SUGGESTIVE ACTIONS FOR FORMULATION OF ACTION PLAN FOR USAGE OF TREATED WASTE WATER FROM SEWAGE TREATMENT PLANTS

1. Estimate Present and Projected Sewage Generation and Treatment Capacity.
2. Identify bulk users of Water: Industrial Clusters, Metro Rail, Indian Railways, Infrastructure Projects, Agriculture, Bus Depots and PWD.
3. Quantify their potential Water Demand
4. Development of Dead Water Aquatic Sources (Lake, Pond etc).
5. Time line for establishing such infrastructure (Treatment, Conveyance and Utilization of Treated Sewage)
6. To promote use of treated waste water for various usage.
7. To promote supply of treated sewage to industrial clusters
8. Industrial clusters can set up treatment facility to meet their raw water requirement instead of drawing groundwater.
9. Maximizing re-use of treated waste- water will minimize groundwater abstraction

Above action point may use in formulation of Action Plan (with fixed timeline) for Utilization of Treated Sewage.

Action Plan for Usage of Treated Waste Water from Sewage Treatment Plants in Andhra Pradesh is also being attached for reference.

Action Plan for Usage of Treated Waste Water from Sewage Treatment Plants

February, 2019

Municipal Administration & Urban Development Department

Government of Andhra Pradesh

TABLE OF CONTENTS

1. INTRODUCTION

India is urbanising at a rapid pace. At the current rate it is expected that 50% of the population would be residing in urban areas by next decade, this puts a stress on the available resources in urban areas. This calls for a judicious use of the existing natural resources and protect them from being polluted.

Even today during summer in some of the urban areas the water supply is rationalized (ex. Once every two days or one hour daily). At the same time the existing water sources are being polluted leading to acute shortage of non-polluted raw water for the urban areas. This point at the seriousness required for treatment of all types of wastewater that is being released into the open environment and reuse of waste water in urban areas.

The Ministry of Urban Development, Government of India has launched Atal Mission for Rejuvenation and Urban Transformation (AMRUT) project with an objective to provide basic services (e.g. water supply, sewerage, urban transport) to households and build amenities in cities that will directly improve the quality of life, especially the poor. Under the AMRUT project Sewage Treatment Plants (STPs) are being constructed in various ULBs to treat the sewage water. This treated water should be used for industrial, commercial and municipal greenery purposes among other uses.

2. CURRENT SCENARIO IN ANDHRA PRADESH

Andhra Pradesh is a rapidly urbanizing state; 146 lakh people, or 29.6% (Census 2011) of the state's population live in urban areas, and urban populations are growing at an accelerating pace.

The state of Andhra Pradesh faces serious environmental issues as a result of rapid economic growth, urbanization, and population growth, while the growth of state is both desired and encouraged, water demands are increasing beyond the capacity of the local water resources. A significant deficit exists between the potable water supply and water demands from citizens, commercial establishments, industries and for miscellaneous usage in the state of Andhra Pradesh. Since 1993 the water supply in the state has increased from several hours to reasonable supply by this year from then. Even though state and ULBs are taking steps to increase the city's water supply, the gap between water supply and demand for various needs is projected to continue to increase in the future. Closing this gap is a challenge as water has become a scarce commodity for the population, and the resulting demand for clean water, continues to grow at a fast pace.

Wastewater generation has increased along with the increase in water supply and consumption and the quantity of untreated wastewater discharged into local lakes and rivers has resulted in their becoming polluted and unattractive for most beneficial uses. The State has several natural lakes in the urban area, rivers and river basins and the increased pollution has turned most of the rivers with high BOD concentrations (about 100 mg/L) and no dissolved oxygen. Since year 2000, state is tackling pollution abatement of various lakes in the state under the Lakes Restoration Projects with aid from the Netherlands Government.

The ever-increasing urban population coupled with waste water release into the open environment has put a severe strain on India's fresh water resources, such as rivers, lakes and aquifers. Industrialization and economic growth increased the demand for fresh water while inadequate management and treatment of industrial and domestic wastewater has polluted such water sources. The combined effect of these has not only resulted in scarce and dwindling resources but has also made it difficult for cities to meet their increasing water needs. As a result, cities are adopting unsustainable practices, such as bringing water from distant places thereby increasing pumping stages (which increase the cost of landed water) and over-exploitation of groundwater resources, the ground water availability has gone down at several places.

To bridge the gap between demand and supply, State is executing several projects for augmentation of source for water supply. The unit cost of water, inclusive of capital cost and operating cost, is estimated to be Rs. 18 – 23/m^3. Another option to help

bridge the 'gap' is to recycle treated wastewater. At present, the state generates about 1829 MLD of wastewater, currently of which 448 MLD of wastewater is discharged after treatment in the existing STPs while the balance remains untreated.

To augment the deficient water resources, our cities need to adopt innovative ways such as the rainwater harvesting and recycle/reuse of wastewater. The thinking of town planners needs a paradigm shift to view wastewater as a valuable supplemental source for various applications, such as non-potable municipal and industrial applications, and to augment water sources through appropriate technology and management interventions. Several studies have been conducted to evaluate the options for reuse of treated wastewater. Groundwaters recharge, irrigation use, industrial uses and watering to green belts have been figured as possible options.

There are 32 AMRUT towns and 78 non-AMRUT towns in the state of Andhra Pradesh. Of these combined 110 Urban Local Bodies only 11 local bodies possess Sewage Treatment Plants (STPs), DPRs are currently being developed to construct underground sewerage systems (UGSSs) and STPs in some non-AMRUT towns.

The total Sewage generated from 110 ULBs in the state is 1829 MLD. At present 448 MLD is being treated through existing STPs in 11 ULBs. Further, A capacity of 372 MLD is taken up under One Time Special Financial Assistance (OTSFA), Housing and Urban Development Corporation (HUDCO) & other schemes in 5 ULBs and a capacity of 187 MLD is taken up under AMRUT scheme in 23 ULBs. These schemes are under progress. For the balance STP capacity of 821 MLD is proposed under CIIP at a cost of Rs. 1,477 Crs. The breakup for the STP capacity city wise and district wise is mentioned in the tables below.

TABLE 1: DETAIL OF EXISTING STPS – CITY WISE SUMMARY

Sl. No.	Name of the ULB	Existing STP (MLD)
1	Puttaparthi	1.50
2	Tadipathri	11.50
3	Nagari	4.00
4	Tirupati	50.00
5	Yemmiganur	19.80
6	Kadapa	20.00
7	Pulivendula	6.50
8	Rajamundry	30.00
9	Vijayawada	137.00
10	Vishakhapatnam	162.00
11	Vizianagaram	5.20
	Total	**447.50**

TABLE 2: DISTRICT SUMMARY DETAILS OF STP CAPACITIES

Sl. No.	Name of the Dist.	Population (2011 Census)	Sewerage			
			STP's Capacities (MLD)			
			Existing	Proposed (AMRUT)	Proposed Others (OTSFA, HUDCO and Others)	Proposed CIIP
1	Srikakulam	3,33,439	0.00	10.00	0.00	29.93
2	Vizianagaram	4,29,718	5.20	0.00	0.00	41.65
3	Visakapatnam	19,65,587	162.00	5.00	54.00	12.45
4	East Godavari	10,91,808	30.00	10.00	0.00	71.02
5	West Godavari	8,06,920	0.00	15.00	0.00	82.09
6	Krishna	16,04,944	137.00	10.00	70.00	57.24
7	Guntur	16,76,577	0.00	15.00	143.00	87.85
8	Prakasam	6,27,312	0.00	15.00	0.00	69.31
9	Nellore	9,53,545	0.00	15.00	105.00	31.29
10	Chittoor	1009585	54.00	12.50	0.00	69.67
11	Kadapa	9,06,829	26.50	20.00	0.00	68.06
12	Ananthapur	1104476	13.00	33.00	0.00	88.89
13	Kurnool	11,38,106	19.80	27.00	0.00	106.29
	Total	**1,36,48,846**	**447.50**	**187.50**	**372.00**	**815.74**

The state has issued a GO (GO.MS.135 dated 31-03-2017) on "Waste Water Reuse & Recycle Policy" for effective Water Resource Management for Urban Local Bodies in Andhra Pradesh". The copy of GO.MS.135 is provided as Annexure-I

3. THE POLICY RATIONALE

The rationale behind the adoption of the wastewater reuse, recycle policy by the state of Andhra Pradesh entails the following:

- Coping with the water scarcity situation.
- Protecting the public health and the environment.
- Prevention of contamination of other sources of water.
- Water allocation and movement among sectors also needs to be driven by economic motives.
- Applying the Integrated Water Resources Management (IWRM) approach and best practices.
- Considering the Policy as part of mitigation measures of the effect of climate change.
- Increasing the amounts of treated Wastewater (WW) and considering it as a potential water and revenue source.

This volume of wastewater generation, combined with the decreased volumes of fresh water available for drinking water supply, irrigated agriculture, and industries caused the state of Andhra Pradesh to consider the adoption of policy for wastewater reuse and recycle.

Varieties of crops are grown using irrigated blended wastewater; Principal concerns in the use of wastewater for irrigation include its salinity, chloride concentrations, and the presence of fecal coli forms and nematode eggs. Industrial operations and processes also can use reclaimed wastewater, however there are. Several implementation and management issues related to development and implementation of wastewater recycle and reuse projects, including site conditions, local issues and needs, financial cost benefit analysis, stakeholder sensitivities, application specific criteria for treated wastewater quality, and public health. Since any inadvertent or unauthorized use or discharge of the treated wastewater may pose a huge public health risk, maintaining treated wastewater quality to optimum levels is of utmost importance. Therefore, a risk management framework approach is imperative to provide an ongoing and measurable assurance that performance requirements are being continuously met.

The Indian standards and regulations specify the quality of treated effluents allowed to be discharged or destined for reuse in various urban reuses; where there will be a requirement for a secondary level of treatment. Quality specifications should be in harmony with WHO guidelines for the safe use of treated effluent.

4. POLICY STATEMENTS

On Substitution Priorities

1. Government of Andhra Pradesh and the local bodies will work on increasing amounts of treated wastewater, through developing existing and new facilities.

2. Priority for substitution shall be given to industry or irrigated and irrigable lands with high productivity potential. All water users who are consuming in large scale per day including industrial clusters shall apply on a central portal indicating their requirement of water, this procedure would be followed by all new applicants also.

3. Reclaimed water shall be used for industry and agriculture as much as possible in order to save the fresh water for domestic uses.

4. Water quantities for agriculture shall be determined and tied to the area allowed to be irrigated from ground waters. Substituting the groundwater with blended (treated wastewater or surface water) shall be a major principle. [Convergence with Groundwater Mission, Neeru Chettu]

5. Lands adjacent or close to the substitute water shall have priority in exchange for fresh underground water.

6. Priority utilization and use shall apply to impounded waters in reservoirs; such waters shall be treated for its intended use.

7. Establishment of Decentalized Wastewater Treatment Systems (Dewats)

On Institutional and Administrative Arrangements

1. A mechanism to price (tariff setting) treated wastewater, as well as blended treated wastewater will be developed taking into consideration fairness, cost recovery and economic activities support. Consideration shall be given to suitability, quality, and percentage of fresh water, location and reducing freshwater usage. This will reduce groundwater over- abstracting. A robust mechanism to adjust the prices shall be explored and agreed upon.

2. Technical, financial, economic and legal capacities shall be rebuilt under strong administrative body responsible for water substitution plans implementation. Responsibilities shall focus on change management and capacity building.

3. In cooperation with MOA (Ministry of Agriculture), farmers shall be assisted to choose the right types of produce and adopt the best irrigation and marketing practices.

4. The Water Users Associations shall have a role in implementing this policy. The ministry will work with this association by building their capacities toward better implementation.

5. Monitoring programs shall be crafted and implemented. The reuse of treated wastewater is in wide use across Jordan and gaining an acceptance by government, farmers and communities, and cannot be disputed. Nevertheless, there are areas within the regulatory processes that need to consider a uniform approach to acceptable guidelines, such as the requirements for disinfection and monitoring of indicators (quality and characteristics) at particular times and intervals.

6. The state government or any particular department shall adopt and implement a State-Level and ULB-Level Plan for Operation and Maintenance of Wastewater treatment plants aiming at achieving efficiency and maximum utilization of treated waterwater. The plan will include best available models based on integrated wastewater and septage management principles including private sector participation.

7. Private sector participation in reuse plans will be introduced; Community Based Organizations (CBO's) and Nongovernmental organizations (NGO's) will also be part of the process.

On Resource Management

1. Rain water harvesting in identified critical areas shall be expanded to collect and impound rain water that can be used as substitute water directly and indirectly through ground injection.

2. Wastewater collection and treatment shall be expanded in all parts of the country and according to priorities; substitution requirements is part of.

3. Establishment of decentralized wastewater treatment system and utilizing the treated wastewater at decentralized locations

4. Irrigation schemes shall be rehabilitated and expanded by using treated wastewater.

5. Industries, Farmers, being the recipients and prime beneficiaries, shall participate in managing and monitoring the use of treated wastewater.

6. Fresh water allocated to industries and irrigated agriculture shall be capped and eventually reduced according to medium- and long-term plans to be prepared and implemented after which the reallocation plan can be updated accordingly.

7. A dynamic and sustainable economic development plan coupled with investment program shall be formulated and implemented for the use of surface waters and treated wastewater efficiently.

On Legislations

1. State Level Treated wastewater specifications and standards shall be amended (encouraged to adopt as per IS and ISO standards) to include and ensure a safe reuse and to produce high economic return products, in line with the substitution goals and development requirements in a state suffering from water scarcity.

2. Strict regulatory measures to manage the use of reclaimed water for agriculture or other purposes shall be followed.

3. An integrated approach to water resources management (IWRM), combined with locally appropriate and sustainable risk reduction measures, and the active involvement of stakeholders from different sectors shall be established.

On Public Acceptance and Awareness

1. Awareness and educational programs and campaigns shall be crafted and implemented. These shall target citizens, farmers, industries and grouping them via unions according to their areas so that 1the amount of ground water pumping is reduced and benefits and economic return per cubic meter are optimized.

2. The programs should take into consideration belief and perception of public based on scientific and logical proofs.

On Technology, Research and Development

1. Modern treatment technologies shall be employed that produce reclaimed water directed towards maximizing saving and replacing freshwater for municipal consumption.

2. The Effluent quality standards shall be revised to suit various reuse purposes.

3. Domestic wastewater shall be treated and purified for full utilization for industrial, agricultural, cooling and other uses.

4. The related data and information will be tabulated and organized for easy use and reference. It will be part of the information system that will facilitate research.

5. WASTEWATER REUSE AND OPPORTUNITIES

Urban Reuse

While there are several major categories of water reuse, urban water reuse is only now emerging in India. Some important components of the reclaimed water portfolio of many emerging urban reuse plans are:

- irrigation landscape irrigation
- fire protection and toilet flushing
- recreational opportunities without human contact

Urban reuse is often divided into the following categories:

- **Unrestricted**: The use of reclaimed water for non-potable applications in municipal settings where public access is not restricted.
- **Restricted**: The use of reclaimed water for non-potable applications in municipal settings where public access is controlled or restricted by physical or institutional barriers, such as fences or timings of application of the reuse water or temporal access restriction.

When treated, wastewater is used to irrigate residential areas, public parks and related sports etc. or is used for toilet flushing and washing, it has to receive significant treatment and high-level disinfection so as to be not considered a threat to public health. Suggested minimum water quality criteria for urban non-potable water reuse are as below.

TABLE 3: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR URBAN NON-POTABLE REUSE

Parameter	Units	Value
BOD_5	mg/L	≤ 3[3]
Turbidity	NTU	≤ 2
Fecal coli forms	MPN/100 ml	NIL
Chlorine residual	mg/L	1 – 2
pH		6 – 9
Color (Hazen)		Non-detectable

Agricultural Reuse

Use of wastewater in agriculture has a long history and currently represents a significant percentage of use worldwide, especially in emerging economies such as India. With increasing population and sanitation, more treated wastewater is available. The cost of treating wastewater to secondary (and sometimes even higher) standards is generally lower than the cost of pumping potable water from distant sources or for producing it from unconventional water sources (e.g., desalination).

The option of allocating treated wastewater to irrigation is often the preferred and least expensive alternative for municipalities. Irrigation of crops (both food and non-food) with untreated wastewater is widely practiced in many parts of the developing world with accompanying adverse public health outcomes. Nonetheless, this practice represents an economic necessity for many farming communities and for the rapidly expanding population at large, much of which is dependent on locally grown crops.

The WHO guidelines (WHO, 2006) for irrigation with treated wastewater have been successfully applied to irrigation reuse applications throughout the world. However, the CPHEEO Manual 2013 has suggested the following standards which should be followed at a minimum.

TABLE 4: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR AGRICULTURAL REUSE (SOURCE: CHAPTER 7, PART A OF THE CPHEEO 2013 MANUAL ON SEWERAGE AND SEWAGE TREATMENT)

Parameter	Units	Value
Intestinal nematodes	No./litre	< 1
Faecal coliforms	MPN/100 ml	Nil (for crop eaten raw) & <230/100 ml (for crops eaten cooked or non-edible crops)
pH		6 – 9

Environmental/Recreational Reuse

Environmental reuse primarily includes the use of treated wastewater to support wetlands and to supplement stream and river flows. Aquifer recharge also may be considered environmental reuse, but because this practice is integral to management of many complex issues it is recommended as an area of future study.

TABLE 3: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR ENVIRONMENTAL/ RECREATIONAL REUSE (SOURCE: CHAPTER 7, PART A OF THE CPHEEO 2013 MANUAL ON SEWERAGE AND SEWAGE TREATMENT)

Parameter	Units	Value
BOD_5	mg/L	≤ 10
TSS	mg/L	< 5
Faecal coliform	MPN/100 ml	Nil
pH		6.5 – 8.3
Total Kjeldahl Nitrogen (as N)	mg/L	< 5 for impoundments, < 10 for Horticulture
Dissolved Phosphorus (as P)	mg/L	1
Colour (Hazen)		Non-detectable

Impoundments

As with any form of reuse, the development of water reuse projects that include impoundments will be a function of water demand coupled with a cost-effective source of suitable quality reclaimed water. Regulation of impoundments that are maintained using treated wastewater has to be according to the potential for contact for that use. Please refer above Table 3 for minimum suggested standards.

Wetland and River/Stream Flow Augmentation

As with impoundments, water quality requirements for wetlands and river or stream augmentation will be based on the designated use of the water course and the aim to enhance an acceptable appearance. In addition, there should be an emphasis on creating a product that can promote native aquatic life. The quality of the reclaimed water discharged to the receiving water body is critical to evaluating its benefits to the stream. Water reclamation for stream augmentation applications requires consideration of a complex set of benefits and risks. Suggested minimum water quality criteria are given in Table 6.

TABLE 6: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR WETLAND AND RIVER/STREAM FLOW AUGMENTATION (SOURCE: USEPA 2004 GUIDELINES)

Parameter	Units	Value
BOD_5	mg/L	≤ 3[4]
TSS	mg/L	≤ 5
Faecal coliform	MPN/100ml	≤ 50[a]
Chlorine residual	mg/L	1 – 2
pH		6 – 9

Industrial Reuse

Traditionally, pulp and paper facilities, textile facilities, and other facilities using reclaimed water for cooling tower purposes have been the primary industrial users of reclaimed water. However, the industrial use of treated wastewater has grown in a variety of industries ranging from electronics to process industries, food processing, as well as a broader adoption by the power-generation industry. Over the past few years, these industries have embraced the use of such water for purposes ranging from process water, boiler feed water, and cooling tower use to flushing toilets and site irrigation. Since industry can control water quality within their processes, specific standards for industrial use are not being provided here. Table 5 provides typical water quality requirements for different industrial applications.

Reuse by Construction Industry

The construction industry is the newest entrant to the industrial category and many urban utilities are now supplying treated wastewater for construction. The suggested standards for construction should follow the standards as provided in the CPHEEO Manual and established by the Bureau of Indian Standards.

Ground Water Recharge

Groundwater recharge to aquifers not used for potable water has been practiced for many years but has often been viewed as a disposal method for treated wastewater effluent. In addition to providing a method of treated effluent disposal, groundwater recharge of treated wastewater can provide a number of other benefits, including the following:

- Recovery of treated water for subsequent reuse or discharge
- Recharge of adjacent surface streams
- Seasonal storage of treated water beneath the site with seasonal recovery for agriculture.

In many cases, groundwater can be recharged in a manner that also utilizes the soil or aquifer system where such water is applied as an additional treatment step to improve the quality. Suggested water quality criteria that need to be met at a minimum for groundwater recharge are given in the Table 8.

However, as cautioned by the CPHEEO, 2013 Manual, such use should be considered after careful study of site conditions and requirements with strict monitoring measures.

TABLE 8: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR GROUNDWATER RECHARGE (SOURCE: USEPA 2004 GUIDELINES)

Parameter	Units	Infiltration basins	Vadose zone /recharge wells	Direct injection
Drinking water standards	mg/L	Not applicable	Not applicable	As applicable
Total nitrogen	mg/L	≤ 12	≤ 12	≤ 12
pH		6 – 9	6 – 9	6 – 9

Indirect & Direct Potable Use

It is well known fact that water reclamation for non-potable applications is well established. The use of reclaimed water to augment potable water supplies has significant potential for helping to meet future needs, but planned potable water reuse only accounts for a small fraction of the volume of water currently being reused worldwide. On the other hand, the unplanned reuse of wastewater effluent as a water supply is common, with some drinking water treatment plants using waters for which a large fraction originated as wastewater effluent from upstream communities, especially under low-flow conditions. This is true in all states. However, in India and other developing countries direct potable water reuse is an area of future growth and there needs to be more research and success before it is promoted in India.

Currently, there are only general discharge standards available for discharge of wastewater in India and this Policy has attempted to provide some minimum criteria as a starting point for reuse of discharged wastewater.

6. ACTION TAKEN BY ANDHRA PRADESH

The Andhra Pradesh government proposes to use the treated water for thermal power plants/industrial establishments etc., near the treatment plants. Substantial work has been carried out for three ULBs in the State and the status of the same is provided below.

- From 13 MLD STP at Mudasarlova, 200KLD of treated sewerage is being supplied to Golf club, Visakhapatnam. The same is being used for maintenance of grass. The copy of MoU is provided as **Annexure-II.**
- From 38 MLD at Saraswathi Talkies 2 MLD of water is being supplied to Visakhapatnam Port Trust. The same is being used for wetting of roads in VPT area.
- From 50 MLD STP in Tirupati, an amount of 2.5 MLD of treated water is being supplied to Srikalahasti Pipes Limited.

Proposed Reuse of Treated Water

- Greater Visakhapatnam Municipal Corporation (GVMC) through Greater Visakhapatnam Smart City Corporation Limited (GVSCCL) has identified the opportunities to reuse 45 MLD of treated wastewater in Vishakhapatnam Steel Plant (VSP). Accordingly, series of discussions were held with VSP. A Memorandum of Understanding (MoU) has been signed by GVMC with VSP as a result of these discussions. The copy of the MoU is provided in the **Annexure-III**.
- Greater Visakhapatnam Municipal Corporation (GVMC) identified the opportunity to reuse 21 MLD of treated wastewater in Hindustan Petroleum Corporation Limited (HPCL). Accordingly, series of discussions were held with HPCL. A Memorandum of Understanding (MoU) has been signed by GVMC with HPCL as a result of these discussions. The copy of Minutes of meeting indicating the agreement with HPCL is provided as **Annexure-IV**.
- 20 MLD treated water from Vijayawada Municipal Corporation (VMC) is planned to be used in Dr. N. Tata Rao Thermal Power Plant (VTPS). The discussions are being carried out with VTPS in this regard. The Memorandum of Understanding has not yet been signed with VTPS. The copy of the latest communication from VMC to VTPS is provided in **Annexure-V**.

- 3.5 MLD treated water from Tadipatri Municipality is planned to be used in Gerdau Steel Plant. Series of discussions were held with Gerdau steel plant in this regard. The signing of Memorandum of Understanding with Gerdau Steel Plant is under progress. The copy of the latest communication from Tadipatri Municipality to Gerdau Steel Plant is provided in **Annexure-VI**.

Based on the experiences gained in carrying out the above-mentioned activities, further opportunities of treated wastewater reuse for the Industrial purposes in the state are being identified.

7. WAY FORWARD

FRAMEWORK FOR CONSTRUCTION OF STP'S

- City level action plans will be prepared for reuse of the treated wastewater.

S.No	Number of STPs	Capacity of STPs in MLD	Scheme Under which STPs are proposed to take up	Expected Date of Completion
1.	02	120.00	HUDCO, OTSFA	September, 2020
2.	13	92.50	AMRUT	December, 2020
3.	10	95.00	AMRUT	June, 2021
4.	02	150.00	HUDCO, OTSFA	June, 2021
5.	01	102.00	HUDCO	December, 2021
6.	35	400.00	CIIP	December, 2022
7.	40	415.75	CIIP	June, 2023
Total	**103**	**1375.25**		

As mentioned above a total 103 STPs will be constructed with a total capacity of 1375.25 MLD by June 2023. The capacity building activities as mentioned in section below will be conducted as per the given timelines.

8. Institutional Development & Capacity Building Initiatives

To institutionalize the policy initiatives as envisaged in the policy Document (G.O. Ms. No. 135 of MA&UD (UBS) dated 31.03.2017, the following initiatives are envisaged

Envisaged Interventions – Long Term Actions	Timeline
1. Set up a State Level Empowered Committee (SEC) – for policy decisions regarding • Review and Refinement of Policy Directions • Developing Long-term plans and reforms to promote recycling and reuse of treated waste water. • Policies for integrating Systems of Source Water Augmentation, River Basins Management, Rain Water Harvesting, protection of Water Bodies • Setting up Projects' Priorities and Approval • Water allocation for mandatory uses in Industrial, Agricultural and other Urban use purposes • Appointment Policy Implementation, Monitoring, and Quality Control Agencies • Disputes Resolution	30th April, 2019
2. **Setting up a Technical Cell (STC) for providing**; • Secretarial and Technical Assistance to SEC • Technical Standards, • Preparation of DPRs • Projects Evaluation, • Monitoring of Projects Execution.,etc., • Technology Based Monitoring System i. Projects Execution ii. Projects Operation – Water Treatment, Emission, Reuse • Capacity Building and R&D • Public Awareness	15th May, 2019
3. ULB / Utility (Treatment Plant) Level Systems • Enacting By-laws • Creating database of waste water generators and potential users treated waste water: • Manufacturing, infrastructure, and construction industries, • agricultural, commercial and urban users • Establishing Water Metering Systems	30th October, 2019

Envisaged Interventions – Long Term Actions	Timeline
• Project Estimates Preparation – Transmission Lines, Networks etc., • O&M Costs Assessment and Cost Projections i. Transportation ii. Energy Use and Costs	

Envisaged Interventions – Short Term Actions	Timeline
1. Preparation of City Waste Water Reuse and Recycle Plan (CWWRRP) – This concept should be considered as part of city sanitation plan for the cities. Every city must possess a city waste water reuse and recycle plan. The components like, either formation of a city level stakeholder's committee or farming a sub group in City Sanitation Task Force(CSTF) will decide different options and resources available within the city to reuse and reduce the treated water for water conservation either at centralized or decentralized method. A state level concept note will be developed and circulars will be issued to urban local bodies to follow the guidelines.	31st May, 2020
2. Capacity Building Program – As per the CPHEEO Manual every urban local body is having an environmental engineer looking after solid waste management and liquid waste management. Similarly, these environmental engineers will also be given a task of preparing the city capacity building program. A training program will be held for all these engineers with the help of experts guiding them to prepare city level framework on the above issue.	31st May, 2020
3. Capacity Building for Stakeholders -. An awareness program will be conducted to the Public representatives, NGOs and other identified stakeholders on the quality of treated water and possible reusing opportunities in different sectors. This will help in understanding the need to use treated waste water as a source and a positive attitude towards the treated water.	31st May 2020

9. CONCLUSION

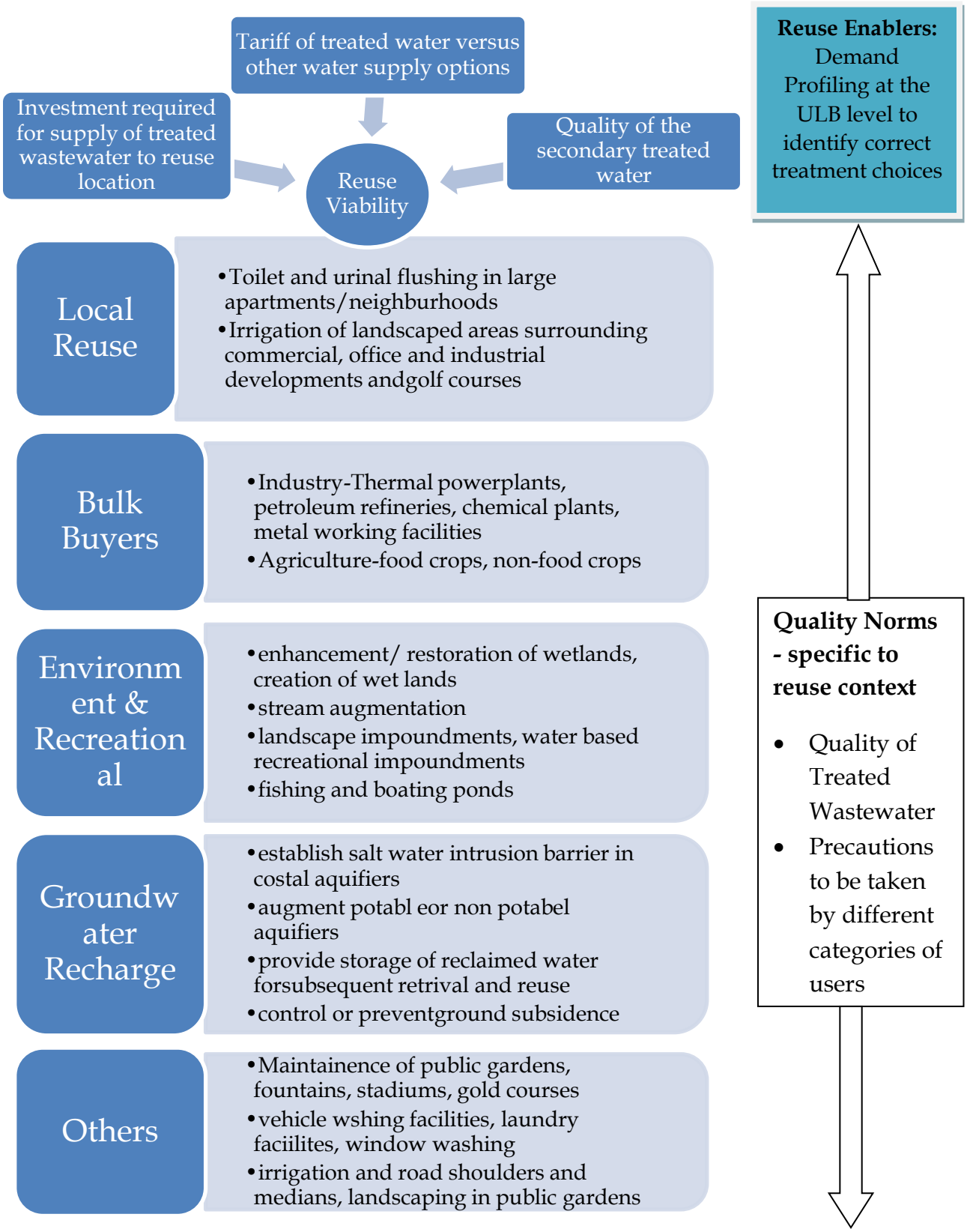
There is no doubt, waste water should be treated as a resource with great opportunities. This document talks about the current status of wastewater treatment infrastructure in Andhra Pradesh and the planned future capacities for treatment. We have highlighted the ways in which this treated water can be used in various areas ranging from irrigation use to industrial use.

There should be a strong state and central government policy that incentivises the use of treated waste water and discourages the excessive use and extraction of groundwater by industries. The state government should make policies that go in line with the central government policies. This calls for a strong waste water reuse policy from the central government which targets, setting out the legislative, regulatory and financial measures needed to achieve these targets. This policy should define quality norms (from Ministry of Environment and Ministry of Water Resources) for different grades of industrial water which will help standardise design of reuse systems nationwide. National level norms for water safety planning and risk management are also needed to build credibility for reclaimed water as a reliable alternative.

State level workshops are an opportunity to sensitize utility managers about water reuse, covering technology options, new standards, policy incentives, implementation challenges, and best practices in procurement and treatment around the world. At the ULB level, there should be a detailed case study of the sources of waste water and the ways to treat them either at the centralized or decentralised method, terms of the design capacity, technology and treatment level required for use of treated water in various areas that suit the ULBs needs. The ULBs should come with a case based financial model which helps to receive sustained revenue, with minimum Operation & Maintenance.

The investment towards establishment of treatment plants and revenue from the sale of treated water by sensitizing the public will give returns in long terms humongous benefits and reduce the strain on our natural water resources.

10. WASTE WATER REUSE FRAMEWORK



Note: The other byproducts of waste water treatment include bio solids or sludge, biogas. These can be used as manure, source of fuel for brick-making, etc.

Annexure I - G.O.Ms.No.135 on Waste Water Reuse & Recycle Policy

GOVERNMENT OF ANDHRA PRADESH
A B S T R A C T

Municipal Administration & Urban Development – Waste Water Reuse & Recycle Policy as part of implementation of reforms under the AMRUT for the year 2016-2017 – Approved – Orders – Issued.

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MUNICIPAL ADMINISTRATION & URBAN DEVELOPMENT (UBS) DEPARTMENT

G.O.Ms.No.135 Dated:31-03-2017

Read:-

From the Director of Municipal Administration, Guntur Letter Roc No.1638/2017- M3 dated 14.03.2017.

*** ***

O R D E R:

In the circumstances reported by the Director, Municipal Administration, Guntur in the reference read above, Government hereby approve the "Waste Water Reuse & Recycle Policy" for effective Water Resource Management for Urban Local Bodies in Andhra Pradesh as annexed to this order.

The Director, Municipal Administration, Guntur shall take necessary further action in the matter.

(BY ORDER AND IN THE NAME OF THE GOVERNOR OF ANDHRA PRADESH)

R.KARIKAL VALAVEN
PRINCIPAL SECRETARY TO GOVERNMENT

To
The Director, Municipal Administration, Gorantla, Guntur.
Sf/Sc

//FORWARDED BY ORDER//

ASSISTANT DIRECTOR

POLICY ON
"WASTEWATER REUSE & RECYCLE FOR URBAN LOCAL BODIES"
IN ANDHRA PRADESH

Towards Effective Water Resource Management

Table of Contents

Annexures

ABBREVIATIONS

AMRUT	ATAL MISSION FOR REJUVENATION AND URBAN TRANSFORMATION
APSPCB	ANDHRA PRADESH STATE POLLUTION CONTROL BOARD
BOD	BIOLOGICAL OXYGEN DEMAND
C&D	CONSTRUCTION AND DEMOLITION
CA	CONCESSIONAIRE AGREEMENT
CAPEX	CAPITAL EXPENDITURE
COD	CHEMICAL OXYGEN DEMAND
CPCB	CENTRAL POLLUTION CONTROL BOARD
CPHEEO	CENTRAL PUBLIC HEALTH AND ENVIRONMENTAL ENGINEERING ORGANIZATION
GIZ	DEUTSCHE GESELLSCHAFT FÜR INTERNATIONALE
GO	GOVERNMENT ORDER
GOAP	GOVERNMENT OF ANDHRA PRADESH
HH	HOUSEHOLD
IRR	INTERNAL RATE OF RETURN
MLD	MILLION LITRES PER DAY
MOEF	MINISTRY OF ENVIRONMENT AND FOREST
MOU	MEMORANDUM OF UNDERSTANDING
NUSP	NATIONAL URBAN SANITATION POLICY
O&M	OPERATION AND MAINTENANCE
OPEX	OPERATIONAL EXPENDITURE
PPP	PUBLIC PRIVATE PARTNERSHIP
RCC	REINFORCED CEMENT CONCRETE
SAC	SWACHH ANDHRA CORPORATION
SBM	SWACHH BHARAT MISSION
SLB	SERVICE LEVEL BENCHMARK
SNUSP	SUPPORT TO NATIONAL URBAN SANITATION POLICY
SOTW	SECONDARY TREATED WATER
SPCB	STATE POLLUTION CONTROL BOARD
STP	SEWAGE TREATMENT PLANT
STW	SECONDARY TREATED WATER
TF	TRICKLING FILTER
TMC	TADIPATRI MUNICIPAL COUNCIL
TSS	TOTAL SUSPENDED SOLIDS
ULB	URBAN LOCAL BODY
UGD	UNDERGROUND DRAINAGE
VGF	VIABILITY GAP FUNDING
WHO	WORLD HEALTH ORGANISATION
WSP	WASTE STABILISATION POND

1 INTRODUCTION

India faces serious environmental issues as a result of rapid economic growth, urbanization, and population growth. These include pollution in urban and industrial areas and resource constraints with respect to water, land, forests, and energy. Growing water scarcity and water pollution are the most severe environmental problems in the country. in addition, scanty rainfall due to climate change has had a compounding effect on these resources. Erratic and unfavorable monsoon conditions have led to over-exploitation of groundwater resources. Less than normal precipitation has resulted in less accumulation of fresh water. The low level of water inflow coupled with increased exploitation has resulted in depleting water levels in reservoirs and rivers.

The state of Andhra Pradesh is also witnessing similar status quo, while the growth of state is both desired and encouraged, water demands have increased beyond the capacity of the local water resources. A significant deficit exists between the potable water supply and water demands in the state of Andhra Pradesh. Since 1993 the water supply in the state has been restricted to several hours per day on alternate days. Even though state and ULBs is taking steps to increase the city's water supply, the gap between water supply and demand is projected to continue to increase in the future. closing this gap is a challenge as water has become a scarce commodity and the population, and the resulting demand for clean water, continues to grow at a fast pace.

Wastewater generation has increased along with the increase in water consumption and the quantity of untreated wastewater discharged into local lakes and rivers has resulted in their becoming polluted and unattractive for most beneficial uses. The State has several rivers and river basins and the increased pollution has turned most of the rivers into a 'dead' waterway with high BOD concentrations (about 100 mg/L) and no dissolved oxygen. Since year 2000, state is tackling pollution abatement of various lakes in the state under the Lakes Restoration Projects with aid from the Netherlands Government. Despite polluted conditions; farmers and communities in the downstream continue to use the River water as raw water source for various purposes such as agricultural irrigation and for drinking water. The strain on water resources has led to excessive pumping of groundwater and groundwater levels are dropping fast.

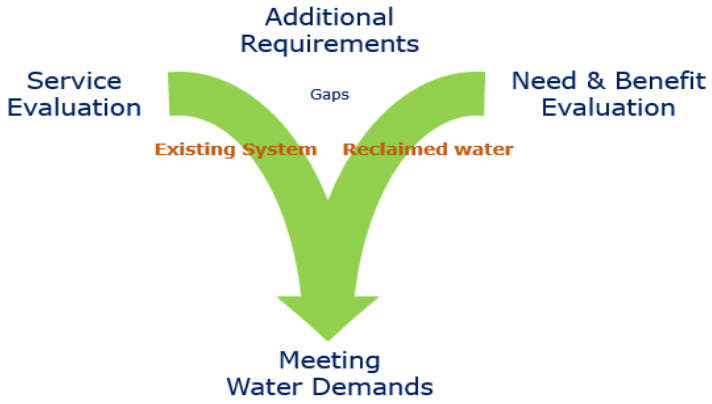
The ever-increasing urban population coupled with poor sanitation facilities has put a severe strain on India's fresh water resources, such as rivers, lakes and aquifers. Industrialization and economic growth has increased the demand for fresh water while inadequate management and treatment of industrial and domestic wastewater has polluted such water sources. The combined effect of these has not only resulted in scarce and dwindling resources but has also made it difficult for cities to meet their increasing water needs. As a result, cities are adopting unsustainable practices, such as bringing water from distant places thereby increasing pumping stages (which increase the cost of landed water) and over-exploitation of groundwater resources.

To bridge the gap between demand and supply, State is executing the several Water Projects. The unit cost of water, inclusive of finance cost and operating cost, is estimated to be Rs. 18 – 23/m^3. Another option to help bridge the 'gap' is to recycle treated wastewater. The state generates about 1068 MLD of wastewater, Currently, only about 115 MLD of wastewater is discharged after treatment while the balance remains untreated. The state is evaluating the techno-commercial and environmental feasibility of recycling the treated wastewater to help

bridge the demand-supply gap.

To augment the deficient water resources, Indian cities need to adopt innovative ways such as the rainwater harvesting and recycle/reuse of wastewater. The thinking of town planners needs a paradigm shift to view wastewater as a valuable supplemental source for various applications, such as non-potable municipal and industrial applications, and to augment water sources through appropriate technology and management interventions. Several studies have been conducted to evaluate the options for reuse of reclaimed water. Groundwater recharge, irrigation use, industrial use have figured as possible options.

However, mechanisms to monitor the benefits and revenue generation need to be established to effectively implement and derive the desired benefits from reuse and recycle besides the public health and environmental benefits which are paramount. Implementation of recycle and reuse water projects immensely depends on the site conditions, financial cost-benefit analysis and stakeholders' acceptance. Rainwater harvesting is also being implemented under the "NEERU CHETTU" project with reasonable success. Thus, many



initiatives are being taken by state to augment the fresh water supply.

FIGURE 1: MEETING WATER DEMANDS WITH RECLAIMED WATER

2 The Policy Rationale

The rationale behind the adoption of the wastewater reuse, recycle policy by the state of Andhra Pradesh entails the following:

a) Coping with the water scarcity situation
b) Protecting the public health and the environment
c) Water allocation and movement among sectors also needs to be driven by economic motives
d) Applying the Integrated Water Resources Management (IWRM) approach and best practices
e) Considering the Policy as part of mitigation measures of the effect of climate change
f) Increasing the amounts of treated Wastewater (WW) and considering it as a potential water and revenue source

With the current population of 49.38 million across 13 districts, the urban population is substantial at 30% of the total population. Total wastewater generated in the state of Andhra Pradesh is approximately 1068 MLD, however, amongst all 110 ULB[1]s in the state have a total capacity of the waste water treatment of 295 MLD and about 197 MLD capacity of waste water treatment plants are under construction.

This volume of wastewater generation, combined with the decreased volumes of fresh water available for drinking water supply, irrigated agriculture, and industries caused the state of Andhra Pradesh to consider the adoption of 'source substitution[2]' and wastewater reuse, recycle policy.

Varieties of crops are grown using irrigated blended wastewater; Principal concerns in the use of wastewater for irrigation include its salinity, chloride concentrations, and the presence of faecal coliforms and nematode eggs. Industrial operations and processes also can use reclaimed wastewater, however there are. several implementation and management issues related to development and implementation of wastewater recycle and reuse projects, including site conditions, local issues and needs, financial cost benefit analysis, stakeholder sensitivities, application specific criteria for treated wastewater quality, and public health. Since any inadvertent or unauthorized use or discharge of the treated wastewater may pose a huge public health risk, maintaining treated wastewater quality to optimum levels is of utmost importance. Therefore, a risk management framework approach is imperative to provide an ongoing and measurable assurance that performance requirements are being continuously met.

The Indian standards and regulations specify the quality of treated effluents allowed to be discharged or destined for reuse in various urban reuses; where there will be a requirement for a secondary level of treatment. Quality specifications should be in harmony with WHO guidelines for the safe use of treated effluent

Benefits of Wastewater Recycling

Instituting wastewater recycling presents several advantages to the state of Andhra Pradesh. First, it reduces the demand for conventional water and sewerage infrastructure. It is important to note here that these costs are not excessive, and in fact less than what would be required to build, extend, and operate a conventional sewerage system. State money saved can then be redirected for other purposes – expanding access to piped water and sanitation, for example.

Second, **wastewater recycling conserves water**. Depending on the extent of the treatment and reuse possibilities, water usage can be cut by 20-50%. Many of India's cities such as Bangalore, Pune, and Delhi suffer from shortages of drinkable water and are currently attempting to institute wastewater recycling polices to combat current crises – Andhra Pradesh has the opportunity to avoid those crisis in the first place by enacting 21st century policies like wastewater recycling.

Lastly, **wastewater recycling** reduces pollution. Currently, the vast majority of wastewater is directed straight to open drains. Flowing through drains, this wastewater passes on into surface water bodies and groundwater, contaminating these twin sources of water, and in turn, spreading diseases through the population – particularly women and children. Moreover, sometimes the water doesn't flow through open drains, instead sitting stagnant and providing disease-spreading mosquitos ample breeding grounds. Instituting a wastewater recycling policy would meet this problem at its source – treating water and reducing the amount of polluted water in open drains.

3 Objectives of the Policy: "Moving from Theory to Action"

(Convergence w/SDG Goals)

This policy is intended to direct the water sector towards more efficient use of water resources. It details the intention to reuse treated wastewater in irrigation that enables freeing fresh water to be utilized for municipal uses. It also provides for using the treated wastewater in other economic activities. It calls for expanding collection and treatment of wastewater, updating and development of standards and practices for substituting fresh water used in irrigation and industry by treated wastewater after blending it. The policy aims also at increasing surface water utilization for municipal uses and thus decreasing the strain on groundwater.

[1] *Amongst 110 urban local bodies only 8 ULBs have partial sewerage network coverage and sewage treatment capacities & 3 additional ULBs are in the process of implementation of sewerage facilities.*

[2] *Use of reclaimed water for non-potable purposes offers the potential for exploiting a "new" and captive resource that can substitute the potable water source. This idea, known as "source substitution," is not new. In fact, the United Nations Economic and Social Council (UNESC) enunciated a policy in 1958 that "No higher quality water, unless there is a surplus of it, should be used for a purpose that can tolerate a lower grade." Many urban, commercial and industrial uses can be met with water of less than potable water quality.*

Although the policy can be better implemented through centralized wastewater collection and treatment systems, the decentralized systems are still needed to suit different locations. Local reuse systems should also accompany the decentralized systems.

The objectives are:

1. Managing the scarce water resources efficiently, maximizing the benefits and returns, and proposing actions required for implementation
2. Protecting the public health, environment and nature
3. Enhancing economic efficiency
4. Ensuring sustainability and preserve fresh water The main Pillars of this Policy are:

1. Water needs and competition between economic centres
2. Public health and Environmental considerations
3. Availability of infrastructure
4. Public acceptance
5. Suitability and adequacy of high quality water
6. Sustainability and enforcement of regulations, and adequate collaboration with research and development departments.

4 Policy Statements

4.1 On Substitution Priorities

1. Government of Andhra Pradesh and the local bodies will work on increasing amounts of treated wastewater, through developing existing and new facilities.
2. Priority for substitution shall be given to industry or irrigated and irrigable lands with high productivity potential.
3. Reclaimed water shall be used for industry and agriculture as much as possible in order to save the fresh water for domestic uses.
4. Water quantities for agriculture shall be determined and tied to the area allowed to be

irrigated from ground waters. Substituting the groundwater with blended (treated wastewater or surface water) shall be a major principle. [Convergence with Groundwater Mission, Neeru Chettu]

5. Lands adjacent or close to the substitute water shall have priority in exchange for fresh underground water.
6. Priority utilization and use shall apply to impounded waters in reservoirs; such waters shall be treated for its intended use.

4.2 On Institutional and Administrative Arrangements

7. A mechanism to price (tariff setting) treated wastewater, as well as blended treated wastewater will be developed taking into consideration fairness, cost recovery and economic activities support. Consideration shall be given to suitability, quality, and percentage of fresh water, location and reducing freshwater usage. This will reduce groundwater over- abstracting. A robust mechanism to adjust the prices shall be explored and agreed upon.
8. Technical, financial, economic and legal capacities shall be rebuilt under strong administrative body responsible for water substitution plans implementation. Responsibilities shall focus on change management and capacity building.
9. In cooperation with MOA (Ministry of Agriculture), farmers shall be assisted to choose the right types of produce and adopt the best irrigation and marketing practices.
10. The Water Users Associations shall have a role in implementing this policy. The ministry will work with this association by building their capacities toward better implementation.
11. Monitoring programs shall be crafted and implemented. The reuse of sewerage effluent is in wide use across Jordan and gaining an acceptance by government, farmers and communities, and cannot be disputed. Nevertheless, there are areas within the regulatory processes that need to consider a uniform approach to acceptable guidelines, such as the requirements for disinfection and monitoring of indicators (quality and characteristics) at particular times and intervals.
12. The state government or any particular department will adopt and implement a State-Level and ULB-Level Plan for Operation and Maintenance of Wastewater treatment plants aiming at achieving efficiency. The plan will include best available models based on integrated wastewater and septage management principles including private sector participation.
13. Private sector participation in reuse plans will be introduced; community based initiative organizations (CBO's) and Nongovernmental organizations (NGO's) will also be part of the process.

4.3 On Resource Management

14. Rain water harvesting in identified critical areas shall be expanded to collect and impound rain water that can be used as substitute water directly and indirectly through ground injection.
15. Wastewater collection and treatment shall be expanded in all parts of the country and according to priorities; substitution requirements is part of.
16. Irrigation schemes shall be rehabilitated and expanded.
17. Ground Water Users Associations will be established in identified critical areas.

Industries, Farmers, being the recipients and prime beneficiaries, shall participate in managing and monitoring the ground water used, treated wastewater use and possibility of blending.

18. Fresh water allocated to industries and irrigated agriculture shall be capped and eventually reduced according to medium and long term plans to be prepared and implemented after which the reallocation plan can be updated accordingly.
19. A dynamic and sustainable economic development plan coupled with investment program shall be formulated and implemented for the use of surface waters and treated wastewater efficiently.

4.4 On Legislations

20. State Level Treated wastewater specifications and standards shall be amended to include and ensure a safe reuse and to produce high economic return products, in line with the substitution goals and development requirements in a state suffering from water scarcity.
21. Strict regulatory measures to manage the use of reclaimed water for agriculture or other purposes shall be followed.
22. An integrated approach to water resources management (IWRM), combined with locally appropriate and sustainable risk reduction measures, and the active involvement of stakeholders from different sectors shall be established.

4.5 On Public Acceptance and Awareness

23. Awareness and educational programs and campaigns shall be crafted and implemented. These shall target citizens, farmers, industries and grouping them via unions according to their areas so that 1the amount of ground water pumping is reduced and benefits and economic return per cubic meter are optimized.
24. The programs should take into consideration belief and perception of public based on scientific and logical proofs.

4.6 On Technology, Research and Development

25. Modern treatment technologies shall be employed that produce reclaimed water directed towards maximizing saving and replacing freshwater for municipal consumption.
26. The Effluent quality standards shall be revised to suit various reuse purposes.
27. Domestic wastewater shall be treated and purified for full utilization for industrial, agricultural, cooling and other uses.
28. The related data and information will be tabulated and organized for easy use and reference. It will be part of the information system that will facilitate research.

Annexure 4

Wastewater Reuse and Opportunities

Urban reuse

While there are several major categories of water reuse, urban water reuse is only now emerging in India. Some important components of the reclaimed water portfolio of many emerging urban reuse plans are:

- irrigation landscape irrigation
- fire protection toilet flushing
- recreational opportunities without human contact Urban reuse is often divided into the

following categories:

- **Unrestricted**: The use of reclaimed water for non-potable applications in municipal settings where public access is not restricted.
- **Restricted**: The use of reclaimed water for non-potable applications in municipal settings where public access is controlled or restricted by physical or institutional barriers, such as fences or timings of application of the reuse water or temporal access restriction.

When treated, wastewater is used to irrigate residential areas, public parks and related sports etc. or is used for toilet flushing and washing, it has to receive significant treatment and high-level disinfection so as to be not considered a threat to public health. Suggested minimum water quality criteria for urban non-potable water reuse are as below.

TABLE 1: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR URBAN NON-POTABLE REUSE

Parameter	Units	Value
BOD_5	mg/L	≤ 3[3]
Turbidity	NTU	≤ 2
Faecal coliforms	MPN/100 ml	NIL
Chlorine residual	mg/L	1 – 2
pH		6 – 9
Colour (Hazen)		Non-detectable

Agricultural reuse

Use of wastewater in agriculture has a long history and currently represents a significant percentage of use worldwide, especially in emerging economies such as India. With increasing population and sanitation, more treated wastewater is available. The cost of treating wastewater to secondary (and sometimes even higher) standards is generally lower than the cost of pumping potable water from distant sources or for producing it from unconventional water sources (e.g., desalination).

The option of allocating treated wastewater to irrigation is often the preferred and least expensive alternative for municipalities. Irrigation of crops (both food and non-food) with untreated wastewater is widely practiced in many parts of the developing world with accompanying adverse public health outcomes. Nonetheless, this practice represents an

[3] *Designated best use classification of inland surface water – Class B Outdoor Bathing*

Economic necessity for many farming communities and for the rapidly expanding population at large, much of which is dependent on locally grown crops.

The WHO guidelines (WHO, 2006) for irrigation with treated wastewater have been successfully applied to irrigation reuse applications throughout the world. However, the CPHEEO Manual 2013 has suggested the following standards which should be followed at a minimum.

TABLE 2: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR AGRICULTURAL REUSE (SOURCE: CHAPTER 7, PART A OF THE CPHEEO 2013 MANUAL ON SEWERAGE AND SEWAGE TREATMENT)

Parameter	Units	Value
Intestinal nematodes	No./litre	< 1
Faecal coliforms	MPN/100 ml	Nil (for crop eaten raw) & ≤230/100 ml (for crops eaten cooked or non-edible crops)
pH		6 – 9

Environmental/Recreational Reuse

Environmental reuse primarily includes the use of treated wastewater to support wetlands and to supplement stream and river flows. Aquifer recharge also may be considered environmental reuse, but because this practice is integral to management of many complex issues it is recommended as an area of future study.

TABLE 3: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR ENVIRONMENTAL/ RECREATIONAL REUSE (SOURCE: CHAPTER 7, PART A OF THE CPHEEO 2013 MANUAL ON SEWERAGE AND SEWAGE TREATMENT)

Parameter	Units	Value
BOD_5	mg/L	≤ 10
TSS	mg/L	< 5
Faecal coliform	MPN/100 ml	Nil
pH		6.5 – 8.3
Total Kjeldahl Nitrogen (as N)	mg/L	< 5 for impoundments, < 10 for Horticulture
Dissolved Phosphorus (as P)	mg/L	1
Colour (Hazen)		Non-detectable

Impoundments

As with any form of reuse, the development of water reuse projects that include impoundments will be a function of water demand coupled with a cost-effective source of suitable quality reclaimed water. Regulation of impoundments that are maintained using treated wastewater has to be according to the potential for contact for that use. Please refer above Table 3 for minimum suggested standards.

Wetland and river/stream flow augmentation

As with impoundments, water quality requirements for wetlands and river or stream augmentation will be based on the designated use of the water course and the aim to enhance an acceptable appearance. In addition, there should be an emphasis on creating a product that can promote native aquatic life. The quality of the reclaimed water discharged to the receiving water body is critical to evaluating its benefits to the stream. Water reclamation for stream augmentation applications requires consideration of a complex set of benefits and risks. Suggested minimum water quality criteria are given in Table 4.

TABLE 4: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR WETLAND AND RIVER/STREAM FLOW AUGMENTATION (SOURCE: USEPA 2004 GUIDELINES)

Parameter	Units	Value
BOD_5	mg/L	≤ 3[4]
TSS	mg/L	≤ 5
Faecal coliform	MPN/100ml	≤ 50[a]
Chlorine residual	mg/L	1 – 2
pH		6 – 9

Industrial reuse

Traditionally, pulp and paper facilities, textile facilities, and other facilities using reclaimed water for cooling tower purposes have been the primary industrial users of reclaimed water. However, the industrial use of treated wastewater has grown in a variety of industries ranging from electronics to process industries, food processing, as well as a broader adoption by the power-generation industry. Over the past few years, these industries have embraced the use of such water for purposes ranging from process water, boiler feed water, and cooling tower use to flushing toilets and site irrigation. Since industry can control water quality within their processes, specific standards for industrial use are not being provided here. Table 5 provides typical water quality requirements for different industrial applications.

High technology reuse

The use of reclaimed water in high-technology manufacturing, such as the semiconductor industry, is a relatively new practice. Within the semiconductor industry, there are two major processes that use water:

- microchip manufacturing, which has rarely utilized reclaimed water
- circuit board manufacturing, which uses water primarily for rinse operations.

While only circuit board manufacturing uses reclaimed water in the actual production process, both microchip and circuit board manufacturing facilities do use treated wastewater for cooling water and site irrigation. Reclaimed water for circuit board manufacturing requires very advanced treatment and is not discussed here.

TABLE 5: TYPICAL WATER QUALITY REQUIREMENT FOR INDUSTRIAL REUSE (SOURCE: CHAPTER 7, PART A OF THE CPHEEO 2013 MANUAL ON SEWERAGE AND SEWAGE TREATMENT)

Constituent, mg/L	Industrial Application				
	Boiler feed	Pulp and paper	Textiles	Petroleum and coal	Cooling water
Calcium	0.01 – 0.4	20	–	75	100
Iron	0.05 – 1.0	0.3 – 1.0	0.1– 0.3	1	–
Manganese	0.01 – 0.3	0.05 – 0.5	0.1– 0.05	–	–
Alkalinity as $CaCO_3$	40 – 350	100	–	125	–
Chloride	–	200 – 1,000	–	300	100
TDS	200 – 700	–	100	1,000	–
Hardness as $CaCO_3$	0.07 – 350	100	25	350	–
Ammonium-N	0.1	–	–	–	1 – 3
Phosphate-P	–	–	–	–	0.6
Silica	0.7 – 30	50	–	–	20
Colour (Hazen)	–	10 – 30	5	–	–

[4] *Designated best use classification of inland surface water – Class C drinking water source with conventional treatment followed by disinfection*

Reuse by construction industry

The construction industry is the newest entrant to the industrial category and many urban utilities are now supplying treated wastewater for construction. The suggested standards for construction should follow the standards as provided in the CPHEEO Manual and established by the Bureau of Indian Standards.

Ground water recharge

Groundwater recharge to aquifers not used for potable water has been practiced for many years but has often been viewed as a disposal method for treated wastewater effluent. In addition to providing a method of treated effluent disposal, groundwater recharge of treated wastewater can provide a number of other benefits, including the following:

- Recovery of treated water for subsequent reuse or discharge
- Recharge of adjacent surface streams
- Seasonal storage of treated water beneath the site with seasonal recovery for agriculture.

In many cases, groundwater can be recharged in a manner that also utilizes the soil or aquifer system where such water is applied as an additional treatment step to improve the quality. Suggested water quality criteria that need to be met at a minimum for groundwater recharge are given in the Table 6.

However, as cautioned by the CPHEEO, 2013 Manual, such use should be considered after careful study of site conditions and requirements with strict monitoring measures.

TABLE 6: SUGGESTED MINIMUM WATER QUALITY CRITERIA FOR GROUNDWATER RECHARGE (SOURCE: USEPA 2004 GUIDELINES)

Parameter	Units	Infiltration basins	Vadose zone / recharge wells	Direct injection
Drinking water standards	mg/L	Not applicable	Not applicable	As applicable
Total nitrogen	mg/L	≤ 12	≤ 12	≤ 12
pH		6 – 9	6 – 9	6 – 9

Indirect & direct potable use

Water reclamation for non-potable applications is well established, as discussed earlier in this chapter. The use of reclaimed water to augment potable water supplies has significant potential for helping to meet future needs, but planned potable water reuse only accounts for a small fraction of the volume of water currently being reused worldwide. On the other hand, the unplanned reuse of wastewater effluent as a water supply is common, with some drinking water treatment plants using waters for which a large fraction originated as wastewater effluent from upstream communities, especially under low-flow conditions. This is true in India as well. However, in India and other developing countries direct potable water reuse is an area of future growth and there needs to be more research and success before it is promoted in India.

Currently, there are only general discharge standards available for discharge of wastewater in India and this Policy has attempted to provide some minimum criteria as a starting point for reuse of discharged wastewater.

Annexure - 8

Enacting Wastewater Regulations

To institute wastewater regulations, the state would first institute regulations for new construction, and after a grace period, apply this regulation to existing construction as well wherever feasible.

New Construction

All new construction of buildings over a certain water usage threshold should include provisions for to treat and re-use greywater. There are many treatment providers on the market: most treatment consists of a sedimentation tank, followed by a simple anaerobic multi-baffled series of chambers, and lastly followed by a gavel filter (or planted filter) based aerobic process, whereby water is increasingly treated as it moves through each section. A simple example is shown below.[1]

The construction plans for all new facilities should include plans for wastewater treatment and municipal engineers or inspectors must monitor construction to ensure that these systems are built, operated, and maintained. Municipalities may choose to waive the requirement for buildings that can be easily connected to an existing functional sewerage system if that is a less expensive option.

In addition to infrastructure, developers should include plans for the use of wastewater. These plans can include the installation of a duel plumbing system, by which wastewater is used to flush toilets, the use of wastewater for landscape irrigation, car washing, clothes washing, or groundwater recharging (where applicable). If a development cannot find uses for all of its own wastewater, it shall make arrangements with either the municipality or nearby agricultural/industrial users to appropriately use the treated wastewater.

These small treatment units should be subject to monthly or annual inspections (as possible) to ensure their proper operation. The treatment facilities cannot exist only for show and developments should be penalized if their wastewater treatment and recycling system remains out of commission for more than two months (an adequate time to repair/fix the system if needed). The inspections shall also include water quality testing to ensure the treated wastewater meets appropriate standards for non-potable treated water.

Applicability

These wastewater recycling regulations should be applicable to all developments

[1] This is not the only technology available, or the best for all situations, but it is the "archetypical" option for wastewater treatment and is shown as an illustration or example.

consuming large amounts of water and producing large amounts of wastewater. These developments include the following:[2]

- Apartment buildings and housing clusters with more than 60 units or a certain amount of built-up areas[3]
- Office buildings
- Shopping malls
- Hotels
- Wedding Halls
- Large restaurants (with special provisions for the large amounts of oil and grease that may flow into the system)
- Schools, both government and private
- Universities, both government and private
- Hospitals (with special provisions for any hazardous wastewater)
- Airports
- Government buildings (Municipal headquarters, police stations, department buildings, etc.)
- Factories

Existing Construction

The status of existing construction is clearly different; in many cases, there may be no room to construct basic greywater treatment infrastructure; if buildings are connected to an existing sewerage system, then there is no need. However, it should not be assumed that *all existing construction* cannot implement wastewater construction. Existing developments should be given two years of time to come into compliance to the wastewater recycling regulations, or seek a waiver based on the logistical impossible of complying. Buildings already connected to functioning sewerage systems need not seek any waiver.

The state or municipal government may choose to utilize escalating penalties and fines over several years to bring all existing developments into compliance; they may also choose to use incentives, such as discounts on water charges or tax exemptions for the development of wastewater treatment and reuse systems.

Demand Profiling

The state and municipalities shall also endeavour to enable the reuse of treated wastewater. There may be cases where an institution produces more wastewater than it can use. The municipality shall ensure that this wastewater can be used either by the municipality itself (for municipal irrigation) or for agricultural, industrial, or groundwater recharge

[2] This list, however, is not exclusive.

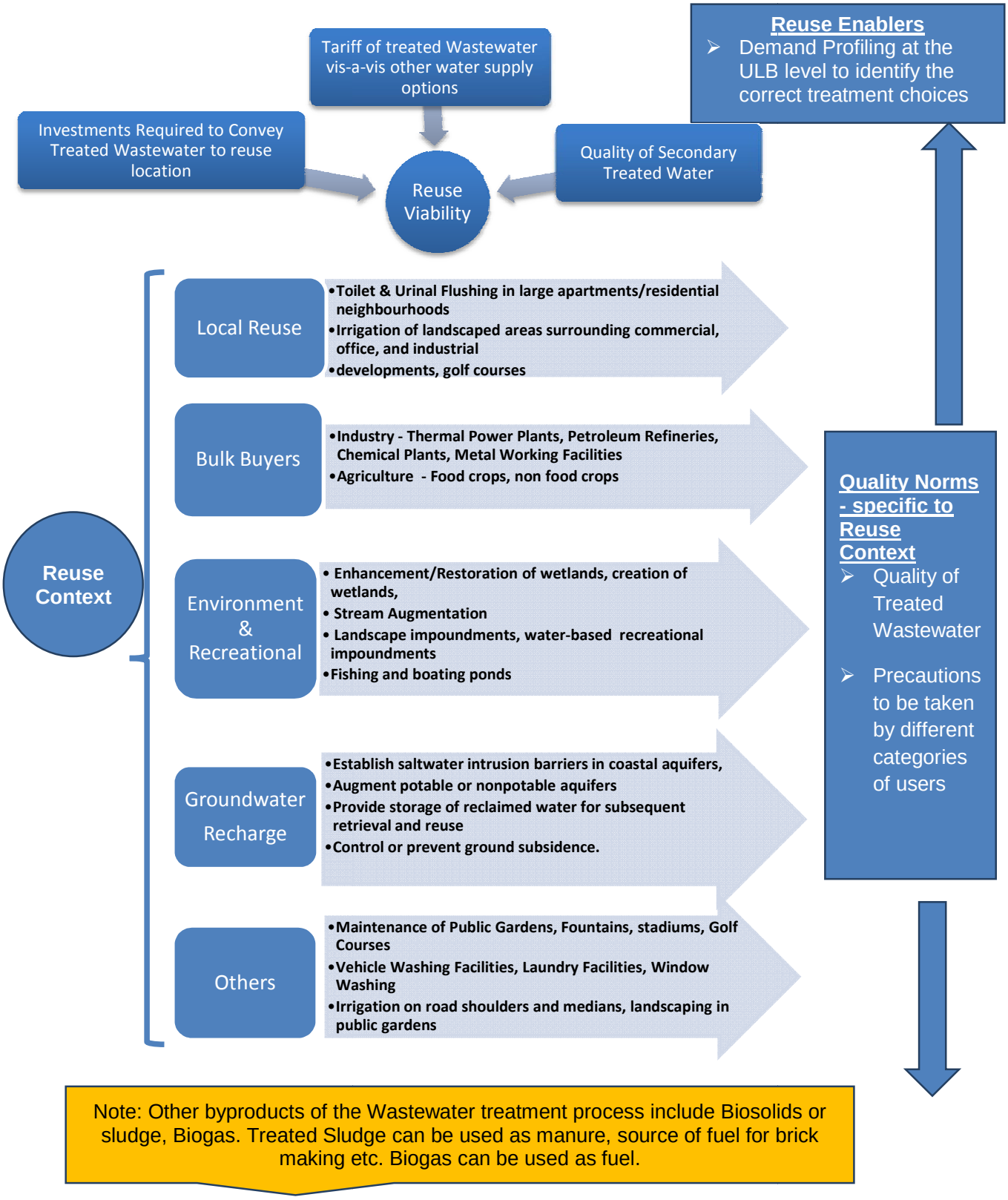
[3] These numbers are not intended to be final, but are a starting point for discussion. More research must be conducted before setting final standards as of the creation of this document.

purposes.

A key component of this process is "demand profiling." Demand Profiling at the ULB level shall help in identifying the different reuse contexts that exist in the ULB. Based on this, it will be possible to identify the major and minor demand drivers. The major demand drivers will mostly determine the quality parameters that the treated wastewater needs to conform to. The design of the treatment systems will be influenced by these quality parameters. Such a pro-active approach shall help avoid situations where reuse becomes infeasible because the correct treatment technologies were not chosen resulting in loss of precious water. In cases where the treatment systems are yet to be setup, it will definitely help to locate the treatment systems close to the sources of demand. This will bring down the costs of conveyance, making reuse viable.

As far as local reuse is concerned, the generation and consumption almost always occur within the same boundaries/premises. As a result, the treatment is always done closer to the source of the demand. Thus, the focus is more on being able to identify the right treatment option to be able to generate treated wastewater of the desired quality.

Annexure 9: Wastewater Reuse Framework



Note: Other byproducts of the Wastewater treatment process include Biosolids or sludge, Biogas. Treated Sludge can be used as manure, source of fuel for brick making etc. Biogas can be used as fuel.

Annexure II – MoU with Golf Club Visakhapatnam

Tel./Fax : +91 891 2794301

EAST POINT GOLF CLUB

ESTD. 1884

Mudasarlova, Visakhapatnam - 530 040, A.P., INDIA.

1884-2009 125 YEARS

Patron-In-Chief : Vice Admiral HCS Bisht, AVSM

President
Vice Admiral Dinesh Deshpande AVSM VSM
Ph : 2577238 (O), 2710504 (R)

Vice - President
Dr M B Patrudu
Mobile : 98480 18123

Hon. Secretary
Cmde G Vinod Babu (Retd) VSM
Mobile: 96036 68968

Hon. Treasurer
Mr SAN Raju
Mobile: 8106315989

Member Tournament, Handicapping & Rules
Mr Mohammed Saleh
Mobile: 9866122970

Member Course Maintenance
Mr Chanchal Gupta
Mobile: 9848194645

General Maintenance, Infrastructure and Course Development
Mr MAN Raju
Mobile: 9492226444

Member Administration / Co-ordination
Mr G Sreedhar
Mobile: 9959022033

Member Social & Marketing
Mr RVS Raju
Mobile: 9849827788

Member Junior Golf
Mr SRN Reddy
Mobile: 9885326155

Member Bar & Catering
Mr D Ramesh
Mobile: 9848273333

Naval Representative
Lt Cdr Sanjeet Kumar Dhaka
Mobile: 9346320273

Email : epgc@epgc.in
Web site : www.epgc.in

Date : 21-09-2016

To,
The Commissioner,
Greater Visakhapatnam Municipal Corporation,
Visakhapatnam.

Dear Sir,

Ref: 1.) MoA Dt.18-05-2012 between GVMC and East Point Golf Club, Vsp.
2.) Your Lr.Rc.No.2711/2012/EE(UGD)/SE(P2)/GVMC, Dt: 02-08-2016 .

This is to bring to your kind notice that, we have concluded an agreement of taking a maximum of 200 Kilo liters per day (200 KLD) subject to availability of treated water. The cost of treated sewage water at Rs. 2.25/- per KL with an annual increment @ 5% cumulatively will be paid by us on basis of actual quantity supplied, which is accounted through a measuring device installed at your site.

As our actual consumption of treated water is far less than 60% i.e 120KLD of 200KLD requirement, we had been charged only minimum consumption charges for 120 KLD for 304days in your earlier bills. (A copy of your bill is enclosed herewith for kind reference).

Sir, During STP maintenance or breakdown, we do not get treated water for weeks and further for optimal use of water, we do not draw water from STP during rains etc.

However, we are paying the bill up to 17-05-2016 amounting to Rs.487252/- after adjusting advance payment of Rs.82350/- made earlier.
Henceforth, we would request you to raise the bills monthly on actual consumption basis, for which act we would be thankful to you.

Thanking you

For East Point Golf Club

Commodore G V Babu, VSM, (Retd)
Hon. Secretary

Encl: Cheque No: 135311 dated 16-09-16 of SBH for Rs. 487252/-.

21/9/16
Cell No-9985720259

Annexure III – MoU with Visakhapatnam Steel Plant

राष्ट्रीय इस्पात निगम लिमिटेड
(भारत सरकार का उपक्रम)
Rashtriya Ispat Nigam Limited
(A Government of India Undertaking)
CIN : U27109AP1982GOI003404

Ref.VSP/18/GM(E&U)/71
Date:10-08-2018

To
The MD & CEO
Greater Visakhapatnam Smart City Corporation Limited
C/o Greater Visakhapatnam Municipal Corporation Limited
Room No.204, Tenneti Bhavan, Asilmetta Junction
VISAKHAPATNAM-530002

Dear Sir,

Sub: Supply of treated sewage water to Steel Plant Reg
Ref: RINL Letter Ref No VSP/18/GM(E&U)/26 dated 15-03-2018

We take pleasure to inform you that in its 313th meeting held on 29th May 2018, the RINL Board accorded In- principle approval for conveying RINL's acceptance to the proposal for treated sewage water supply at the tariff of Rs 35 / KL (Rs 15/- KL towards Fixed charges and Rs 20 /- KL towards consumption based charges) to an extent of 5 MGD (23 MLD) in the first phase which is likely to commence from December 2019 and another 5 MGD (23 MLD) supply of treated sewage water in next phase i.e, in the year 2021.

Further Board directed RINL/VSP to discuss the detailed terms and conditions along with break up of Fixed cost component separately for 5 MGD (23 MLD) and 10 MGD (45 MLD) and put up to the Board for final approval.

Hence you are kindly requested to advise the concerned officials for initiating further discussions on these issues with RINL/VSP at the earliest.

Thanking you

Yours Sincerely,

V. Ramanujam 10/8
General Manager (Energy & Utilities)

हिन्दी के प्रयोग का स्वागत है, पत्र का उत्तर शीघ्र दिया जायेगा।

Annexure IV – Copy of Minutes with HPCL

Annexure V – Copy of latest Communication to VTPS

MUNICIPAL ADMINISTRATION DEPARTMENT

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From
Sri M.A. Shukoor, B.Tech., M.I.E.,
Chief Engineer I/c,
Municipal Corporation,
VIJAYAWADA.

To
The Chief Engineer,
Operations & Maintenance,
Dr Narla Tata Rao Thermal Power Station,
IBRAHIMPATNAM – 521 456
VIJAYAWADA

Lr No: E9-129747/2016, Dt. 09-09-2016.

Sir,

Sub: Vijayawada Municipal Corporation – Engineering - Reuse of treated sewage water of Vijayawada city for Dr Narla Tata Rao Thermal Power Station, Vijayawada (VTPS) - Required information – Requested - Regarding.

Ref: Visit of our Urban Infrastructure Expert, Mr B. Chiranjeevi with appointed consultant on 3rd Sept 2016 at VTPS.

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It is to inform that the Government of India has issued a memo vide No.K-15016/205/2015-SC-1, Dt.10/12–5-2016 of Ministry of Urban Development about the revised tariff policy on which Thermal Power Plants including the existing plants located within 50 KM radius of sewage treatment plants of Municipality/Local body/Similar organisations shall mandatory use treated sewage water produced by the bodies (Copy enclosed).

In this connection it is to inform that the Vijayawada Municipal Corporation is generating sewage water of 139MLD against a treatment capacity of 150MLD. For explore the feasibility of reuse of treated sewage water for secondary use of Thermal Power Plant in place of fresh water, the Vijayawada Municipal Corporation has called EOI for appointment of a consultant M/s Blue stream, Infrastructure development consultant Pvt. Ltd., Pune has been appointed for this project.

The Vijayawada Municipal Corporation is proposed to supply treated sewage water after territory treatment to Dr Narla Tata Rao TPS (VTPS) for other than drinking and boiler application i.e. ash handling and cooling purpose.

It is very thankful to you for the visit our staff and consultant and discussions with VTPS officers on 03-09-2016. The gist of discussions and the required data is herewith mentioned.

Sr. No.	Discussions / Required Data	Information received from VTPS	Required data from VTPS
1.	Exact unit wise water account of the plant for various purposes for 12 months of one complete year and the units of electricity produced in respective month.		Provide the data
2.	Pumping hours records for ash handling and cooling tower water supply pumps	The discharge of cooling tower pumps was stated to be 16000 Tons/hr per pump, two pumps operating at a time for 210 MW For other purposes 2000 Tons/hr two operating at a time for 210 MW	Confirm and also provide the daily pumping hours for these pumps for a period of 1 year
3.	Internal water supply pipe alignment for cooling tower and ash handling area		Provide a drawing showing these pipelines.
4.	Information regarding WTP at TPS and if Softener is present then its OBR and production volume		Provide the Data
5.	Availability of land for one day storage in the premises	As informed by VTPS officers currently land availability in VTPS premises is issue. Inform whether land will be available for reservoir of 6-8 hrs capacity.	Provide suggestion if we can get 100 m X 100 m plot of land for constructing 8 hrs storage.
6.	Water rates for the VTPS charged for raw water		Provide the Data
7.	Cost Audit report showing the unit cost of production of electricity and the cost of water in it for the last three years.		Provide the Data
8.	Whether treated effluent is recycled or not?	Currently waste water from Ash Handling Area, Cooling Effluent, Blow Down and Domestic Effluent of Old Plant is discharged into Krishna River and Waste water from New Plant is used for irrigation purpose.	Confirm the information
9.	Whether ash slurry or disposal is a continuous process requiring continuous water supply.		Provide the Data
10.	Is there any new proposal for capacity augmentation or replacement ofold?	Planning of replacing old two units of 210 MW by one unit of 800 MW	Confirm for planning of replacing of old two units and also confirm if the new plant will have once through cooling or closed cycle.

11.	Is there any plan to change in light of MOEF directions for reducing specific water consumption to 2.5 litr per KWH?		Please specify
12.	Cooling technologies for various units	Old plant is having once through type cooling system and new plant is having closed cycle type system	Confirm the information
13.	O & M Expenditures of water & waste water treatment systems at TPS		Provide the Data
14.	Water balance report of TPS of last three years		Provide the Data

I therefore, request you to provide necessary data for preparing the project report and also consent letter for using of treated sewage water for secondary use of Thermal Power Plant.

Yours faithfully,

9/9/16

Chief Engineer I/c
Municipal Corporation,
9/9/16 Vijayawada

Annexure VI - Copy of latest communication to Gerdau Steel Plant

Our ref: GSI/UTY/2018/02 Date: 21-Sep-2018

To

The Municipal commissioner,

Tadipatri Municipality.

Sub: Utilization of waste water from Tadipatri Municipal Corporation's STP#2.

Ref: Your draft MOU for taking STP#2 waste water

We thank you for sharing the draft MOU on taking waste water of STP#2. We have gone thru' the draft MOU and would like to communicate our concurrence as follows:

1. We agree to take the "As Is" condition waste water from STP#2 initially for the period of THREE years subject to the below point #2.

2. At the end of the THREE year term, we wish to extend the contract period for another 25 year or more, therefore we request your good office to recommend our proposal to Govt. of Andra Pradesh to issue necessary orders in this connection.

3. We expect to install the new treatment module in our plant premises for treating this STP#2 water to suit our process needs and this would take 18 month time (Provided that no issues in Right of Way for pipeline laying from STP#2 to Gerdau Premises) for "Engineering, procurement and construction" of treatment plant after signing the MOU. **Hence the First MOU to be made for "18 month + 3 years" period**.

4. We agree to the price of waste water (INR 4/Cubic meter) fixed by Honorable municipality.

5. We request Honorable municipality to allocate the land along the route of existing Nalla in order to lay the Underground pipeline from existing STP#2 to our premises so that we can avoid Right of Way (RoW) issues and subsequent time delays in project execution.

6. Moreover, we have shared our comments on "Draft MOU" and the same has been enclosed herewith for your review and concurrence.

Kindly consider the above points and revise the MOU accordingly in order to move forward further.

Thanks and regards,

For Gerdau Steel India Pvt. Ltd

Elangovan Arumugam

GM – Energy & Utility

Enclosure: Draft MOU with Gerdau' s comments