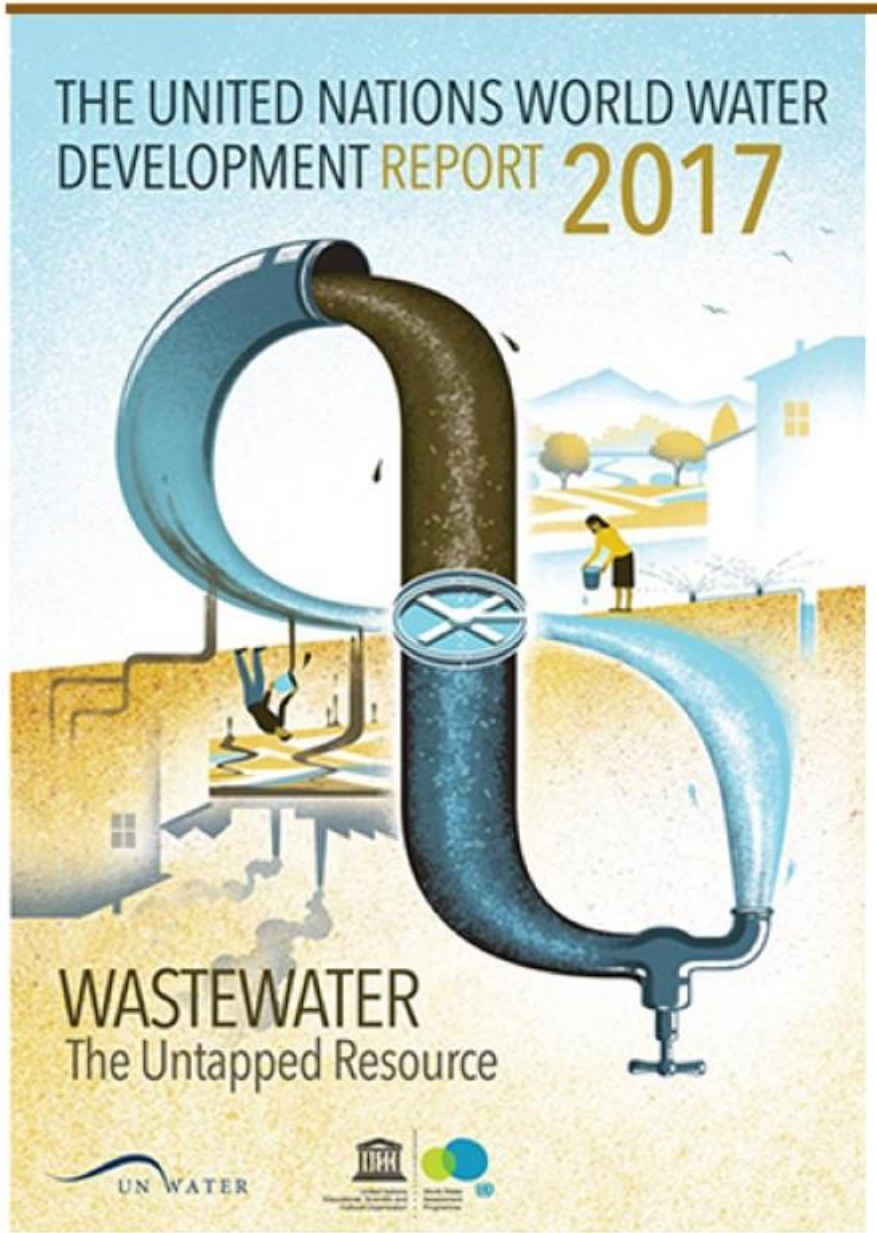


"State of world's water resources is quite disturbing !"



About 4 billion people, representing nearly two-thirds of the world population,experience severe water scarcity during at least one month of the year

(Mekonnen and Hoekstra, 2016)



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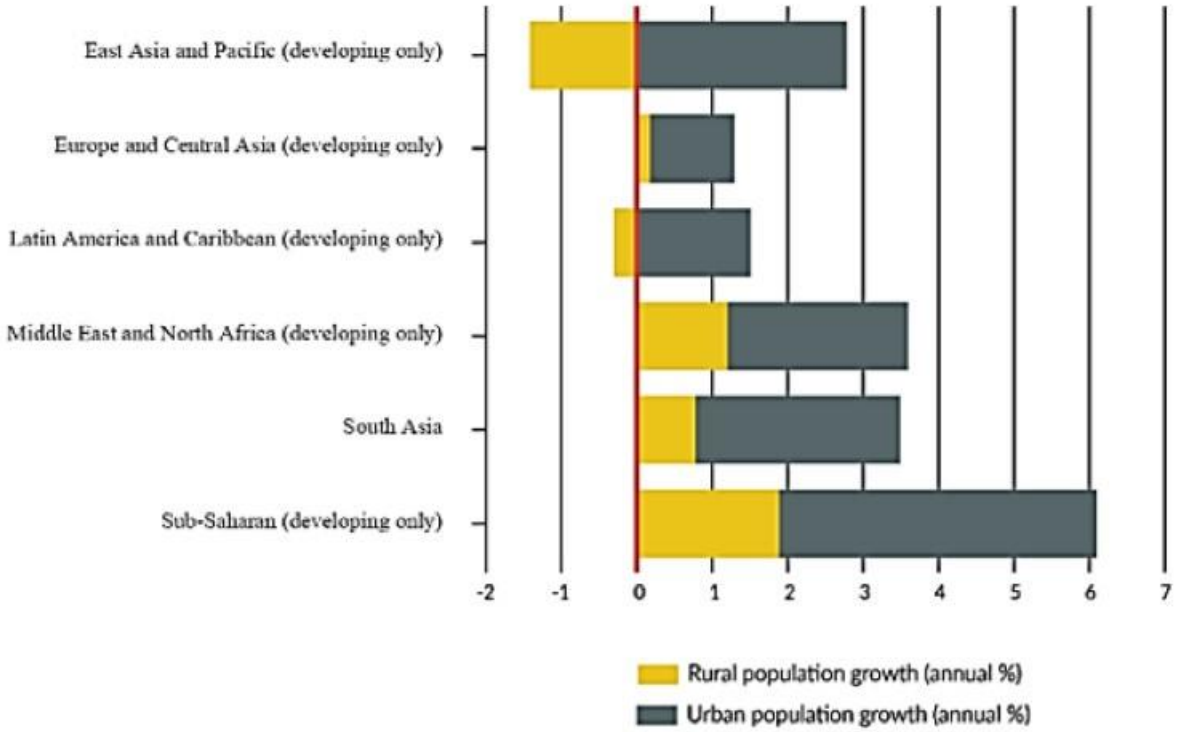
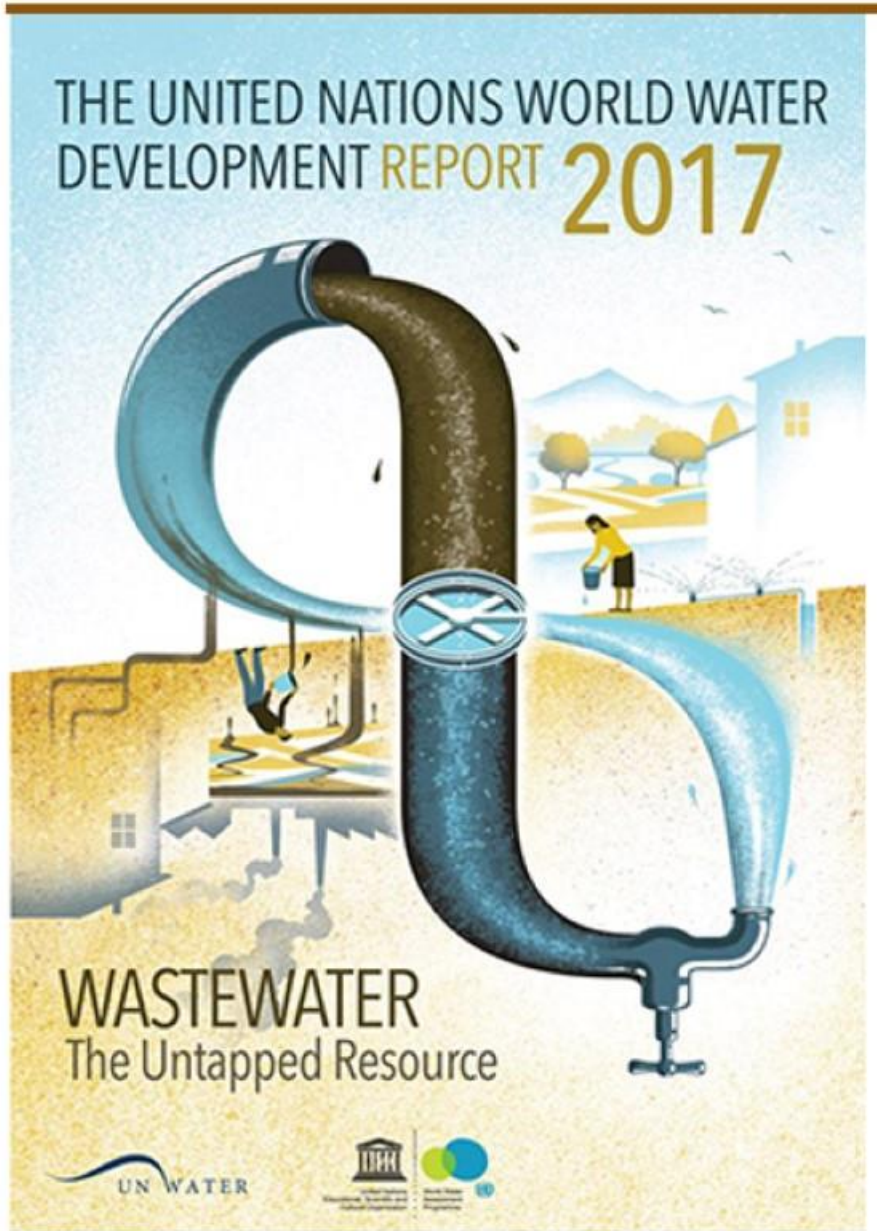


An estimated 2.3 billion of additional people to live in cities by 2050 aggravating this crisis even further.....



"State of world's water resources is quite disturbing !"

On top of it, With the existing climate change scenario, by 2030, water scarcity in some arid and semi-arid places will displace between 24 million and 700 million people. (UNESCO, 2009).

In a parallel world, the FAO's AQUASTAT database estimates global freshwater withdrawals at 3,928 km³ per year. An estimated 44% (1,716 km³ per year) of this water is consumed, mainly by agriculture through evaporation in irrigated cropland.

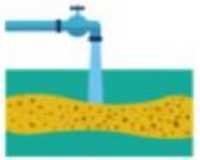
The remaining **56% (2,212 km³ per year) is released into the environment as wastewater** in the form of municipal and industrial effluent and agricultural drainage water

Source:

REUSING WATER

IRRIGATION

AQUIFER RECHARGE



INDUSTRIAL PROCESSES

HEATING/COOLING

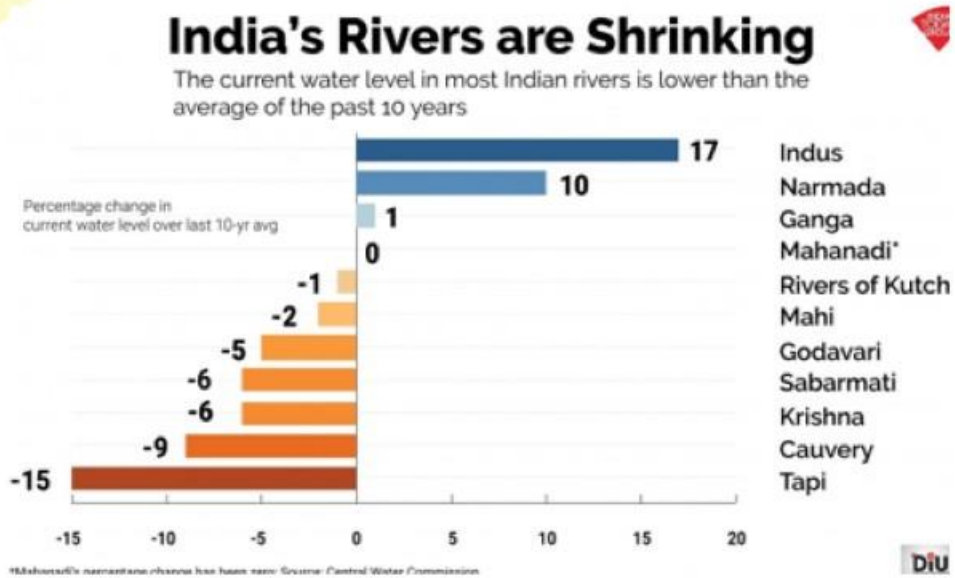
POTABLE WATER

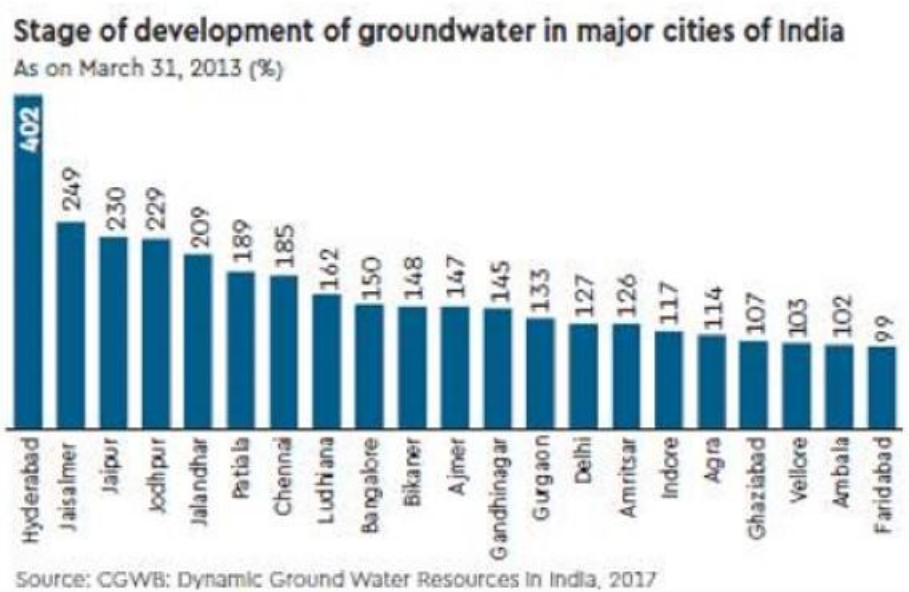
Wastewater's vast potential as a source of recoverable resources remains largely underexploited

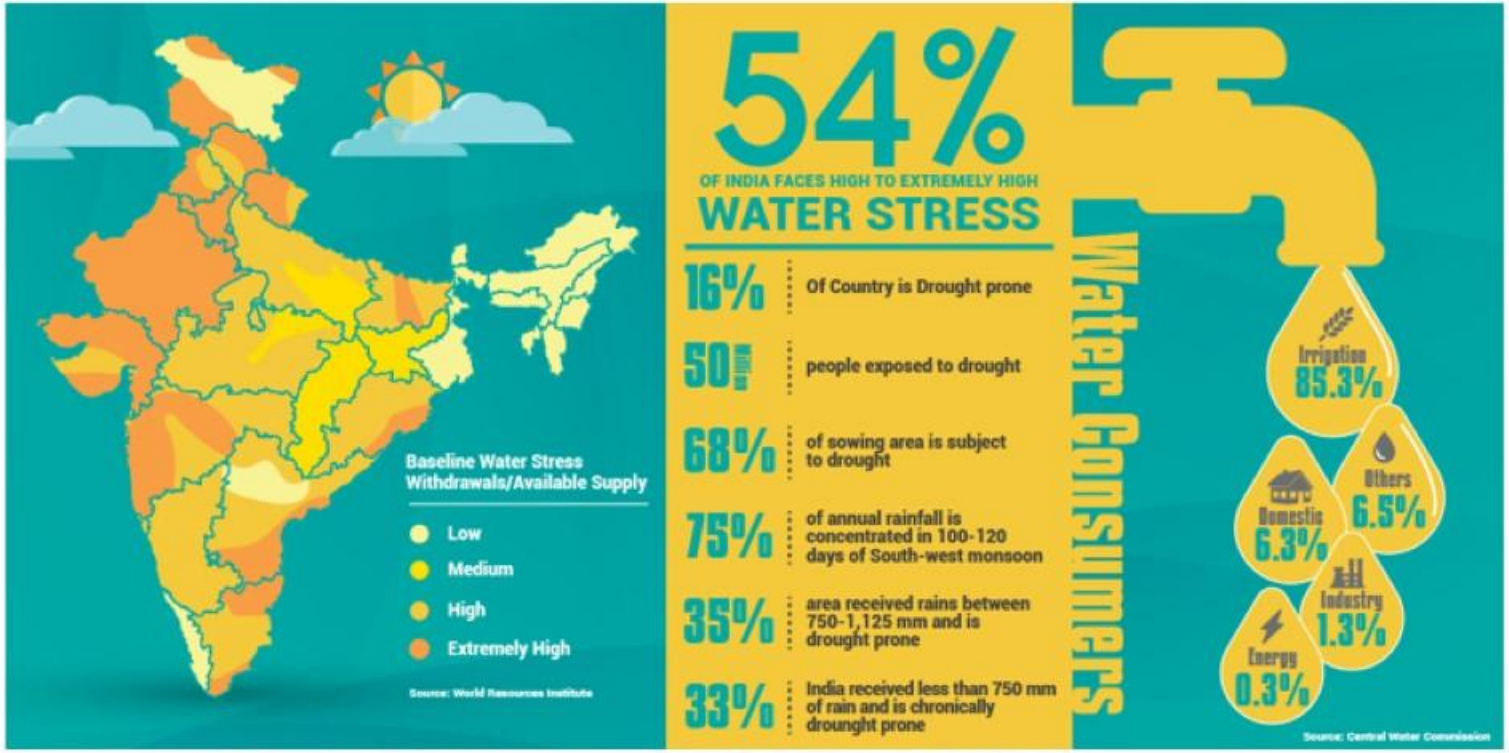
The recovery of nutrients and energy can add revenue streams to recover investment and O&M cost.

Source:

THE WATER STORY OF INDIA



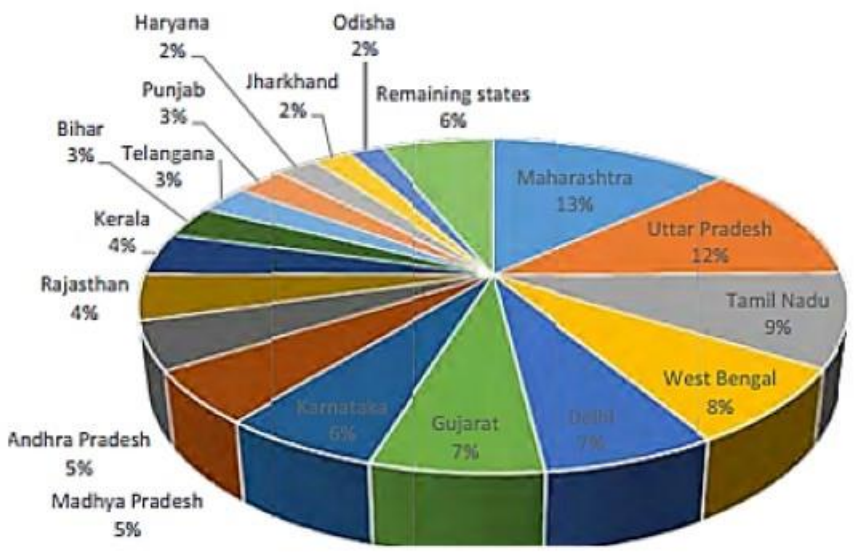




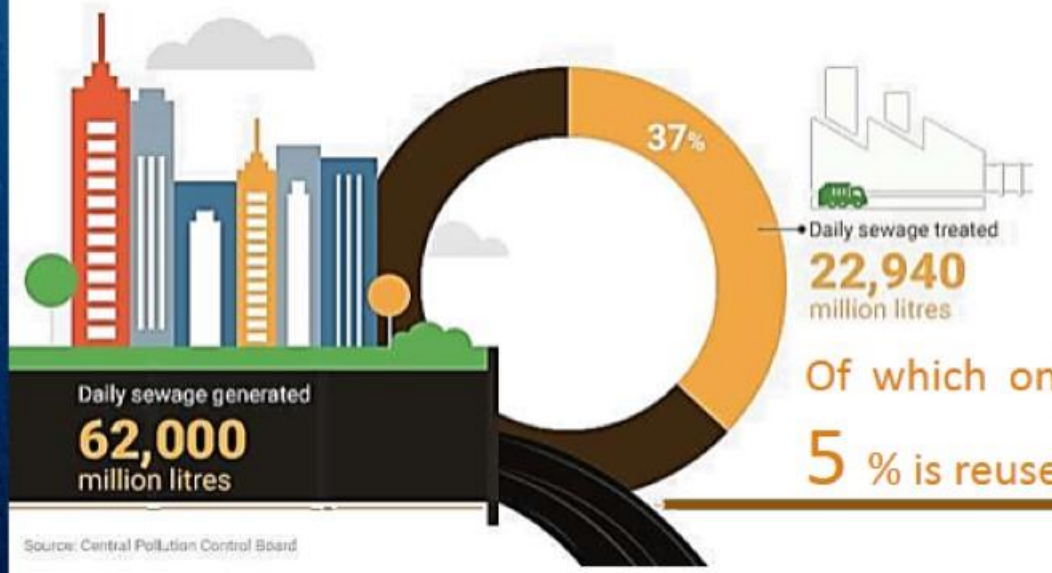
Source: Central Water Commission Report,2017

WASTEWATER REUSE: THE UNTAPPED POTENTIAL

Today, an estimated 62000 (MLD) sewage is generated in major cities of India, however the sewage treatment capacity is only of 22940 MLD. (<30%)



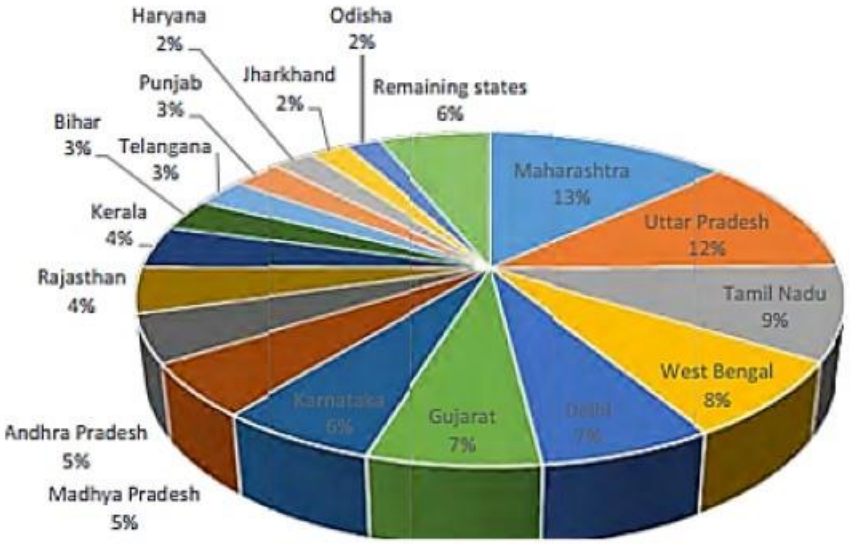
*State wise share of volume of WW generated



Of which only

5 % is reused

WASTEWATER REUSE: THE UNTAPPED POTENTIAL



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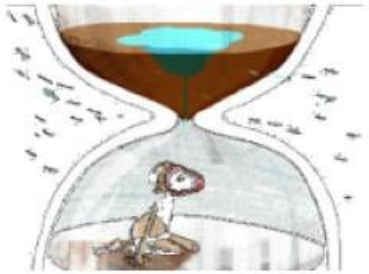
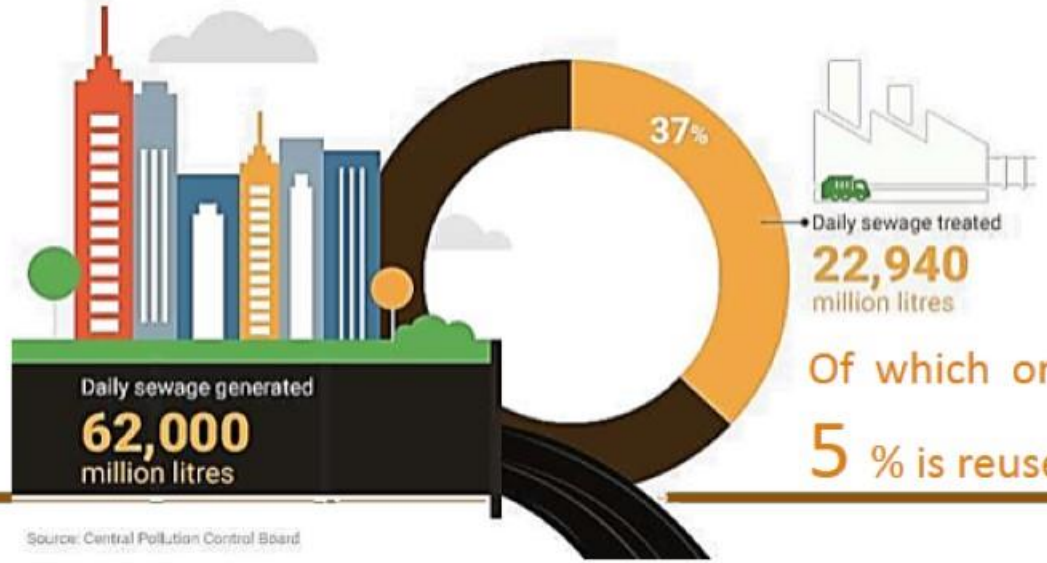


GW contamination

Public health risk

Loss of marine ecosystem



Of which only

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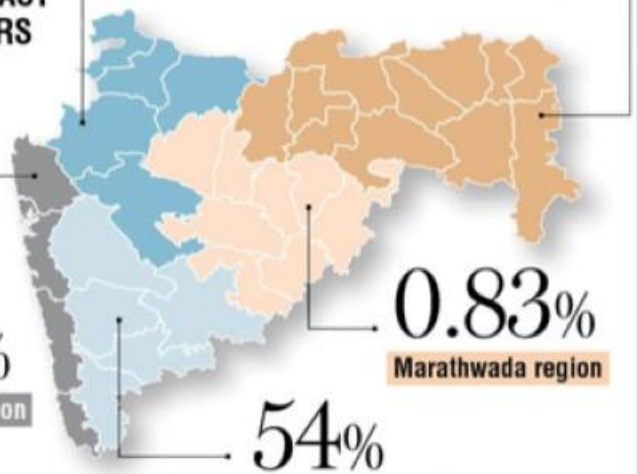
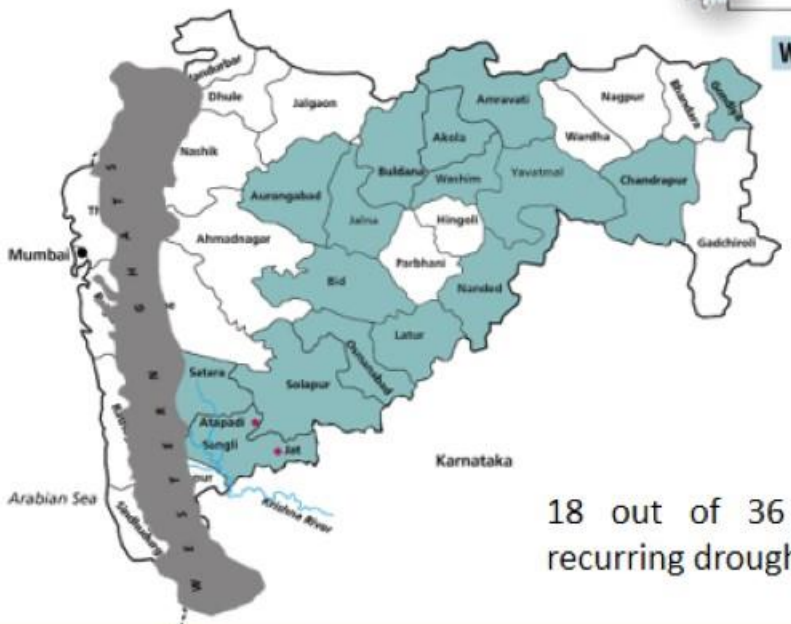
Source: *CPCB Report, 2016

THE CASE OF MAHARASHTRA

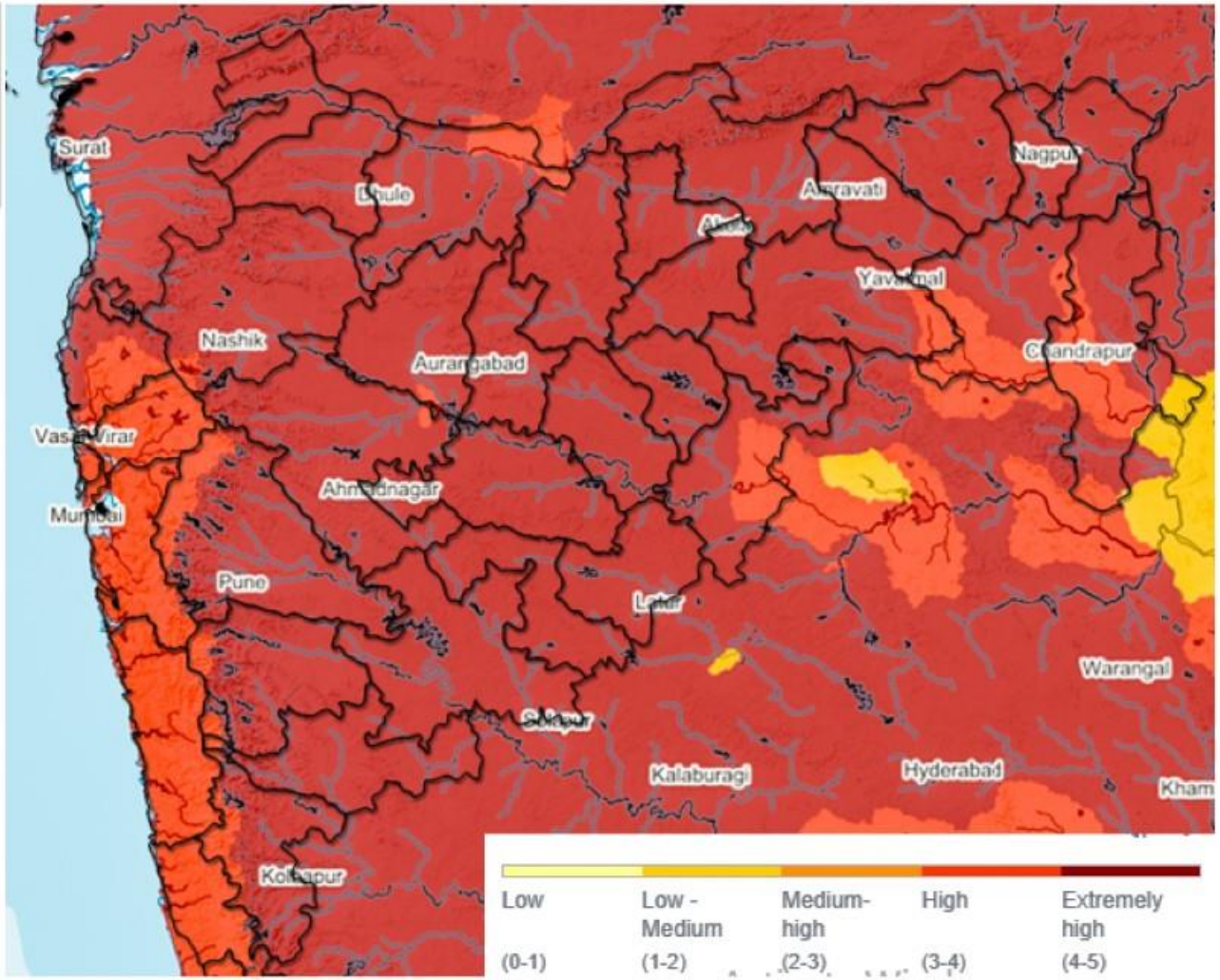
MARATHWADA HAS BEEN FACING DROUGHT FOR THE LAST FOUR YEARS



Region wise storage capacities
State average :33.99 % (2017)
& declining sharply.



18 out of 36 districts prone to recurring droughts (2008-2018)

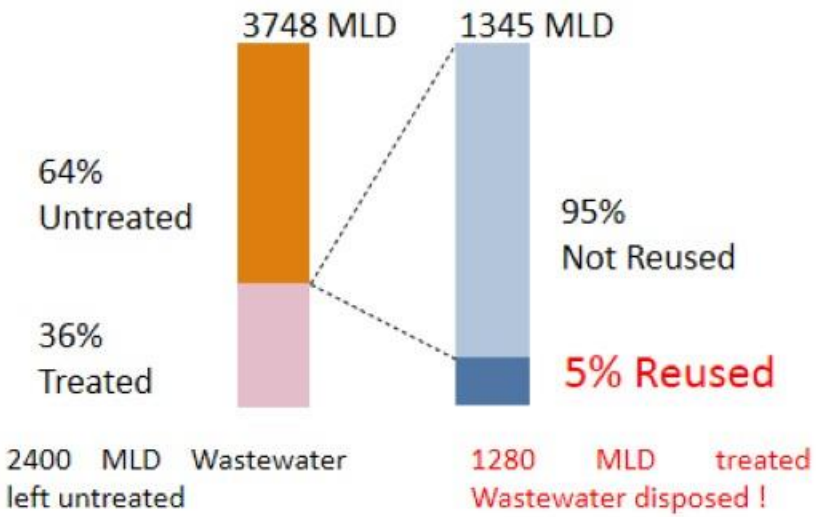


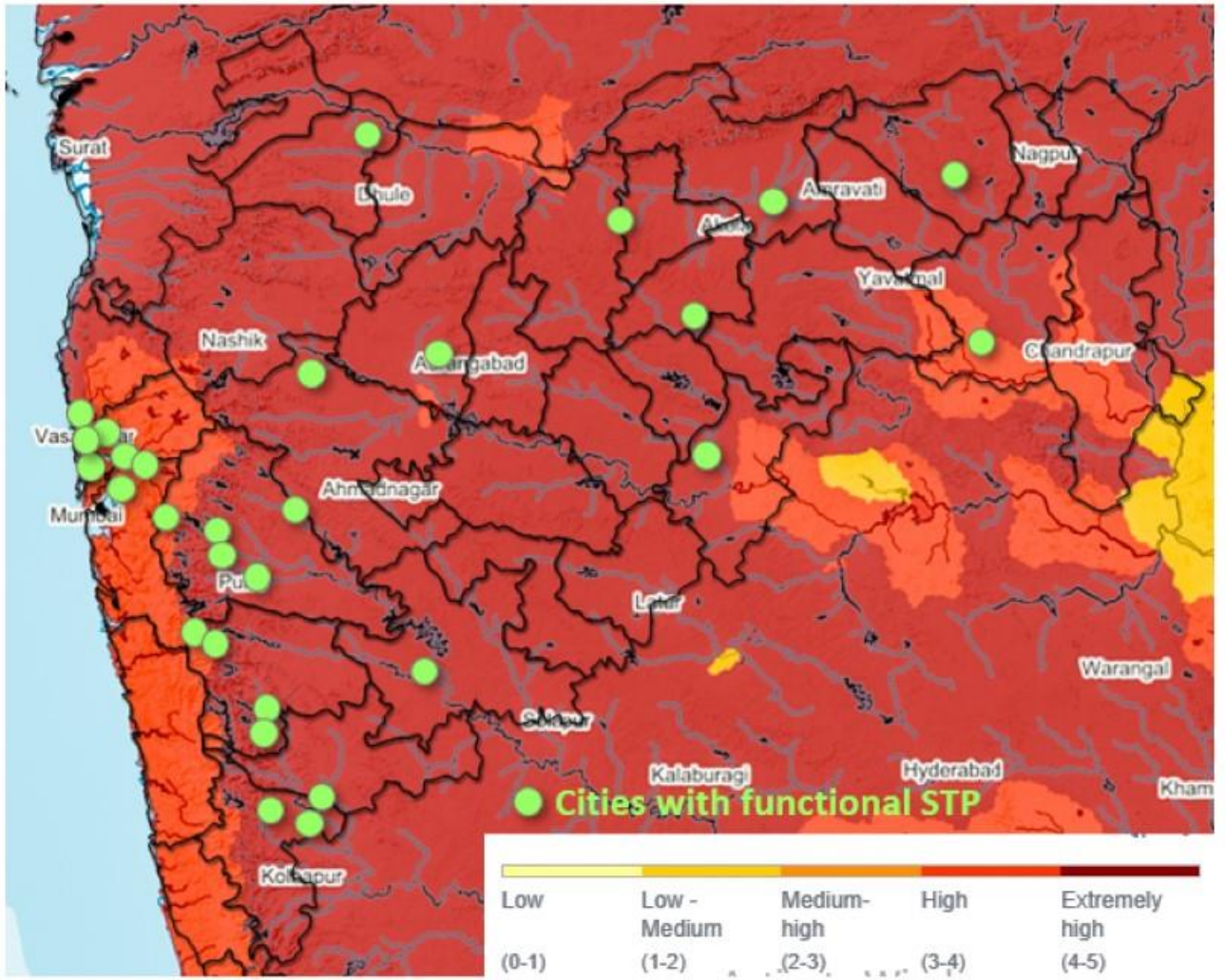
89 % of the state geographical area falls under 'high risk 'zone.

Source: Water risk atlas, AQUEDUCT

THE CASE OF MAHARASHTRA

- Maharashtra generates about 8197 MLD of sewage every year and has an installed treatment capacity of **4260 MLD which implies that more than 50 % of the sewage is disposed of to the surface waterbodies**.
- The state has 27 CETPs and 78 STPs out of which only 60 are operational , 10 , non functional ad remaining 8 are under construction.
- **Only 5 % of the treated water is currently being reused while 95 % is disposed off without reusing**





89 % of the state geographical area falls under 'high risk 'zone.

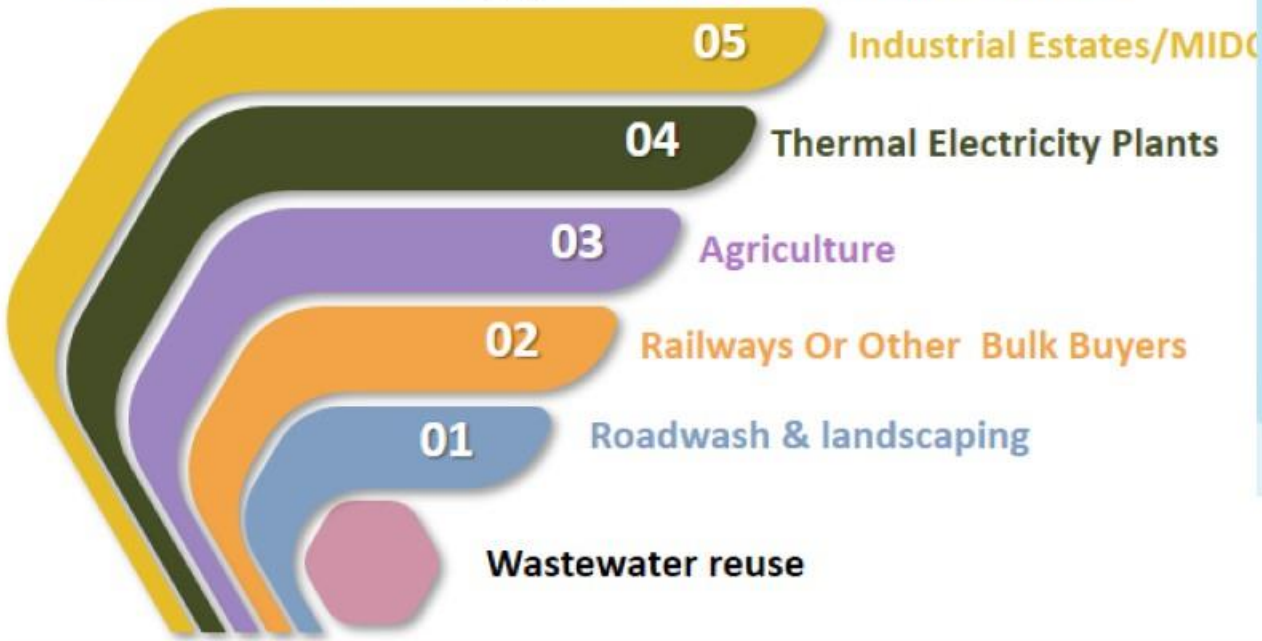
Source: Water risk atlas, AQUEDUCT

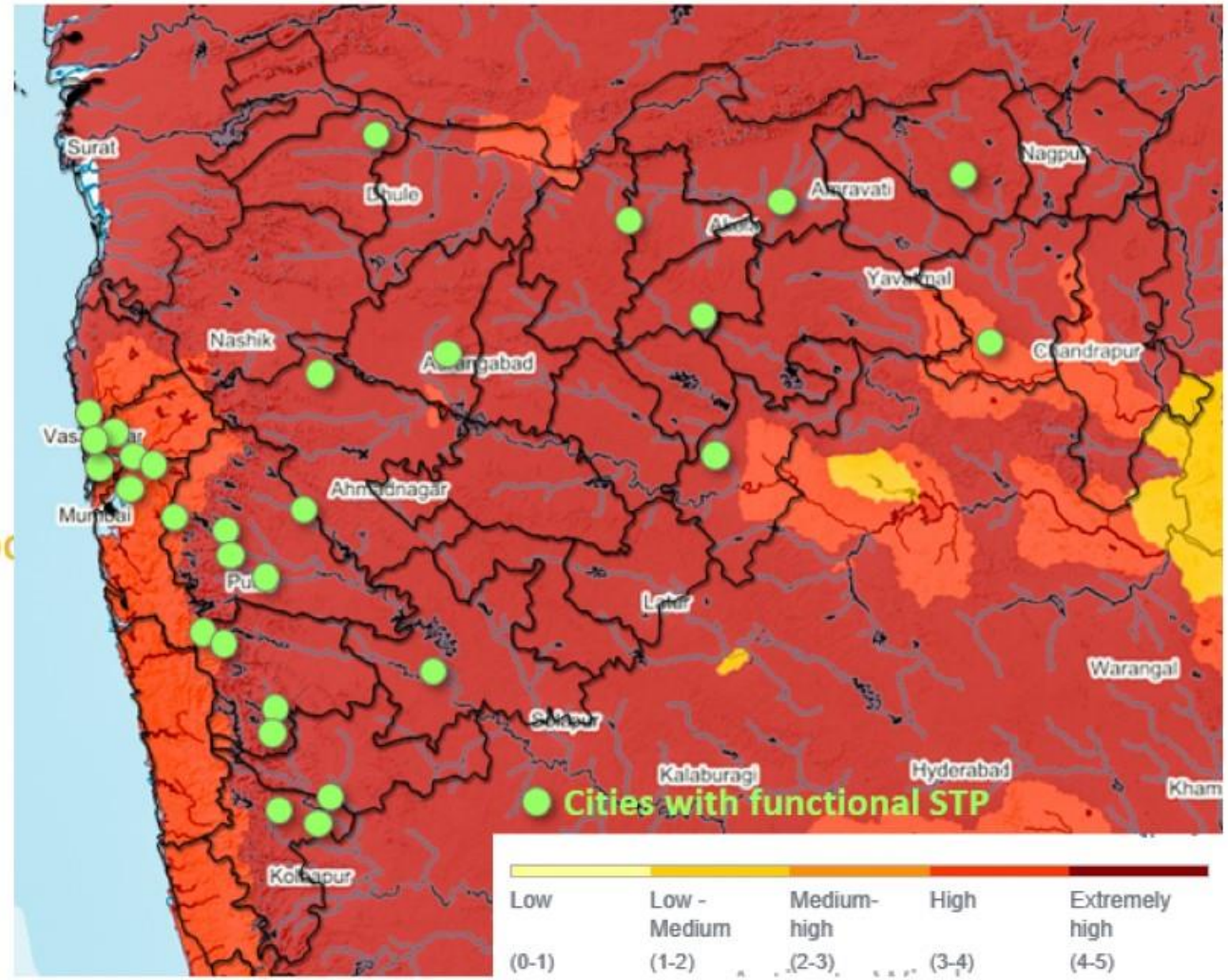
THE CASE OF MAHARASHTRA

Owing to this scenario the state released a policy called the Policy For Recycle And Reuse Of Wastewater For Maharashtra,2017

"The policy mandates that, The ULB is primarily responsible for creating the wastewater management capability/plant, in accordance; and to prepare and implement a plan for the recycle and reuse of the wastewater as per the available funds. "

As it was found that state is a leading producer of numerous cash crops **which contributes 12% of the state's economy** and this is endangered by repeated drought , housed **233 industrial areas** & **23 Thermal power stations all of which are highly water intensive economical activities**





89 % of the state geographical area falls under 'high risk 'zone.

Source: Water risk atlas, AQUEDUCT

PROBLEM STATEMENT

This research is aimed at probing on how to make the best productive reuse of treated Municipal Wastewater generated in the STPs of these urban centers of Maharashtra and conduct a pan-state suitability study for its different usage scenarios.

Source: Water risk atlas, AQUEDUCT

KEY RESEARCH QUESTIONS

What is the current on-ground status (nature and extent) of wastewater reuse in urban areas of Maharashtra?

Which areas further have a scope and potential to reuse its treated wastewater and for what best suitable purpose?

What are the constraints and challenges faced by the ULB in mainstreaming reuse of treated wastewater?

How to Develop an Innovative & sustainable business model for various reuse options.(in context to a select Maharastrian City)

Source:

METHODOLOGY

- Systematic literature review for India and Maharashtra
- Secondary case studies, city specific scientific papers ,research reports and review of past research projects
- Extensive comparative performance assessment of various towns and cities

- overall analysis drawn out based on the detailed study of ground water , surface water(river basins) rainfall etc.
- ascertain zones that are water deficit, and hence determine our area for prioritizing wastewater reuse.
- pan state assessment of existing treatment and reuse infrastructure of the state and its associated performance.

- based on findings of Stage I and Stage II where a gap assessment will be carried out and a range of supportive measures, key factors and critical steps for promotion of wastewater reuse shall be prescribed.
- Prescribe recommendations to facilitate /upscale / mainstream safe reuse of wastewater along with identification of barriers, pre requisites and incentivization of the concerned stakeholders..

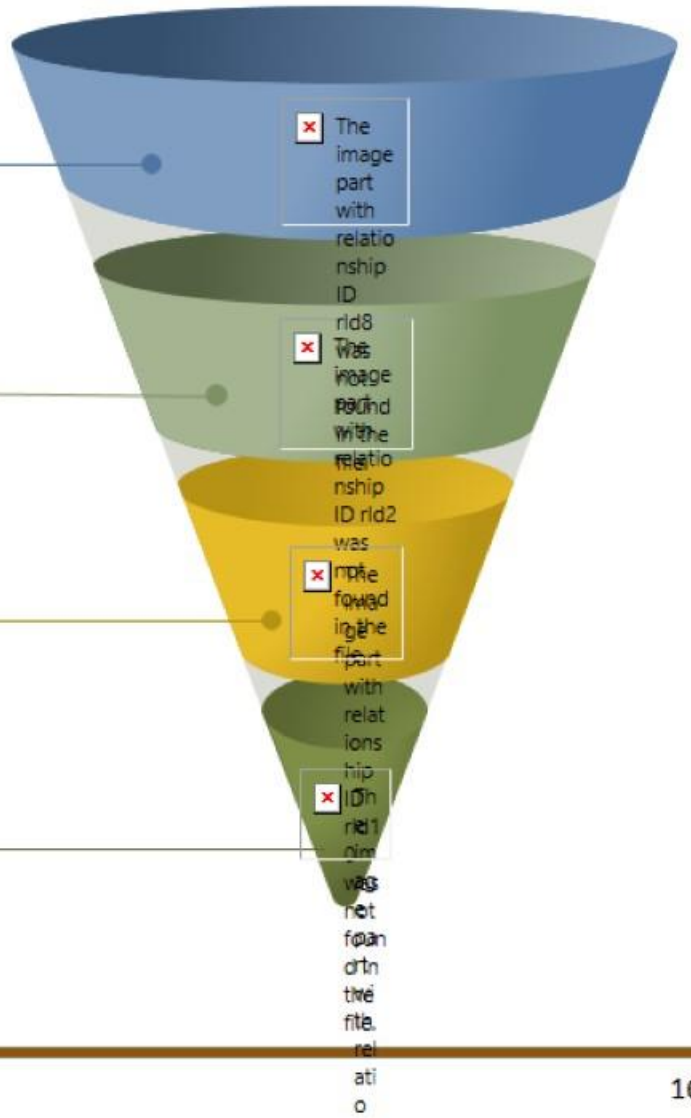
- Develop a feasible project option(s) which is city specific based on the previous stages along with estimating project costs , technical details, cost benefit analysis for the same and explore the combination of various stakeholders funding the for the overall sustainability & durability of the project.

STAGE ONE
BACKGROUND STUDY

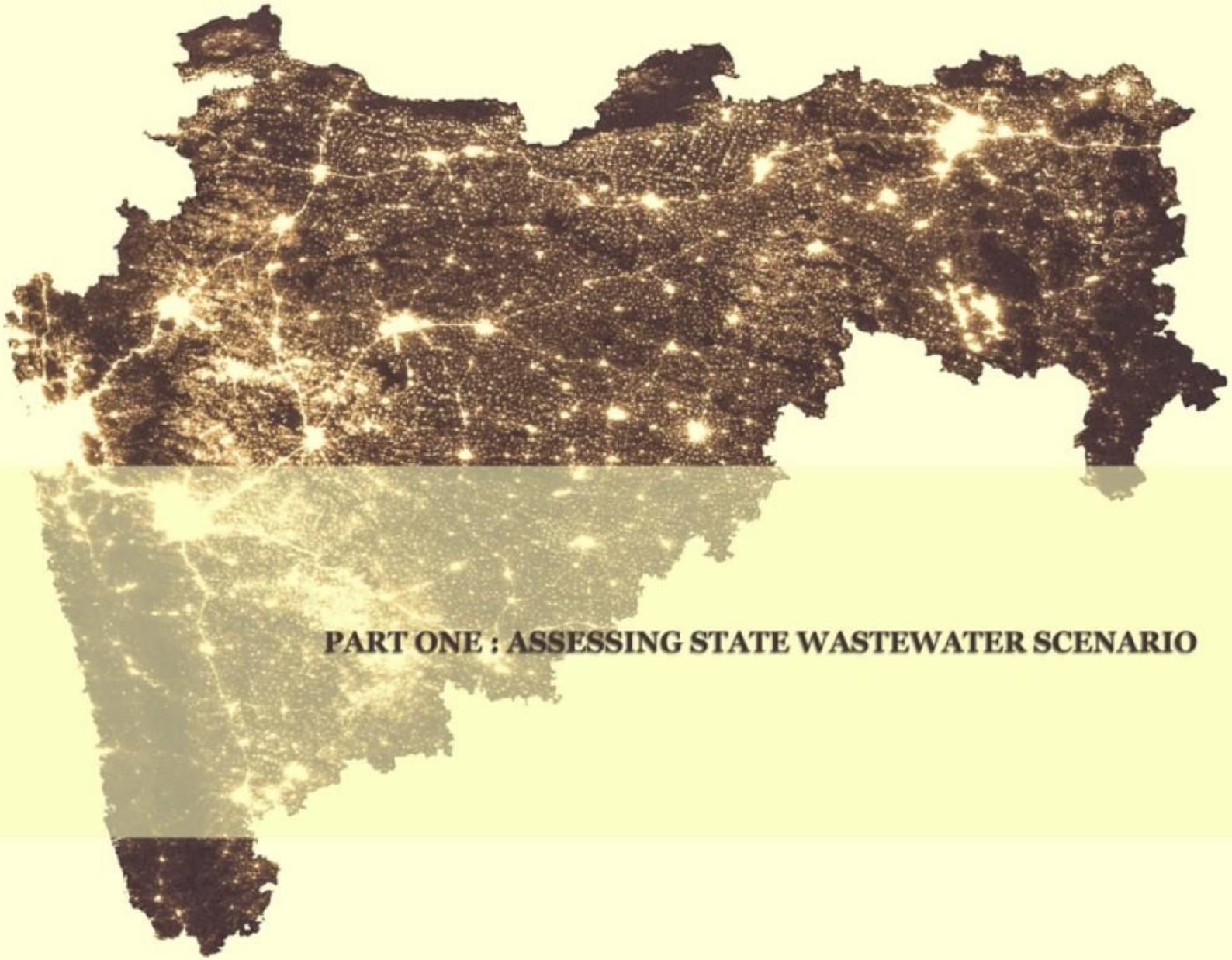
STAGE TWO
BASELINE ASSESMENT

STAGE THREE
GAP ANALYSIS

STAGE FOUR
RECOMMENDATIONS & PROJECT FORMULATION

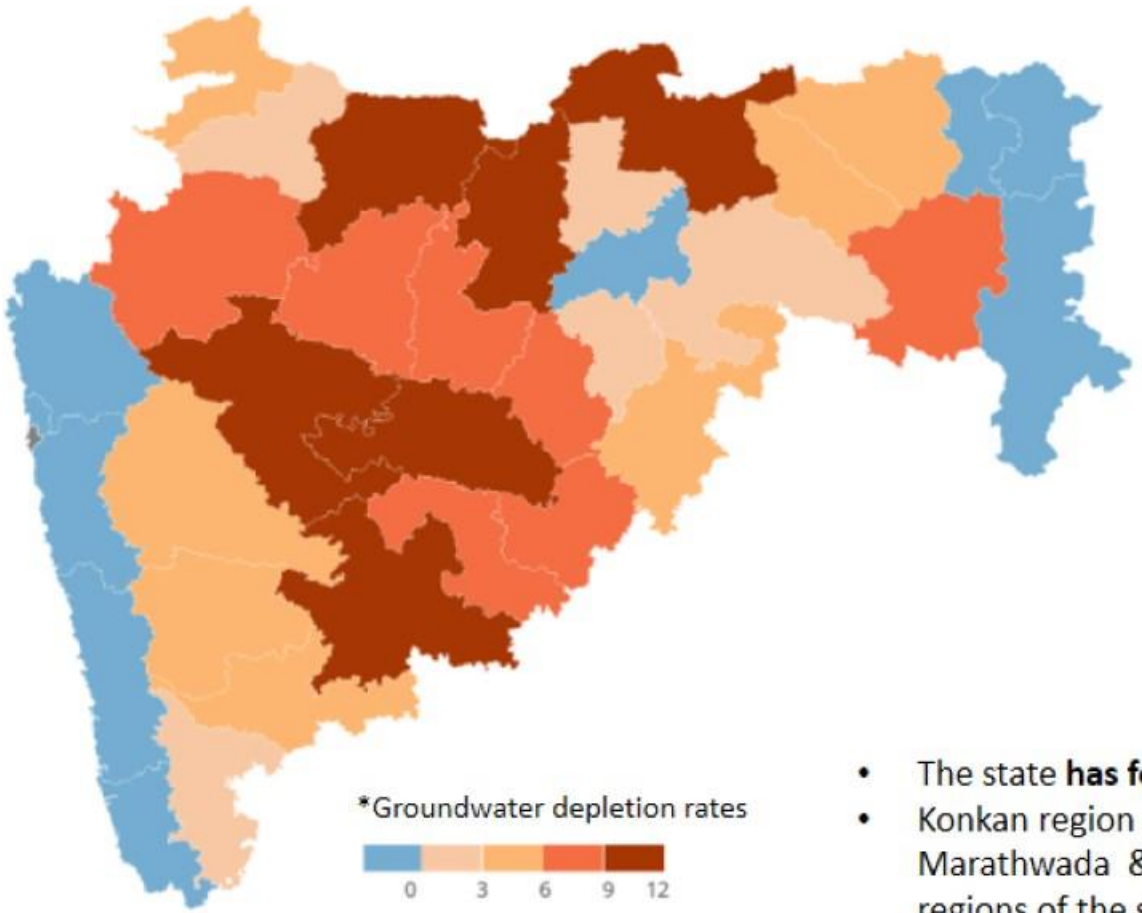


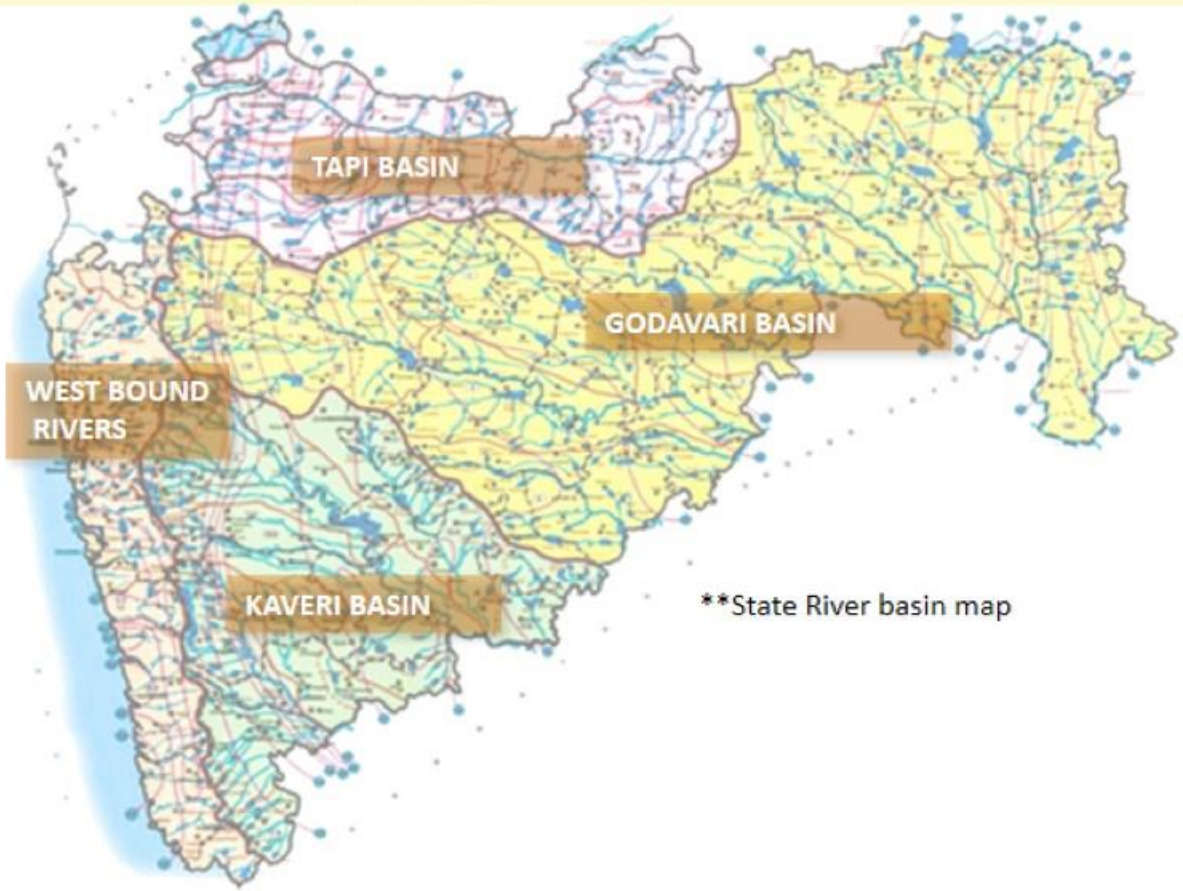
Source:



PART ONE : ASSESSING STATE WASTEWATER SCENARIO

STATE WATER PROFILE :RIVER BASINS & GROUND WATER DEVELOPMENT



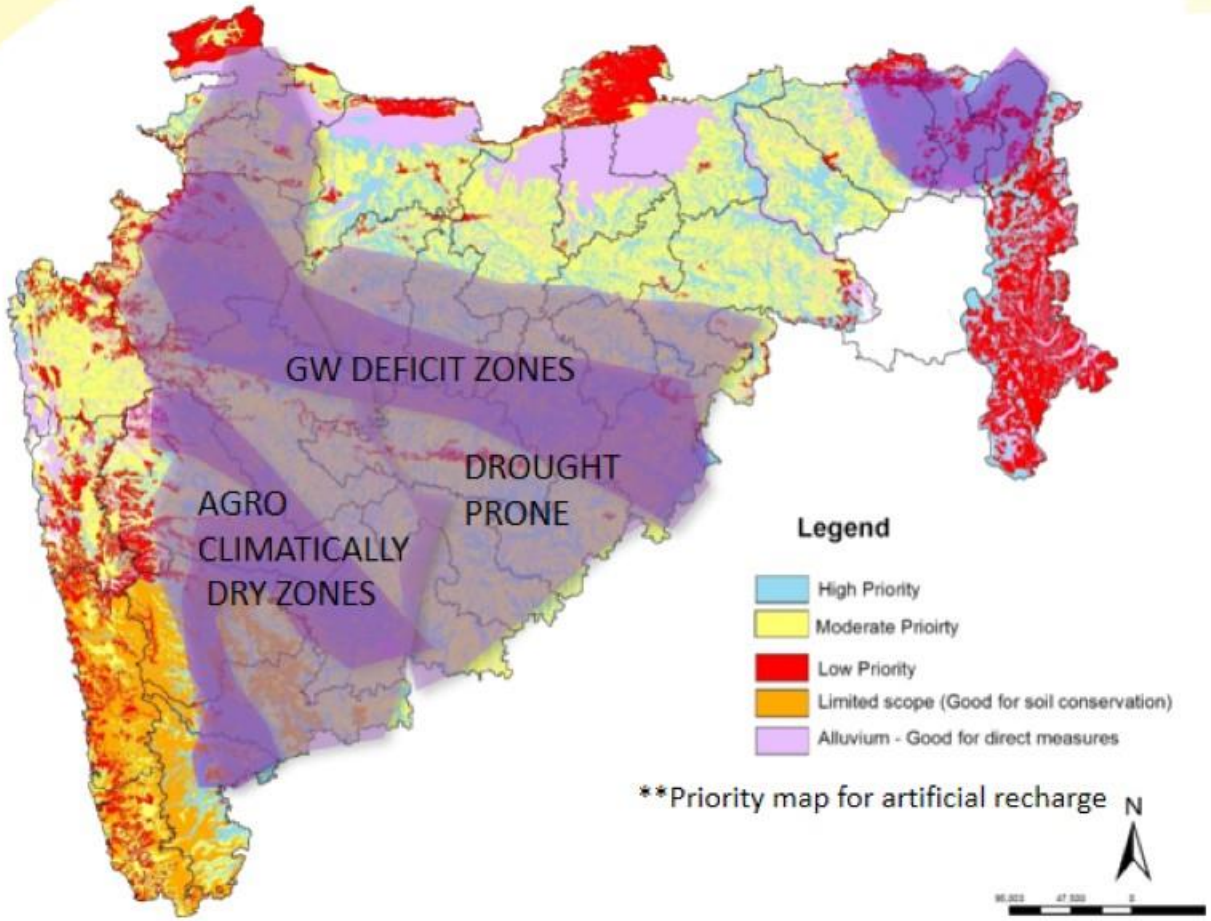


**State River basin map

- The state **has four major river basins** of varying surface capacity largely dependent of the soil type
- Konkan region which has all Its rivers west bound is the most water rich zone of the state whereas Marathwada & Vidarbha region which makes up the Godavari basin is the most water scarce regions of the state
- Parts of Tapi, Godavari and Kaveri basin are critically depleted in groundwater hence these areas fall under high priority zone for GW recharge

Source: * GW surveys and development Agency,Water supply and Sanitation Dept, Gov of Maha.**GW yearbook of Maharashtra , CGWB

IDENTIFYING WATER STRESED REGIONS/PRIORITY AREAS FOR WW REUSE

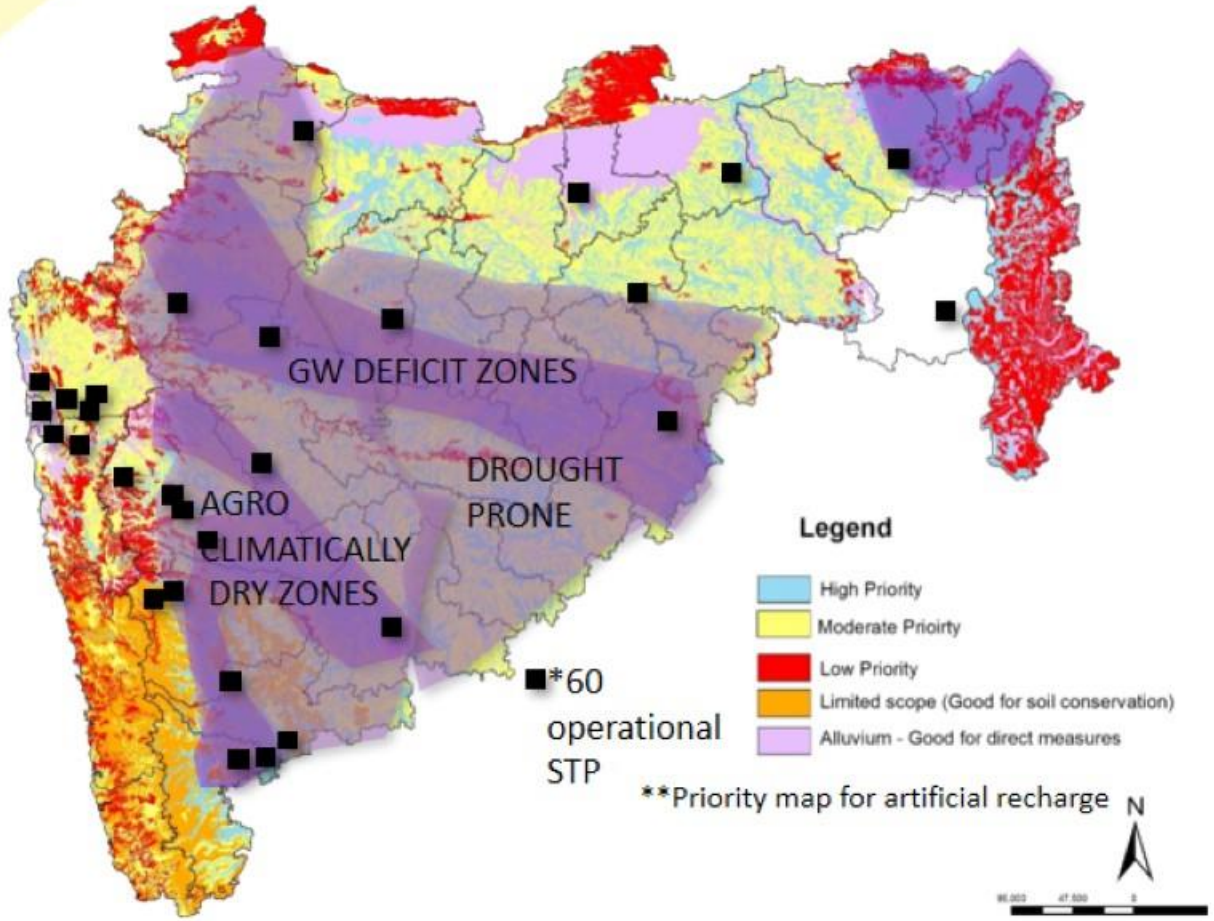


On overlapping the basin map with the groundwater depletion map and comparing it with priority zones for artificial recharge we arrive at the areas which urgently requires a relook to promote wastewater reuse on a priority basis.

Priority 1: Drought prone areas reported for the last five –six years
Priority 2 : the agro climatically water scarce zone of the state
Priority 3:Areas where artificial recharge is required on an urgent basis

Source: GW yearbook of Maharashtra , CGWB

THE WATER FACTORIES :IDENTIFYING AVAILABLE TECHNOLOGY & LEVELS OF TREATMENT



- **PRIMARY(Sand & Carbon Filtration)-**Ulhasnagar,Solapur , Sangli, Bhiwandi
- **ASP**-Amravati, Aurangabad, Chandrapur,Mira Bhandar , Nagpur,Nashik , Navi Mumbai
- **SBR-**Pune , Pimpri Chinchwad,Greater Mumbai, Kalyan , Kolhapur, Aurangabad, Chandrapur,
- **MBR-** Nagpur, Greater Mumbai, Pune, Pimpri Chinchwad
- **UF/MF+RO- Nil**

- **Dhule, Nashik, Aurangabad, Sangli, Nanded, Nagpur,Solapur** are districts where there is an urgent requirement of mainstreaming wastewater reuse as an alternative source of water supply for non potable purposes.
- **Jalna , Beed , Latur , Parbhani , Hingoli** must also consider of commissioning an STP to meet its water demands a the earliest

Level	Secondary			Tertiary
Influent	Raw sewage			SWT
Technology	ASP	SBR	MBR	UF/MF+RO
BOD	<30	<5	<5	<2
COD	<250	<50	<50	<50
TSS	<50	<10	<1	<1
N	~45	<10	<10	--
PH	~5	<1	<1	--

Source: *INVENTORIZATION OF SEWAGE TREATMENT PLANTS,CPCB,,2015

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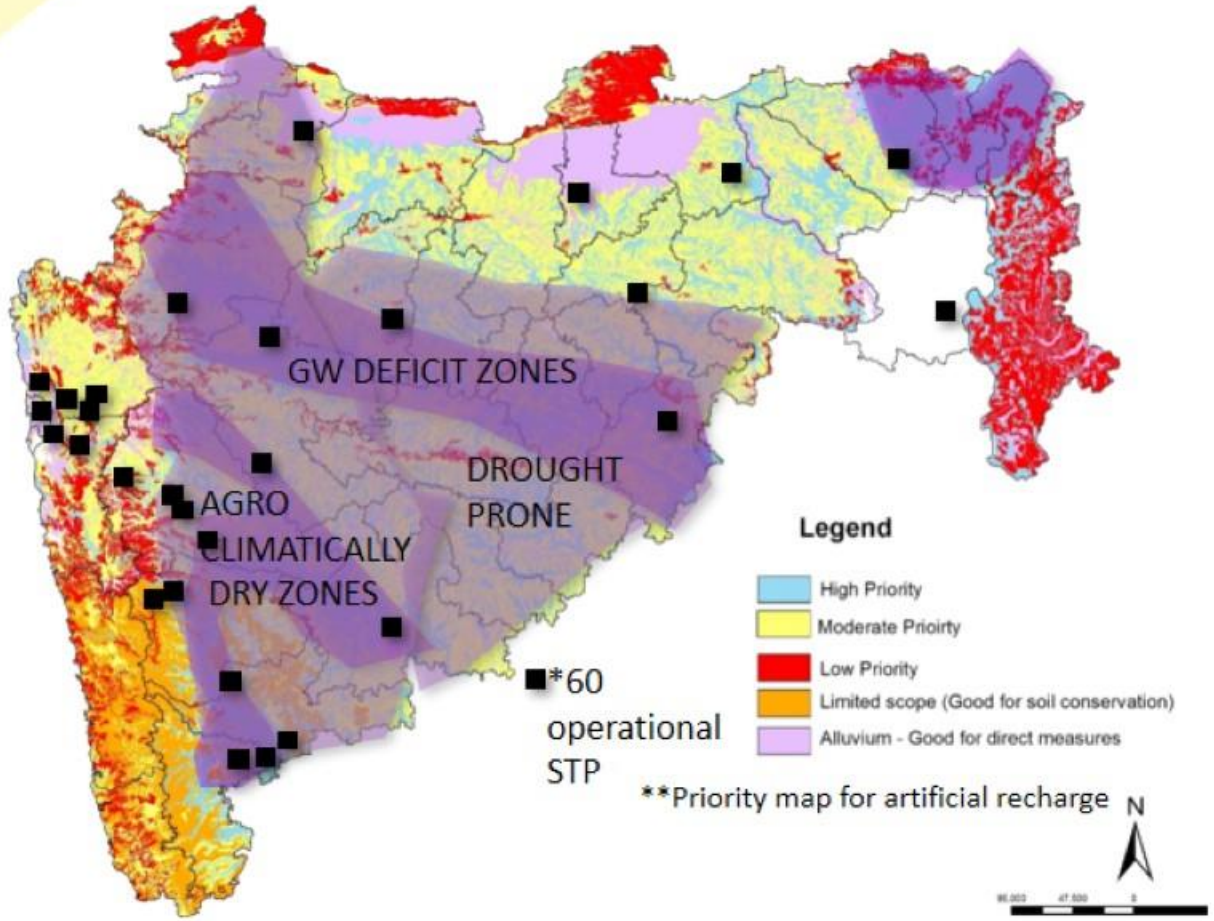

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- **UF/MF+RO- Nil**

PRIMARY LEVEL

STW → Meets CPCB discharge norms and usually discharged into water bodies

Sand and carbon filtration — Pre-treatment depth filtration that removes suspended solids

Grade I water → Can be used for gardening, toilet flushing and cleaning

SECONDARY LEVEL

Ultra/micro filtration — Using semi-permeable membrane removes micro particulate solids.

Grade II water → Can be used for low-end industrial uses like cooling

RO — Membrane-based reverse osmosis process removes dissolved solids in water.

Grade III water → Can be used as process water in many industries

TERTIARY LEVEL

Ultraviolet treatment — Disinfection process to inactivate bacteria and microbial pathogens

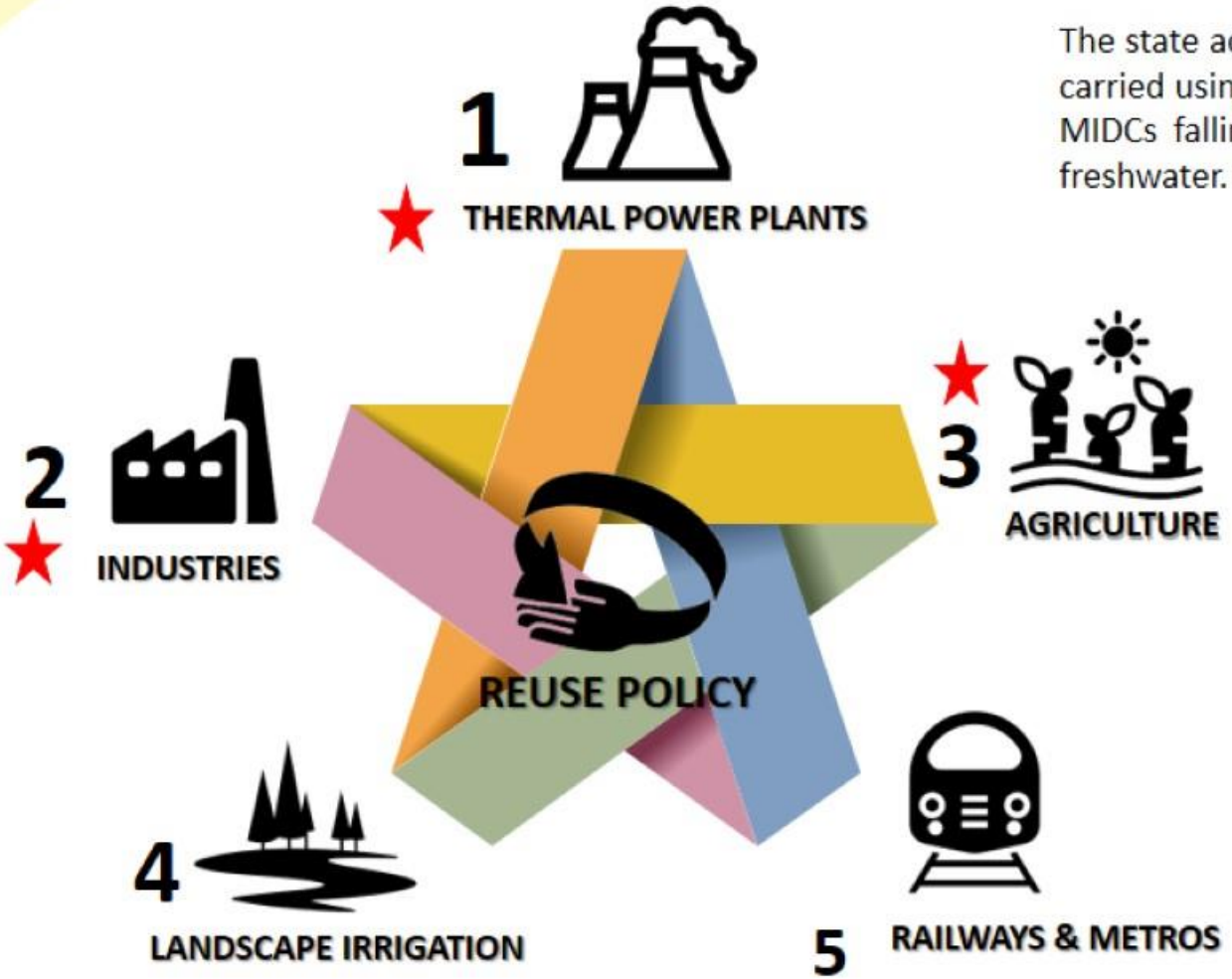
Grade IV water → Can be used as potable water for human consumption

Demineralisation — Ion exchange/equivalent process to remove certain constituents from water

Grade V water → Can be used for in precision industries such as electronics

Source: *INVENTORIZATION OF SEWAGE TREATMENT PLANTS,CPCB,,2015

STATE REUSE POLICY HIGHLIGHTS & ANALYSIS



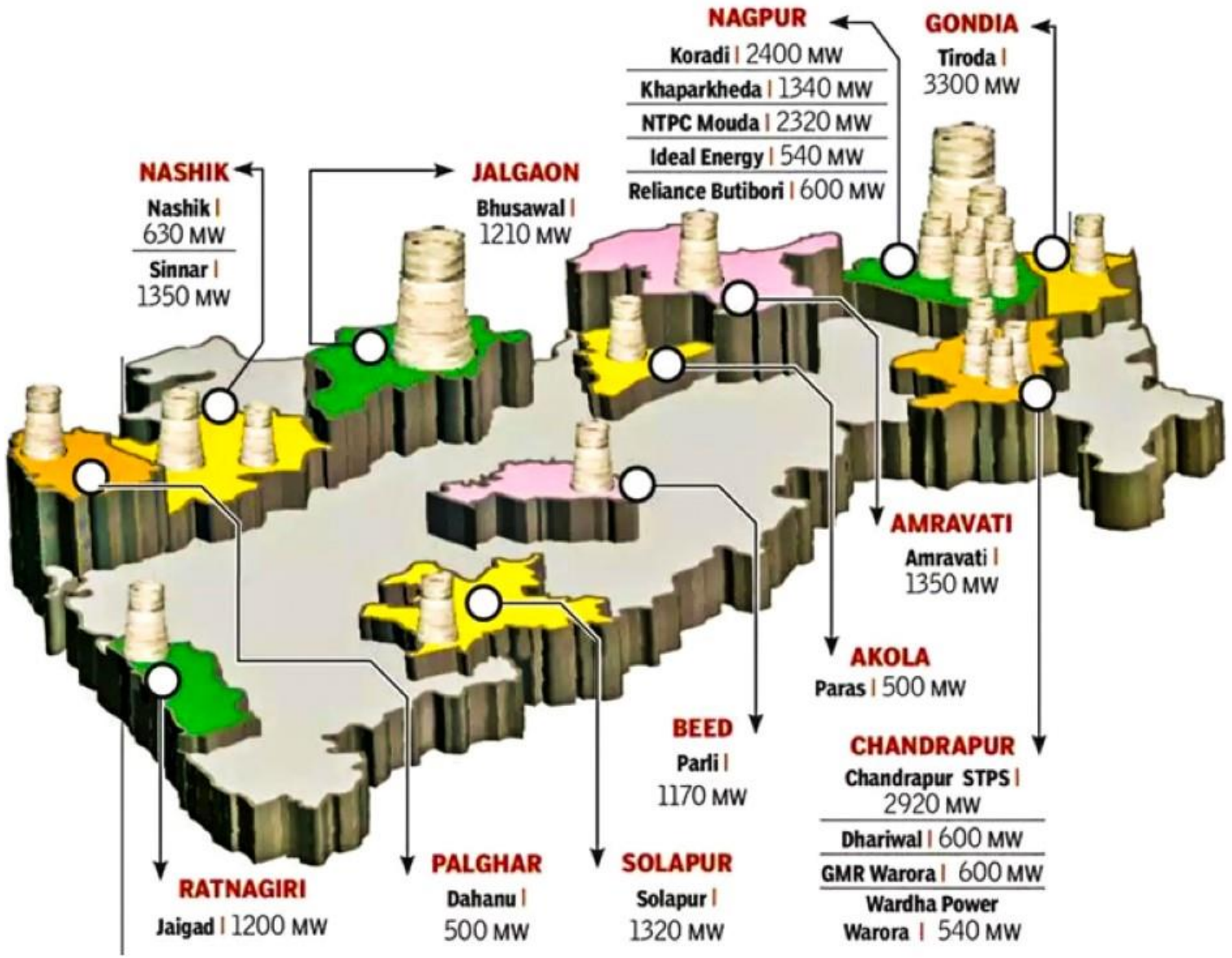
Mandated areas of reuses specified under the policy

The state adopted a reuse policy which prioritizes the different usage types which can be carried using treated waste water generated from the STPs. It has mandated all TPPs and MIDCs falling within50 KM radius of any STP to use treated wastewater instead of freshwater. However,

- The policy is more inclined towards **a one-size-fits-all approach** as it doesn't takes into account the water scarcity index for its different districts. There are both water plus and deficit districts which require a different approach altogether.
- The policy **encourages centralized collection** and treatment system which is in cases of most districts is **cumbersome to achieve** .
- Reuse of treated wastewater will require conveyance from the STP to the end users. The document **lacks the details of mode/method of conveyance** & its associated funding/ institutional mechanism of the same.
- The policy doesn't specify the apex authority which shall have the **selling rights or details of profit share** if it is a PPP venture from the revenue generated.
- Most of the contract **lack a plan for reuse of treated wastewater** from the treatment facility center if it doesn't fall within the 50 KM radius of an MIDC or TPP, even in districts that are drought prone.

Source:

WASTEWATER REUSE IN THERMAL POWER PLANTS



- 23 Thermal power stations
- 4500 litres of water per MW per hour of is the approximate demand of these plants
- Water requirement is taken from **nearby dams, draining the water that could be lifesaving as drinking water** and fulfil agricultural needs of the parched villages in the regions.

THERMAL PP	OUTPUT(MW)	DAILY WATER DEMAND(MLD)
AMRAVATI	1350	112.5
BHUSAWAL	1210	116.6
BUTIBORI	600	50
CHANDRAPUR	2920	243
DAHANU	500	41.7
DHARIWAL	600	50
GMR WARORA	600	50
IDEAL ENERGY	540	45
JAIGAD	1200	100
KAPARKHEDA	1340	111.7
KORADI	2400	200
MAUDA	2320	193.3
NASHIK	630	51.7
PARAS	500	41.1
PARLI	1170	92.8
SINNAR	1350	112
SOLAPUR	1320	110
TIRODA	3300	191
WARDHA WARORA	540	45

Source: INSTALLED CAPACITY OF MAHAGENCO:(As on 31-10-2017)

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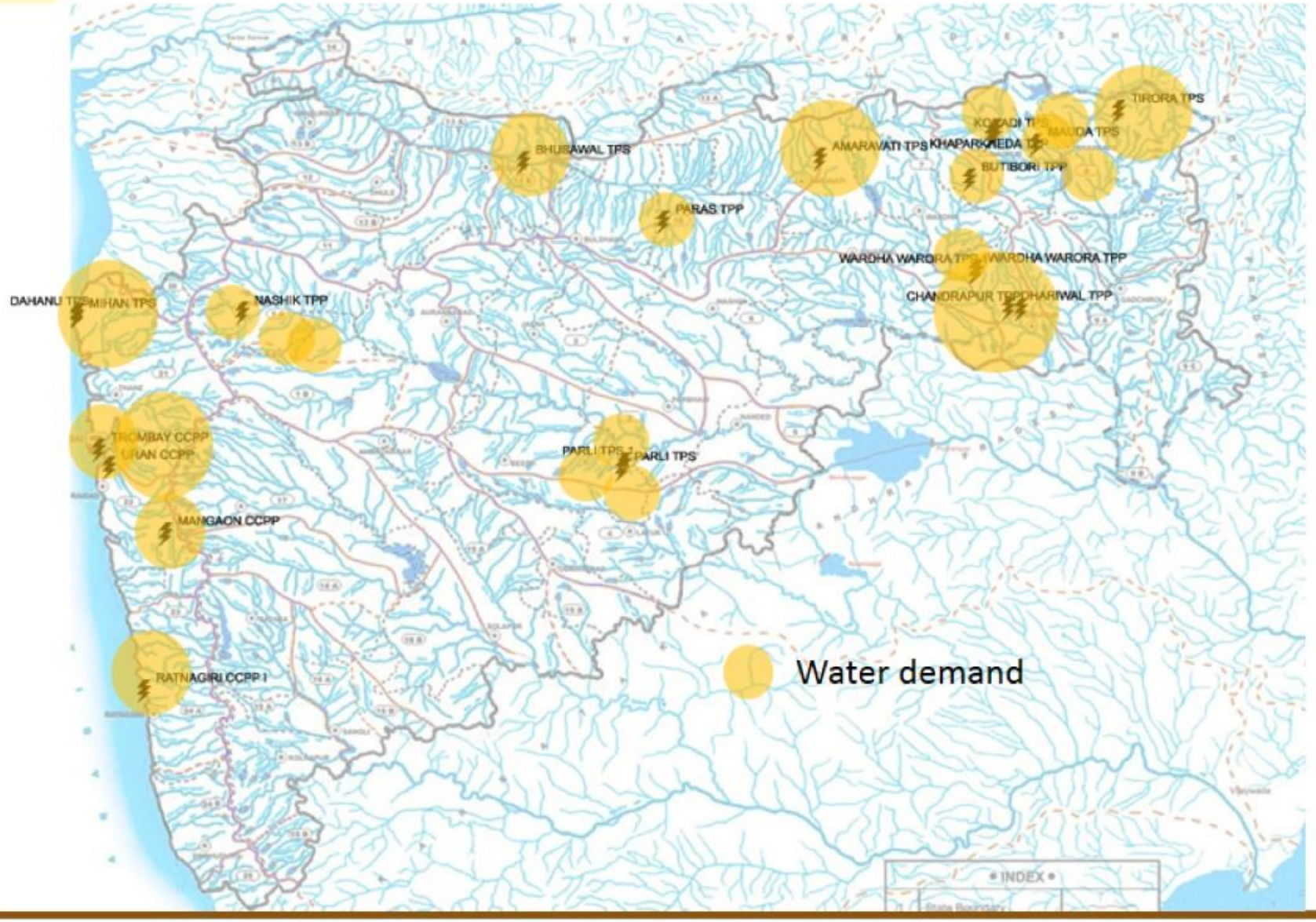
WASTEWATER REUSE IN THERMAL POWER PLANTS



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Source: INSTALLED CAPACITY OF MAHAGENCO:(As on 31-10-2017)

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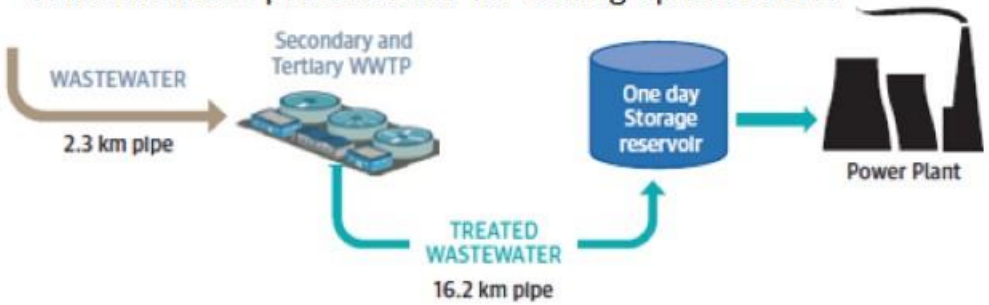
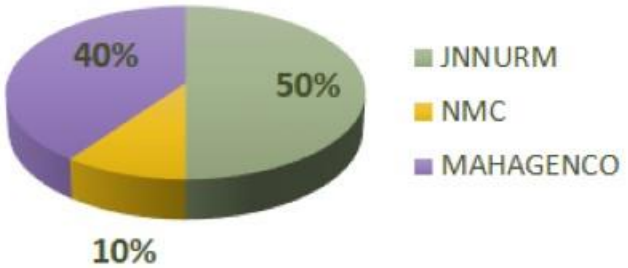
CURRENT REUSE PRACTICES IN THE STATE : POWER PLANTS

- A 30 yr. BOT contract between MAHAGENCO & NMC, Project cost:193 CR
- MAHAGENCO to pay 15 CR/ year for 110 MLD of raw sewage to NMC
- NMC shall also provide land for setting up the WWTP



Project scheme



Share of funds borne by organizations

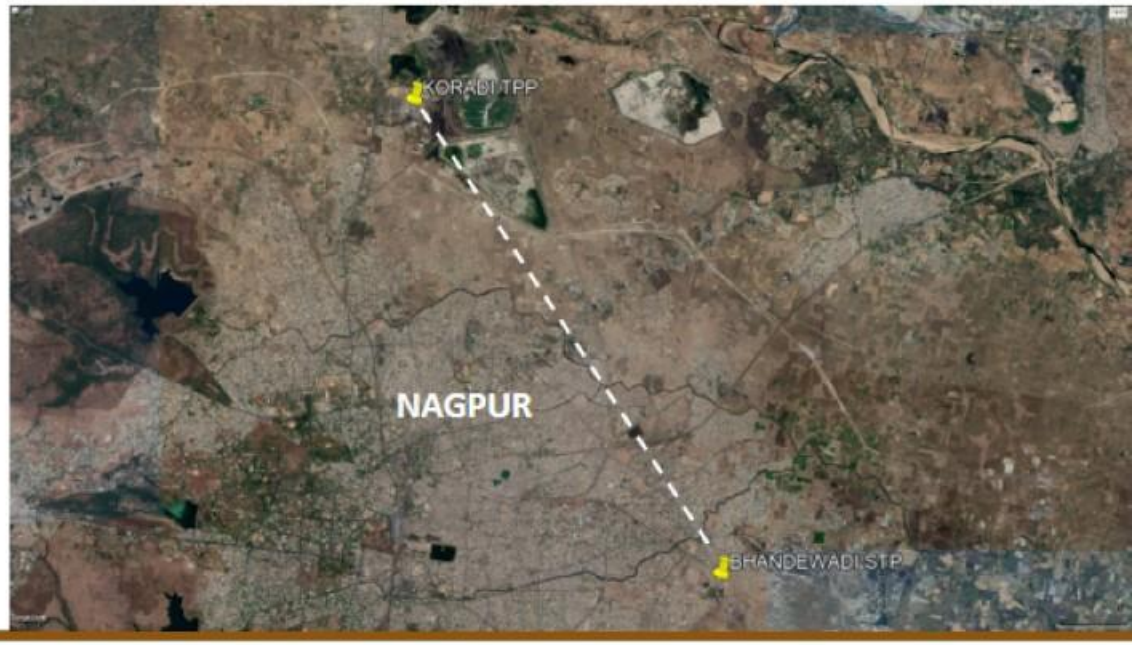
Benefits of the Wastewater Treatment Project

Economic

- For the power plant. Treated wastewater is less expensive, of more consistent quality and quantity, and more sustainable than freshwater. **The power plant pays INR 3.4 instead of INR 9.6 per cubic meter of water.** Using wastewater also results in increased resilience to droughts, reducing supply risks
- For NMC. The revenue stream from treated wastewater fees can cover the O&M costs of other wastewater treatment plants.

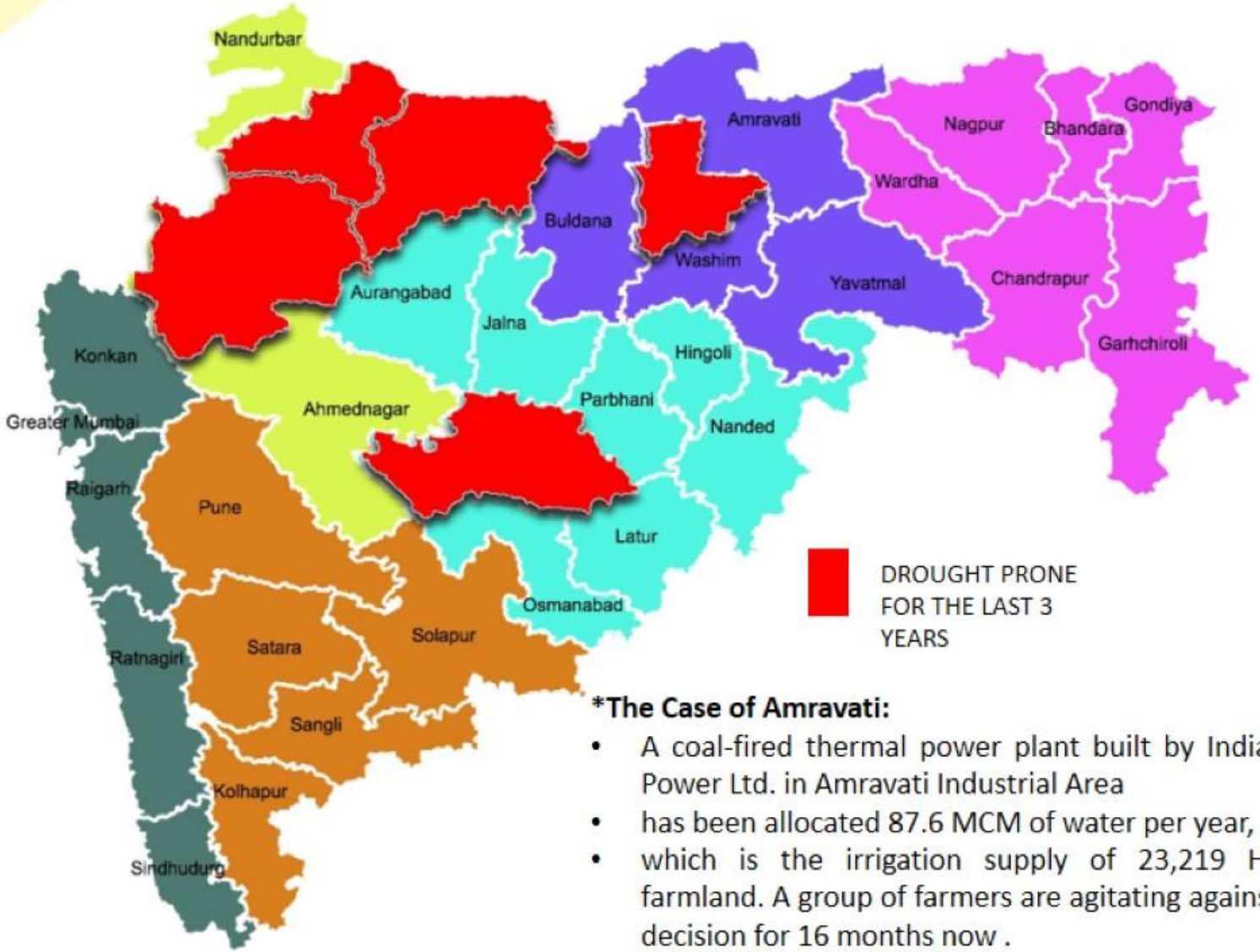
Environmental and social

- The project reduces net freshwater extractions by the power sector, freeing up freshwater resources for other uses ie. around 47 Mm3 per annum
- Increased urban wastewater treatment capacity results in cleaner and healthier water bodies, with the associated environmental and social benefits
- The project serves as model for other cities and states to follow.



Source: Wastewater: From Waste to Resource, Case of Nagpur,World bank report, 2018

CHALLENGES OF REUSE IN THERMAL POWER PLANTS



***The Case of Amravati:**

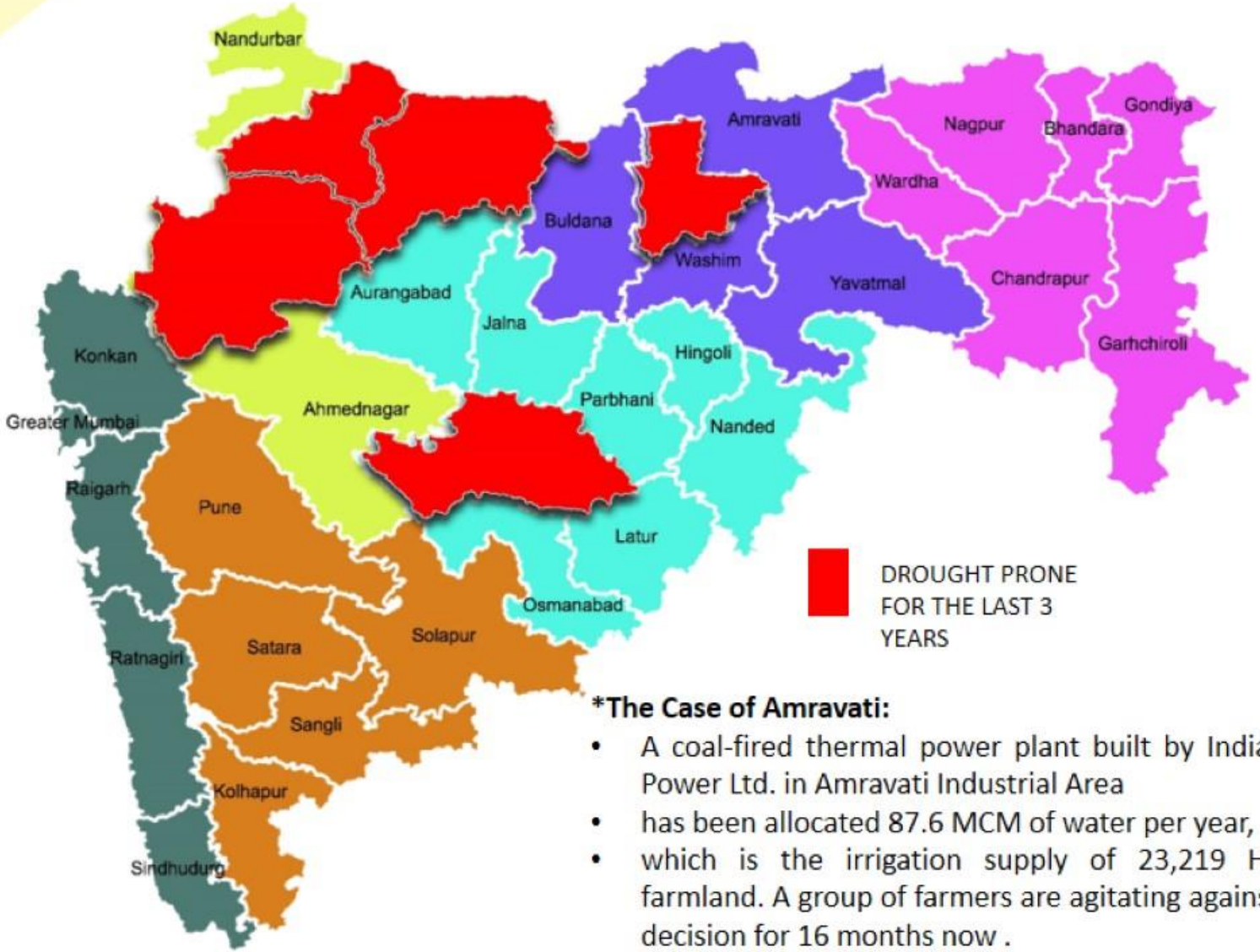
- A coal-fired thermal power plant built by Indiabulls Power Ltd. in Amravati Industrial Area
- has been allocated 87.6 MCM of water per year,
- which is the irrigation supply of 23,219 Ha of farmland. A group of farmers are agitating against the decision for 16 months now .

Thermal power plants that are presently operating in the drought hit regions of the state

Thermal power plant	Location (district)	Capacity MW	Water source
Bhusawal thermal power station, operated by Mahagenco	Jalgaon	1420 (unit 2, 3, 4 and 5)	Hatnur dam on Tapi river.
Paras thermal power station, operated by Mahagenco	Akola	500 (unit 3 &4)	Two barrages- Lower Mun barrage and upper Mun barrage near Balapur.
Parli thermal power station, operated by Mahagenco	Beed	1130 (unit 3 4 5 6 and 7)	Khadaka barrage on Godavari river, Parli taluk, Beed district.
Nasik thermal power station, operated by Mahagenco	Nasik	630 (unit 3 4 and 5)	Sewage treated from Nasik Municpal corporation via the Gangapur dam.
Total		3680 MW	

Source: Energy-Water nexus, A study on Water and Coal Power Linkages in India,Heinrich bolt Stiftung , India, 2018,*Coal Power Plants and water use in Maharashtra, Greenpeace, 2013

CHALLENGES OF REUSE IN THERMAL POWER PLANTS



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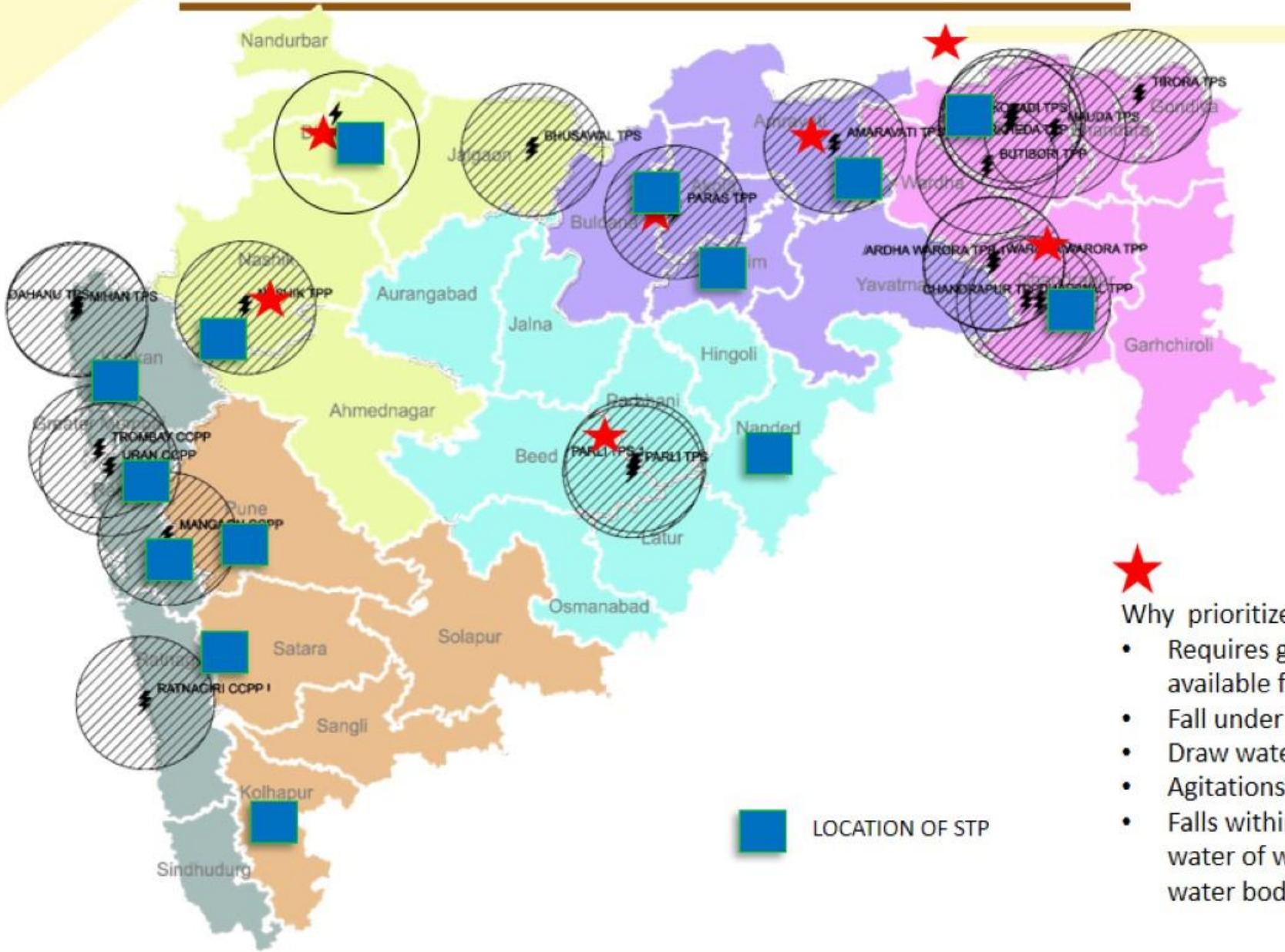
Thermal power plants that are proposed in this region

Nasik Thermal Power Project, Operated by India bulls.	Nashik	2700 MW
NTPC Solapur	Solapur	1320 MW
Bhusawal thermal power station, operated by Mahagenco	Jalgaon	660 (unit 6)
Paras thermal power station, operated by Mahagenco	Akola	250 (unit 5)
Parli thermal power station, operated by Mahagenco	Beed	250 (unit 8) – on going
Nasik thermal power station, operated by Mahagenco	Nasik	660 (unit 6)
Nardana power station (Operated by Shirpur Power Limited)	Dhule	300 Mw
Total		9440 MW

Source: Energy-Water nexus, A study on Water and Coal Power Linkages in India,Heinrich bolt Stiftung , India, 2018,*Coal Power Plants and water use in Maharashtra, Greenpeace, 2013

WASTEWATER REUSE POTENTIAL IN THERMAL POWER PLANTS



- The state reuse policy mandates use of treated wastewater from the STPs falling within the 50 km radius of these thermal plants.
- Marathwada and Vidarbha regions are the most vulnerable to water scarcity hence the reuse of wastewater should be considered as priority in the thermal plants of these regions

Why prioritize reuse in these locations?

- Requires grade II quality water for its cooling towers readily available from the STP
- Fall under drought hit zones
- Draw water from the nearby surface waters
- Agitations going on for water allocations
- Falls within 50 km radius of an existing /functional STP, the treated water of which is currently disposed of to the nearest surface water body

Source:

CURRENT WASTEWATER REUSE PRACTICES IN MIDCs

Extent of wastewater use for industry in Maharashtra

Currently industries in the state is practicing wastewater reuse which is more of **an in-house format**: wastewater generated is treated by the industry is treated by the plants which is located well either their premise and has been commissioned by themselves. Reuse of Municipal wastewater in such industries is still an **unexplored venture by most ULB and industry owners.**

Some of the cases of in house treatment and reuse are :

1. Volkswagen, Pune , MBBR

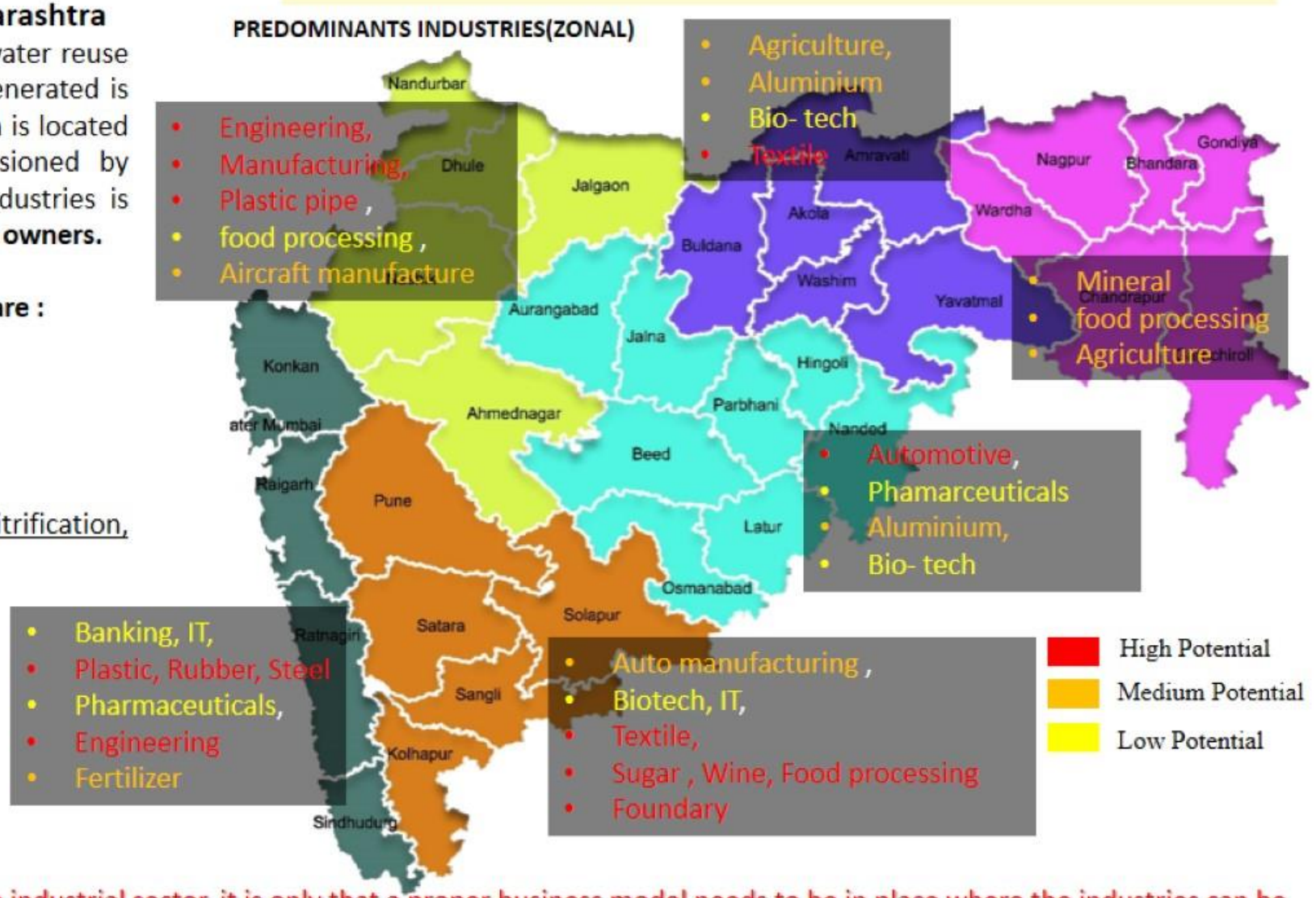
Treated water output=830 cum/day
Output BOD <5 mg /L
Output COD<30 mg/L
Output TSS<5 mg/L

2. HPCL Refinery , Bombay, Nitrification/De-Nitrification, MBBR Treated water output=7.6 MLD

Output BOD <5 mg /L
Output COD<20 mg/L
Output TSS<7 mg/L

3. Dahej Petrochemical Plant,MBBR

Treated water output=45 MLD(4 modules)
Output BOD <5 mg /L
Output COD<30-40 mg/L
Output TSS<10 mg/L



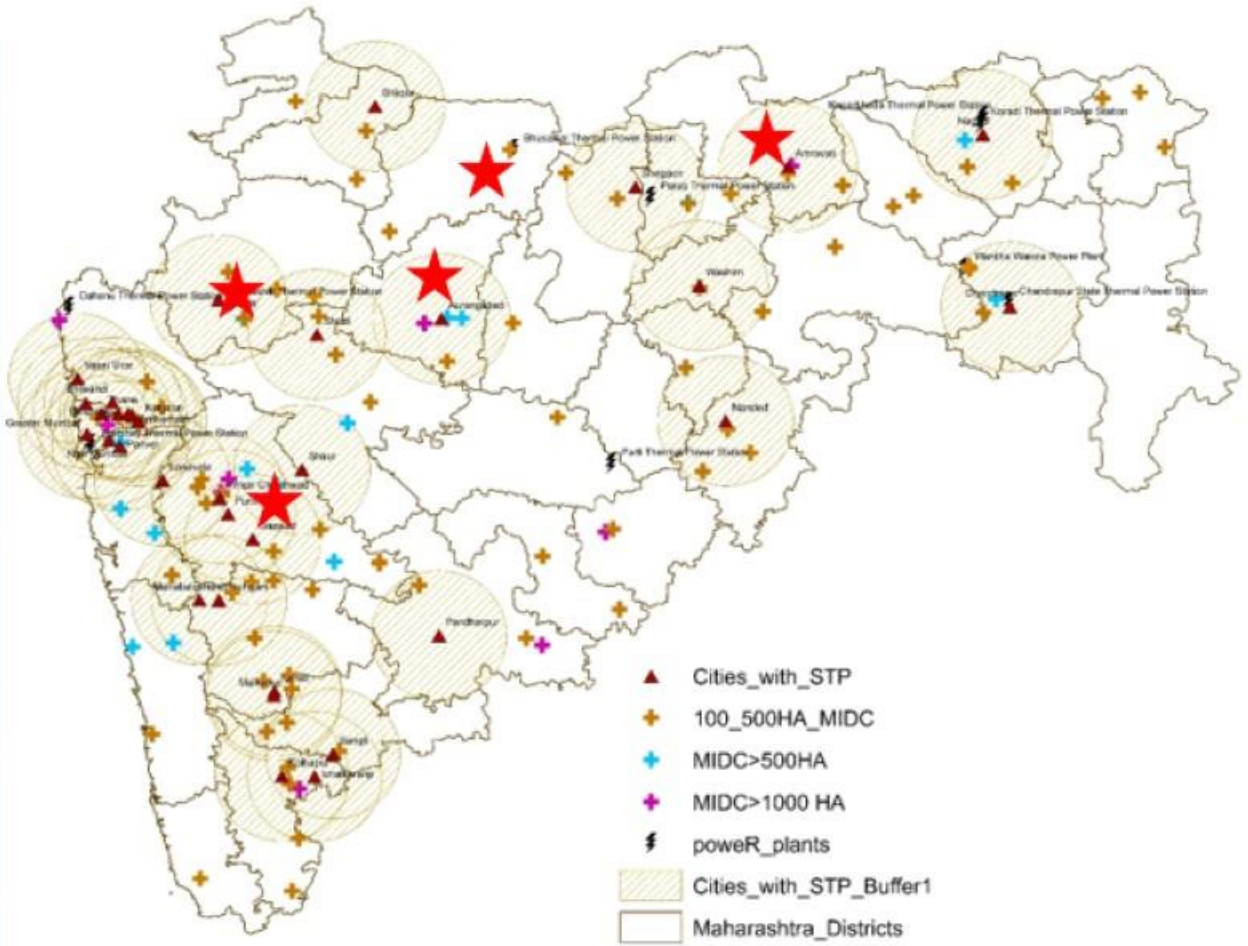
Clearly, wastewater reuse has immense potential in the industrial sector, it is only that a proper business model needs to be in place where the industries can be the direct beneficiaries and the ULB can make considerable revenue out of it

Source: MIDC India portal.

WASTEWATER REUSE POTENTIAL IN MIDC

Estimated wastewater Quantity & quality requirement for different industry types.

INDUSTRY TYPE	SUB CATEGORY	DAILY WATER REQUIREMENT	TREATMENT REQUIRED
PULP AND PAPER	MECHNICAL PIPING	58000 GALLON /TON	Oxidation , coagulation , filtration, Disinfection (grade III,ASP/SBR)
	CHEMICAL UNBLEACHED	75000 GALLON/TON	
	MILLS, PAPER AND PACKAGING, PRINTED PRODUCTS	34000 GALLON/TON	
	BLEACHED	92000 GALLON/TON	
CHEMICAL	REFRIGERANT GAS	58.5 CUM/ UNIT	Oxidation , Disinfection (grade II, ASP)
	RAW VINYL	15.13 CUM/UNIT	
	CAUSTIC	2.4 CUM/UNIT	
	CHLORINE	2.4 CUM/UNIT	
	CHLOROMETHANE	3.6 CUM/UNIT	
MINING & METAL	Foundries, Metal Product, Machine and Tool , Electroplating, Aircraft manufacture, Aluminium	28.6 CUM/TON(STEEL)	Oxidation , coagulation , filtration, Disinfection (grade IIIASP/SBR)
NON METAL	Leather , Plastic, Rubber		Oxidation , Disinfection (grade III,ASP/SBR)
TEXTILES	SIZING AND SUSPENSION	4000 LITRE PER 1 TONNE /DAY	Oxidation , coagulation , filtration, Disinfection (grade III)
	SCOURING, BLEACH AND DYE		
*CEMENT		3548 KL/DAY	Oxidation , coagulation , filtration, Disinfection (grade III,ASP/SBR)
*AGRO BASED	FERTILIZERS	12,829 gallons/ ton of phosphate and potash.	Oxidation , Disinfection (grade III, ASP/SBR)



Hence wastewater from STPs of Jalgaon, Kolhapur,Nashik , Pimpri Chinchwad ,Washim and Aurangabad are best suited examples for reuse for industrial purposes in Maharashtra

Source: JOURNAL OF IND. POLLUTION CONTROL,IMPACT OF CEMENT INDUSTRY ON THE GROUND WATER QUALITY - Siddiqui, R.N. Shukla and Akbar Ziauddin** FAO Guidelines

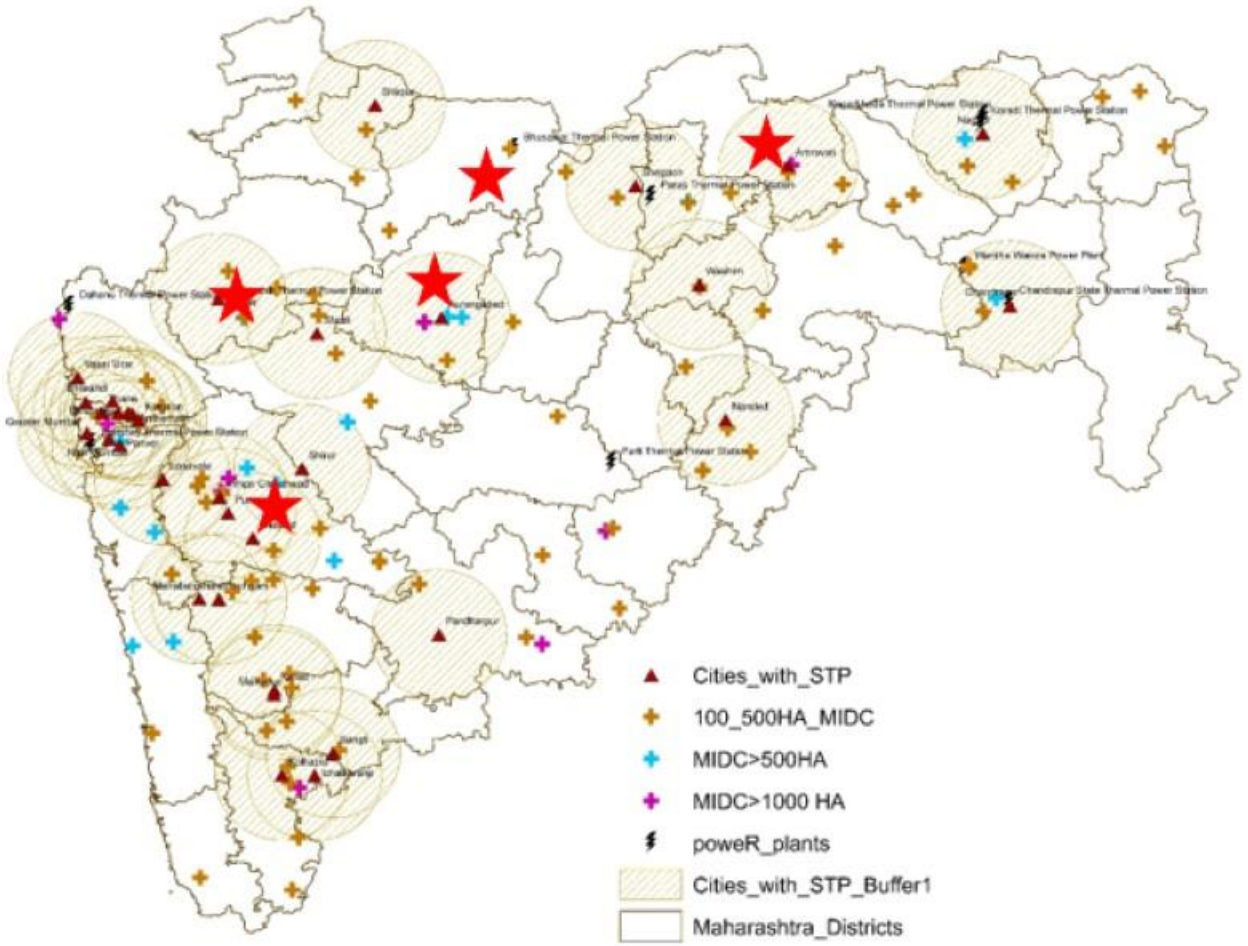
WASTEWATER REUSE POTENTIAL IN MIDC

- Given the kind of industries, surface and GW development in this region the districts which should prioritize the use of wastewater are as follows:
  - Amravati(plastics and textile)
  - Akola (automotives)
  - Aurangabad(textile)
  - Jalgao(food processing)
  - Dhule(agro based)
  - Nashik(aircraft manufacture)

Water depleted district
+
Water intensive MIDC
+
Grade III requirement of water quality(ASP/SBR) which is the output quality of the STPs
+
STP falls in the buffer zone of MIDC
+
Scale of MIDC

- However, as per the reuse policy
  - Amravati(plastics and textile)
  - Akola (automotives)
  - Aurangabad(textile)
  - Jalgao(food processing)
  - Dhule(agro based)
  - Nashik(aircraft manufacture)
  - Washim(Aluminium production)
  - Pimpri Chinchwad(Textile & Foundry)

These cities have TPPs within 50 km of their STP radius which is given an upper hand in usage for waste water



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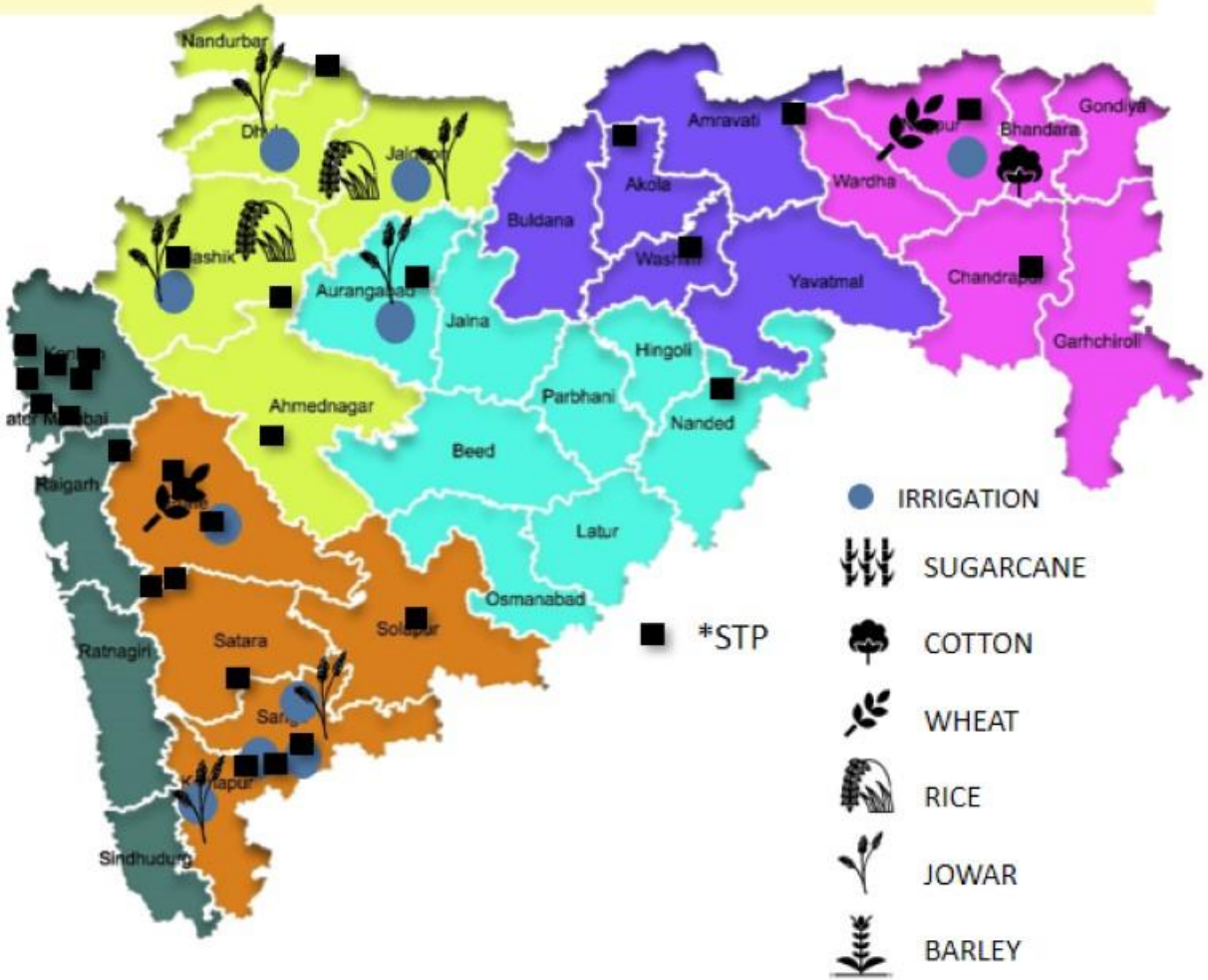
CURRENT REUSE PRACTICES IN THE STATE AND CHALLENGES : AGRICULTURE

- Percent of net sown area with wastewater is as **high as 92 %** in some parts of Maharashtra(Marathwada region)
- Kolhapur, Miraj Sangli , ichalkaranji, jalgaon, nashik,Nagpur, Dhule, Pune, and Aurangabad are the districts practicing wastewater irrigation
- wastewater is used to irrigate vegetables, especially green leafy vegetables.
- In Sangli, Miraj, Ichalkaranji, Aurangabad, Kolhapur, Nashik and Dhule, **fodder crops and sugarcane** were cultivated using wastewater.
- **Fruit, bulb** and vegetable seeds like tomato,onion and chillies are wastewater irrigated only in Pune.
- Farmers using wastewater are either **not aware of the health risks** associated with wastewater use or did not perceive them to be significant.
- Practices of indirect usage of treated wastewater is observed in the sumer months in two of these formats:a) either using one part of wastewater with three parts of freshwater or b) irrigate their fields alternately with freshwater and wastewater



Maharashtra has since long been practicing Irrigation using wastewater , but little is known about the quantum of water getting used and how are the farmers channeling in the wastewater to their farms

Source: Water Policy Research HIGHLIGHT, Wastewater irrigation in Maharashtra,IWMI –TATA water policy program,2017

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CURRENT REUSE PRACTICES IN THE STATE AND CHALLENGES : AGRICULTURE

Extent of wastewater use for irrigation Maharashtra

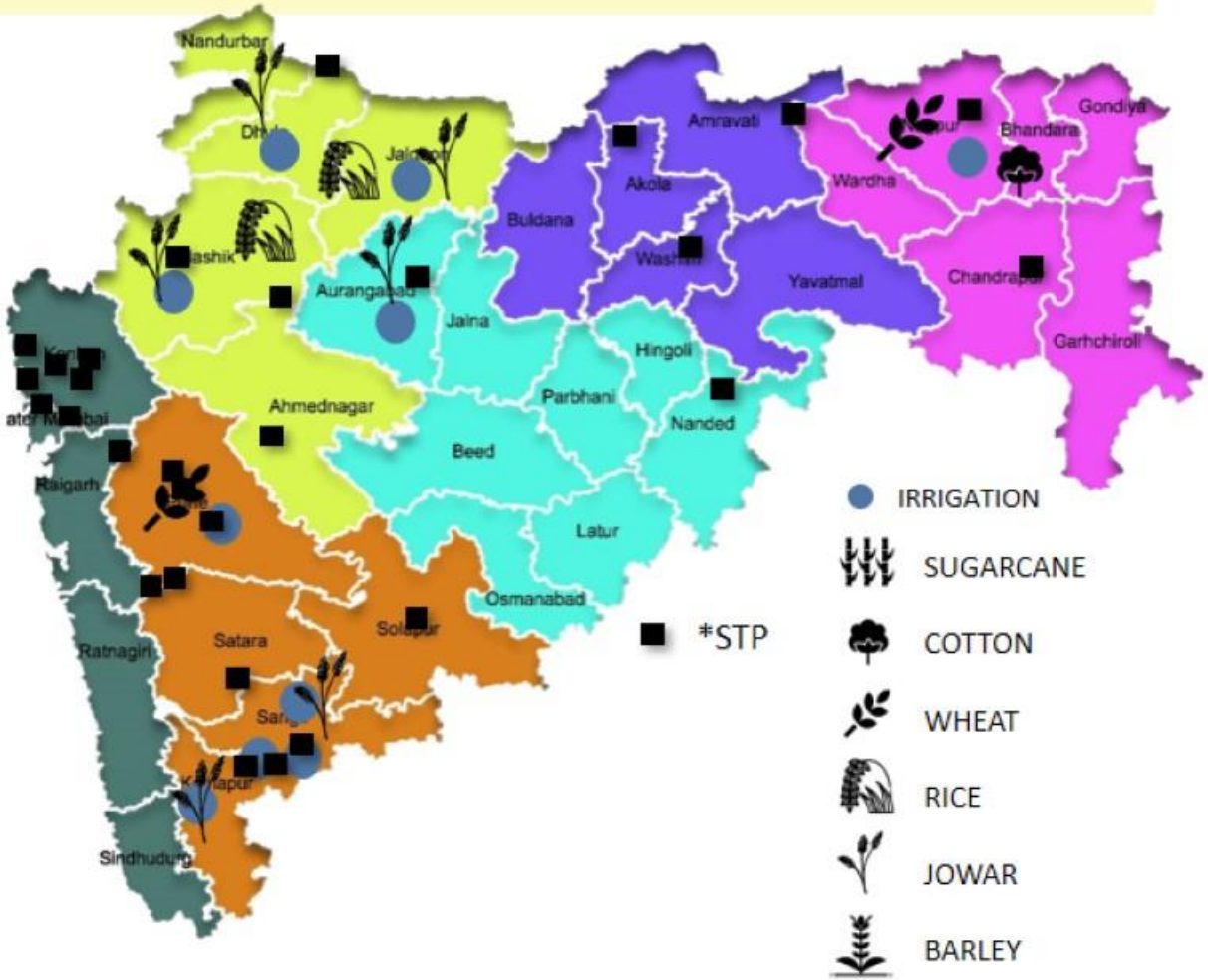
Location	No. of Villages	Sample size	Net Irrigated Area (ha)	Net WW Irrigated Area (ha)	% Net WW Irrigated Area	Gross WW Irrigated Area (ha)	Cash Profit per ha (₹/ha.)
Kolhapur	Urban Area	8	1,172	77	7	113	₹ 2,07,792
Miraj	2	10	1,405	120	9	190	₹ 1,17,500
Sangli	3	12	1,115	130	12	220	₹ 1,21,308
Ichalkarangi	4	15	2,851	375	13	510	₹ 1,96,667
Jalgaon	2	6	5,435	1,232	23	N.A.	₹ 43,019
Nashik	8	18	2,113	925	44	1,560	₹ 45,405
Purandar LIS	4	12	49,941	25,498	51	N.A.	₹ 41,768
Nagpur	29	17	5,375	3,186	59	9,557	₹ 6,84,650
Dhule	4	12	476	350	74	868	₹ 77,143
Pune	9	2	7,223	5,579	77	N.A.	₹ 94,820
Aurangabad	15	9	1,128	1,036	92	2,072	₹ 5,82,046
TOTAL	**76+**	**121**	**76,044**	**38,507**	**51**		**₹ 1,19,970**

The biggest challenge in wastewater reuse in agriculture arise due to

- its potential health impacts.
- Ready availability of freshwater in most places
- Lack of awareness amongst the farmers related to nutrient content of the latter

These can be mitigated if

- enough attention is paid to basic, cost-effective wastewater treatment
- education of farmers and adoption of simple safety measures at the farm.
- key economic actors – municipal authorities and farmers – work together to fulfil each other's needs(eg . Conveyance etc)



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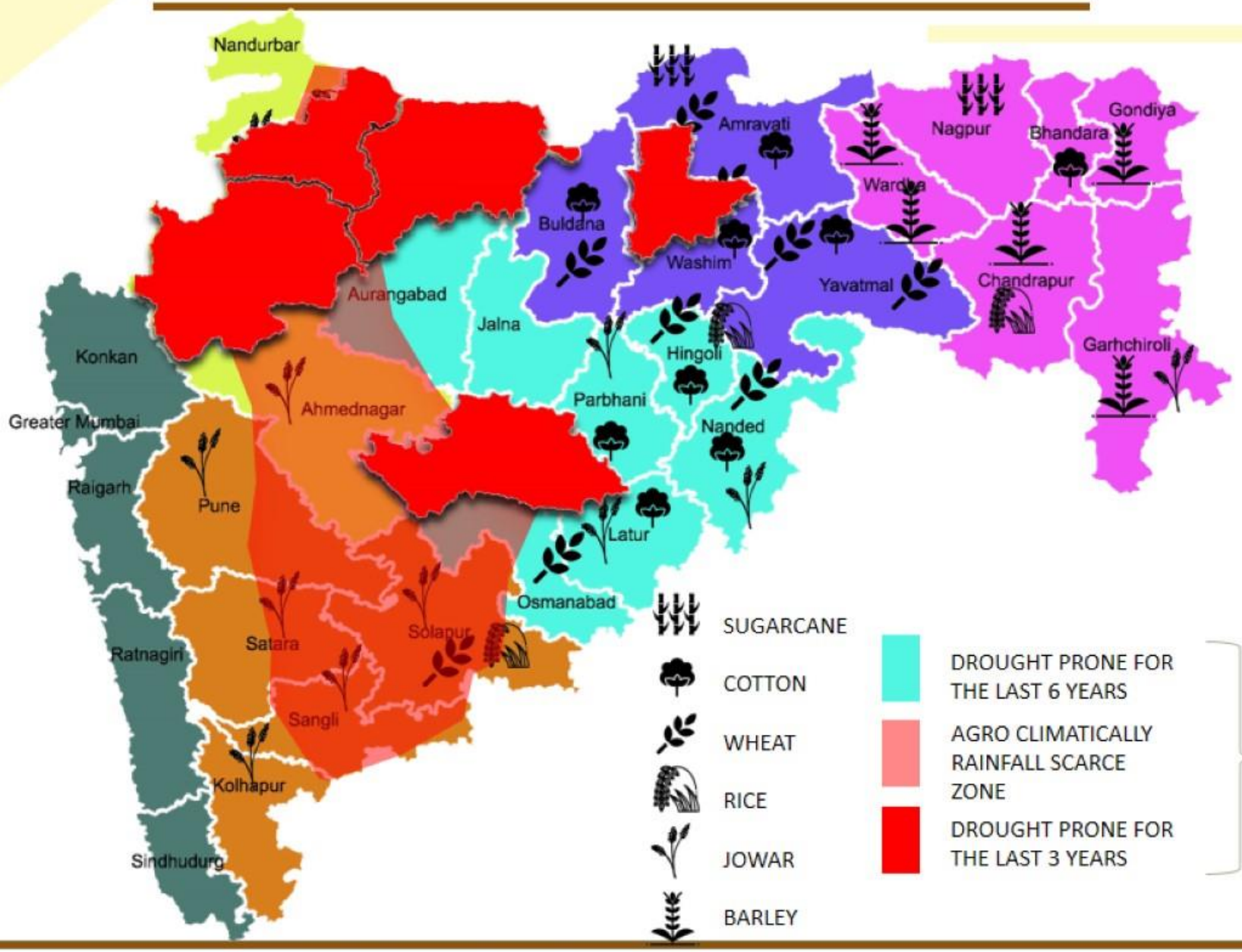
STATE AGRICULTURAL MAP

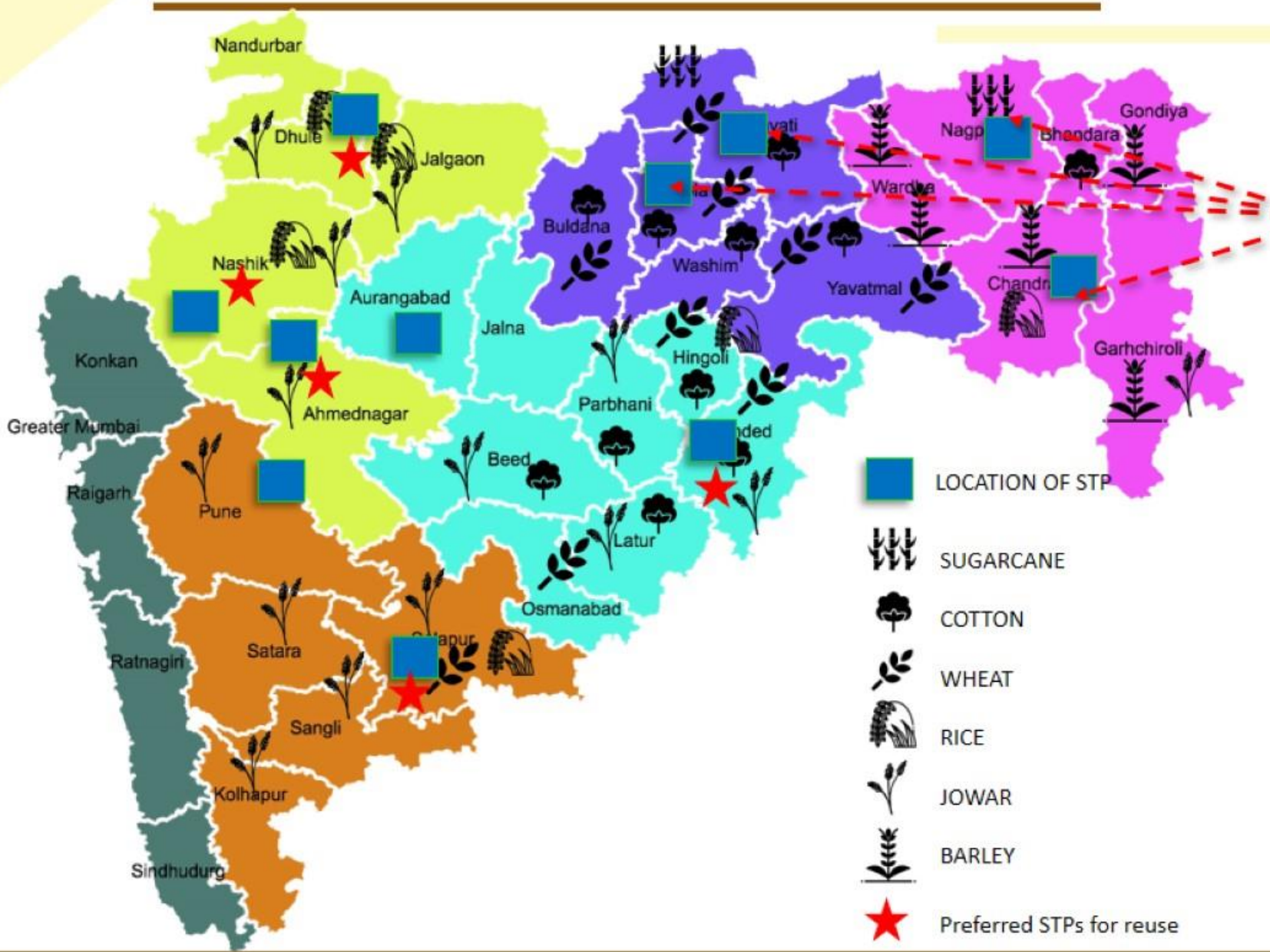


CROP TYPE	WATER REQUIREMENT
COTTON	7000-29000 L/KG
RICE	3000-5000 L/KG
SUGARCANE	1500-3000 L/KG
WHEAT	900 L/KG
JOWAR	600 L/KG
BARLEY	450-650 L/KG

Cotton , Wheat , Rice and Jowar being the most water intensive crops are being grown in the driest regions of the state.

Source: Living Waters and thirsty crops , Report on Water demand of crops, WWF, 2016

WASTEWATER REUSE POTENTIAL IN AGRICULTURE



Although water intensive crops are grown in these districts but wastewater from these STPS should be first preferred for Industrial and TPP usage as per the policy

- Dhule
- Nashik
- Ahmednagar
- Pune
- Solapur
- Nanded
- Aurangabad

Probable districts where wastewater reuse can be explored for irrigational purposes

★

- Dhule
- Nashik
- Ahmednagar
- ~~Pune~~
- Solapur
- Nanded
- ~~Aurangabad~~

- Pune & Aurangabad have MIDCs >1000 HA , hence should be considered for Industrial reuse first
- **Cities most preferable for reuse in agriculture**

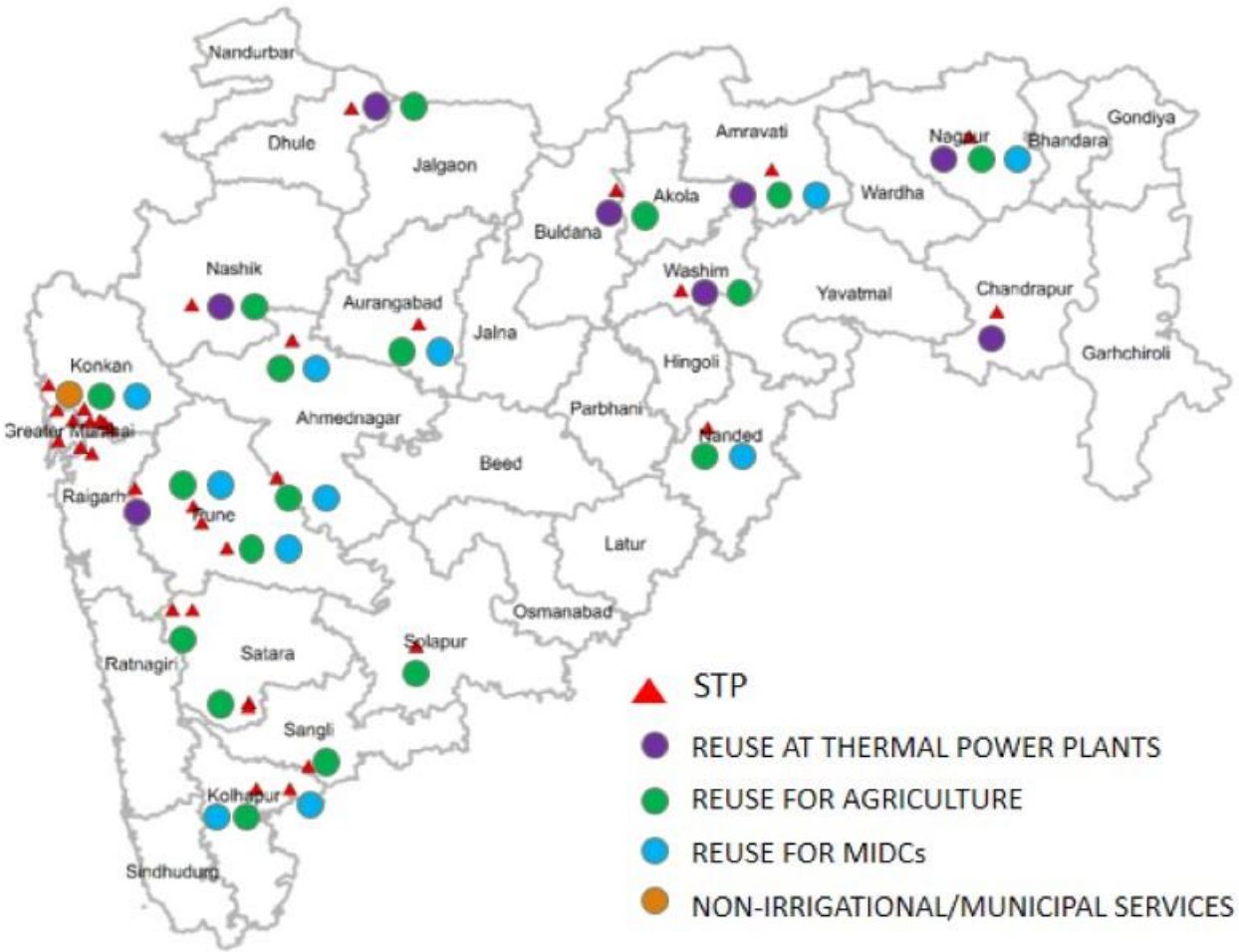
Source:

CONCLUSION: FEASIBILTY ANALYSIS FOR WASTEWATER REUSE POTENTIAL ACROSS STATE

- The assessment brings us to conclusion that most **districts can reuse its water for more than one purposes** if planning is done carefully
- Cities with more than one STP can assign **different STP for different usage types**
- **Districts of Nagpur , Nashik, Pimpri – Chinchwad, Kalyan Dombilvili & Kolhapur** generate an approximated average of 100-150 MLD treated sewage , sufficient enough to meet mutilple needs
- Out of them **Nashik ,Nagpur, Kolhapur, Nanded, Dhule and Akola fall under the water scarce zones** of Maharashtra, hence there is a urgent need of carefully devised wastewater reuse and management plan for these districts

Based on the state level assessment **Dhule, Nagpur, Nashik, Aurangabad, Kolhapur & Pimpri Chinchwad** were considered for further developing a reuse plan due to the following reasons:

- Quantum of treated water generated,
- kind of water surplus/ deficit zone of the state
- Kind of agriculture practiced currently
- Number of MIDCs and cooperative industries in and around the STPs of these cities.
- Percentage of wastewater treated
- Current level of reuse and the level of public acceptance in regards of the same

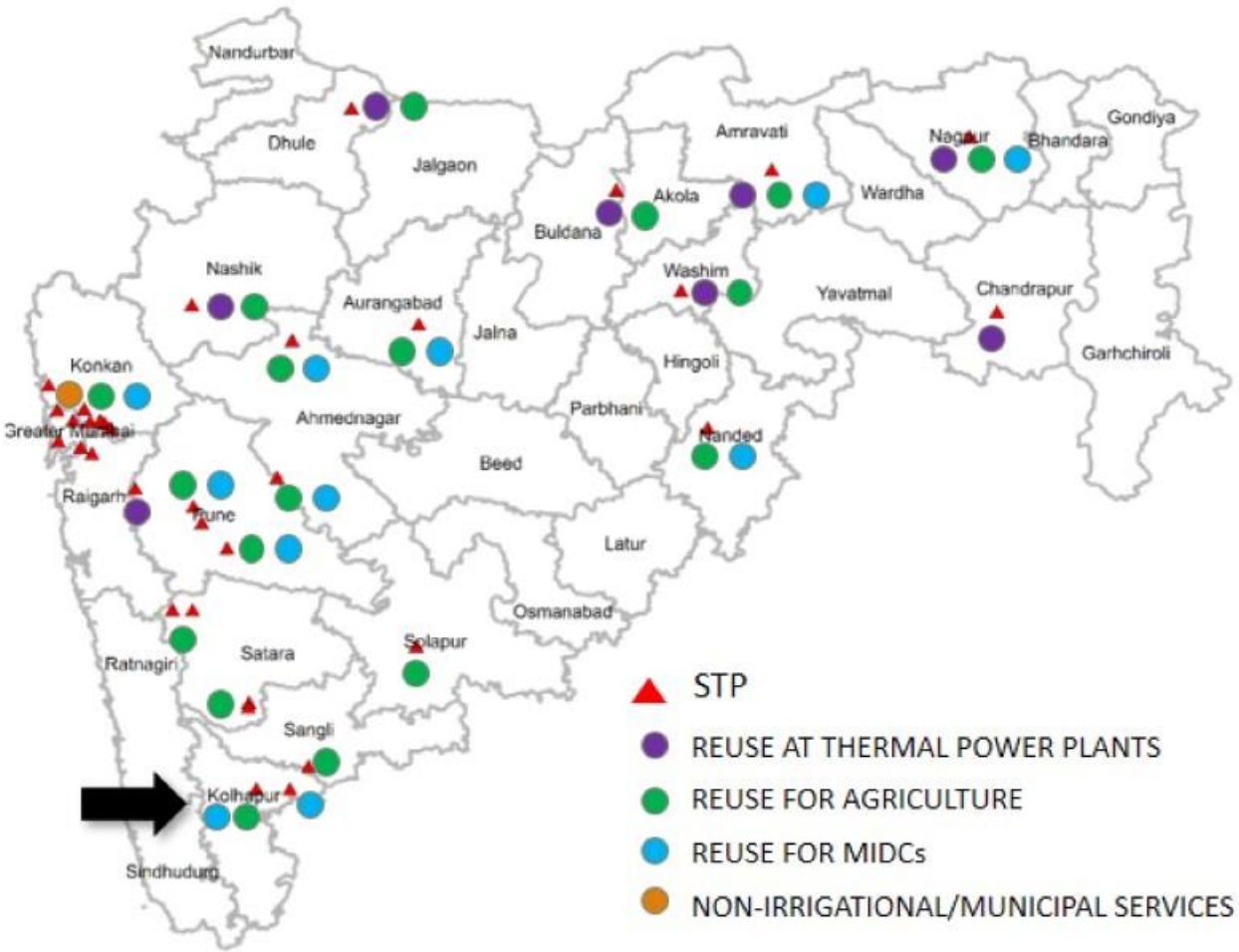


Source:

CONCLUSION: FEASIBILTY ANALYSIS FOR WASTEWATER REUSE POTENTIAL ACROSS STATE

Out of the above mentioned districts , **Kolhapur was found to be the best case for developing a detailed wastewater management** plan due to the following reasons:

- City **treats as high as 91 % of its total sewage generated**, to grade III water
- Found to have **3 MIDCs** of various sizes which had water intensive industries
- The city although a water plus district ,**falls under the high priority zone for artificial discharge** given the fact the sub soil is made up of basalt which doesn't allow water to percolate .
- Kolhapur is said to be the sugar bowl of the country with 130 sugar mills and large tracts of **sugarcane farms production of which is very water intensive.**



Source:

SUMMARY

The State despite having some of the most efficient & robust STPs in the country **grossly lack a plan for reuse of the treated wastewater**

There is no official **documentation/records of treated sludge reuse** despite of it being of such huge value. Sludge reuse largely remains under-explored and exploited

These **STPs come at a huge capital cost** and hence they should be considered as a **potential source of revenue generation** .

With over 4000 plus industrial units wastewater reuse has immense potential in the state run MIDCs,especially those in the water scarce regions of the state. **Industrial reuse remains largely unexplored**

Persistant reluctance from the ULB end.as **most ULBs are struggling to bring in more sewered connections** , its collection , conveyance , treatment and disposal and further reuse seems a distant dream

There is an **absolute dearth of data** in terms of quantifying the exact amount of water getting reused in various regions of the state. (especially in case of agriculture and industries)

Reuse often **demands for additional plan for conveyance** (if it is to be supplied in a centralized format).Which is for most reuse types are **often cost intensive.**

Source:

PART TWO : ASSESSING THE CURRENT PRACTICES AN POTENTIALS OF WASTEWATER REUSE IN KOLHAPUR CITY

WHY SHOULD KOLHAPUR REUSE ITS WASTEWATER?

In 2010, The National River Conservation Plan (NRCP) guidelines published list of "Polluted River Stretches" which declared Panchganga river (BOD between 6-10 mg/l) as the fourth most polluted river of the state.

Parameter	Unit	Effluent Standard	Reported figure
Ph		5.5-9	6.5-8
BOD	mg/L	3 or less	80
DO	mg/L	5 or more	0.6
Faecal coliform index	MPN/100 ml	1000-10000	2500

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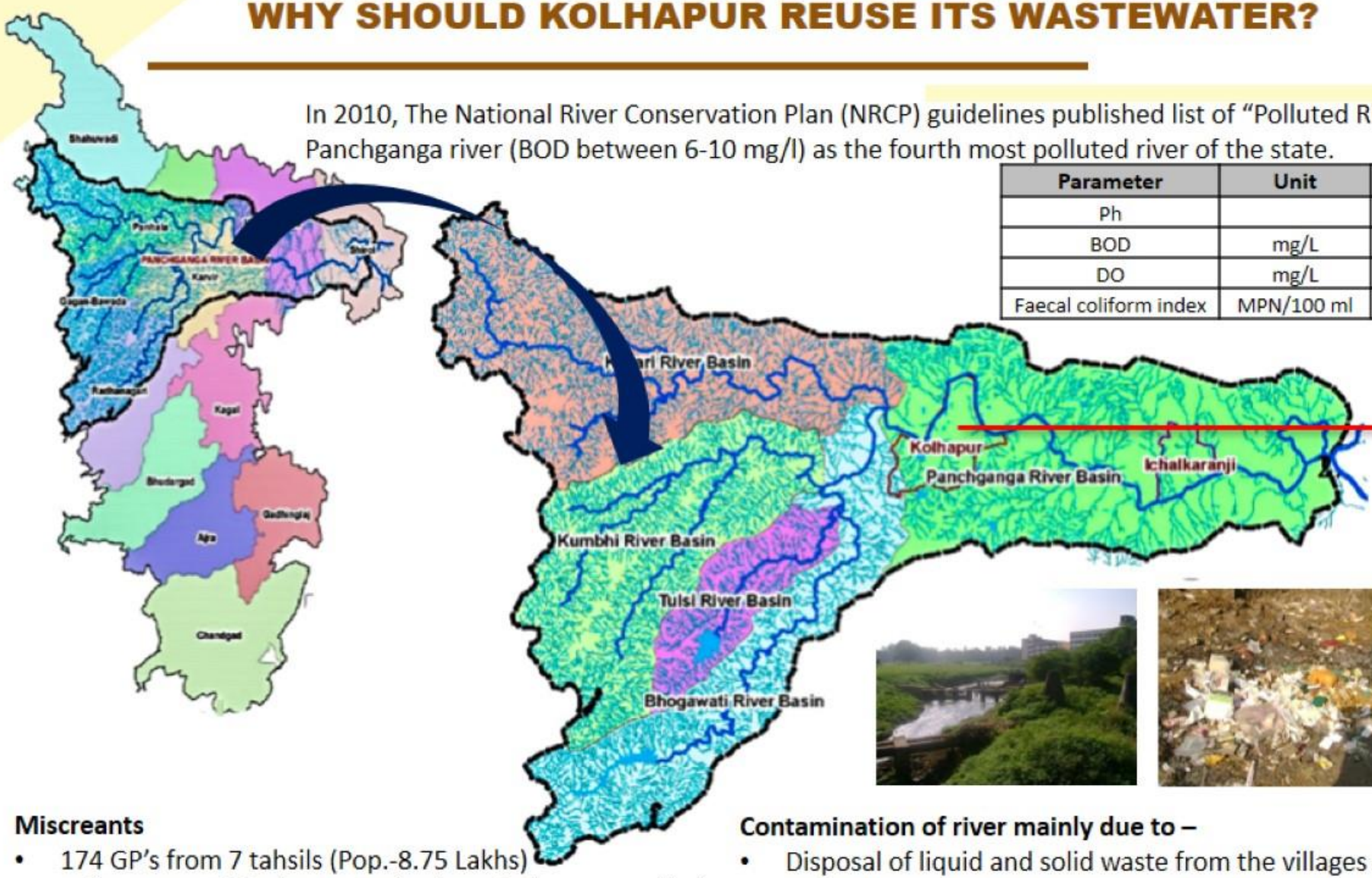
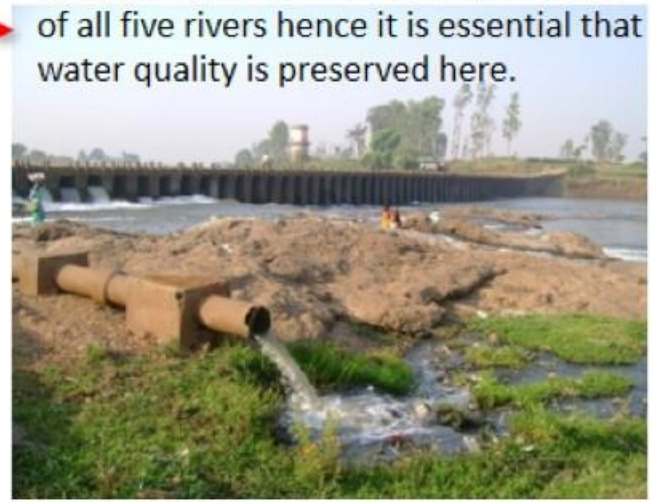


Kolhapur sits at the very merging point of all five rivers hence it is essential that water quality is preserved here.



Miscreants

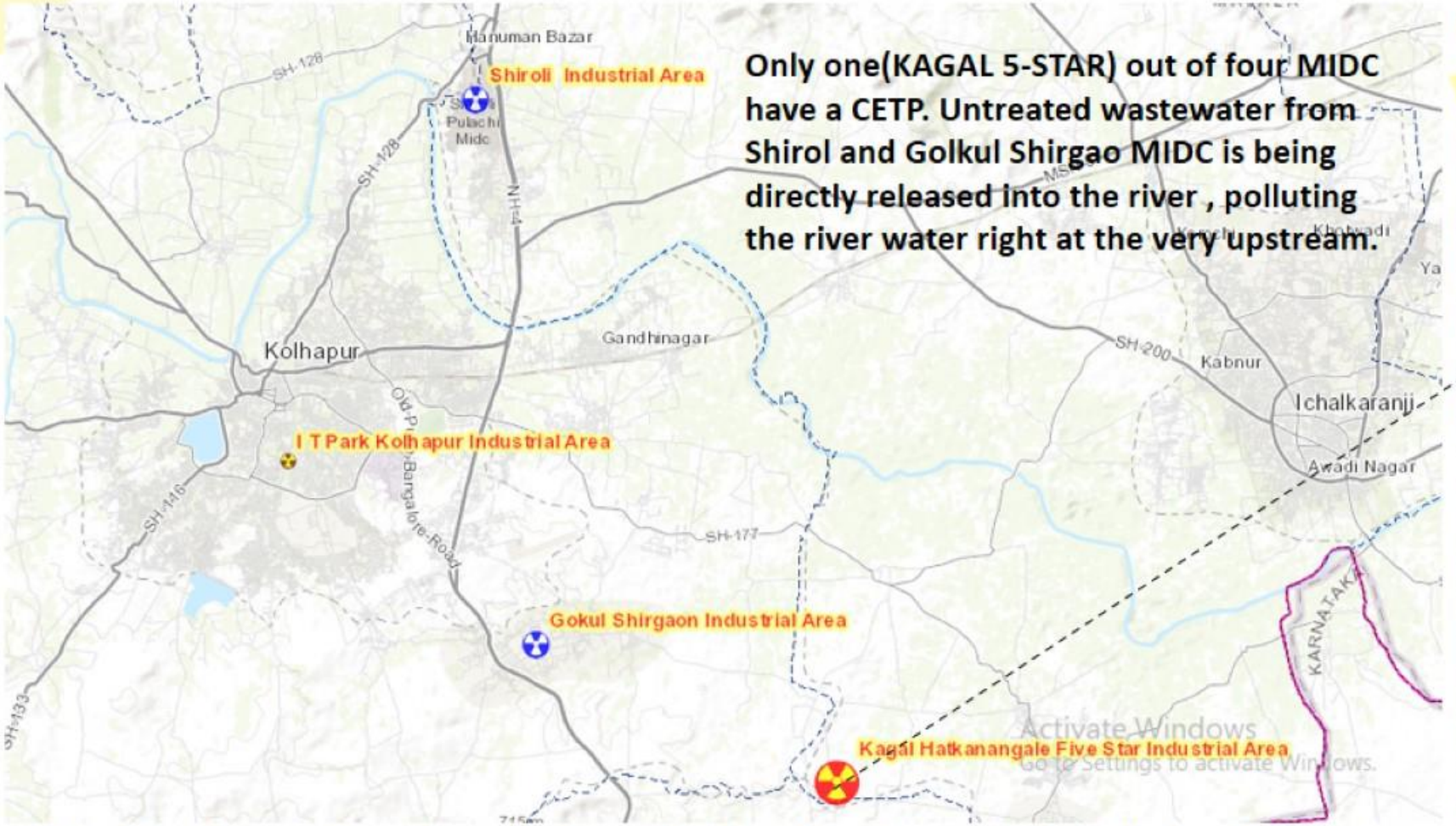
- 174 GP's from 7 tahsils (Pop.-8.75 Lakhs)
- Kolhapur Municipal Corporation(Population-5.49 Lakhs)
- Ichalkaranji Municipal Council (Pop-2.87 Lakhs)

Contamination of river mainly due to –

- Disposal of liquid and solid waste from the villages and cities like Kolhapur and Ichalkaranji
- Disposal of Industrial solid and liquid waste
- Cholera epidemic in March 2010 in Rukadi, Taluka Hatkangale
- ZP, Kolhapur was directed to prepare plan as per order dated 10/05/2013 passed by Hon'ble High court

Source: POLLUTION ABATEMENT OF PANCHGANGA RIVER, KOLHAPUR ZILLA PARISHAD (Rural Water Supply Division)

WHY SHOULD KOLHAPUR REUSE ITS WASTEWATER?



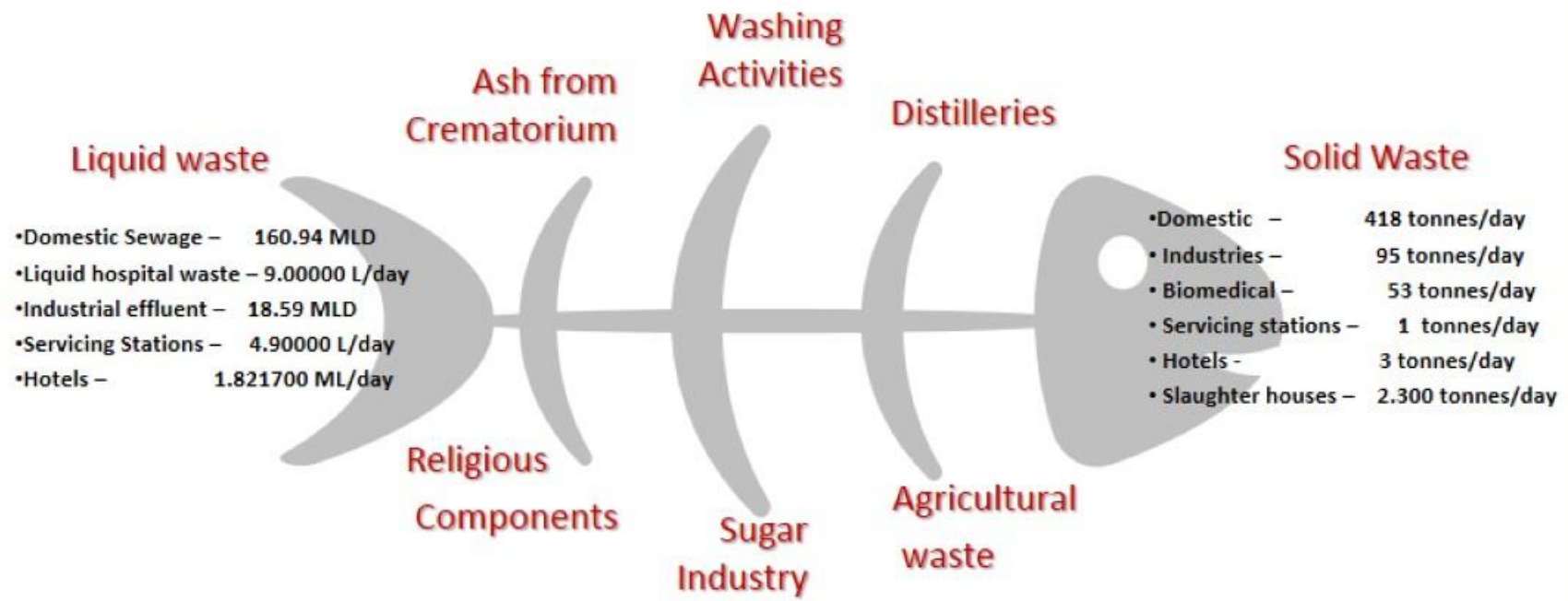
Only one(KAGAL 5-STAR) out of four MIDC have a CETP. Untreated wastewater from Shirol and Golkul Shirgao MIDC is being directly released into the river , polluting the river water right at the very upstream.

CETP at Kagal reuse its waste water for cultivation of bamboo and nilgiri plants which are said to be plants with high transpiration rates . The total cultivated area is approximately 80 acres . However there is a lack of a proper business model which can use these plants for sale and generate revenue out of it .

Source: Data collected from site visit

WHY SHOULD KOLHAPUR REUSE ITS WASTEWATER?

- **In the wake of continuous incidents of massive fish killing in Kolhapur in the past five years a PIL was filed by some environmentalist and citizen group in 2014**
- They conducted studies across the panchganga basin and reported the following incidences:
- Since December 2014, dead fish were seen in Bhogavati river, a major tributary of the Panchganga. Reports of fish killing at Haladi and Parite area
- A comprehensive study was conducted to probe the reasons behind the degrading water quality of the river
- Sugar factories operating often stores effluents in there storage tanks at factory site on the pretext of treatment.



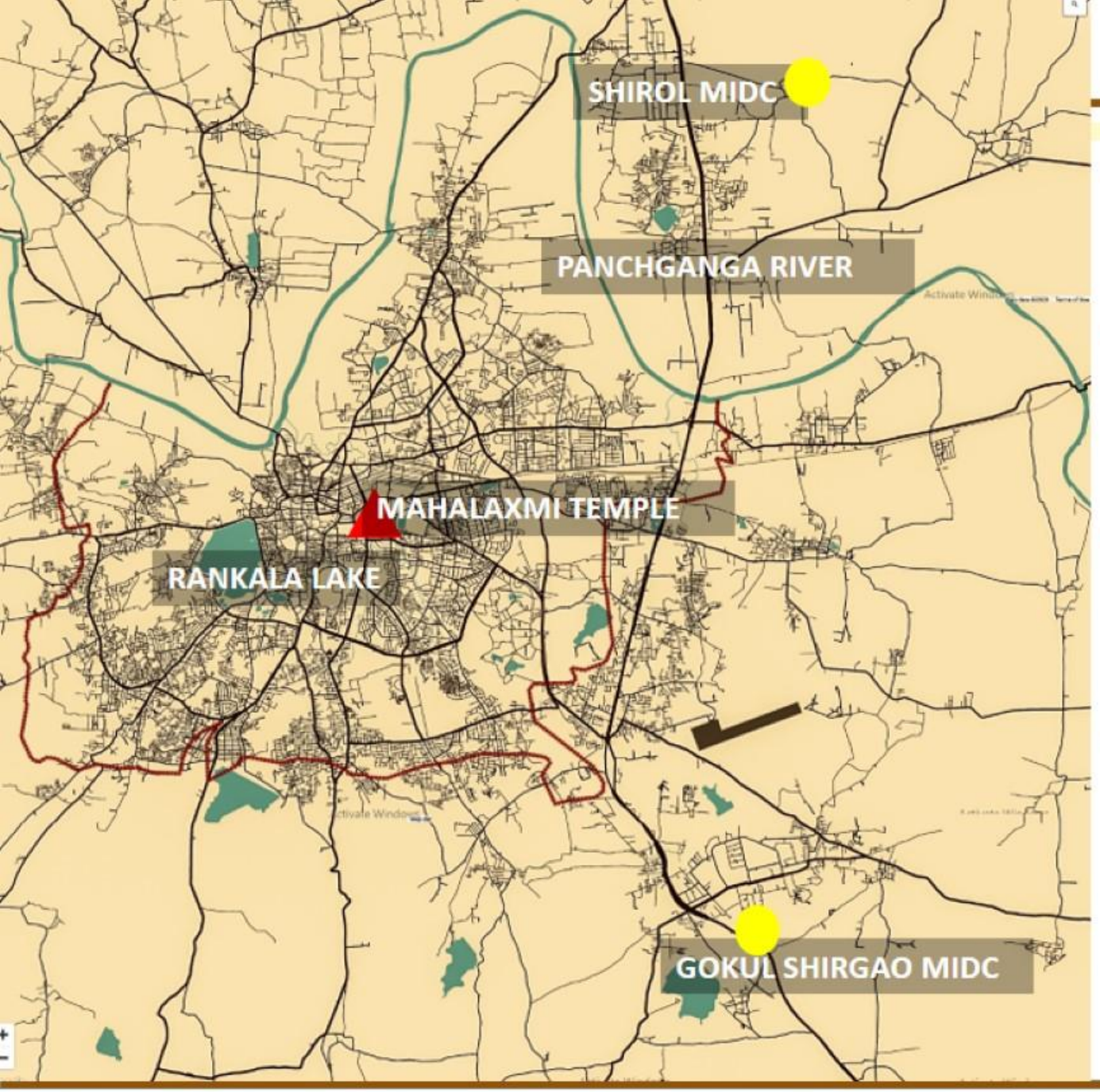
Major reasons of degrading water quality and loss of freshwater ecosystem in Panchganga

As mandated by **The Water (Prevention and Control of Pollution) Act 1974,** the industries and city administration are not allowed to discharge raw sewage directly to panchganga.

Using treated wastewater would :

- Help the region to **maintain its aquatic ecological balance** by limiting the polluted discharge
- The city currently treats 91-93 % of the collected sewage to grade III levels and disposes it to Panchganga ,These STP come at a huge capital and O&M cost hence the treated wastewater reuse plan can be used as a **perfect source of revenue generation for the ULB.**
- The city is surrounded by large tracts of sugarcane farms currently dependent of surface and GW sources of freshwater. Given the high nutrient content of treated wastewater, **sugarcane cultivation can be multiplied in production in a much reduced cost**

Source: Data collected from site visit



KOLHAPUR CITY PROFILE

- Kolhapur is one of the oldest and culturally significant cities of Maharashtra, India, lying along the **bank of the river Panchganga.**

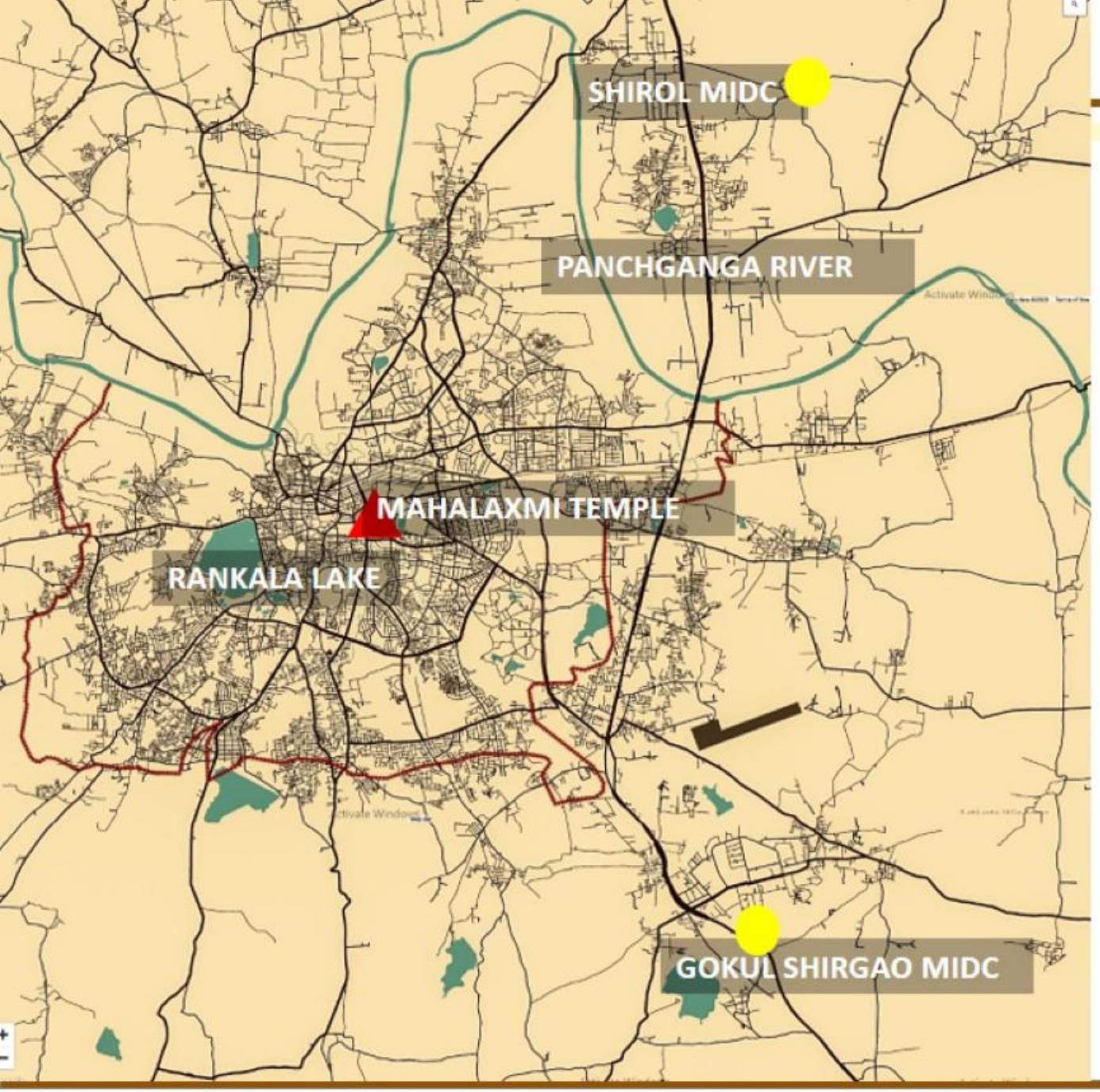
- Its rich cultural heritage and history has given the city a grandeur, which is rare. **It is famous for the Mahalaxmi temple** situated here, along with a host of other natural and man-made tourist attractions

.

- Kolhapur is also well known for its cuisine, especially the non-vegetarian fare, the famous **Kolhapuri chappals (Footwear) and silver jewellery,** sugarcane production industries and so on.

- industrially quite developed with many industrial zones at **Shirol, Gokul Shirgaon, Kagal Hatkanangale and Ichalkaranji** famous for sugar industry, foundries and textiles , non-material minerals, chemicals and drugs, oil engine, spare parts, aluminum vessels and so on .

Source: REPORT ON ENVIRONMENTAL STATUS OF KOLHAPUR REGION MAHARASHTRA.MPCB



KOLHAPUR CITY PROFILE

Total population:5.5 L(3.8% of Maha population)

Population density: 504/ sqkm

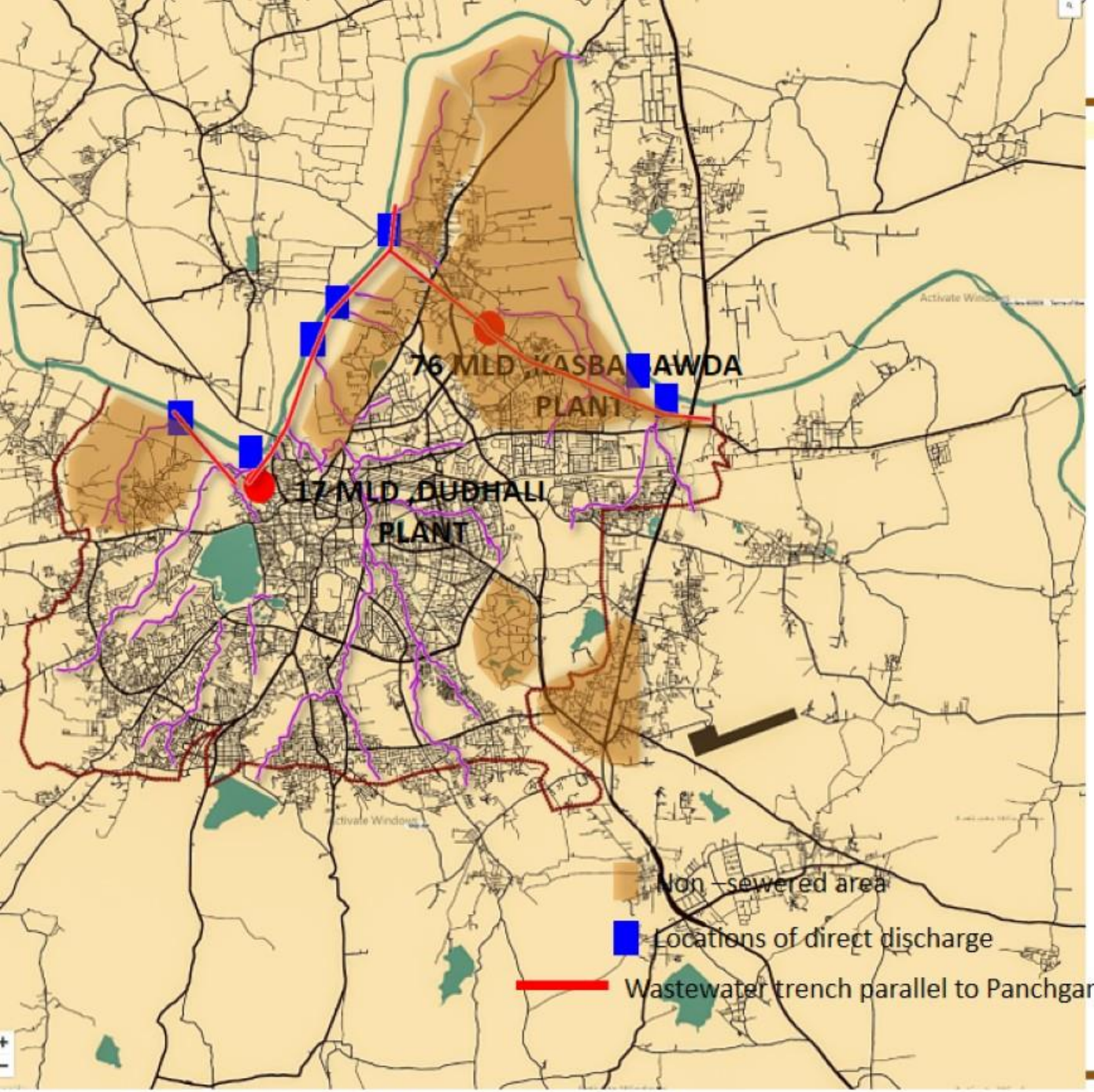
Area: 66.82 sqkm

Daily water requirement: 120 MLD

Rainfall:1100 mm

Climate:31°C and 19°C mean max & min temp

Source: REPORT ON ENVIRONMENTAL STATUS OF KOLHAPUR REGION MAHARASHTRA.MPCB



SANITATION STATISTICS

96 MLD sewage generation

92% treatment

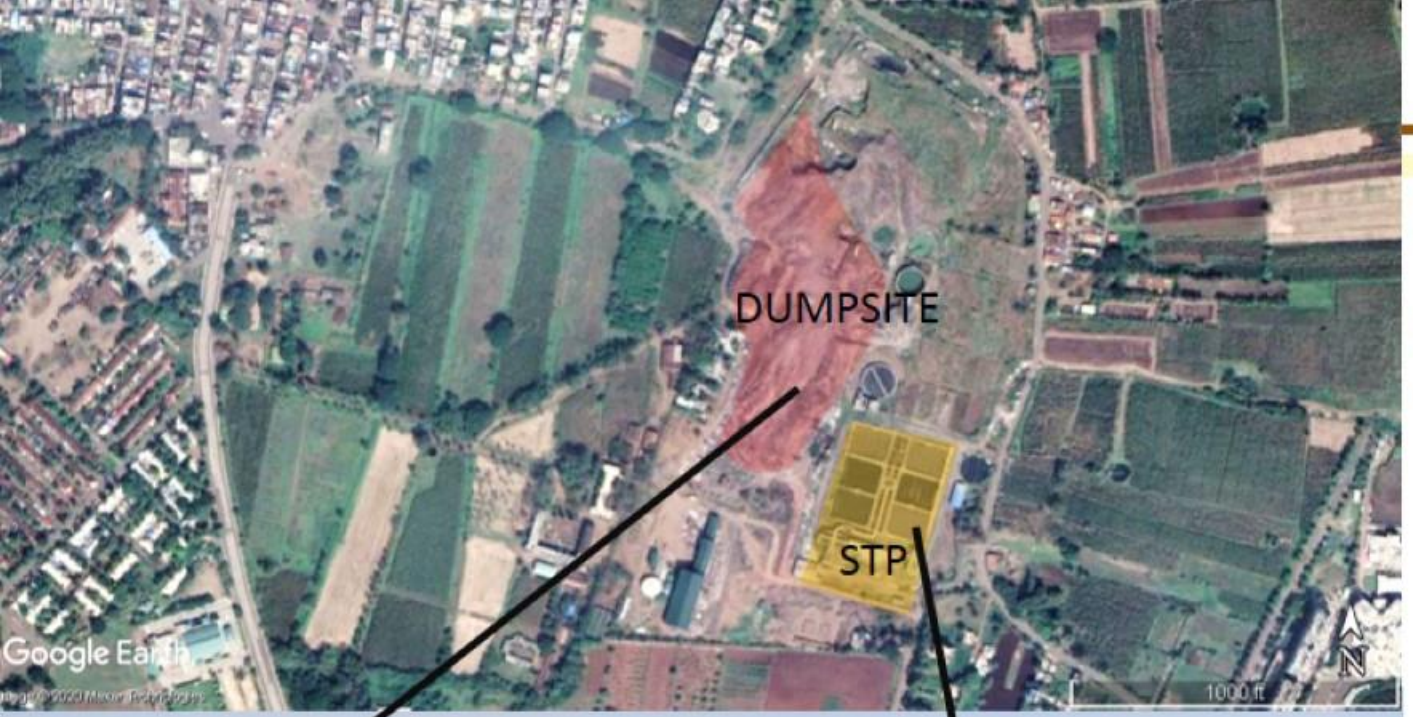
55 % area under networked coverage

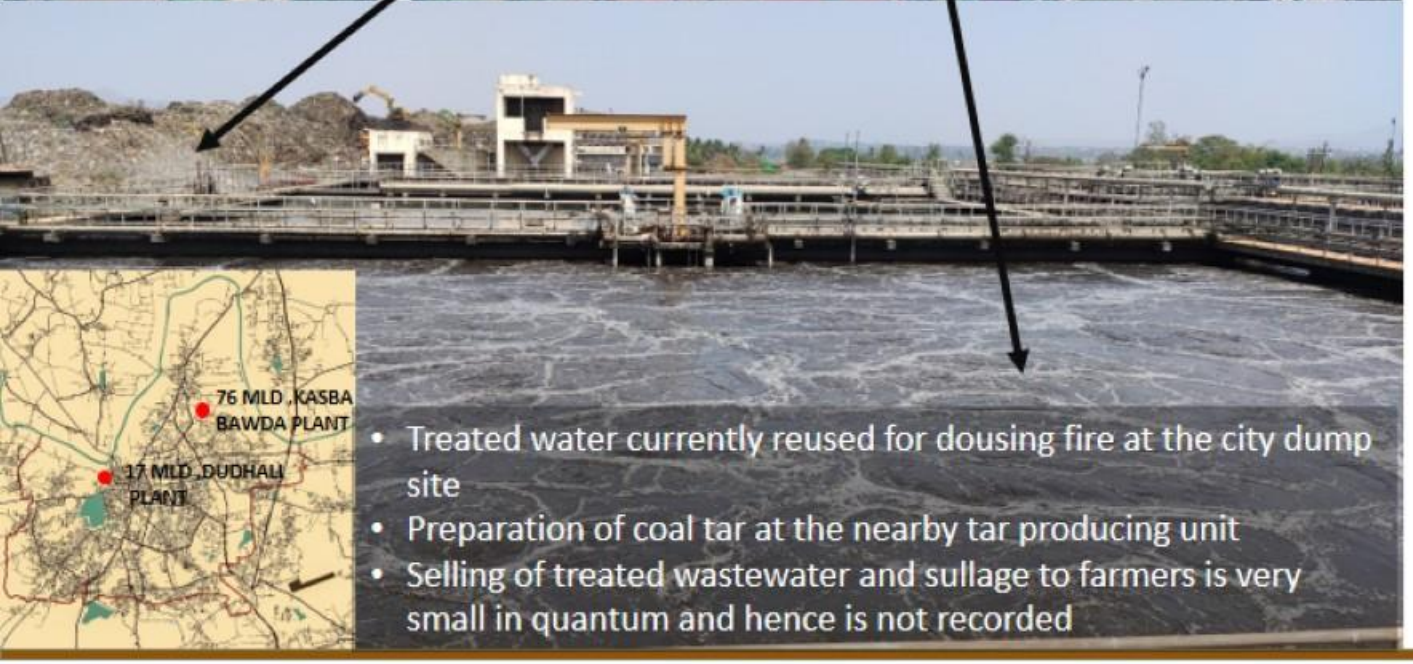
6 major lakes

- 45% city area unsewered
- 5010 septic tanks cleaned monthly @ Rs 500/ trip
- This is equivalent to 35 % of the registered properties within ULB limits
- 2-4 trips made by desludging operators per day
- **The city lacks a reuse plan for the treated water as discharge from STP is let out to Panchganga**
- A 6 KM trench parallel to Panchganga has been proposed for receiving all the waste incoming from the nalas which will be directed further to the STP for treatment.(work has not yet started)

Source: Data collected from various stakeholder consultation during site visit 1

STP AT KASBA BAWDA





- Treated water currently reused for dousing fire at the city dump site
- Preparation of coal tar at the nearby tar producing unit
- Selling of treated wastewater and sullage to farmers is very small in quantum and hence is not recorded

- Plant capacity of 76 MLD
- currently treated water is disposed of to Panchganga River (3 kms from the STP)
- KMC in a concessions contract (DBOM) WITH VISHWA Infrastructure
- No mention of selling rights of treated water either by KMC or the operator
- Cost of treatment Rs 2500 / MLD

PARAMETERS	STANDARD VALUE(MG/L)	OUTLET VALUE
BOD	Not to exceed 30	8
COD	250	10
TSS	NOT TO EXCEED 5	1
TKN	NOT TO EXCEED 5	1
PHOSPHORUS	NOT TO EXCEED 5	0.08
OIL & GREASE	NOT TO EXCEED 5	0.4
PHOSPHORUS	25	0.008
TURBIDITY	1	0.28
DO	NOT TO EXCEED 5	2.8
ALKALINITY	9	7.3
CODUCTIVITY	10	1.1
MPN	50	27
PH	6.5-7.5	7.4
HARDNESS	10	6.8

The output discharge is fit for the following purposes:

- Gardening, Irrigation,
- Road Side Plantation,
- Curing Water For Construction,
- MSW Facility For Spraying Purpose,
- And All Other Non Potable, Non Tangible Water Uses.

Source: Data collected from site visit

STP AT DUDHALI

- Treated water currently reused for agriculture in sugarcane farms
- Reuse of sludge has also been observed but this arrangement is all in all an unofficial one

- Plant capacity of 17 MLD
- currently treated water is disposed of to Panchganga River (0.5 kms from the STP)
- KMC in a concessions contract (DBOM) WITH LAXMI Infrastructure
- No mention of selling rights of treated water either by KMC or the operator
- Cost of treatment Rs 2500 / MLD

PARAMETERS	STANDARD VALUE(MG/L)	OUTLET VALUE
BOD	Not to exceed 30	7
COD	250	10
TSS	NOT TO EXCEED 5	1
TKN	NOT TO EXCEED 5	1
PHOSPHORUS	NOT TO EXCEED 5	0.08
OIL & GREASE	NOT TO EXCEED 5	0.4
PHOSPHORUS	25	0.008
TURBIDITY	1	0.28
DO	NOT TO EXCEED 5	2.8
ALKALINITY	9	7.3
CODUCTIVITY	10	1.1
MPN	50	27
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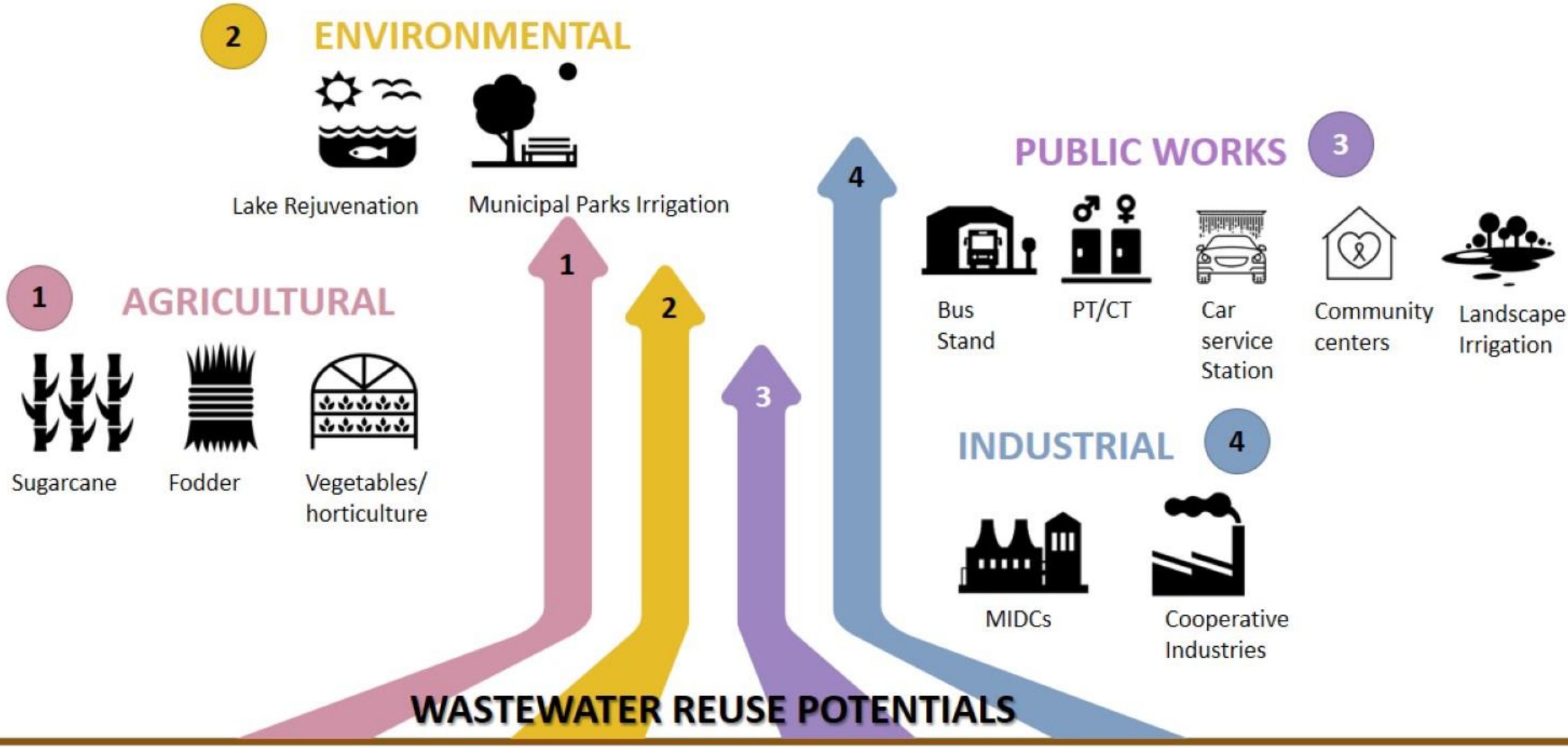
- Curing Water For Construction,
- MSW Facility For Spraying Purpose,
- And All Other Non Potable, Non Tangible Water Uses.

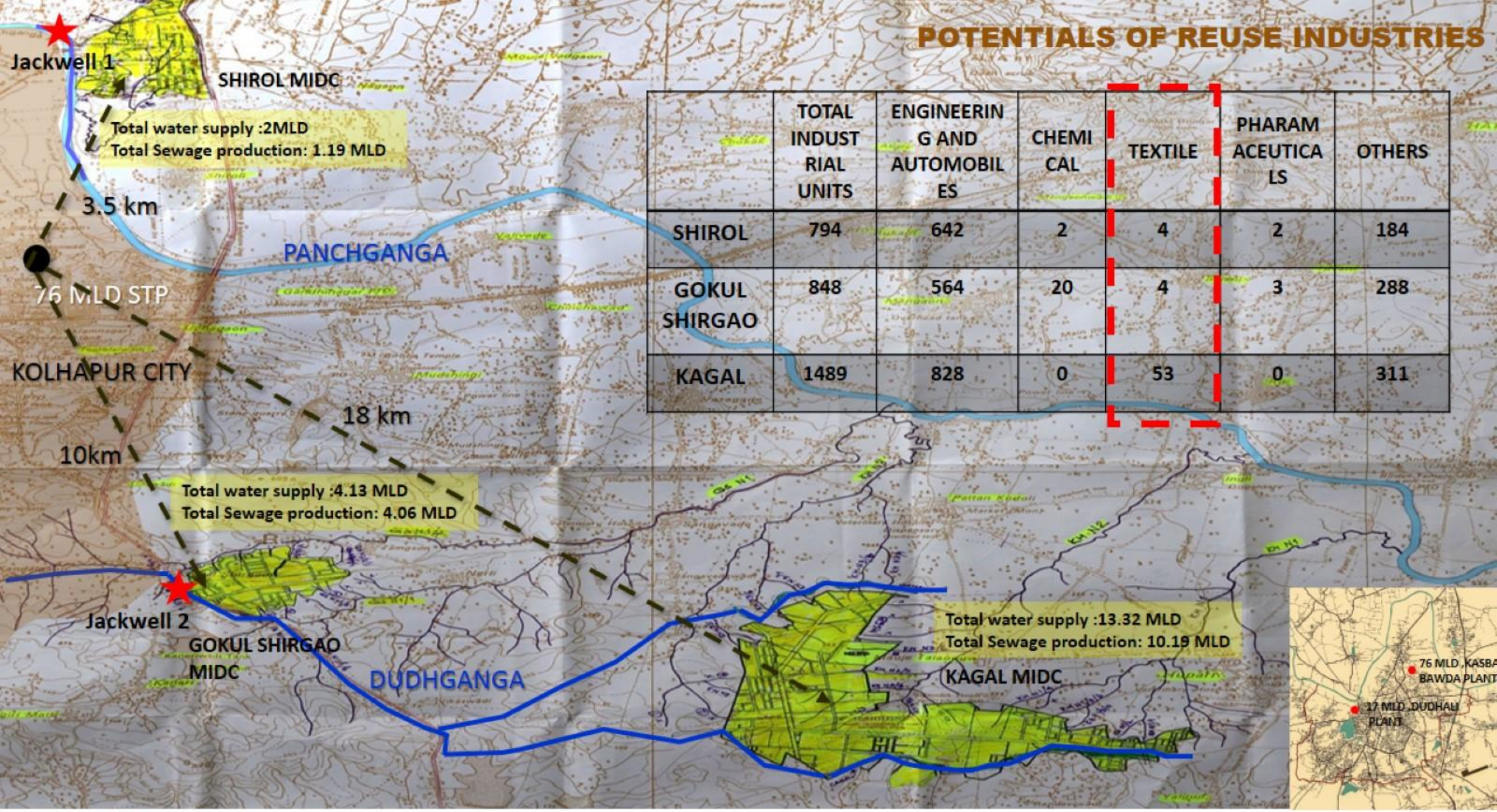
Source: Data collected from site visit

IDENTIFYING POTENTIALS OF REUSE IN KOLHAPUR



Source:

POTENTIALS OF REUSE INDUSTRIES



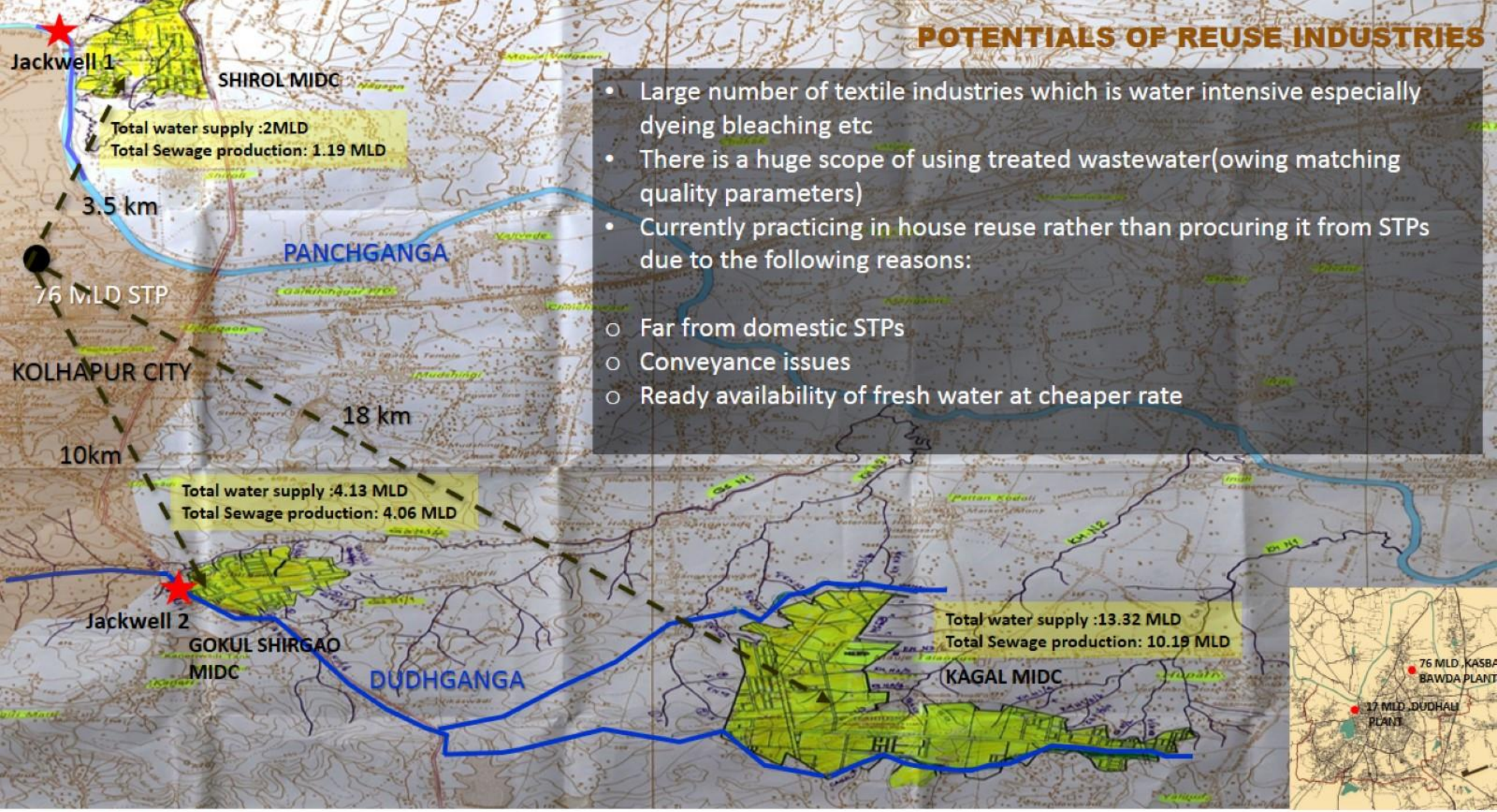
	TOTAL INDUSTRIAL UNITS	ENGINEERING AND AUTOMOBILES	CHEMICAL	TEXTILE	PHARAMACEUTICALS	OTHERS
SHIROL	794	642	2	4	2	184
GOKUL SHIRGAO	848	564	20	4	3	288
KAGAL	1489	828	0	53	0	311

Source: Data collected from site visit

POTENTIALS OF REUSE INDUSTRIES

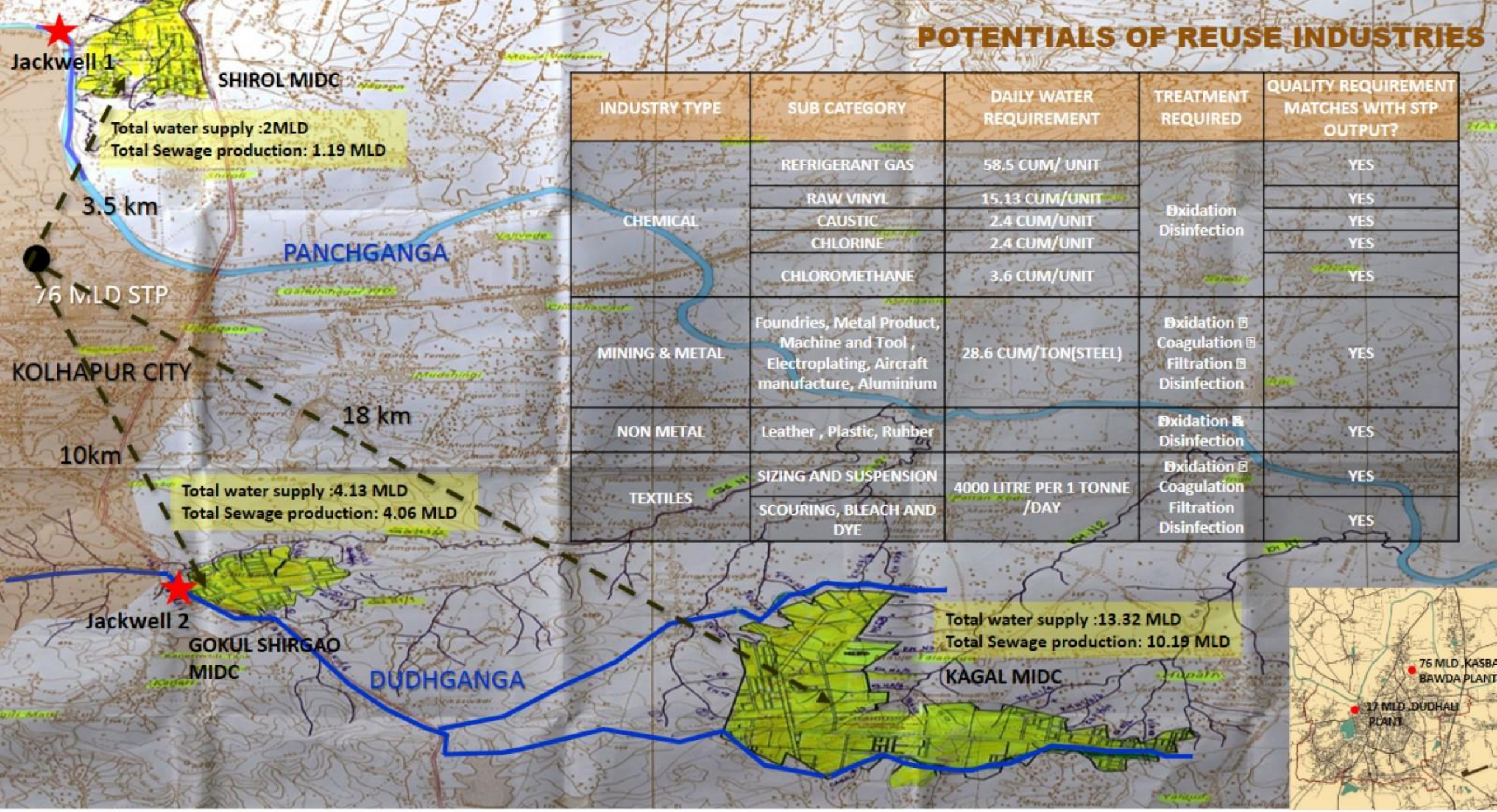
- Large number of textile industries which is water intensive especially dyeing bleaching etc
- There is a huge scope of using treated wastewater(owing matching quality parameters)
- Currently practicing in house reuse rather than procuring it from STPs due to the following reasons:

  - Far from domestic STPs
  - Conveyance issues
  - Ready availability of fresh water at cheaper rate



Source: Data collected from site visit

POTENTIALS OF REUSE INDUSTRIES



INDUSTRY TYPE	SUB CATEGORY	DAILY WATER REQUIREMENT	TREATMENT REQUIRED	QUALITY REQUIREMENT MATCHES WITH STP OUTPUT?
CHEMICAL	REFRIGERANT GAS	58.5 CUM/ UNIT	Oxidation Disinfection	YES
	RAW VINYL	15.13 CUM/UNIT		YES
	CAUSTIC	2.4 CUM/UNIT		YES
	CHLORINE	2.4 CUM/UNIT		YES
	CHLOROMETHANE	3.6 CUM/UNIT		YES
MINING & METAL	Foundries, Metal Product, Machine and Tool , Electroplating, Aircraft manufacture, Aluminium	28.6 CUM/TON(STEEL)	Oxidation Coagulation Filtration Disinfection	YES
NON METAL	Leather , Plastic, Rubber		Oxidation & Disinfection	YES
TEXTILES	SIZING AND SUSPENSION	4000 LITRE PER 1 TONNE /DAY	Oxidation Coagulation Filtration Disinfection	YES
	SCOURING, BLEACH AND DYE			YES

Source: Data collected from site visit

POTENTIALS OF REUSE INDUSTRIES

- There is no treatment facility centre for treating the effluent generated from MIDC of Shirol & Gokul Shirgao.
- Water bill is paid to the State irrigation Dept . @ 25 Rs /cum of water by the three MIDCs

MIDC	CURRENT COST OF WATER	DISTANCE FROM STP	COST OF LAYING PIPELINES FOR CONVEYANCE	COST OF EXCAVATION	TOTAL
SHIROL	1.8 cr/yr	3.5	1,95,650	1,260,000	1.4 cr
GOKUL SHIRGAO	3.7 Cr/yr	10	5,59,00,000	3,600,000	5.9CR
KAGAL	12 Cr/yr	18	10,062,000	6,480,000	16.5 CR

Jackwell 1

SHIROL MIDC

Cost of drawing water from the Jackwell : 1.8 CR/ year

Can be considered for reuse purposes

Cost of drawing water from the Jackwell : 3.7 CR/ year

Jackwell 2

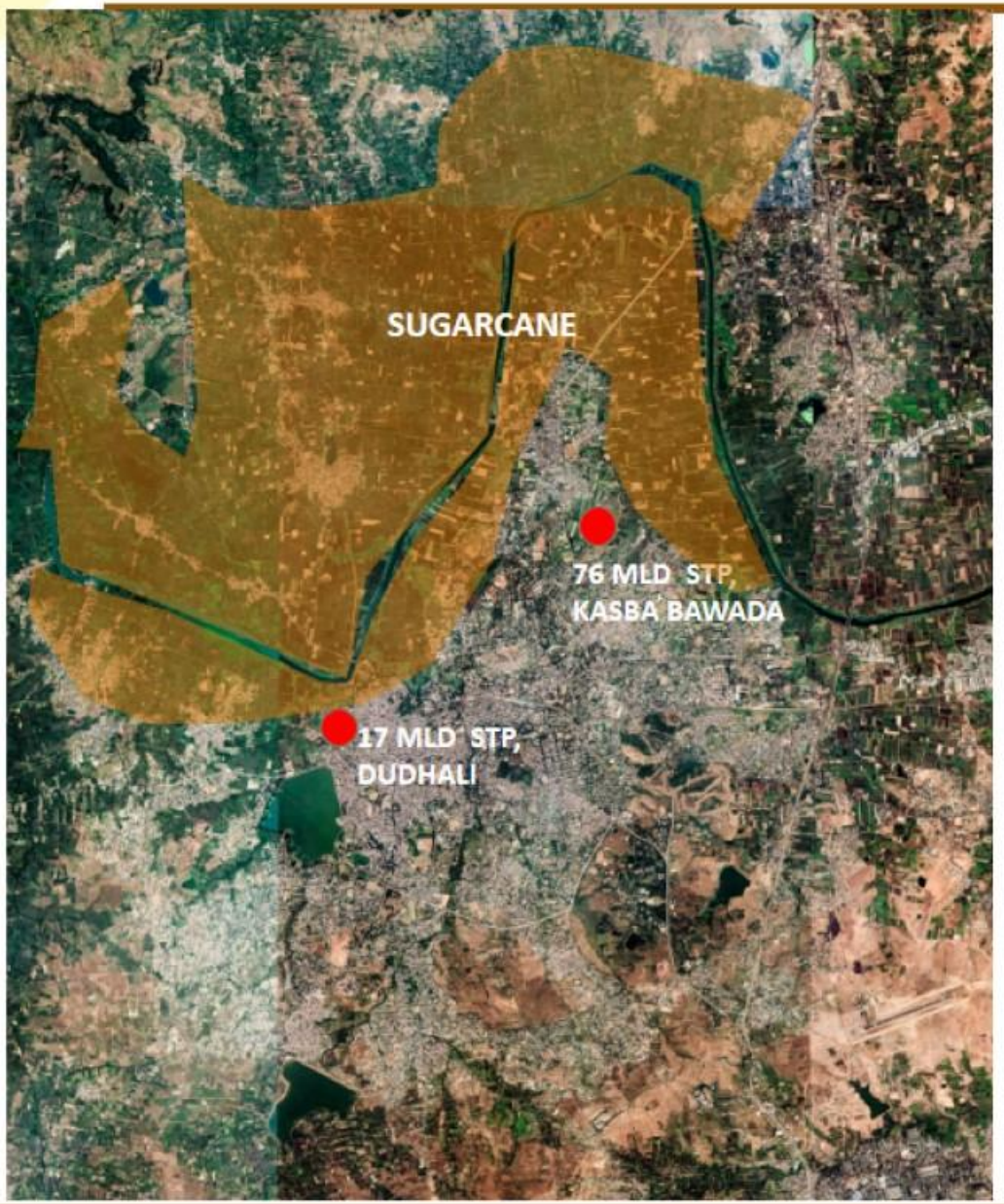
GOKUL SHIRGAO MIDC

Cost of drawing water from the Jackwell : 12 CR/ year

KAGAL MIDC

Source: Cost estimates as per Maharashtra SOR for Pune region, cross setion of trench considered 600X600 mm, for laying HDPE pipelines of dia 230 mm

POTENTIALS OF AGRICULTURE REUSE



- Kolhapur is predominantly cultivated by sugarcane,cotton and vegatables in 219 Ha of peri urban areas
- 2 MLD of wastewater currently supplied to farmers from Dudhali STP at free of cost (plan for the next three years), pumping cost to be born by the contracted firm whereas the cost of laying pipelines was a collective venture by the farmers group in the area through pooling funds for the same.
- Dried sludge is also sold as sludge cakes needed for good quality manuring of the soil absolutely free of cost to the farmers.

- *Cash expense / HA for sugarcane: **63,300 /- (wastewater)**
- *Cash expense / HA for sugarcane: **72,400 /- (freshwater)**

Expense include heads under labour, energy, fertilizer & pesticide

Source: Data collected from site visit,* Water Policy Research HIGHLIGHT, Wastewater irrigation in Maharashtra,IWMI –TATA water policy program,2017

POTENTIALS OF PUBLIC WORKS REUSE

Bus station
Probable requirement:
12500L/ day

Public Toilets
Probable requirement:
20000 L/ day

Car service stations
Probable requirement:
8000 L/ day

Road & Median Wash
Probable requirement:
10320 L/ day

Community Centre
Probable requirement:
12000 L/ day

Source: Detailed calculation mentioned in Annexure

PRIORITY ASSESEMNENT OF PUBLIC WORKS REUSE

Economics of conveyance:

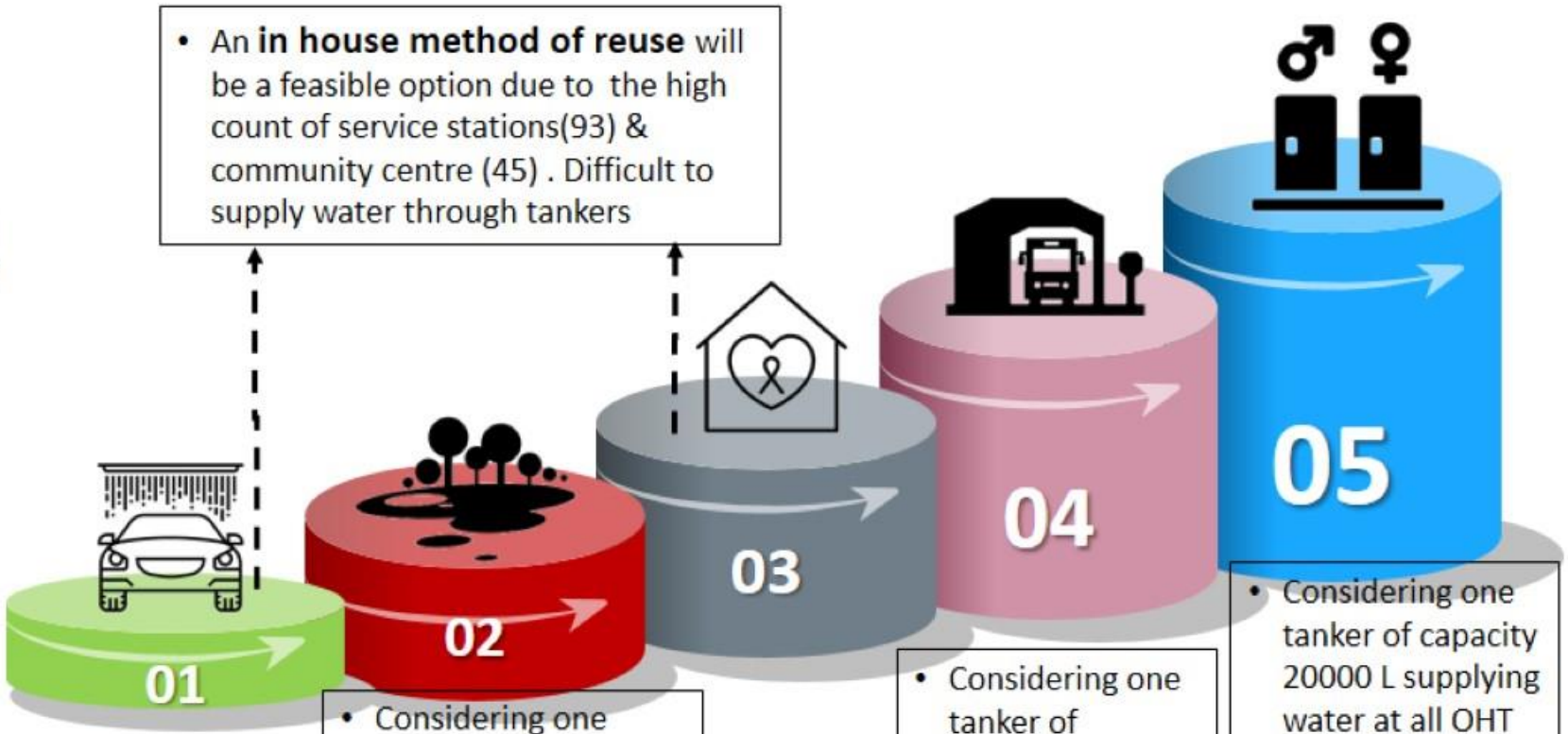
- **No. of tankers in KMC : 2**
- **Capacity of one tanker : 12000 l,20000 l**
- **Cost of using one tanker/day: Rs. 5000**

An approximate amount of Rs 12435/- per day shall be the cost incurred to KMC for delivering 32500 l of water per day.

~Rs 0.38 / liter per day .

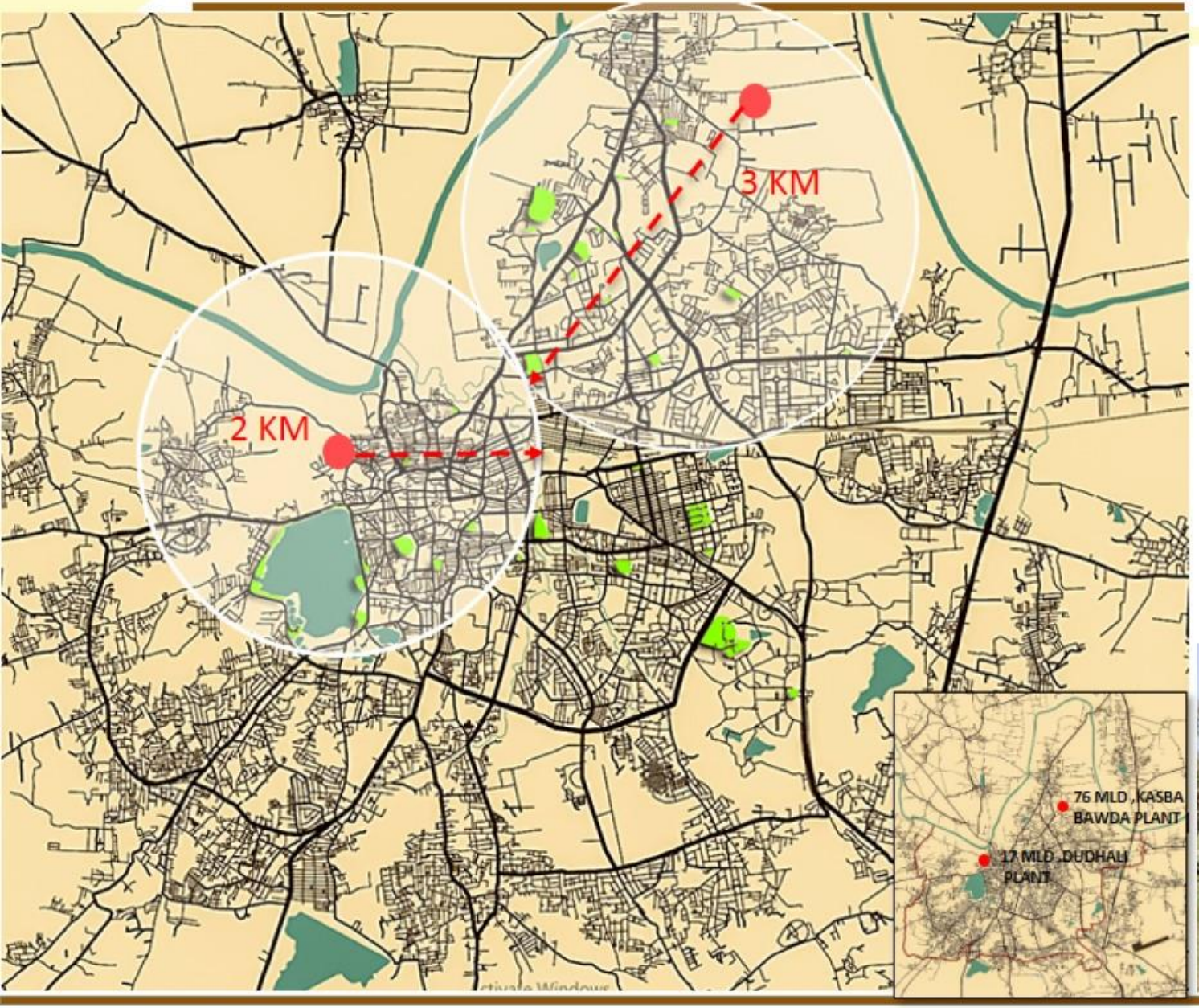
This can be easily recovered through appropriate tariffing structure an can prove to be a reliable and consistent source of revenue for the ULB

Additionally will help reduce the pressure on borewells and put a limit to GW extraction in the city..The water from which can be saved to be used in extreme summer months



Source:

POTENTIALS OF ENVIRONMENTAL REUSE: COMMUNITY PARKS & GARDENS

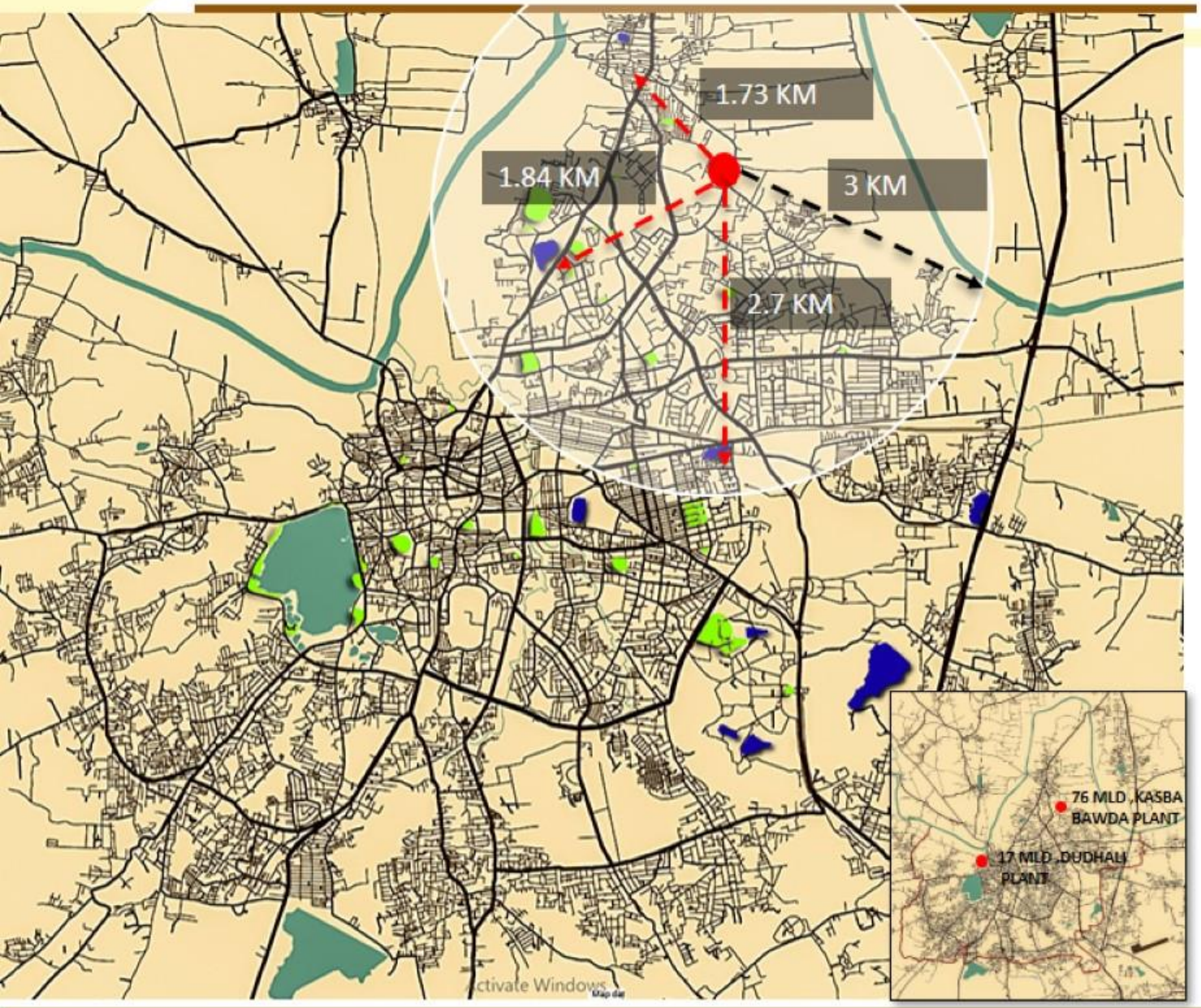


54 Community parks and gardens

- There are **10 small and big parks falling under 3 km radius** from the Kasba Bawda plant and **another 8 parks within 2 km radius from the Dudhali Plant,**
- These parks currently draw bore well water / municipal supply water for its landscaping purposes.
- *Total water demand for parks=6 MLD
- Use of treated water for landscaping can be **done through hiring private tanker contractors** as laying pipes not feasible.(dense locality around the parks, length of pipe network, pumping issues due to geographical constraints etc.).

*considering daily requirement of 10 mm water for parks:607020 sqm (area of these 18 parks)=6070 cum~6070000 liter/day

POTENTIALS FOR ENVIRONMENTAL REUSE: LAKE REJUVINATION



6 Lake Rejuvenation

Currently treated water is being disposed to the Panchganga River which is 3 Km from the STP.
This water can be directed to the lakes through pipelines or through scheduled tanker refilling once every month

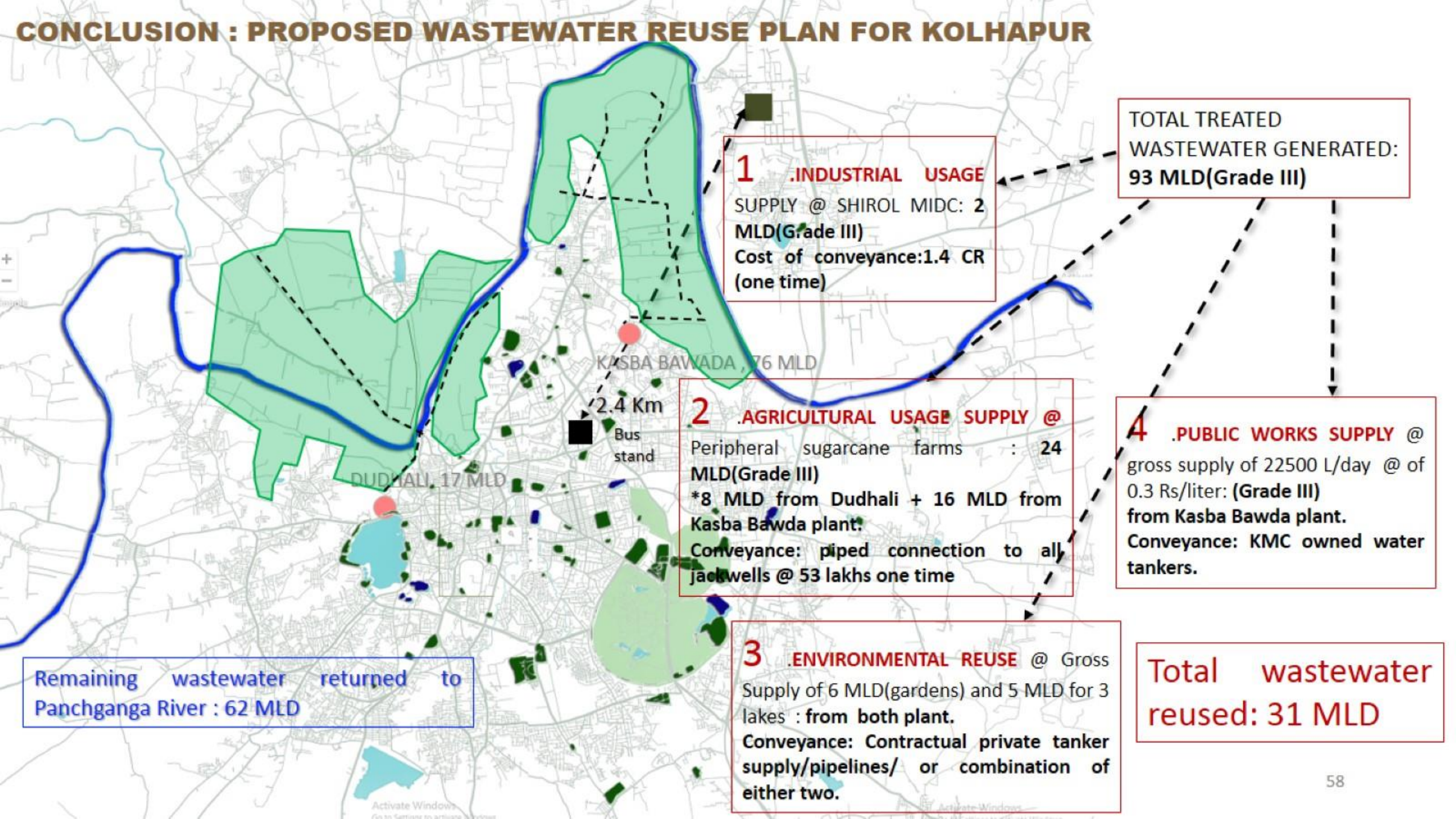
Potential water requirement for all three lakes* = 174.6 ML/ month

Conveyance cost option 1:
Cost of laying pipielines :a) excavation works :17,91,840 /-
b) laying PVC pipelines:11,86,860/-
Total: 35,21,040/- one time~35 Lakhs

Conveyance cost option 2: .
through KMC tankers which costs around 5000/- - 6000/- per day with a capacity of 12000 L each
Total: 4.5L/- per month (though cheap but not feasible as no. of trips would be exceedingly high)

*174,660 cum =174660000 L/ month (in case of every month refilling), considering average depth of 1.5 M

CONCLUSION : PROPOSED WASTEWATER REUSE PLAN FOR KOLHAPUR



TOTAL TREATED WASTEWATER GENERATED: **93 MLD(Grade III)**

1 .INDUSTRIAL USAGE
SUPPLY @ SHIROL MIDC: **2 MLD(Grade III)**
Cost of conveyance:1.4 CR (one time)

2 .AGRICULTURAL USAGE SUPPLY @
Peripheral sugarcane farms : **24 MLD(Grade III)**
***8 MLD from Dudhali + 16 MLD from Kasba Bawda plant.**
Conveyance: piped connection to all jackwells @ 53 lakhs one time

3 .ENVIRONMENTAL REUSE @ Gross Supply of 6 MLD(gardens) and 5 MLD for 3 lakes : **from both plant.**
Conveyance: Contractual private tanker supply/pipelines/ or combination of either two.

4 .PUBLIC WORKS SUPPLY @ gross supply of 22500 L/day @ of 0.3 Rs/liter: **(Grade III)**
from Kasba Bawda plant.
Conveyance: KMC owned water tankers.

Remaining wastewater returned to Panchganga River : 62 MLD

Total wastewater reused: 31 MLD

PROPOSED WASTEWATER REUSE PLAN FOR KOLHAPUR: COST BENEFIT ANALYSIS

2 ENVIRONMENTAL

Capital Investment Required: **0.35 Cr**

Annual Revenue Generated: **NA**

Intangible benefit in terms of maintaining water quality for srce watersa & GW levels

3 PUBLIC WORKS Proposed SP=Rs 6/KL

Capital Investment Required: **0.3 Cr**

Annual Revenue Generated: **0.04 Cr**

Percent reduction in water bills: **50%**

- Reduced dependency on groundwater

1 AGRICULTURAL Proposed SP=Rs 0.8/KL

Capital Investment Required: **0.5 Cr**

Annual Revenue Generated: **0.06 Cr**

Percent reduction in water bills: **30%**

- Round the year availability of water
- Reduced dependency on chemical fertilizers

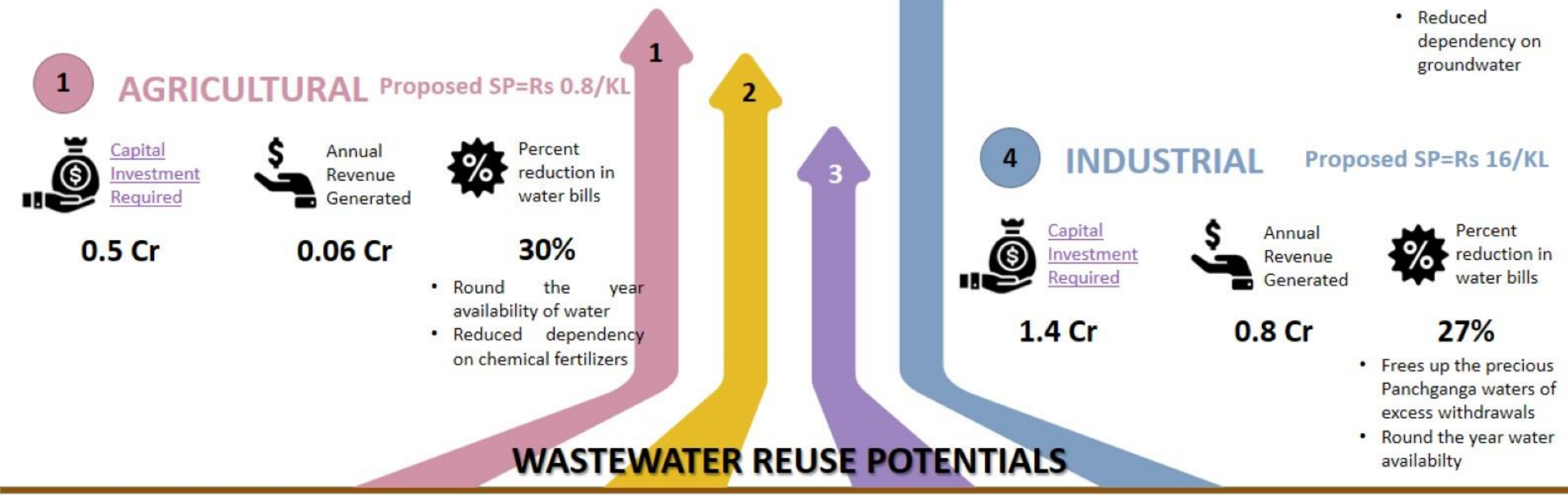
4 INDUSTRIAL Proposed SP=Rs 16/KL

Capital Investment Required: **1.4 Cr**

Annual Revenue Generated: **0.8 Cr**

Percent reduction in water bills: **27%**

- Frees up the precious Panchganga waters of excess withdrawals
- Round the year water availabilty



Source: Detailed out calculation mentioned in the Annexure

PROPOSED BUSSINESS MODEL FOR REUSE PLAN: A CUT AND FILL APPROACH

2 ENVIRONMENTAL

Capital Investment Required: **0.35 Cr**

Annual Revenue Generated: **NA**

Intangible benefit in terms of maintaining water quality for srce watersa & GW levels

PUBLIC WORKS 3

Capital Investment Required: **0.3 Cr**

Annual Revenue Generated: **0.04 Cr**

Percent reduction in water bills: **50%**

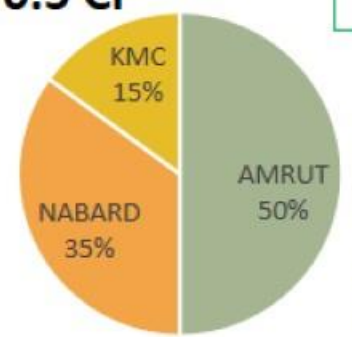
- Hard to attract money, which is devoted only for environmental benefits more so because of its intangible nature of recovery.
- Unwillingness of State road transport authority to invest initially
- revenue generation of public toilets not very strong

1 AGRICULTURAL

Capital Investment Required: **0.5 Cr**

Annual Revenue Generated: **0.06 Cr**

Percent reduction in water bills: **30%**



Share of funds for investment

INDUSTRIAL 4

Capital Investment Required: **1.4 Cr**

Annual Revenue Generated: **0.8 Cr**

Percent reduction in water bills: **27%**

Shirol MIDC Association

Balance profit= 0.15 CR

Net annual profit to KMC = 0.25 CR~ 25 L

Source:

SUMMARY

Kolhapur is one of the **forerunners in treating its wastewater (92%)** a feat which is still very difficult for other same sized ULB to achieve in the state & even country

This plan proposes to use one third of the waste water generated into various usages which can actually be **consistent source of revenue** for the ULB all throughout the year

The proposed plans **is of a closed loop nature** where the revenues generated from a specific source is the source of capital cost required for securing the conveyance of other Kinds of usage which does not ensure a buyer.(environmental usages)

Public acceptance & social behavior stands as he biggest challenge in materializing the plan majorly due to two reasons a) availabilty of freshwater , good rainfall days b) health risks associated with people handling the wastewater.

Conveyance **still persists to be the weakest link** in materializing this plan.Reluctance of tanker contractors can be a huge setback for such reuse plans to actually work

RECOMMENDATIONS

01

Bulk users of water like hotels, restaurants, community halls, car service stations and apartments with more than 20 units must have **an in house treatment and reuse mechanism**. This will **reduce a major burden from the centralized system** and fits perfectly well to the ever growing outskirts of the cities and towns.

Laying of conveyance mains **requires joint efforts of multiple stakeholders operating at various scales**. An informed decision making is the need of the hour especially when there is an absence of a dedicated wastewater regulatory authority.(ULB, Irrigation department, Gram panchayat etc)

02

03

CETPs for other two MIDCs should also be commissioned at the earliest given the dire implications they pose over quality of Panchganga waters. Treated water of which can be deployed for various in house purposes too.

Sludge reuse remains one such unexplored part of the reuse plan which **has immense potential and need to be mainstreamed** to bring a positive impact on the yields and also on the expenditure incurred on procuring synthetic fertilizers.

04

05

For a reuse plan to materialize , Kolhapur itself is the greatest challenge by the virtue of it being a water plus zone .Thus **continued and structured efforts to sensitize public** towards reuse hence becomes of supreme importance for its unhindered mass acceptance.

Source:

RECOMMENDATION / STATE ACTION PLAN FOR UPSCALING WASTEWATER REUSE

01 

Identification of Drivers, Opportunities, and Challenges for Water Reuse.

02 

Identification of sources of water and probable application of reuse.

03 

Allow consideration of water reuse with integrated and collaborative action at the Basin scale.

04 

Coordinate with relevant stakeholders while ensuring maximum alignment with relevant state and national policies, programs and missions.

05 

Improve Availability of Water Information along with improvisation of outreach & communication on water reuse.

06 

Ensure/Facilitate Financial Support or appropriate incentivization for the buyers

Wastewater Reuse

Of Late, infrastructure development has totally been 'water-centric' & is being largely funded by the central government. Given the worsening water crises in many Maharashtrian cities, the moment has come for the central government to shift its focus to wastewater by jointly engaging with state government & invest equally in developing wastewater reuse infrastructure too for an overall water resilience and prolonged water security.

Source:

THANK YOU !

DETAILED CALCULATIONS & ASSUMPTIONS CONSIDERED IN THE FEASIBILITY STUDY FOR VARIOUS REUSE TYPES (slide 42)

PROJECT FEASIBILITY ANALYSIS FOR REUSE AT SHIROL MIDC

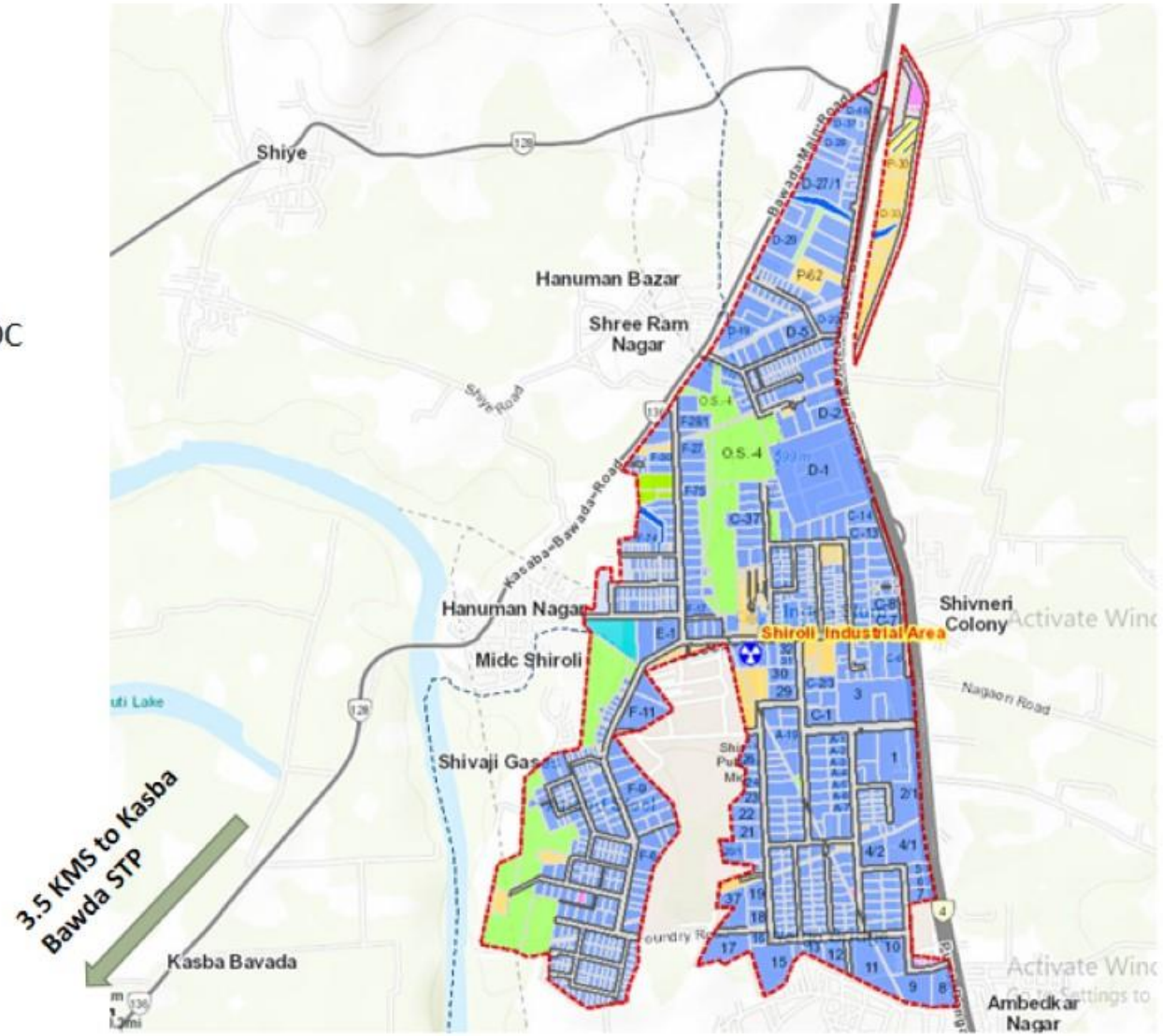
No. of Industrial units: 794
No of water intensive units(automobiles and textiles):642+4
Daily water demand :2MLD
Total cost incurred for drawing freshwater:1.8 CR/ annum (Rs49/ KL)

Investment in laying conveyance mains:1.4 Cr (one time)
Total cost incurred for drawing treated wastwater:1.3 CR/ annum(considering selling tariff @ Rs 16 /Kl, taking cue from case studies and the rate at which MIDC buys freshwater)
Net annual profit= 27 %

Annual cost savings in using treated wastewater =0.5 Cr
Break even time for recovering cost incurred on laying conveyance mains= 2.8 years ~ 3 yrs

Cost of treatment incurred by KMC in treating wastewater=Rs 2.5/KL
Considering an additional Rs 1.5 for pumping the treated water
Total cost price of treated WW to KMC= Rs 4/ Kl
Annual income of KMC by selling 2 MLD water =*Rs24000/ day
~87,60,000 / year
~87 Lakhs/annum profit

*Selling Price of2MLD water @Rs16/KL per day.=Rs 32000.
Cost Price of treating 2MLD water @ Rs 4 /KL=Rs8000
Therefore, net gain per day on selling 2 MLD treated water = Rs 24000



Source:

PROJECT FEASIBILITY ANALYSIS FOR PUBLIC WORK REUSE

Freshwater

	A	B	C	D=C(upper limit)/B	
Usage Type(for 1 unit)	**Requirement /Day(l)**	**Requirement/Month(l)**	**COST OF Freshwater SUPPLY/ MONTH (RS)**	**COST PER Month(rs/L)**	**monthly cost of freshwater per Kl**
BUS STATION	12500	375000	3000-4500	0.012	12
CAR STATION	8000	240000	3000-5000	0.020833	20
PUBLIC TOILET	20000	600000	5000-6000	0.01	10
COMMUNITY HALLS	12000	360000	6000-7500	0.208333	208

Treated wastewater

			A=cost price	B=selling price	C=B-A(profit per month)	
Usage Type(for 1 unit)	**Requirement /Day(l)**	**Requirement/Month(l)**	**COST OF wastewater treatment/ MONTH (RS)@ Rs 0.0025/l A**	**monthly cost of wastewater @ 6 /kl**	**Total monthly cost born by KMC for selling treated WW**	**COST OF wastewater transportation / MONTH (RS)**
BUS STATION	12500	375000	937.5	2250	1312.5	150000
CAR STATION	8000	240000	600	1440	840	175000
PUBLIC TOILET	20000	600000	1500	3600	2100	150000
COMMUNITY HALLS	12000	360000	900	2160	1260	175000

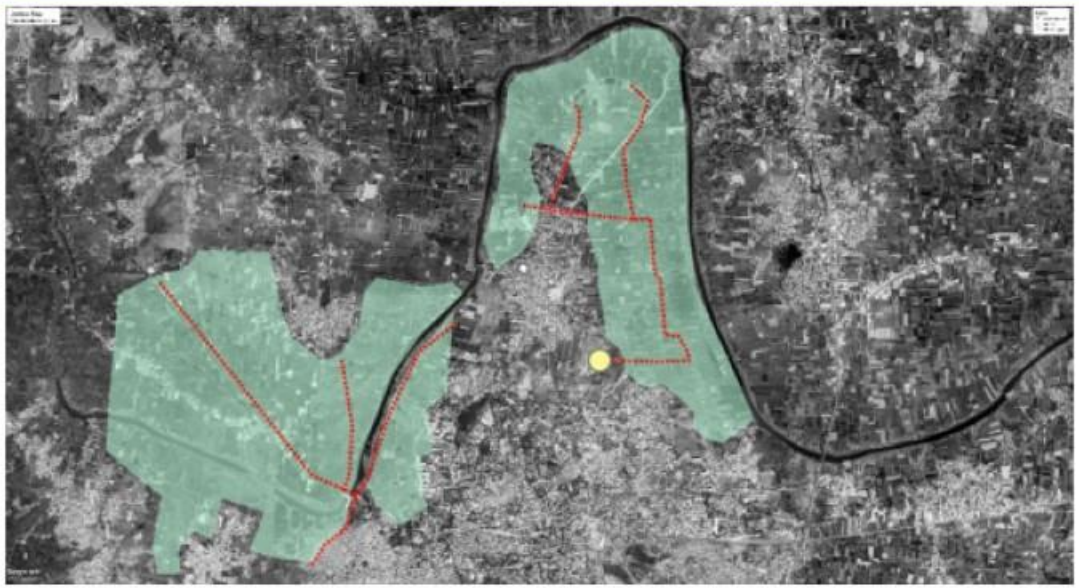
Total annual income : (1312 * 12 + 2100 * 12)
=Rs 40950/-

Total capital investment reqd: 150000+150000
= Rs 3,00,000 per month

Source:

PROJECT FEASIBILITY ANALYSIS FOR AGRICULTURAL REUSE

line name	line length(m)	cost of excavation(cross section of trench 1500m x 1500 m)	cost of laying pipeline(HDPE pipeline of 230)	total (inclusive of labour charges and O & M) Cr
dudhali STP to irrigation well	950	342000	320150	662150
	2329	838440	784873	1623313
Kasba Bawda STP to irrigation well	1823	656280	614351	1270631
	2570	925200	866090	1791290
total cost(one-time)				5347384
				53 lakhs



Crop type	Net sown area(Ha)	Productivity/ Ha	Water req/ton	Total water req/ yr
sugarcane	130	70 ton	75 ton	682,500 ton
cotton	53	3 ton	40 ton	6360 ton
vegetables	26	10 ton	18 ton	4680 ton

Annual water requirement =693540 Ton
Total water requirement per day=2100 ton~2 MLD
Cost of treating 2 MLD water= Rs 5000
Cost of treating and pumping 1 L water/day = Rs 0.0035
Annual cost to KMC=693540000l x.0035 l=2427390 rs pEr annum-**A**

Current cost of freshwater borne by farmers =Rs 70 / Ha/day*(Rs 1.5 /KL)
Total revenue income @ Rs 40 /Ha/ day (Rs 0.8 /KL)= Rs 8360(30x 209 Ha)/day{Half of current price}
Annual income=Rs 3051400~30.5 Lakhs/ year-**B**

Total revenue generation for KMC can be Roughly around 30 Lakhs per year at a cost which is 40 % less the price of freshwater which the farmers currently pay for irrigation.
Net annual gain 6,24,010 per annum(B-A)
Initial investment by KMC, NABARD and AMRUT funds

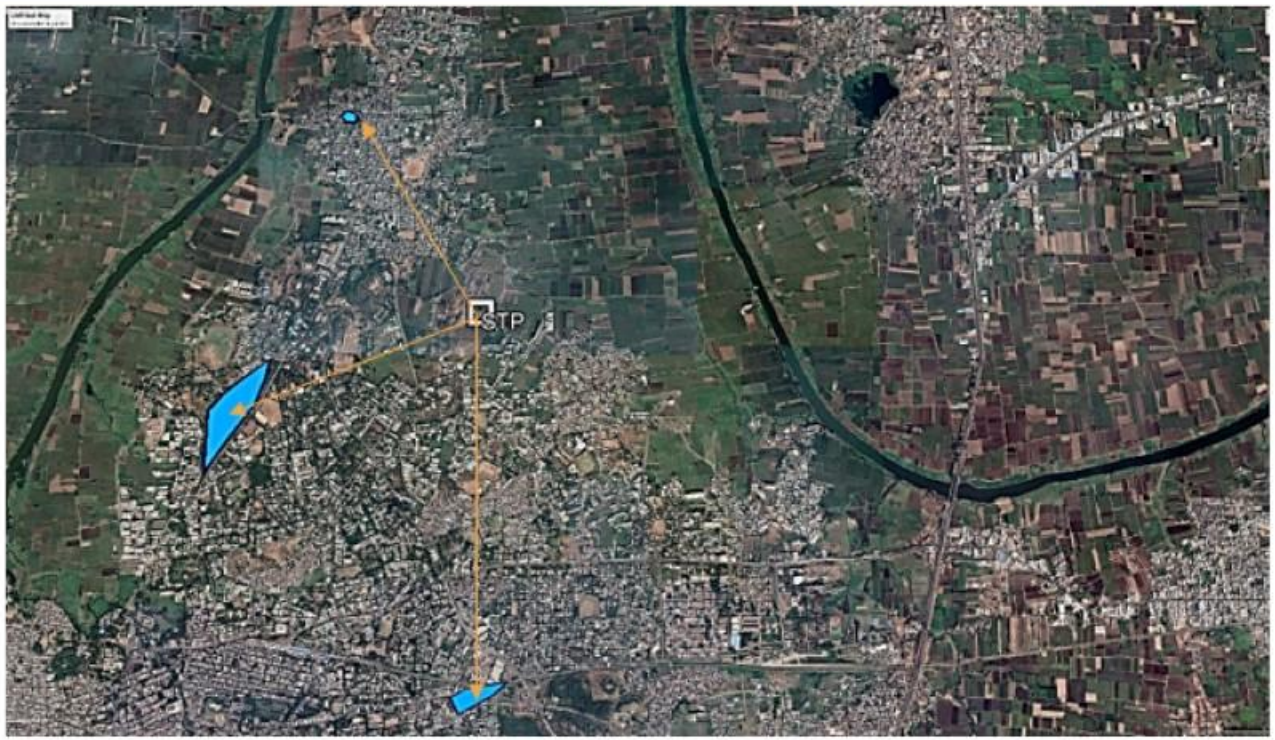
Source:

PROJECT FEASIBILITY ANALYSIS FOR ENVIRONMENTAL REUSE

lake no.	length of pipe(m)	cost of excavation(cross section of trench 1500m x 1500 m)	cost of laying pipeline(HDPE pipeline of 450 mm)	total (inclusive of labour charges and O & M) Cr
lake 1	1800	387,840	419200	807,040
lake 2	2700	576,000	707400	1,283,400
lake 3	2300	828,000	602600	1,430,600
total cost(one time)				3,521,040
cost of 2 tankers @ Rs 5000/ day for gardens and park supply water for 300 days				3,00,000
total investment reqd.				3,521,040

Assumptions:

- Rs 262 /rmt pipe dia for conveyance mains .
- Rs 160 /cum ,Excavation for foundation / pipe trenches in earth, soils of all types, sand, gravel and soft murum, including removing the excavated material upto a distance of 50 metres and lifts as below, stacking and spreading as directed, normal dewatering, preparing the bed for foundation and excluding backfilling, etc. complete.
- considering 300 days in a year of service contract



Source:

THE END