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NATIONAL FRAMEWORK ON SAFE REUSE OF TREATED WATER

NOVEMBER 2022

DEVELOPED IN ASSOCIATION WITH

INDIA-EU WATER PARTNERSHIP

EUROPEAN UNION

german cooperation
DEUTSCHE ZUSAMMENARBEIT

NATIONAL FRAMEWORK
ON
SAFE REUSE OF TREATED WATER

November 2022

Developed in Association with

गजेन्द्र सिंह शेखावत
Gajendra Singh Shekhawat

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

जल शक्ति मंत्री
भारत सरकार
Minister for Jal Shakti
Government of India

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MESSAGE

Water resources, both in terms of quantity and quality that is readily available, are crucial for all development activities. Water resources are becoming increasingly scarce and contaminated as a result of urbanisation and population increase. Changes in rainfall patterns due to climate change also pose a potential to exacerbate these effects in numerous locations.

Water shortages are a recurring problem in India, which is home to 16% of the world's population but only has 4% of the world's fresh water resources. Wells, ponds, and storage tanks are drying because groundwater resources are being over-relied upon and are being used in an unsustainable manner. This has made it even harder to get access to water and has exacerbated the water crisis.

Wastewater is becoming increasingly recognised as a potential "new" source of clean water for non-potable purposes, which has positive social, environmental, and economic effects. Government of India has been promoting reuse of treated water for various non-potable purposes specially for industrial use, horticulture, agriculture etc.

I am confident that the present Framework on the Safe Reuse of Treated Waste Water will promote effective reuse of treated water for long term sustainability. The framework will provide guidance to States in developing the State policies on reuse of treated waste water.

I would like to acknowledge the support extended by Indo-European Water partnership in developing this framework. I am hopeful that the framework would contribute towards achieving the Ministry's vision of Optimal sustainable development, maintenance of quality and efficient use of water resources to match with the growing demands on this precious natural resource of the country.

(GAJENDRA SINGH SHEKHAWAT)

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MESSAGE

India has experienced a sharp rise in its urban population in recent decades. By 2050, it is predicted that 50% of the Indian population would reside in urban areas. The current natural resources are constantly under great pressure from the expanding population. The primary problems with India's "Water Resources" can be roughly divided into problems with water availability and quality for usage in the household, industrial, and service sectors. Looking at the current situation in light of these two factors, provides an overview of the issues at hand and a framework for improvement in terms of action at the policy and consumer level.

The use of treated wastewater as a resource alternative is encouraged by the increasing demand on water resources. It can be shown that despite the fact that India generates large amount of wastewater and a potential for water reuse, little study and information are available, leading to wasteful discharge. Reusing wastewater necessitates the establishment of an integrated strategy that takes into account all the aspects of technical viability, economic viability, and social acceptance in addition to a guiding management structure that might support the current water resources.

In order to ensure sustainability, I am optimistic that the current Framework on the Safe Reuse of Treated Waste Water will encourage efficient reuse of treated water. States will receive assistance from the framework when creating their own state policies for the reuse of treated waste water.

(Bishweswar Tudu)

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MINISTRY OF JAL SHAKTI
DEPARTMENT OF WATER RESOURCES,
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FOREWORD

India has more than 18% of the world's population but has only 4% of world's renewable water resources.India's current water requirement is estimated to be around 1,100 billion cubic meters (BCM) per year, which is projected to increase to 1,447 BCM by 2050. As water availability is limited, efficient use of water is key to meet our growing water requirement.

India generates about 72 billion liters per day (BLD) of sewage. Under various programs of Government of India, including Namami Gange Mission, National River Conservation Program and AMRUT 2.0, a concerted attempt is underway to give a boost to the existing sewage treatment capacity. This is in addition to the efforts being made by the StateGovernments on their own.

Reuse of treated used water, therefore, must become a critical part of our strategy to improve water use efficiency to meet the growing water requirement of the country. States like Haryana, Gujarat and Karnataka have taken a lead in framing reuse of treated used water policies.

The National Framework on the Safe Reuse of Treated Water aims to facilitate widespread and safe reuse of treated wastewater to reduce pressure of scarce freshwater resources, reduce pollution of the environment and risks to public health, by adopting a sustainable circular economy approach.

It is expected that the Framework will encourage all States and Union Territories to adopt policy for reuse of treated water in various ways including in industry and agriculture.

I congratulate the National Mission for Clean Ganga for bringing out this Framework.

(Pankaj Kumar)

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PREFACE

India is in the league of water stressed countries and is ranked as the 13th most water-stressed nation in the world. In most areas of India, the groundwater that many urban, commercial, and industrial users depend on, is considered stressed, while surface water abstractions have reached unsustainable levels. This has resulted in, increasing competition among users and hence increasing conflicts; and increasing pollution levels worsening the environment. Hence, there is urgent need to have better water management- in supply and demand side, reduce pollution and improve water use efficiency.

3Rs- Reduce, Reuse and Recycle – and the 2Rs- rejuvenate water bodies and Respect water- added by National Water Mission are the vital mantras to ensure water security. Reuse of treated water is seen as a part of a larger circular economy approach where waste is seen as a resource and has the potential to generate income. This change in strategy may enable practical, affordable solutions to the current capacity and financial restraints, hastening the transition to universal collection and treatment.

The introduction of the concept of Safe Reuse of Treated Water (SRTW) into water resource strategies and policies could provide additional resources for multiple uses and water security for fast growing cities, industry, agriculture and the environment. So far, India has no national policy regarding SRTW, though few State policies are in place. By advocating a self-financing and integrated circular economy strategy, the Framework is complementary to other policy instruments on universal sanitation. This framework is prepared by NMCG in association with GIZ, after multi-stakeholder consultations and exploring best practices around the world.

The proposed framework will set the priorities and direction for the Safe Use of treated Waste Water by moving India on the pathway of mainstreaming SRTW by 2022 and will contribute to the nation's commitment to environmental sustainability and achieving of SDG 6.3

The users of this framework may provide their feedback/ suggestions for further improvement in this framework.

(G Asok Kumar)

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National Water Policy 2012 provides standards for reuse of waste water. The importance of reuse of treated wastewater has gradually become a planning and management priority due to rapid urbanisation and, hence, accelerated wastewater generation. The introduction of the concept of treated wastewater reuse into water resource strategies and policies could provide additional resources for multiple uses and water security for fast growing cities, industry, agriculture and the environment.

This framework is developed as a set of directives that may be incorporated into State policies. The benefits anticipated from the application of these guidelines may include but not restricted to - improved water security, environment, economy et al.

The brief description of the framework is mentioned below:

(a) The framework's primary goals are to provide the context, priorities, and direction for SRTW, increase awareness of its significance, and its implementation through support programmes.

(b) The term 'used water' has been adopted rather than 'wastewater'. 'Apna Jal' terminology is proposed to be adopted for 'Treated Used Water' with the aim to shift perceptions towards treated used water being a resource and opportunity, rather than a liability.

(c) The framework addresses non-potable reuse of use water in rural and urban areas. In terms of economic growth and water ecosystem, it acknowledges regional differences that necessitate a context-specific approach, particularly for determining priorities for reuse. The framework calls for discouraging the reuse of untreated used water.

(d) As per the Constitution of India, water and sanitation is a state subject. However, the central government shall work to promote cleanliness of streams and wells. The framework thus briefly discusses various central and state laws and policies which influences the safe reuse of treated water.

(e) A wide range of institutions from the national to local levels are involved in the implementation of the National SRTW Framework. At the Central/ State/ ULB and PRI levels, it necessitates high levels of cooperation as well as clearly defined roles, duties, and implementation plans. Similar to this, each State must clearly define the regulatory and operational responsibilities of water regulators with regard to TUW and ownership of TUW. The framework thus proposes institutional arrangement along with their roles and responsibilities at central and state level and required approach for effective implementation of reuse of treated water.

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(f) The framework provides options of various business models that may be adopted and includes few case studies where the reuse of treated water has been implemented in a sustainable way. The framework also proposes factors and principles that may be adopted for determining the price of treated water.

(g) The framework highlights some of the key high-risk situations and corresponding mitigation strategies regarding the implementation of reuse of treated water.

(h) It is understood that at the initial stage the implementation of reuse of treated water may require finance either from Central or State government. The framework thus suggests that financing of such projects may be explored through various ongoing schemes/ programs, depending upon the eligibility criteria provided in the framework.

(i) The performance targets of SRTW, price mechanism, service standards, outcome, incentives and penalties/ sanctions require a monitoring mechanism. The framework thus proposes an institutional structure and defines the roles and responsibilities of central and state level institutions and of the implementing agency.

(j) The capacity building of planners, managers, designers and users at National/ State/ ULBs and PRIs along with promotion of research and development work is a key enabler for the successful execution of the framework. The framework broadly provides for such strategies that may be taken up at central and state level.

I take the opportunity to express my profound gratitude to Indo-German 'Support to Ganga Rejuvenation Project' GIZ-SGR and India-EU Water Partnership (IEWP), who have provided technical support and guidance in the preparation of the framework. Support from GIZ team led by Ms Martina Burkard, Head of Programme GIZ-SGR and Mr Jeremy Bird, Ex-CEO Mekong River Basin Commission for providing technical support at various stages of preparation of the framework is appreciated. Special mention is accorded to the former Director General of National Mission for Clean Ganga, Shri Rajiv Ranjan Mishra and the former Executive Director (Projects) of National Mission for Clean Ganga, Shri Ashok Kumar Singh for their support and guidance during the conceptual stages of the framework.

I also like to thank officials of Ministry of Housing and Urban Affairs, Ministry of Environment, Forest and Climate Change, Ministry of Agriculture & Farmers' Welfare and Ministry of Power, Department of Drinking Water and Sanitation and organisations such as NITI Aayog, Central Pollution Control Board, Central Ground Water Board, Central Water Commission, State Local Bodies and industry associations like Federation of Indian Chambers of Commerce & Industry, Confederation of Indian Industry for providing their enriching inputs in the drafting of this framework.

I would also like to express my sincere thanks to my team members Shri Madhava Kumar R (Economic and Financial Advisor), Ms Nidhi Dwivedi (Project Officer), Shri Sumit Chakraborty (Urban Planning Expert, KPMG PMC NMCG) and Shri Rishabh Chaudhary (Support Engineer, Assystem STUP PMC NMCG) for generously supporting with their technical inputs and all-round support in the preparation of this framework.

(D P Mathuria)

CONTENTS

Abbreviations

AMRUT	Atal Mission for Rejuvenation and Urban Transformation
BOD	Biological Oxygen Demand
BOO	Build-Own-Operate
BOOT	Build-Own-Operate and Transfer
BOT	Build-Operate and Transfer
CGWB	Central Ground Water Board
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSO	Civil Society Organisation
CSPs	City Sanitation Plans
CSR	Corporate Social Responsibility
DBO	Design-Build-Operate
DDWS	Department of Drinking Water Supply, MoJS
DFBOT	Design-Finance-Build-Operate and Transfer
ECs	Emerging Contaminants
EU	European Union
FPO	Farmer Producer Organisation
FSSAI	Food Safety and Standards Authority of India
FSSM	Faecal Sludge and Septage Management
FSTP	Faecal Sludge Treatment Plant
GoI	Government of India
GST	Goods Services and Tax
HAM	Hybrid Annuity Models
IEC	Information, Education and Communication
IEWP	India-EU Water Partnership
JJM	Jal Jeevan Mission
KL	Kilo Litre
M&E	Monitoring & Evaluation
MGWB	Model Groundwater Bill
MLD	Million Litres per Day
MoAFW	Ministry of Agriculture and Farmers' Welfare
MoCI	Ministry of Commerce and Industry
MoEFCC	Ministry of Environment, Forest and Climate Change
MoHUA	Ministry of Housing and Urban Affairs
MoJS	Ministry of Jal Shakti
NEP	National Environment Policy
NGO	Non-Governmental Organisation
NGT	National Green Tribunal
NMCG	National Mission for Clean Ganga
NRCD	National River Conservation Directorate
NUSP	National Urban Sanitation Policy
NWA	National Water Academy

NWM	National Water Mission
NWP	National Water Policy
NWQMP	National Water Quality Monitoring Programme
O&M	Operation & Maintenance
PMKSY	Pradhan Mantri Krishi Sinchayee Yojana
PPP	Public Private Partnership
PRIs	Panchayati Raj Institutions
QIP	Quality Improvement Programme
SBM	Swachh Bharat Mission
SDG	Sustainable Development Goal
SLBs	Service Level Benchmarks
SPCB	State Pollution Control Board
SPV	Special Purpose Vehicle
SRTW	Safe Reuse of Treated Water
STP	Sewage Treatment Plant
STW	Secondary Treated Water
TDS	Total Dissolved Solids
TNA	Training Need Assessment
TSS	Total Suspended Solids
TUW	Treated Used Water
UDD	Urban Development Directorate
ULB	Urban Local Body
UT	Union Territory
UV	Ultraviolet
VGF	Viability Gap Funding
WHO	World Health Organisation
WUAs	Water Users' Associations
ZLD	Zero Liquid Discharge

1 Terminology

1.1 Glossary

Circular Economy: a model of production and consumption that reduces waste to a minimum by recovering, reusing and recycling materials for productive purposes and thereby reducing the pressure on natural resources.

Emerging Contaminants (ECs): chemicals that had not previously been detected (or were previously found in far lesser concentrations) and pose a risk to human health and the environment including pharmaceuticals, personal care products and endocrine disrupting compounds.[1]

Implementing agency: the entity responsible for provision of used water services which includes conveyance, treatment, distribution of treated used water and all other functions related to management of the services. This role is typically provided by the State or Urban Local Body or parastatal agency or Panchayati Raj Institutions and is referred to as the implementing agency. Private sector companies may provide the service through private public partnership arrangements with the implementing agency (see Annex 2).

Industry effluent: wastewater discharged from industries that comprises a variety of pollutants depending on the nature of industry. Industrial effluent is a separate resource that is covered under other policy instruments.

Safe Reuse of Treated Water (SRTW): the beneficial and safe use of treated used water for a range of purposes as defined in Section 3.3.2 of this Framework. (Also referred to in related documents as treated wastewater reuse). Direct reuse relates to applications where the TUW is conveyed straight to the designated end-use whereas indirect reuse involves a mixing or dilution of the TUW with other sources of water before it is reused, as in the case of discharge of TUW to a surface water body or groundwater.

Sewage: is defined as the used water containing human body waste matter (faeces and urine etc.) either dissolved or undissolved; discharged from toilets and other receptacles intended to receive or retain such human body waste. The effluent coming out of septic tanks or any such facility is also termed as sewage.[2]

Sewage Treatment Plant (STP): equipment and structures that treat sewage.

Treated Used Water (TUW): the treatment of used water for non-potable purposes through one or more of a number of primary, secondary and tertiary processes. Also referred to in other documents as treated wastewater.

Treatment:

Primary Treatment: involves screening and grit removal, equalization and the removal of high concentration of solids that might decrease the efficiency of subsequent treatment processes.[3]

Secondary Treatment: commonly used to describe any of the following biological processes: activated sludge, extended aeration, trickling filters, aerobic and anaerobic lagoons and anaerobic and facultative (mixed) ponds.[4] Also referred to as Secondary Treated Water (STW).

Tertiary Treatment: a further stage of treating sewage or effluents, by removing suspended solids and or pollutants. Consequential removal of suspended solids may also remove residual BOD or other pollutants. Tertiary treatment of effluents may consist of varied processes, the most common being, Grass Plots, Reed Beds, Upward flow Clarifier, Rapid Gravity Sand Filter, Micro-strainer, Sand Filter, Drum Filter, Lagoons, Nitrifying Filter.[5]

Used Water[6] a combination of one or more of: a) domestic effluent consisting of blackwater (excreta, urine and faecal sludge) and greywater (kitchen and bathing used water); b) water from commercial establishments and institutions, including hospitals; c) stormwater and other urban run-off; d) industrial effluent, e) agricultural, horticultural and aquaculture effluent, either dissolved or as suspended matter. This Framework addresses the reuse of treated used water from sources (a), (b) and (c). 'Used water' is also referred to as wastewater in other documents.

Zero Liquid Discharge (ZLD): refers to installation of facilities and systems towards transformation of industrial effluent to absolute recycling of permeate and converting solute (dissolved organic and in-organic compounds/salts) into residue in the solid form, by adopting method of concentration and thermal evaporation.[7]

1.2 *Apna Jal* – Our Water

Addressing public perceptions about used water and building confidence in the implementation measures proposed in both national Framework and state policies is critical for its uptake. Throughout this Framework, the term 'used water' has been adopted rather than 'wastewater'. After treatment to the required standard, it is safe for reuse.

As in the case of other countries, India will adopt terminology that captures the notion of safe and beneficial use of Treated Used Water (TUW) – *Apna Jal* or 'Our Water'.[8] Use of this term aims to shift perceptions towards treated used water being a resource and opportunity rather than a liability. Following treatment to the required standard, *Apna Jal* denotes water that can be reused for the purposes set out in section 3.3.2.

Under this Framework, TUW is not currently intended for direct use as potable water in India. This may be considered in the future as technology evolves and the necessary enabling conditions and compliance mechanisms are institutionalized.

2 Introduction

2.1 Existing situation

In 2021, the total volume of sewage generated by households in urban India was 72,368 MLD[9] amounting to an annual volume of 26,414 million cubic meters. Of this amount, the estimated infrastructure capacity for treating sewage to secondary level is 44% (31,841 MLD) and approximately 15% of that capacity is not fully operational. Actual collection and treatment is estimated to be 63% (20,235 MLD), of which only a small proportion is reused.[10] Therefore the potential for improvement is significant. The balance of uncollected and untreated water is released into water bodies and the environment leading to contamination and health concerns, particularly where dilution levels of the receiving water body are low.

Directives to ensure separation of industrial and municipal used water are not universally enforced resulting in cross contamination of heavy metals and emerging contaminants, with consequences of bio-accumulation in the aquatic life of receiving water bodies. Untreated or primary treated used water is frequently accessed informally by farmers,[11] particularly in peri-urban areas. Without safeguards in place, this leads to health risks to both the water users and consumers. Although data on such informal use in agriculture is not available, the scale is significant, requiring attention to be paid to the transition to a more structured approach.

Efforts are underway to increase the percentage of collected and treated used water. However, the scale of the challenge is large and there are resource and capacity constraints. Until recently, used water collection and treatment has been viewed as part of a 'linear' process, but more recently they are being seen as components of a wider circular economy (Circular Economy in Municipal Solid and Liquid Waste)[12] approach, with waste considered as a resource and able to generate revenues. This shift in approach can facilitate cost-effective and fit-for-purpose solutions to the prevailing capacity and financial constraints, thereby allowing a faster transition to universal collection and treatment.

Extreme water scarcity across many parts of India is also a major driver for change in perceptions towards used water. Globally India is ranked as the 13th most water stressed country.[13] Groundwater, the crucial source of many urban, commercial and industrial users is classified as stressed across much of India[14], while surface water abstractions are reaching unsustainable levels leading to deterioration of the environment and increasing competition and consequent conflicts between users.[15]

In the past few years, several pioneer States have initiated reforms to embrace SRTW by adopting or drafting policies.[16] The underlying principles are common with different emphasis to reflect local conditions and priorities. They provide a wealth of details and experience that has informed the development of this Framework.

Mandatory targets for SRTW have been set by the pioneer states. The most ambitious is Gujarat with a 100% reuse target by 2030. State policies also prescribe mandatory usage

of TUW for industrial estate/zones within a certain distance from a STP. This ranges from 30 km in the case of Karnataka to 50 km in Gujarat, Tamil Nadu and Haryana.

National water quality standards on sewage treatment for discharge into surface water bodies are prescribed by CPCB. This is subject to rulings of the NGT, that may impose higher standards. Some basic standards for SRTW in India have been set by CPCB and CPHEEO[17] but, with the introduction of mandatory use and a wide range of potential end users, greater resolution of reuse standards specific to a particular end-use is required. This will provide clarity to allow selection of the most appropriate and efficient business model and facilitate monitoring and compliance mechanisms. Significant investment in developing the capacity of monitoring systems and laboratories is needed as part of the overall SRTW framework to provide confidence that prescribed quality standards are being met and address the challenge of monitoring more complex parameters, such as heavy metals, emerging contaminants and bioaccumulation.

International experience

A recent comparative assessment of SRTW policy frameworks in EU countries, Indian States of Gujarat and Haryana and other selected countries including Israel and Singapore identified a number of key principles for consideration in formulating national framework including:

- SRTW has significant potential to improve critical water resource deficits.
- Targeted water reuse could assist in restoring water supply demand balance.
- It is critical to ensure that SRTW strategy and framework protects water users and the environment.
- The challenge will be to ensure wide understanding of the issues and opportunities within the political, policy, regulatory, operational and public communities.
- Adequate funding and incentives are critical prerequisites for success.

Source: IEWP (India-EU Water Partnership). 2019. Review and Comparative Assessment of Policies on Treated Wastewater Reuse. Policies and approaches of Indian States, the European Union, selected EU Member States and global examples.

2.2 Need for the Framework

Several factors combine to justify the rationale and urgency for this Framework and the actions it promotes. The high levels of physical water stress in many parts of the country and ever-increasing pressure on freshwater resources are key drivers for utilising all forms of water including used water. This is amplified by increasing demands across water using sectors as the economy grows, higher expectations from a more affluent society for more reliable supplies of water, and a changing climate that brings greater uncertainty in terms of extended periods of drought and variability of supply. Increasing water stress, climate change and rising water demand from agricultural, residential and industrial sectors would necessitate the usage of using locally treated water vis-a-vis that of fresh water. This is especially critical given the country's projected demand for water exceeds the available supply[18], thereby also impacting the country's energy output. In purely financial terms, SRTW provides a local source of water for cities and industry that

obviates the need to transfer freshwater sources from ever increasing distances, fostering self-reliance.

The Framework is complementary to other policy instruments on universal sanitation by promoting a self-financing and integrated circular economy approach. In the absence of widespread collection and treatment, there remains a risk that expanded sanitation will have the unintended consequence of greater volumes of untreated used water being discharged into water bodies. As a reliable and consistent source, SRTW can potentially generate revenue, sustainably augment existing treatment capacity, finance and accelerate expansion of coverage.

As a State subject, each State needs to have its own policy on SRTW suited to the local context but embracing a common set of principles. Some States have already moved along this pathway. The lack of a national framework on SRTW has to some extent constrained implementation of reforms across India for channelling national support programmes. The Framework will foster a close partnership approach of combined responsibility at National and State levels for meeting SRTW goals through joint programmes with participating States.

2.3 Guiding Principles

Key principles to consider in defining SRTW framework and administering financial support programmes:

a) adopt participatory planning processes involving stakeholders relevant to the end use of TUW;
b) provide clarity on system of prioritization and allocation of TUW based on social, economic and environmental benefits;
c) encourage uptake though mandatory re-use provision[19] and high quality of service provision;
d) establish water quality standards fit for the purpose of end-use;
e) establish the price of TUW to be competitive in respect of alternative supplies and sufficient for sustained O&M;
f) adopt a risk-based precautionary approach to reuse;
g) adopt an incremental approach based on available resources and time to build capacity;
h) incentivize compliance;
i) address issues related to existing uses of used water;
j) encourage projects to adopt a consistent approach with long-term commitments that provide stability for investors and end-users.

3 Objectives and Scope

3.1 Vision

The Vision of the Framework is:

Widespread and safe reuse of treated used water in India that reduces the pressure on scarce freshwater resources, reduces pollution of the environment and risks to public health, and achieves socio-economic benefits by adopting a sustainable circular economy approach.

It heralds a shift from existing perspectives on waste to a new understanding of Our Water, *Apna Jal.*

3.2 Objectives

The main objectives for the Framework are to set the context, priorities and direction for SRTW, raise awareness of its importance and facilitate its implementation through support programmes. More specifically, the Framework will:

a) Move India on a pathway of mainstreaming SRTW by 2022 by encouraging States to adopt the necessary enabling environment and actively promoting its implementation.
b) View SRTW as part of the wider water cycle encouraging multiple cycles of use-reuse.
c) Contribute to the Government's commitment to environmental sustainability and achievement of SDG 6.3 on improving water quality through increased recycling and safe reuse.
d) Define the roles and responsibilities of various government entities and agencies and of other key stakeholders such as industry and other parts of the private sector, local government, civil society organisations and citizens.
e) Establish funding mechanisms and support synergies among relevant Central Government programmes[20] such as AMRUT, NMCG, SBM and JJM.
f) Support initiatives on river basin planning including the potential for SRTW within the catchment water cycle and clarify entitlements for used water.

3.3 Scope

The Framework covers non-potable reuse of urban and rural used water. It recognizes diversity across the country in relation to levels of economic development and water endowment that call for a context-specific response, particularly in relation to setting priorities for re-use.

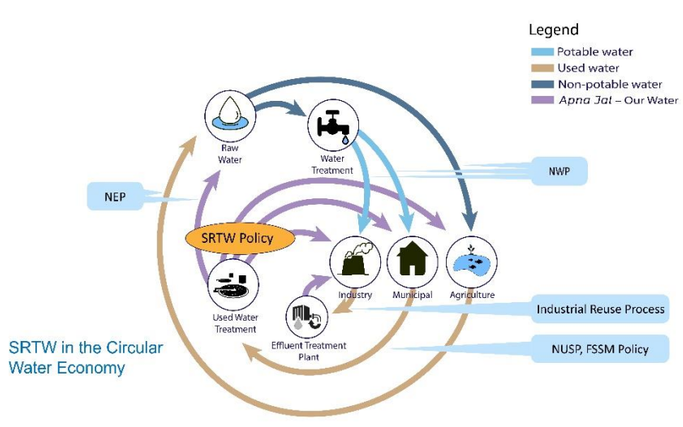
The Framework embraces the principle of integration and holistic management of the water cycle by encouraging linkages to existing and proposed policies on sanitation, faecal sludge management, and the re-use of industrial used water, within a broader context of river basin planning and actions to address climate change.[21]

It fulfils three distinct functions of SRTW from national to local level by providing:

a) the **mandate for the reuse** of treated used water for a range of non-potable end-uses, setting out the principles to incorporate in the planning and design of SRTW projects and encouraging adoption of national standards for different end-uses;

b) a **mechanism to support SRTW** through provision of incentives, including access to funding programmes, and disincentives, including the actions at central level to facilitate uptake across the country; and
c) a **model policy framework for States** to consider and adapt in the development and enhancement of their own policy, regulatory and implementation instruments, (Annex 1).

It is expected that the Framework will lead to the development of guidance material on successful business models and create an enabling environment for innovation in technologies and institutional arrangements.



Policies	
NEP, 2006	National Environment Policy
NUSP, 2008	National Urban Sanitation Policy (under revision)
NWP, 2012	National Water Policy (under revision)
FSSM, 2017	National Policy on Faecal Sludge and Septage Management
MGWB, 2005, 2017 (draft)	Model Groundwater (Sustainable Management) Bill, 2017
SRTW (draft)	**National Policy on Safe Reuse of Treated Water**
Programmes	
ABY	Atal Bhujal Yojana
AMRUT	Atal Mission for Rejuvenation of Urban Transformation
JJM	Jal Jeevan Mission
NMCG	National Mission for Clean Ganga
NRDWP	National Rural Drinking Water Programme
PMKSY	Pradhan Mantri Krishi Sinchai Yojana
SBM	Swachh Bharat Mission
Standards and Compliances	
CPCB, SPCB CPHEEO Manual	Central / State Pollution Control Board(s) Central Public Health Environmental Engineering Organization
NGT	National Green Tribunal (oversight)

Figure 3.1 SRTW Framework in relation to related policies and programmes in the water cycle

3.3.1 Sources of water to be reused

The Framework covers used water generated by households and commercial enterprises in both urban and rural settings. This can be used water associated with an STP or an FSTP. Used water from industry is covered by other policy instruments[22] although the Framework recognises that industrial used water is not universally separated from municipal used water flowing into an STP. In such cases, particular emphasis is required on assessing the levels of risk including heavy metals and emerging contaminants. Figure 3.1 shows how the SRTW Framework fits within the wider framework of policies and programmes dealing with used water.

Collection systems for stormwater will increasingly be separated from sewerage systems as part of the move towards integrated urban water management. Achieving required end-use water quality standards from relatively uncontaminated stormwater can be achieved with lower treatment costs, including the use of nature-based solutions.

3.3.2 Potential areas of reuse

SRTW is very context specific, with States having different endowments of natural resources, variations in levels of urbanisation, industrialisation and rural economy, and their own development priorities. Neither is the situation homogeneous within States, with many having districts that can be characterised water scarce or water rich contrasting with the designation of the State as a whole. Similarly, some States with a predominantly industrial-based economy have districts where agriculture dominates and vice-versa. A degree of flexibility is therefore required for setting priorities of reuse.

In general, water-scarce States are likely to view augmentation of freshwater resources by SRTW as more urgent than States with higher water availability. However, there are a range of other benefits to make SRTW an appealing proposition to all States including reduced contamination to the environment, improved public health, and as a potential revenue stream to improve the financial sustainability of STPs.

There are a wide range of potential non-potable end users for SRTW in urban, rural and peri-urban settings, including:

a) industry (including industrial estates, power generation and railways)
b) agriculture (including forestry and horticulture) and aquaculture
c) municipal uses (e.g., landscaping, parks, toilet flushing and fire-fighting)
d) environment, including discharge into surface water bodies, maintenance of wetlands and environmental flows
e) aquifer recharge[23] (aquifer recharge should be kept as last priority when there is no other alternative for use of TUW. The level/ quality of treatment of TUW and method of recharging groundwater would need to be determined by States during the finalisation of their respective policies)
f) construction
g) on-site use within STPs for landscaping and cleaning of desludging vehicles.

The viability of end-use will depend on a range of factors including proximity to the source of used water, reliability of supply, collection and treatment costs, and ability of the end user to pay. The general expectation for this Framework is for SRTW to involve treatment to secondary level. Subsequent tertiary treatment will be required and viable for certain reuse applications, in which case the additional costs are to be borne by the end-user. In some cases, a single universal treatment process to tertiary level may be more cost effective and this will be assessed during a feasibility study. Limited in-field treatment of used water, for example using settling ponds, is sometimes practised in informal irrigated agriculture but should only be promoted where safety concerns to users and potential consumers have been fully addressed, e.g., in non-edible crops. The reuse of untreated used water should be discouraged.

3.4 Milestones

The Framework anticipates a situation where all States in India have adopted and started to implement SRTW policies by the end of 2022, with those States that already have SRTW policies undertaking to review them within the same timeframe to incorporate any relevant provisions necessary to satisfy eligibility criteria for national support programmes. Overall, the Framework will contribute to achievement of targets of the 2030 Agenda of Sustainable Development Goals (SDGs).

Specific short to medium term milestones are proposed for consideration in developing State policy:

a) States to set targets for 100% collection of used water and 100% treatment of used water collected to enable the achievement of targets for reuse.
b) Where STPs are operational and collection and treatment capacity already exists, 50% of TUW to be safely reused[24] by 2025 and 100% by 2030.
c) Where STPs do not exist or are non-operational and collection and treatment capacity does not yet exist, 30% of used water is to be collected, treated and safely reused by 2030, 50% by 2035 and 100% by 2045. To supplement State-wide milestones, targets can also be linked directly to establishment of STPs, e.g. 50% reuse within 5 years of establishing an STP and 100% within 10 years. A situation of universal treatment and reuse will effectively lead to 'zero discharge cities.'

4 Expected Outcomes

As the Framework is implemented incrementally across the country, it is expected to yield significant benefits in terms of:

a) **water security** – by using TUW to replace freshwater currently used across a wide range of purposes, thereby reducing pressure on surface and groundwater resources.
b) health benefits – as a consequence of reduced pollution of water bodies and replacement of contaminated water by treated water.
c) environmental benefits – by reducing the contamination of surface water bodies and groundwater from pollution by human waste.
d) **social benefits** – through improvements in productivity and wellbeing as a consequence of the health and environmental benefits.
e) **economic benefits** – by treating waste as a resource and opening up a revenue stream for treating used water, reducing risk and increasing confidence in food safety, and providing green jobs.
f) **innovation and more efficient technology** – as research and development flourishes and benefits of scale are achieved.
g) **increased capacity** to implement SRTW projects including cross-sector collaboration
h) **reduced climate emissions**- possible savings from reduced pumping of freshwater from aquifers or distant water surface water sources.

5 Legislative and Regulatory Context

5.1 Related Central Laws and Policies

According to the Constitution of India, water, sanitation and used water are State subjects. In relation to SRTW they are influenced by a number of national laws, including:

a) The Water (Prevention and Control of Pollution) Act, 1974 that emphasizes to maintain and restore the 'wholesomeness' of aquatic resources by not discharging sewage or pollutants into water bodies including lakes.
b) The Ganga Action Plan, 1986 that was launched to protect river Ganga from further pollution, improve the quality of water treatment of the sewage, and to prevent the mixing of industrial wastes.
c) The Environment Protection Act, 1986 which is an umbrella legislation designed to provide a framework for central government coordination of the activities of various central and state authorities established under previous laws, such as the Water Act and the Air Act. It relates to the protection and improvement of the human environment and the prevention of hazards to human beings, other living creatures, plants and property.

It is also influenced by the:

a) National Water Policy (NWP, 2012), that has a focus on reducing water pollution and the draft revised NWP (2020) that embraces the imperative of recycling and reuse.
b) National Urban Sanitation Policy (NUSP, 2008), that focusses on sanitary and safe disposal of human waste and recommends recycle and reuse.
c) National Environment Policy (NEP, 2006), that emphasizes recycling sewage and used water from municipal and industrial sources, before discharge to water bodies. NEP emphasizes the need to prepare and implement action plans for major cities for addressing water pollution, comprising regulatory systems relying on an appropriate combination of incentive-based instruments, projects and partnerships.
d) National Faecal Sludge and Septage Management Policy (FSSM, 2017), that focusses on leveraging FSSM to achieve 100% access to safe sanitation, achieving integrated citywide sanitation, safe disposal of faecal waste in urban areas of India, mandates strict environmental discharge standards, and promotes an appropriate, affordable and incremental approach to achieving these standards.

These policies are complementary to Goal 3 of the National Water Mission (NWM) which emphasizes promoting recycling of used water for meeting water needs of urban areas.

The Ministry of Power under its 2016 Tariff Policy, requires thermal power plants located within 50 km radius of a sewage treatment plant (STP) of a ULB to mandatorily use TUW.[25]

Service Level Benchmarks (SLBs) of the Ministry of Housing and Urban Affairs (MoHUA) mandate the extent of reuse and recycling of sewage in urban areas as 20%.[26]

The National Water Quality Monitoring Programme (NWQMP) of India, through its network of SPCBs, advises central and State governments on prevention, control, abatement of water pollution and sets standards on water quality in streams and wells.

The Guidelines of National Building Code 2016[27], emphasizes the reuse of treated sewage and sullage in commercial or residential multi-storeyed complexes for flushing of toilets, horticulture and fire-fighting purposes. It also suggests separate storage tanks and separate distribution pipes.

The National Guidelines on Zero Liquid Discharge (ZLD) developed by CPCB for 22 industrial sectors have raised the issue that, depending on the type of industry, ZLD may cause generation of hazardous solid waste causing disposal issues, higher overall operations cost, capital cost, space requirements and increased carbon footprint. ZLD also needs to reinforce the requirement for no mixing of industrial used water with municipal used water.

The CGWB Master Plan for Artificial Recharge to Ground Water in India (2013)[28] emphasizes that where TUW is used for recharge, careful monitoring is required to detect any possibility of contamination through a network of monitoring wells. A CGWB notification to regulate and control groundwater requires that, where viable, TUW is used rather than groundwater for purposes like toilet flushing, for irrigating green areas, and use in residential buildings, and infrastructure requiring more than 12.5 m^3/d of groundwater.[29] In the case of critical and over-exploited areas, it also requires certification from a responsible government agency that TUW is not available within a 10 km radius before a groundwater licence can be issued.

Through one of its objectives, the PMKSY emphasises exploring the feasibility of reusing treated municipal used water for peri-urban agriculture.

Other progressive GoI policies related to SRTW include that of the Ministry of New and Renewable Energy to generate green energy from biogas and convert sludge to manure.

5.2 Existing State Policies and regulations

According to the 73rd and 74th Constitution Amendment Acts of India, 1992, the *Panchayati Raj* Institutions (PRIs) and ULBs have been delegated the responsibility of providing water, sanitation and used water services in rural and urban settings respectively. The ULBs are levying user charges to operate the utilities for collection and treatment of used water, and conservation and augmentation of the water sources.

At the time of preparing the Framework, 12 States had SRTW polices, either approved or at an advanced stage of drafting. The majority of these State policies prescribe mandatory usage of TUW for industrial estate/zones within a certain distance from an STP provided the off-take is shown to be viable.

Most of the States with SRTW policies provide targets to improve the collection of sewage along with treatment and reuse within a defined timeframe based on city size. Along with these, ULBs have set targets ranging from 20% to 25% of TUW, replacing freshwater

usage in the initial years. For some States, the target varies by city size. States like Gujarat and Haryana prescribe higher targets in subsequent years, to achieve 100% reuse by 2030 and 2033 respectively, while Karnataka prescribes 50% reuse by 2030.

Most States with reuse policies mandate usage of TUW in agriculture only if surplus quantity is available after meeting the demands of mandatory usage for other purposes.

All the existing State SRTW policies mention that the treatment of used water shall be done according to effluent discharge norms set by the CPCB and SPCBs. The Central Government shall have the prerogative to make more stringent norms as and when required.

The majority of the State SRTW policies have excluded aquifer recharge, whereas some have referred to the CPHEEO Manual (2013) for water quality standards for aquifer recharge, return flows and agricultural use.

A number of States have adopted policies on septage management while others have State septage management guidelines.

6 Roles and Responsibilities

Implementation of the National SRTW Framework involves a wide range of institutions from national to local levels (Table 6.1). It requires considerable levels of coordination and clearly articulated roles, responsibilities and implementation arrangements at the Central, State, ULB and PRI levels. Similarly, the regulatory and operational mandate of water regulators in respect of TUW and ownership of TUW needs to be clearly delineated by each State.

The national level has a number of obligations including ensuring common regulatory standards for water quality, irrigated agriculture and food safety; providing technological guidance on appropriate business models and overall risk management; overseeing performance targets and service level benchmarks; application of incentives and penalties/sanctions; raising awareness of potential for SRTW; and research and capacity building.

The Ministry of Jal Shakti (MoJS), Government of India (GoI) will be responsible for the overall interpretation, coordination and guidance of the Framework. It will disseminate the Framework among the State governments and ULB/PRI administrations as well as dovetail it with the Department of Water Resources' Development programmes and national Missions, such as the National Mission for Clean Ganga (NMCG) and AMRUT and SBM under the Ministry of Housing and Urban Affairs (MoHUA). It will also provide the necessary strategic planning and support to the States and ULBs to design, lead and implement a national awareness campaign and capacity building programme.

While the National and State level institutions support the regulatory framework, the ULBs and Panchayati Raj Institutions (PRIs) lead in the on-ground implementation of SRTW. It requires strong local level institutions, stakeholder engagement, coordination and partnerships. Each State and City need to formulate its own SRTW strategy and action plan and integrate the same in their respective State and City Sanitation Plans (CSPs) in overall conformity to the Framework. A template for State Level SRTW Policy is given in Annex 1.

Other stakeholders such as industries, farmer communities, Water Users Associations (WUAs), NGOs, CSOs, the private sector (small, medium and large), research organisations also have a critical role to play in achieving safe and sustainable SRTW.

Table 6.1 Roles of key institutions and stakeholders at the National and State levels

Institutions	Lead Roles
National Level	
A. National Advisory Council on SRTW (see section 8.1)	a) Apex body to promote SRTW b) Provide a forum for inter-agency cooperation on SRTW at national level c) Approve eligibility criteria for financing SRTW from national programmes d) Encourage establishment of new and existing programmes to accelerate uptake of SRTW, including measures by ministries to streamline administrative mechanisms e) Promote a national level information campaign, targeted messaging, consistent awareness and behaviour change campaign for overcoming negative perceptions on SRTW and encouraging support for circular economy solutions. f) Coordinate preparation of SRTW guidelines across different end-uses by relevant agencies g) Coordinate national level monitoring and reporting on SRTW h) Support research and capacity building in the sector
B. Ministry of Jal Shakti, Dept of Water Resources	a) Act as Secretariat of National Council on SRTW b) Lead national level efforts to support States in adopting and aligning SRTW Policies and programmes c) Design and administer a national programme for funding support and other incentive measures and sanctions needed to encourage SRTW application. d) Ensure consistency of SRTW interventions with related water quality, environmental and river basin planning requirements e) For Ganga States - NMCG to facilitate implementation of SRTW f) Facilitate and coordinate a national programme of capacity building for SRTW
C. MoJS-Dept of Drinking Water and Sanitation	a) Issue guidelines on reuse of treated greywater in rural areas b) Support funding/financing of reuse projects in rural areas c) Plan and implement SRTW projects in rural areas under SBM for greywater management d) Develop capacity building modules for SRTW in rural areas
D. Central Ground Water Board	a) Issue guidelines and notifications to States on overexploited regions and require promotion of SRTW in those regions b) Issue guidelines on risk assessment for aquifer recharge in relation to areas with high concentrations of heavy metals, emerging pollutants etc c) Monitor TUW in aquifer recharge d) Conduct research studies on impact of groundwater
E. Central Water Commission	a) Develop capacity building modules through National Water Academy (NWA) or training directorates. b) Provide guidelines on allocation of TUW by the State at the basin levels. c) Fund research on SRTW
F. Ministry of Housing and Urban Development (MoHUA)	a) Stimulate and coordinate implementation of the SRTW Policy in States and Cities b) Link SRTW projects with AMRUT Programme
G. Central Public Works Department (CPWD)	a) Develop guidelines for standardization and use of Treated Used Water (TUW) in construction industries
H. Central Public Health and Environment Engineering Organisation	a) Develop guidelines on standards for different types of end uses in partnership with CPCB b) Provide technical and planning support to States and ULBs including technical guidelines and training modules that can be adapted by States
I. Ministry of Environment, Forest and Climate Change (MoEFCC)	a) Enforce compliance of the relevant environmental laws and rules during the treatment, conveyance and reuse of TUW according to the reuse and discharge norms b) Ensure common regulatory standards for water quality and safety of agricultural and aquaculture products in consultation with MoAFW.
J. Central Pollution Control Board (CPCB)	a) Issue SRTW end-use water quality standards for each type of reuse for implementation by SPCBs through coordination with related agencies. b) Prepare monitoring guidelines on SRTW for different end uses c) Prepare standards for biosolids as part of a complementary initiative to the Framework on SRTW d) Assess emerging contaminants and accordingly develop and notify the standards
K. Ministry of Agriculture and Farmers' Welfare (MoAFW)	a) In consultation with CPCB, ensure common regulatory standards for safety of edible agricultural and aquaculture products, including from bioaccumulation of emerging contaminants b) Issue guidance on SRTW in agriculture and aquaculture and the types of crops that can be grown c) Conduct research study on soil health and bioaccumulation in crops to assess the impact of irrigation with TUW
L. Food Safety and Standards Authority of India (FSSAI), Ministry of Health and Family Welfare	a) Monitor and ensure compliance of food safety standards, including for the export of agricultural produce from India b) Clarify standards of food products for specific markets within and outside India
M. The Ministry of Commerce and Industry (MoCI),	a) Mandate and promote SRTW in industry clusters in India b) Provide incentives for SRTW in order to promote reuse by industries c) Monitor uptake of SRTW by industry
N. Ministry of Panchayati Raj	a) Liaise with DDWS on implementation of SRTW in rural areas b) Stimulate PRI engagement on SRTW programmes
O. NITI Aayog	a) Tracking progress with regard SRTW for inclusion in the Composite Water Management Index b) Alignment of SRTW programmes with ongoing efforts and tracking progress of SDG targets
State Level	
P. State Government	a) Establish a State Committee on SRTW with representatives from all end-use stakeholders to provide coordination across agencies on developing and implementing the State SRTW policy.

Institutions	Lead Roles
	b) Adopt a State Policy on SRTW reflecting the principles and provisions set out in the national Framework c) Create a State funding scheme for SRTW to complement national and local funding
Q. State Committee on SRTW (supported by a Technical Cell)	a) Approve a State-wide Strategy and Implementation Plan for SRTW b) Approve a State-wide TUW pricing policy c) Coordinate STP mapping of TUW supply and demand d) Establish a system of tradable certificates for TUW e) Coordinate Information, Education and Communication (IEC) activities in the State f) Oversee State-level monitoring and reporting on SRTW
R. State Department of Urban Development	a) Develop State level SRTW Policy, strategy and implementation Plan b) Develop operative guidelines on SRTW c) Allocate funding through specifically created State funding schemes for SRTW. d) Undertake State level monitoring, evaluation and compliance e) Implement measures to encourage private sector participation
S. State Pollution Control Board (SPCB)	a) Regulatory role in water quality assessment b) Water quality monitoring of groundwater and in rural areas. c) Monitoring, evaluation and compliance of WQ standards d) Review risk assessments and environmental clearances for SRTW projects
T. State Department of Agriculture/Irrigation	a) Develop TUW Guidelines for the crops used for cultivation under SRTW based on national guidance b) Develop guidelines for addressing prior utilisation of used water for agriculture in relation to any change of use resulting from new SRTW projects c) Monitor agricultural use of TUW and bioaccumulation of heavy metals and emerging contaminants d) SRTW for irrigation to be considered in preparation of District and State Irrigation Plans under PMKSY
U. State Department of Water Resources	a) Review SRTW implementation plans and project proposals from the perspective of State and river basin water balances b) Identify areas of high-water stress where SRTW projects can be prioritised
V. State Department of Industries	a) Mandate industries to meet minimum reuse targets b) Ensure compliance by industries to meet minimum reuse targets
W. Urban Local Bodies (ULBs) (including parastatal agencies and SPVs)	a) Develop city-based strategy on SRTW, including pricing strategy for TUW b) Implement online SRTW monitoring and reporting system and regularly evaluate SRTW strategy and implementation plan c) Implement IEC campaigns for behaviour change to engage diverse stakeholders and public acceptance of SRTW d) Implement municipal bye-laws for sanitation tax and promoting SRTW at household, apartment complexes, hotels, residential institutions
X. Panchayatl Raj Institutions	a) Develop a strategy and implementation plan for SRTW in rural areas incorporating guidelines on SRTW prepared by DDWS

Institutions	Lead Roles
	b) Implement IEC for behaviour change campaign to engage diverse stakeholders and public acceptance of SRTW c) Strengthen human and technical resources, leadership and other skillsets of PRIs and the role of village water and sanitation committees
Y. Private Sector (technology providers, operators)	a) Finance investments, planning, design, operations and management of SRTW projects including through PPP models b) Research and development on new technologies c) Assist ULBs in water literacy campaigns
Z. End users (Industries, power plants, agricultural enterprises, municipalities, others)	a) Proactive engagement in SRTW initiatives b) Commitment to adoption of best practice c) Contribution to monitoring programmes and open reporting of SRTW
AA. Agriculture Universities	a) Can be identified as 'Centre of Excellence' of the Ministry of Agriculture or a 'Key Resource Centre' of Department of Drinking Water and Sanitation (DDWS), MoJS.
BB. NGOs/CSOs	a) Support training and capacity building of different stakeholders b) IEC for behaviour change programmes c) Support involvement of Farmer Producer Organisations (FPOs) and self-help groups in rural SRTW projects

7 Water Quality Standards and Environmental Considerations

Treatment of used water is fundamental for human and environmental health protection as used water, whether treated or not, finds its way back into surface water bodies or percolates into the groundwater. Pandemics highlight the potential risk of pathogens and the requirement for improved water supply, sanitation, hygiene and SRTW. The following principles will be important to consider in determining national standards for reuse and formulating State Policy on SRTW.

a) A uniform minimum treatment standard is to be achieved in all reuse treatment plants.

b) SRTW standards to be 'fit-for-reuse' based on the purpose of use, not a one-size-fits-all. The level and type of treatment depends on its intended re-use. Clarity on end-use standards will lead to potential for standardizing design of SRTW systems thereby reducing costs and implementation timeframes.

c) Sustainable solutions that respond to future trends of emerging contaminants require more stringent used water discharge norms. This also challenges many high-income economies and will take time to fully develop. It should not delay the urgency of expanding coverage of SRTW projects.

d) Water quality of TUW to be monitored for the presence of emerging contaminants, heavy metals, pesticide residues and antibiotic residues. Strict discharge norms on BOD, COD, TSS and TDS are pre-requisites for managing emerging contaminants and mitigating risks in reuse interventions.[30]

e) In parallel with consultative processes to establish national end-use standards for SRTW and to expedite implementation of the Framework, States may consider adopting appropriate interim end-use standards. Once established, standards should remain in force for a reasonable period of time to provide a stable environment for SRTW investment. The subsequent raising of standards requiring upgrading of treatment plants to be subject to a phased transition period.

In addition to standards on quality of TUW, service standards on reliability of supply to end users of TUW and process standards on risk mitigating barriers to ensure safety in usage including measures such as sanitation safety plans, need to be provided.

Monitoring and compliance provisions are given in Section 11.

7.1. Standards for industrial use

For industrial reuse, the responsibility for tertiary treatment to a higher level, depending on industry requirements, rests with the individual industry. A system of open and transparent standards for each category of industrial reuse should be evolved to ensure uniformity and compliance with different industrial groups.

The upcoming Treated Industrial Wastewater Reuse guidelines being drafted by CPCB include water quality standards for reuse of industrial used water and necessary compliance mechanisms. The guidelines are expected to support the respective SPCBs in developing criteria for water quality standards regarding reuse of treated industrial used water for industry, agriculture, horticulture and other purposes.

7.2 Standards for agricultural and aquaculture use

TUW can be reused in agriculture, aquaculture, forestry and horticulture. Using TUW for agriculture and aquaculture requires water quality compliance to protect food safety.

CPHEEO Manual 2013[31] provides a list of Indian crops with guidelines and safety standards for horticulture, edible and non-edible crops.[32] It also has specifications for dissolved phosphorus, nitrogen and faecal coliform.

State PCBs have set minimum standards for treated sewage, specifically for agriculture and other non-potable uses. Development of more specific national end use standards for agriculture as well as aquaculture will be coordinated by CPCB. Situations with increased risk of bioaccumulation of emerging contaminants require a comprehensive monitoring system.

The selection of edible and non-edible crops depends upon the available quality of TUW, soil type, and measures to ensure safety to consumers and farm workers against pollution.

National and State standards are to be periodically reviewed against international standards[33] for relevance and revised as required.

7.3 Standards for non-potable domestic and municipal use

SRTW can be utilised for municipal uses like landscaping, parks, toilet flushing and fire-fighting with quality norms advised by SPCB, CPCB and CPHEEO depending on the reuse option.

7.4 Standards for groundwater recharge [34]

Ground water recharge with TUW of appropriate quality has the potential to contribute in areas that are water stressed and groundwater is overexploited, in coastal areas to reduce saline intrusion, and in other areas where there is a demonstrated need. It requires stringent quality standards, monitoring and compliance measures. A cautious approach needs to be followed both in terms of quality of TUW and also type of recharge system. The precautionary principle should be adopted in order to avoid polluting aquifers. Prior to approval, proposals for groundwater recharge using TUW should be analysed on a case-by-case basis with a risk assessment prepared covering quality of the TUW and type of recharge mechanism.

7.5 Standards for release to surface water bodies including environmental use

CPCB has prescribed a minimum water quality standard for treatment of municipal waste water[35] and industrial effluents[36] discharged to surface water bodies. Stricter norms for minimum water quality standards may need to be set by SPCBs for critical environments, including lakes and wetlands, or where points of TUW discharge are close to the points of extraction of water for domestic water supply. Guidelines on the proximity of TUW discharge to extraction points for drinking water supply are needed as part of the overall framework of standards.

The existing State SRTW policies require that the treatment of used water shall be done according to the effluent discharge norms set by the SPCBs and CPCB.[37]

8 Implementation Approach

Implementation of the framework requires an effective institutional arrangement that enables communication *vertically* between the National, State and ULB/PRI levels, and *horizontally* across the sectors, allowing integrated implementation of relevant sector policies. A set of related strategies and action plans guided by cross-agency coordination mechanisms are required to ensure that measures implemented by the mandated body are both consistent with the direction of the Framework and efficient in terms of use of financial resources.

8.1 National-level Implementation

A **National-level SRTW implementation Strategy** will be fully developed within six months of approval of the Framework setting out time-bound measures to coordinate and incentivize the uptake of SRTW across the country. The measures include:

a) Establishing a national apex body, the **National Advisory Council on Safe Reuse of Treated Water** (the Council), to promote inter-agency cooperation with the aim of stimulating adoption of SRTW. MoJS will work closely with MoHUA and other relevant agencies in implementation of the Framework. The Council will facilitate integration of SRTW indicators within existing missions and programmes.

b) Establishing mechanisms for partial national funding of SRTW to incentivize States to implement SRTW (see section 10).

c) A pragmatic and fast-tracked approach to developing **end-use water quality standards** suited to the type of reuse (see section 7).

d) Preparing **SRTW Technical Guidelines** on a range of topics to provide assistance to States in implementing State policy. These may include aspects related to undertaking feasibility studies, risk and environmental assessments of SRTW projects; risks of bioaccumulation and emerging pollutants; developing criteria for using TUW for aquifer recharge; operation and maintenance; and other relevant topics identified by the Council.

e) Preparing **Training Modules** incorporating best practices in SRTW.

f) Encouraging **Research and Development** on SRTW across the range of technical, financing and pricing, procurement, health and environmental aspects.

g) Establishing a **national monitoring system** to track implementation and provide online reporting.

8.2 State-level Implementation

States are encouraged to prepare a **State SRTW Implementation Strategy and Action Plan** to support and guide the implementation of SRTW projects. Some States already have SRTW policies, while others are at various stages of developing them. The Strategy and Action Plan sets the framework, objectives and timelines for implementation by ULBs and PRIs. Elements of a Strategy and Action Plan include:

a) Setting up an inter-agency **SRTW Committee,** representative of different sectors, to oversee uptake of SRTW. The Committee will embrace consultative process for the development of policy, including establishing priorities of reuse across the State, setting of mandatory usage criteria, identifying "no freshwater zones", implementation targets, and determining pricing policy for TUW. In considering the designation of mandatory use and "no freshwater zone" provisions, the requirement to maintain allocations for potable water and high-quality treatment processes for some industries needs to be taken into consideration.

b) The State may also consider establishing a **SRTW Technical Cell** to support the identification and planning of SRTW projects. The proposed Technical Cell may guide the ULBs/ PRIs in preparation of Detailed Project Reports on SRTW projects.

c) Developing a **Policy on Safe Reuse of Treated Water** in States, where it currently does not exist**.** Related polices, regulations and bye-laws are proposed to be reviewed and amended, as necessary, to ensure consistency. States that have already adopted SRTW policy may review and update the same to ensure consistency with national Framework and eligibility to access national support programmes.

d) Undertaking **mapping of TUW supply and demand,** covering the sources of TUW and potential users across the State to initiate awareness and support programme to match the production of TUW with potential users. Planning for SRTW needs to consider trends in the medium to long term and encourage investment by embracing principles of reliability and consistency. The State Policy shall acknowledge existing users of used water and consider transition arrangements that may be required for existing informal uses of used water, including agriculture.

e) Setting up the **institutional structures for implementing SRTW** including responsibility for regulatory functions, coordination and delivery at the State level and implementation agencies covering municipal and rural areas. This may include a Special Purpose Vehicle (SPV) responsible for sewerage and TUW in cities over 5 lakh population where a parastatal mandated with those responsibilities does not exist.

f) Establishing pricing policies, incentives and penalties.

g) Establishing State programmes for **financial support** that complement existing programmes.

h) Planning and financing of **conveyance grids** for TUW based on the types of end-use.

i) **Support services** including technical assistance in developing feasibility studies and ensuring environmental clearance; assistance in accessing green finance; preparation of state-level guidelines; SRTW promotion through public information campaigns; and capacity building initiatives.

j) Developing a **monitoring and reporting process** linked to national reporting systems.

k) Introducing mechanisms for **dispute resolution** in the event of conflict between end-users or procurement related issues.

8.3 Urban and Rural level Implementation

ULBs and PRIs are encouraged to prepare an **SRTW Action Plan** that demonstrates their commitment to SRTW by:

a) Adopting a **resolution on SRTW** and necessary bye-laws to create an enabling environment.

b) **Identifying funding opportunities** by engaging with state and national level agencies and international partners.

c) Contributing to the state-wide **mapping of SRTW potential**, identifying promising initiatives and preparing feasibility studies that assess long term viability including whether subsidies for treatment or delivery costs are required.

d) Introducing a structure for **levying charges** based on State pricing policy, including consideration of a special cess/rebate to promote SRTW in their jurisdiction.

e) Exploring the potential for **complementary reuse of resources** through recovery of nutrients, salts, heavy metals and other recoverable materials or linkage with energy-from-waste projects.

f) Considering **dis-incentive measures** for unsafe disposal of biosolids generated from TUW or partial treatment of municipal /industrial used water.

g) **Engaging with stakeholders** through open and consultative processes, for example with the involved communities, industries and industry associations, farmers producers' organizations (FPOs), water user associations, civil society organizations, research institutes as well as the relevant government line departments and representatives of national agencies such as CGWB.

h) Prior use of untreated used water by farmers should be addressed and their interests reflected in any new project for SRTW. Until such time as there is capacity to provide farmers with TUW, transitional arrangements are needed to safeguard existing practices, by encouraging on-farm treatment of used water for non-edible crops and agroforestry, and adoption of safety measures (e.g., sanitation safety planning guidance by WHO) to minimize transmission of pathogens to farm workers and consumers. In the case of edible crops, further control measures shall be adopted.

i) Implementing IEC and behaviour change campaigns on SRTW

j) Introducing **monitoring and evaluation systems** and periodically reporting to the State SRTW Committee.

k) Ensuring **compliance** with regulations and standards and implementation of contingency plans.

The Action Plan should be consistent with and support provisions in the NUSP for ULBs to have a City-wide Sanitation Plan, including a detailed plan for safe collection, conveyance and treatment of sanitary waste and institutionalized roles and responsibilities of staff for effective service delivery systems. The Plan should also be consistent with provisions of State FSSM policies.

8.4 Linkage with river basin planning

Linkages with the overall water balance and water allocation system within a river basin is necessary to take advantage of the benefits of TUW as an alternative source of water - a resource that has so far been under-utilized. Responsibilities for ensuring TUW is incorporated within wider river basin planning approaches depend on whether the basin is intra-State or inter-State. Greater emphasis on undertaking a water balance and management at river basin level is encouraged, as promoted in the draft NWP.

8.5 Challenges

Implementation of the Framework faces a number of challenges including:

a) **Public perception and awareness**: Although the Framework does not encompass direct potable use of TUW, the discharge of TUW into natural water bodies ultimately sees a proportion of the used water re-enter the water cycle into water supply treatment and distribution systems, albeit in a diluted form. For some, it may still challenge cultural norms and raise questions about public safety. Similarly, SRTW in certain agricultural, industrial and municipal settings may also raise concerns. Overcoming negative perceptions on SRTW and encouraging support for circular economy solutions will require a programme of consistent and targeted messaging to end users and the public through water communication programmes of the central and State Governments.

b) **Financing and viability**: Achieving SRTW targets require an alignment of interests and incentives amongst the key stakeholders, identifying areas of demand and supply, selecting the most appropriate business model where risks are shared equitably, and designing support programmes that are efficient in time and resources.

c) **Compliance with standards:** Significant efforts will be required to ensure prevailing standards are met, to safeguard public health and the environment. SRTW introduces an additional layer of processes for which compliance has to be assured. A range of approaches is needed including improving the financing and capacity of compliance institutions, introducing transparent self-monitoring systems into business models with sufficient checks and balances, and engaging stakeholders in the process. Food safety is of paramount importance for public health nationally and for export trade. Past international experience has demonstrated the economic impact of non-compliance with food safety standards in relation to foregone export potential. National norms for water safety planning and risk management will be key to expansion of sustainable SRTW in India.

d) **Integration and coordination:** SRTW is one step in the circular economy approach for water supply and sanitation. Other policy elements exist, such as for the recovery and reuse of faecal sludge from septic tanks under the FSSM Policy. Others are gaining attention- including campaigns to promote recovery and reuse of sludge from STPs for usage in power generation or agriculture. Coordination across resource recovery and reuse activities is needed at a range of levels from ULB to National. In the near future, it is expected that SRTW will form part of a wider integrated waste recovery and reuse system. As demand for TUW escalates, competition amongst end-users may arise as in the case of freshwater, requiring an allocation system that prioritizes reuse according to locally relevant economic, social and environmental criteria.

e) **Managing the transition:** The scale of the challenge to reach universal sewage treatment and high levels of safe reuse is considerable and will require States to develop and adopt a strategy and action plan that focuses both on realizing early gains where sources of supply and demand are aligned, in parallel with medium term programmes to introduce an enabling regulatory and pricing environment that provides incentives for change. In managing the transition, safeguards are also required to consider pre-existing uses of used water (formal and informal) and ensure the needs of prior users are addressed.

9 Business Models

9.1 Pricing of SRTW

The price of treated used water shall be determined based on following factors:

a) investment cost including conveyance, treatment and distribution infrastructure;
b) operation and maintenance cost of the infrastructure;
c) quality of water supplied;
d) type of end uses;
e) availability and prevailing price of alternative water sources;
f) other social, cultural and business factors.

The pricing of TUW is expected to reflect the following principles:

a) TUW to be considered as a social, environmental and economic commodity. The price set shall maximize social, environmental and economic returns.
b) The price of TUW shall encourage its use in comparison to usage of freshwater for all types of acceptable end use. Pricing policy and designation of 'no-freshwater' zones may need to be considered as an integral measure.
c) Apportioning and pricing of treated used water and domestic sewage charges together shall aim to achieve economic cost recovery with priority on recovery of operating cost. The ultimate aim is to achieve full cost recovery of capital and operations cost where ability to pay exists, ensuring that the price of TUW does not make end user business unviable.[38]
d) In achieving cost recovery through pricing of TUW, the following aspects are to be considered:
    1. inculcate the practice of payment for TUW with pricing to be structured for incrementally achieving cost recovery over a period of time.
    2. the pricing of TUW shall, at the minimum, aim to recover the additional operating costs incurred for treating used water to applicable reuse standards and its delivery to the end user.
    3. apportioning and pricing of domestic sewage charges and sale of TUW to be structured for recovering the entire operating cost of conveyance of used water, treatment of used water, distribution of TUW, repair, maintenance and overall management including billing for the services. Where viable, part or all of the capital cost of the services shall be recovered.
    4. in cases where it is viable, full cost recovery shall include:
        i. capital cost for the infrastructure – sewer for conveyance of used water, treatment plant and distribution infrastructure for TUW.
        ii. institutional aspects of the sanitation service e.g., the management information systems, accountancy and finance management, billing and collection, customer services, etc. and oversight activities.
        iii. operating, maintaining (on a planned maintenance basis), repairing replacing and extending sanitation service physical infrastructure.
        iv. all other management, operating and maintenance costs.

Additional factors are to be considered in pricing of TUW based on type of end use of TUW and regional context:

a) While TUW is to be priced lower than freshwater, existing subsidies on freshwater can impact the viability of an SRTW project. On a case-to-case basis, State/ ULB/ Parastatal agency/ PRI shall intervene to rectify such market failures, including consideration of 'no-freshwater zones' (Annex 5).
b) Differential pricing shall be applied based on the type of end use and the ability to pay for TUW and cost incurred in accessing freshwater.
c) States shall determine payment by farmers for access to TUW, based on the groundwater situation in the region (with stringent norms for overexploited zones), costs of accessing canal water and other expenses such as cost of pumps, pipes, etc.
d) Farmers currently using untreated used water for informal irrigation may not have the same ability to pay market rates for TUW as new SRTW users and thereby risk losing incomes. States will need to assess the extent of prior use and may consider introducing benefit sharing mechanisms in which a portion of the revenues from new SRTW projects is used to finance improvements in existing farming practices and minimize loss of production.[39]
e) In determining pricing for industries, States shall ensure industries in the State are not disadvantaged in terms of input costs
f) In 'no-freshwater zones' created by the State, pricing incentives shall be provided to promote TUW especially for agriculture and industries.

The price of TUW shall be fixed for a specific duration and suitable price escalation, as decided by the State Committee, shall be applied based on applicable end uses. The Committee shall define the period for reviewing the price of treated used water and set out details of an appeals mechanism.

Users of TUW shall be provided with the purchase agreement[40] by the implementing agency, which shall reflect at the minimum- the price, escalation, payment method, quantity and quality of water, along with other contractual conditions.

The implementing agency shall maintain an escrow account to receive payments from the sale of treated used water and where appropriate, the funds raised from SRTW can be considered to subsidize domestic sewage charges for socially and economically marginalised sections of the society so as to ensure affordability of used water services by them and to finance improvement in service delivery including quality of TUW.

9.2 Guidance on selection of business models and private sector engagement

In the planning of an SRTW project, it is important to develop business models suited to the type of end use. Annex 2 provides brief descriptions of different SRTW business models and some examples of successful SRTW projects implemented in India.

The implementing agency shall develop appropriate business models for setting up of conveyance, treatment and TUW distribution infrastructure, along with its operation and

maintenance to ensure sustainable implementation of SRTW. The implementing agency shall take into account lessons from implementation in other states, with successful examples.

In approving the business models, the implementing agency may consider the following items for the entire value chain, including conveyance of used water, treatment, and distribution of TUW:

a) Appropriate regulations to be developed and applied e.g. used water connection, conveyance coverage, treatment standards, reuse standards, billing and collection protocols, monitoring protocols based on type of end use, penalty mechanisms and reporting.
b) Payment of services by customers for used water services and TUW as per the pricing principles in section 9.1 and the process of billing and collection mechanisms.
c) Financing mechanism and requirement of funds to meet the establishment of infrastructure for SRTW, including any gap in operating cost of the infrastructure.
d) Clear roles and responsibilities of each stakeholder in an SRTW project reflecting their involvement in financing, service provision or regulatory aspects. The implementing agency is expected to identify all relevant stakeholders based on the type of end use of TUW.

The implementing agency may undertake any of the following approaches in implementing the business model: a) Public procurement, b) Private ownership and c) Public Private Partnerships. A state-owned company or institution may directly purchase secondary treated used water from the utility and, if needed, set up additional treatment infrastructure to meet the required water quality standards. Respective state guidelines on procurement shall be applied. States where procurement guidelines are absent may follow national guidelines issued by Department of Expenditure, Ministry of Finance. For economies of scale, states shall encourage clustering of nearby urban and rural areas, where appropriate, to jointly plan reuse of TUW.

The implementing agency shall implement procurement contracts depending upon the most prevalent and successful end use of treated used water and considering highest value of social, environmental and economic returns. The implementing agency shall embrace emerging models and practices as appropriate to their respective context.

In the **Public Procurement Model**, the implementing agency owns and operates the conveyance, treatment and treated used water distribution infrastructure. In addition to covering the items described above in defining the business model, the following additional aspects are included in this model:

a) The implementing agency engages the services of private agency in procurement of technology. The technology choice may be driven by outcome orientation that defines required performance criteria instead of prescribing select technologies. The implementing agency considers encouraging participation of smaller private players

especially for proven well established technology solutions so as to have a larger pool of bidders participating in the tender.
b) The implementing agency ensures funding coverage is met by budgetary resources from central, State government and ULBs or PRIs and, where available, funds from external funding agencies.

In the **Private Ownership Model**, the implementing agency provides either secondary treated water to a private entity which is responsible for treatment to any higher required quality standards. Depending on the local context, the infrastructure for distribution of treated used water shall be owned and operated either by a public or private entity. This model is particularly relevant for provision of industrial grade quality of TUW for industry. In addition to covering all the items described above in defining the business model, the following aspects are also relevant:

a) The procurement models applicable are a) Build-Own-Operate (BOO), b) Build-Own-Operate and Transfer (BOOT), and c) Build-Operate and Transfer (BOT) with user charges, provided the user charges collection risk by the private entity can be mitigated.
b) The implementing agency shall mandatorily provide the quantity and quality of untreated or treated used water, failing which, relevant penalties applicable on the implementing agency may be applied.
c) If the infrastructure for distribution of treated used water is owned and operated by the implementing agency, then the private entity responsible for treatment shall be provided assurance of minimum guarantee on revenue from the sale of treated used water or offtake of assured quantity of treated used water, at fixed price. The private entity shall be responsible to meet the required reuse water quality standards.
d) The implementing agency may require the off-taker of the TUW to be responsible for the costs of distribution.

In the **Public Private Partnerships (PPP) Model,**[41] the implementing agency intention is to engage with a private entity to attract private investment, to leverage its efficiency, and to provide quality treatment facility including distribution infrastructure and services at an optimal cost. In addition to covering all the items described above in defining the business model, the following additional aspects are relevant to this model:

a) The implementing agency shall implement any of the following PPP models or a combination thereof: a) Design-Build-Operate (DBO), b) Design-Finance-Build-Operate and Transfer (DFBOT) or BOT - annuity, c) Hybrid Annuity Models (HAM), and d) BOT – user charges or end user.
b) In contracts where the implementing agency is completely financing the PPP contracts, it shall ensure funding coverage is met by budgetary resources from central government, State government, ULB and PRI along with exploring funds from external funding agencies and banks.

c) For projects in rural areas, the implementing agency shall engage farmer associations such as farmer producer organisations (FPO) and Self-Help Groups in implementing PPP models.

d) The implementing agency shall consider VGF. The guidelines for financial support to PPPs as issued by the Department of Economic Affairs shall be followed for applying VGF. States may provide additional VGF in addition to the funding from central government as per the guidelines.

e) In HAM contracts, the financing arrangement sharing ratio between implementing agency and private entity shall be defined. The implementing agency pay their defined financing share after completion of the treatment plant and the remaining portion is paid in the form of annuities.

f) The implementing agency shall apply one or a combination of following criteria in selecting the PPP operator:

   i. Lowest bid in terms of user fee from consumers
   ii. Royalty paid to ULB per KL of treated used water
   iii. Highest upfront fees
   iv. Lowest present value of subsidy
   v. Lowest capital cost and operations and maintenance cost for projects
   vi. Highest equity premium
   vii. Quantum of State's support solicited in present value

g) The operations and maintenance period shall be long term and the private entity may remain responsible for at least 15 years but not exceeding a 30-year period.

h) A balanced risk allocation and performance-based remuneration shall be applied with a requirement for accountability on the part of both the implementing agency and the private entity.

The business models developed by the implementing agency shall be finalised after adequate due diligence and detailed assessment. The final decision on the approval of the business model shall lay with the State Committee on SRTW. Reuse of TUW can also be included as part of Corporate Social Responsibility (CSR) activities for industries and public sector undertaking.[42]

9.3 Managing risks

The implementing agency shall identify risks and corresponding mitigation measures before the implementation of SRTW projects. An integrated approach to water resources management shall be established, combined with locally appropriate and sustainable risk reduction measures and active involvement of stakeholders from different sectors. Table 9.1 provides some of the key high-risk situations and corresponding mitigation strategies.

Table 9.1 Risks and Mitigation measures

Risks	Mitigation Strategy
A. Limited market acceptance on reuse of TUW	a) The implementing agency undertakes information, education and communication campaign on the benefits of TUW and corresponding regulations b) Create "No freshwater" zones and mandate usage of TUW for certain type of end uses c) Mandatory use of TUW by industrial zones within a certain distance from Sewage Treatment Plant
B. Unable to achieve cost recovery based on pricing of TUW	a) The implementing agency adhere to the pricing principles so that price incentives are there for adoption of TUW b) Subsidy on freshwater can impact the viability of treated used water project and the State/ ULB/ Parastatal agency/ PRI address these on a case-to-case basis and may need to revise the subsidy on freshwater
C. Stakeholders involved in existing practices of using treated and untreated used water can delay the project and make it unsustainable in the longer run	a) The implementing agency engages with stakeholders and arrives at an arrangement that is beneficial to all b) If the existing users of TUW are farmers and priority is mandated to industries, suitable arrangements for sharing and allocation of TUW should be agreed between the stakeholders. When TUW is supplied to farmers, there needs to be a clear case for growing suitable crops as recommended. c) The priority on usage be given to the end user with the highest social, economic and environment returns
D. Lack of available finance for establishing infrastructure for treatment and distribution of TUW	Depending on the local situation, one of the following approaches to be considered: a) States to consider all budgetary resources available at National/ State/ ULB/ PRI, including VGF mechanism b) States to create a SPV to develop distribution grids c) States to create a credit guarantee fund (as part of the SPV) for private entity to finance the investment d) Partnership with industry clusters/ development board/ finance institutions to jointly invest in infrastructure e) Depending on project viability, off takers of TUW to be responsible for treatment and conveyance. This to be strictly applied in water scarce regions with water intensive industries f) States to target investments under Corporate Social Responsibility programmes
E. Delay in project execution due to lack of prioritisation on type of end use of TUW	a) The implementing agency shall align water availability situation along with the highest returns from the investment from social, environmental and economic perspectives in allocating TUW for different types of end uses
F. Assurance on quantity and quality of TUW supplied to end user	a) The implementing agency complies with the purchase agreement b) In case the implementing agency is unable to meet the supply requirements, they may be penalised or required to supply freshwater to the end user c) End users of treated used water are recommended to have back up supply alternatives, in case of emergency situation

Risks	Mitigation Strategy
G. Weak monitoring and enforcement of standards has environment and public health implications from use of TUW for certain end uses	a) Based on the type of end use, the implementing agency engages appropriate institutions in monitoring environment and public health outcomes and enforcement/ compliance of performance criteria b) For an end use in agriculture, the implementing agency may engage with department of agriculture and agriculture universities in respective states for guiding farmers and FPOs on suitable crops and agronomic practices. Additionally, the importance of incorporating sanitation safety measures, during irrigation and periodic monitoring of soil and farmer's health would also be considered c) For an end use in relation to environment, the implementing agency shall engage research institutions and civil society organisations to monitor the quality of water in waterbodies along with creation of public awareness
H. Insufficient bidders in public and PPP procurement models	a) Based on the type of services required from the private entity, the qualification conditions shall encourage small private sector players and local agencies to ensure larger pool in tenders, thereby resulting in lower cost and ease of operations managed locally b) Technology choice driven by an outcome orientation instead of prescribing select technologies will encourage wider participation

10 Financing

10.1 National programmes

The Government of India under the aegis of MoJS may identify national funding mechanisms from ongoing and future programmes to promote SRTW in States and Union Territories (UTs) and issue guidelines on funding eligibility. National funds may be used to partially finance project costs depending on eligibility criteria, with the remaining contribution from the State and/or private entity. The eligibility principles for utilizing national funding for SRTW are given in Annex 4. An additional modality is to provide credit guarantee facility for private entities to access finance for investing in SRTW infrastructure.

Ongoing programmes of the Government of India through which SRTW funding may be sourced include the AMRUT, SBM, JJM, Clean Ganga Fund for Ganga States, and through the NRCD. The initial proportion of funding for SRTW, allocated from such programmes, will be determined for each category of reuse and announced formally by MoJS. The proportion will be reviewed regularly, at least every three years, and adjusted as necessary, taking into account the availability of funding, implementation experience and achievement of SRTW targets.

For TUW in agriculture, PMKSY scheme can be applied for treatment of used water and conveyance of TUW. Funds from the Central Finance Commission shall be used for the development of infrastructure.

10.2 State programmes

SRTW projects will be aligned to the Government of India programmes outlined above along with funding available from the States. Reuse of TUW shall be incorporated in all state level programmes, where relevant, including integrated programmes that recover solids and any other by-products from treating waste water.

In states where there are no parastatal agencies to provide used water services, creation of an SPV may be considered for cities above 5 lakh population to manage sewage and supply TUW to end users. The SPV may also manage and finance infrastructure for distribution of TUW.[43] States may also consider providing credit guarantee facility for private entities to finance investments in SRTW projects. States shall mandate all the ULBs and PRIs to ring fence the sanitation budget line within their respective budgets. States may provide additional VGF as per the PPP guidelines issued by the Department of Economic Affairs, Ministry of Finance.

Respective State UDDs and PRI departments shall coordinate various funding sources and be responsible for convergence. Financing of both capital and operation and maintenance costs of SRTW projects shall include a combination of:

a) Funds provided by Government of India under centrally sponsored schemes.
b) Funds from State government programme and Urban Development Department budget.
c) Funds from Central and State finance commissions.
d) Loans take by State Government from international organizations
e) Funds deployed by PPP operators.
f) Revenue from the sale of TUW and sale of other by-products from the treatment plant.
g) Own source of funds of ULB and PRI which would include sanitation tax or user charges levied and sewerage connection fees.

Funding of pre-feasibility and feasibility assessments may be made available from State urban development department budgets, including from ULBs or parastatal agencies.

The implementing agency shall seek funding for SRTW projects from companies under CSR programmes.

The implementing agency may raise funds for the SRTW investment using social/development impact bonds and suitable financial instruments used by impact investors to promote TUW.

10.3 Incentives

States may consider applying incentives in the form of tax rebates and waivers of other charges for promotion of SRTW in both new properties and in retro-fitting existing properties. They include but are not limited to:

a) Individual households/ apartments/ gated colonies treating their used water in a decentralized manner and reusing it onsite (including dual plumbing) as permissible shall be eligible for rebates in property tax as decided by the State or ULB or PRI.
b) States/ ULB/ PRI may mandate all new apartments/gated colonies, malls, hotels, industries, clubs, colleges, universities, hospitals, sports stadiums etc. to mandatorily treat and reuse the TUW in their premises (including dual plumbing). As a result, these developments may be eligible for rebates in the construction permit fee or other charges, as applicable for sanction of building plans.
c) The implementing agency may give land on lease to PPP operator.
d) States may provide rebate on Goods Services and Tax (GST) on purchase of machinery or equipment for the treatment plant incorporating reuse. The rebate shall be linked to a minimum investment amount.
e) The implementing agency may provide electricity rebates for the operations of treatment plants and conveyance of TUW.
f) States may provide exemption from payment of GST on pipes for conveyance of TUW.
g) State may exempt custom duty on SRTW projects financed by external organisations.
h) States may implement a scheme of issuing and trading of TUW reuse certificates (Annex 2) to incentivise ULBs or PRIs and target end users (e.g. industries) to achieve the targets set on SRTW. The certificates can be used as a mechanism to maintain commitment to SRTW by ULBs or PRI and target end users where viability of reuse is uncertain or low.

11 Monitoring, Evaluation, Surveillance and Review

11.1 Principles and responsibilities for M&E

Monitoring and evaluation of SRTW is required to:

a) Track performance targets on SRTW as set out by the State.
b) Ensure compliance on outcome, process and service standards in SRTW projects.
c) Evaluate pricing of TUW, incentives and penalties/sanctions, and
d) Ensure transparent reporting mechanisms.

At the national level, MoHUA has developed SLBs on used water management to assess performance of citywide sanitation. The benchmark currently has provision for the indicator on reuse of TUW and it shall be updated to capture additional indicators as required by this Framework. Similarly, this should be undertaken by responsible agencies for TUW in rural areas. Consolidation of data captured by the states and ULBs on reuse performance targets shall be undertaken at the national level.

State governments will be responsible for monitoring the performance of the implementing agency in achieving the national targets and targets outlined in their respective state SRTW policies. State governments shall devise data collection and reporting systems using the indicators developed for SLBs. The implementing agency shall develop a database on approved SRTW projects and reporting format to track

compliance on standards. State governments will be responsible to undertake water audits to ensure the overall water balance and water allocation of TUW as an alternative source of water.

The implementing agency will be responsible for leading monitoring and compliance of outcome, process and service standards on SRTW projects implemented within their jurisdiction. Water quality specifications for TUW to be monitored according to CPCB guidelines for the presence of emerging contaminants, heavy metals, pesticide residues and antibiotic residues. The implementing agency will engage with SPCBs for monitoring outcome standards. Based on the type of end use, they will engage appropriate institutions and implement appropriate surveillance measures in monitoring outcome standards. The State may require a percentage of revenue generated from the sale of TUW be allocated for independent monitoring and ensuring compliance. The amount would be determined based on monitoring needs and financial viability of the projects. Institutional responsibilities include:

a) For an end use for **industries,** where quality standards depend upon the nature of the industry and their water quality requirements, self-compliance mechanisms will be put in place and monitoring by SPCB as part of broader regulatory commitments.
b) For an end use in **agriculture**, the implementing agency will engage with departments of agriculture and agriculture universities in guiding farmers on crops developed, incorporating sanitation safety measures on irrigation practices and periodic monitoring of soil and farmer's health. States shall engage irrigation departments in monitoring of reuse in agriculture.
c) For an end use for **environment** purpose, the implementing agency will, as appropriate, engage CGWB, research institutions and civil society organisations to monitor the quality of surface and ground water. They may also be engaged to create awareness on TUW amongst citizens. Relevant State department or State Pollution Control Board shall display through an online system the water quality of the water bodies receiving TUW.

The State shall monitor related provisions outlined in other policies mentioned in section 5 and as, required, implement sanitation safety plans as risk mitigation barriers along with outcome standards in SRTW projects.

11.2 Information systems

At the national level, MoJS shall develop and maintain an online information system to track the progress and extent of reuse, type of end uses, quality of surface and groundwater, and number of jobs created/sustained from SRTW projects. The data shall be linked to monitoring and tracking of SDGs by NITI Aayog. The data collected at the national and state levels shall be reflected as an indicator in India's Composite Water Management Index, administered by NITI Aayog

States shall also develop and maintain their respective information systems which will be integrated with the national online information system. States may request cities to set

up online quality monitoring system to monitor efficiency of treatment operations along with details on all treatment facilities, details on capacity utilisation, treated water quality standards and quantity of TUW reused. States shall audit the information tracked by cities at periodic frequency, as decided by the State Committee on SRTW.

As part of the sustainability reporting mandate, industries and corporate sectors are encouraged to include the percentage of reused treated water in their processes and list their CSR accountability initiatives.

11.3 Periodic review of implementation

States will, through the State Committee on SRTW, periodically assess the implementation of the State policy. This includes evaluation of uptake by end uses, pricing of TUW, incentives, penalties and business models including procurement contracts.

12 Capacity Building, Research & Development and Awareness Generation

12.1 Capacity Building and Training

The National Water Policy (2020, forthcoming) emphasizes the need for capacity building. For SRTW this applies to planners, managers, designers and users at the National, State, ULB and PRI on research, development and promotion of state-of-art technology for effective and economic management of water resources. It requires cooperation between academic/ research institutions and government agencies. These capacity building and training programmes are to include modules on reuse potential of TUW and implementation modalities.

The MoJS will, within a year of Framework approval, formulate a strategy on capacity building programmes for periodic training and re-training of technical and managerial staff for smooth implementation of SRTW in the States, ULBs and PRIs for building capacity at the organizational as well as individual levels for implementing reuse of TUW.

Capacity building programmes need to include training, re-training and Quality Improvement Programme (QIP) for water and sanitation planners and managers at all levels in India, both in public and private sectors. Effective coordination will be required to ensure complementarity across various disciplines.

A Training Need Assessment (TNA) will be undertaken by the State, ULB and PRI on all aspects of operationalization of SRTW including technical, business models and public awareness aspects.

The ongoing in-service training programmes in States, ULB and PRI are to incorporate modules on SRTW for the technical and managerial officials of aligned departments. Specialist agencies of the State Government, academic institutions and private sector organizations with capability to train its State, ULB, PRI personnel and to orientate of elected representatives on aspects related to SRTW are to be identified. These agencies will focus on capacity building (including training and development of systems) and

capacities of ULBs in SRTW, in line with the sectoral reforms that the State may be implementing. ULBs will need to provide training on SRTW to their own staff – using the specialized agency selected by the State Government. ULBs could also utilize ongoing National and State Government Schemes for training and capacity building. Training modules for the implementing agency are to include project preparation, IEC activities, technology, roles, standards, monitoring mechanisms and business models.

Targeted training to be given to a broad range of stakeholders across different sectors of end use such as: Departments of Agriculture and Fisheries, farmer communities, industries, industrial board, municipal end users for green spaces, parks, agroforestry, NGOs, private sector players.

12.2 Research & Development

Relevant National institutions are to be identified to provide model training modules for use by State training institutions. National training and research establishments across a range of sectors, such as agriculture, aquaculture, industry, urban development and other sources and on groundwater, will need to work together to integrate aspects of SRTW into their curricula and applied research activities.

Research and development is to be conducted on new technologies for TUW and also across the range of technical, financing, pricing, procurement, health and environmental aspects.

Regarding water quality, research studies should be conducted to analyze the composition of the pollutants to assess the soil health, emerging contaminants in agricultural produce and impact on groundwater.

12.3 Awareness Generation

Awareness generation programmes for overcoming negative public perceptions on SRTW, based on scientific evidence and early experiences, are to be organized frequently in States, ULBs and PRIs. This may be delivered as stand-alone campaigns or as part of wider water literacy campaigns.

Awareness generation campaigns on SRTW will be undertaken by Ministry of Education for schools, colleges and educational institutions as part of the curricula. Where appropriate, in-situ decentralized used water treatment plants can be established as demonstration sites for SRTW.

Consistent and targeted messaging are to be included throughout the water and sanitation communication programmes of the Central Government. A knowledge base of successful examples will be needed to support the communication efforts.

Annexures

Annex 1: Model Framework for State SRTW Policy

Note: Detailed provisions of the State Policy will be consistent with those of the national framework to facilitate access to support from national level funding programmes.

Cover page
Letter(s) (Minister/Secretary, State Department of Urban Development)
Glossary and Abbreviations

1 Introduction

Describes the current situation in the State related to sanitation provision, treatment of used water and the scale and experiences of SRTW.

2 Objectives of the SRTW Policy

Articulates the objective and vision of SRTW in the State based on the type of sectors driving the State economy and agreed set of priorities for reuse. The State policy will provide timebound targets to be achieved on collection and treatment of used water and on SRTW. The targets are to be consistent with the national service level benchmarks and reuse targets of the national framework. States will introduce mandatory use targets appropriate to the local context as a regulatory measure or as part of incentive programmes, incorporating lessons from implementation experiences gained from other States. Similarly, States will also consider designation of associated 'no-freshwater' zones. In considering the designation of mandatory use and no freshwater zone provisions, the requirement for potable water and high quality treatment processes for some industries needs to be taken into consideration. The policy will also set out the guiding principles governing the planning, design, implementation and monitoring of SRTW programmes/projects in the State.

3 Legislative and Regulatory Context

Describes the framework of related national and State legislation, policies and regulations and municipal rules and regulations within which the State policy will operate.

4 Roles and Responsibilities

Provides a list of all relevant agencies and other stakeholders that will perform roles and assume responsibilities for implementing and overseeing the State policy. It will define the powers and functions of the regulatory authority for SRTW in the State. The focus will predominately be on bodies within the State, including public agencies, local level institutions, end-users, the private sector and civil society and identify the points of interaction with national level agencies and external agencies providing financial and technical support. At the minimum, the State policy should identify roles and responsibilities of State urban and rural departments, ULBs, PRIs, SPCB, parastatals and

SPVs, departments of industries, agriculture and irrigation, the private sector and civil society organisations.

5 Water Quality Standards and Environmental Considerations

Aligned to the national framework and regulations on water quality standards and other norms related to SRTW as well as defining specific standards and requirements of the State level, including linkages with broader water resources and river basin planning.

6 Business Models

Defines the types of business models that are considered appropriate to fulfil the objectives of the State policy with cross referencing to the National framework. Refer to the annex on business models in the National framework.

7 Financing SRTW

Sets out the options for financing SRTW projects including links to central and State programmes and describes other sources including domestic private-sector financing and sub-sovereign and non-sovereign financing from external funding agencies.

8 Implementation Approach and Timeline

Sets out the requirements for the State, ULBs, PRIs and other relevant bodies to develop coordinated SRTW strategies and implementation plans to operationalize and sustainably achieve the targets of the SRTW policy. Includes public awareness campaigns. Refer to the National policy on the suggested strategy for developing the implementation approach and target timelines.

9 Monitoring, Evaluation, Surveillance and Review

Describes the provisions for end-users, SPCBs and other relevant agencies to monitor implementation and performance of SRTW in the State and contribute to State and national level reporting systems. To be included as part of the State level strategy and implementation plan.

10 Capacity Building, Research and Training

Describes the State-wide programme of capacity building, research and training needed for involved agencies and stakeholders to effectively implement SRTW policy and the approach to engaging training institutes and other technical agencies for upgrading institutional and human resources capacity of ULBs, PRIs and others on SRTW.

Annexures (Optional)

State level guidelines, M&E framework, outcome and service standards, model purchase agreements, other relevant documents.

Annex 2 Business Models

There are numerous business models for implementation of SRTW. Some of the successful business models on SRTW implemented in India and globally are provided here as guidance to the implementing agency.

Safe reuse of treated used water in industries

Secondary treated used water from STPs has to be treated further to produce industry grade water for industry or industrial zone. The business models for SRTW in industry can be implemented in one of the following three approaches:

a) Minimum guarantee and fixed price model: The implementing agency enters into a long-term contract with an industry or industrial zone for bulk consumption of TUW at an agreed price. The implementing agency can set up a tertiary treatment unit and operate it on its own. Alternatively, if the implementing agency enters into a PPP arrangement for design, build and operations of the tertiary treatment unit to a private entity, they will be responsible to monitor compliance by the private entity to supply the agreed quantity of TUW to the bulk consumer. The implementing agency makes a net annuity payment to the private entity to ensure a guaranteed minimum revenue. The private entity responsible for treatment can sell additional TUW to other consumers.

b) Reuse buy-back model: An alternative arrangement is for the implementing agency to enter into a PPP arrangement with a private entity to develop and operate a tertiary treatment unit. The implementing agency pays a fixed O&M cost to the private entity and provides full buy back guarantee for TUW. The implementing agency is responsible to deliver TUW to the industries at a price fixed or as agreed with the industries.

c) Reuse PPP model – investment by end user: In this approach, the industry or industrial board purchases secondary TUW from the implementing agency. The industry or the industrial board is responsible for setting up the infrastructure for tertiary treatment and conveyance of the TUW at an agreed price to participating industries. Alternately the industry could contract operation and management of tertiary treatment unit to an agency and pay them a fixed O&M fee.

Surat – revenue generating model for the city from sale of TUW

Surat Municipal Corporation (SMC) with a population of about 7 million is responsible for provision of sewerage and treatment services and has a target of achieving 100% coverage by 2021. The City has 11 STPs of 1173 MLD capacity and is augmenting those with another 6 STPs to provide a total plant capacity of 1,656 MLD. As of June 2020, the City reused 16% of the treated used water out of about 927 MLD collected and treated. SMC has a sewer length of 1,957 kms covering 99.5% of the population.

Surat is also known for its textiles, housing more than 450 textile dyeing and printing houses with considerable potential for reuse of municipal used water providing adequate treatment is undertaken. Pandesara Industrial Estate that lies within the Surat Municipal limits has 125 water consumers of bulk water that could switch to reused water. In 2014 SMC, in collaboration with the Pandesara Industrial Estate and the State Government, built a 40 MLD tertiary treatment plant to supply industrial grade water to the estate. The technology involved sand/disc filtration, ultra-filtration, reverse osmosis and activated carbon filters. Based on the success of this pioneering project, demand for treated used water arose from other industries and industrial estates in SMC. A study undertaken by SMC to estimate the demand for treated used water by industries led to planning of clusters for developing tertiary treatment facilities (Bamroli, Dindoli and Bhesan).

As of 2020, SMC had set up tertiary treatment plants with a combined capacity of 115 MLD for INR 314 crores with financial support from Swarnim Jayanti Mukhya Mantri Sherhri Vikas Yojana of the Government of Gujarat, Smart City Mission of Government of India and numerous industry end-users. Under this model, SMC is responsible for preparation and execution of the project along with allocation of land and funding. A private operator is engaged through tender for construction and operation of the plant for 10 years and the supply of treated used water at the desired quality. The industrial users commit to purchasing an assured quantity of treated used water at a fixed price with annual increases based on increases in O&M cost as per RBI indexation. The tertiary treatment plant for Bamroli cluster has a fixed cost of INR 56 lakhs per month, electricity charges of about Rs 40 lakhs per month, variable cost of INR 1,860 per MLD per month and other additional costs to ensure quality in terms of alkalinity, TDS and color depending on the inlet quality. In 2014, tertiary treated used water was priced at INR 18.2 per KL and in 2020 the rate is at INR 32 per KL. In December 2020 the Bamroli cluster tertiary treatment plant made profits of INR 1.3 crores from the sale of treated used water. SMC generates annual revenue of INR 140 crores from the sale of treated used water. By 2025, SMC plans to productively reuse 70% of total sewage generated by City residents.

Safe reuse of treated used water in agriculture and agroforestry

The business model has high application to treatment plants located at the peri-urban part of a town or city with agriculture in the vicinity or where sufficient land is available for afforestation or for treatment plants in rural areas. The business model is most promising where no alternative water sources are available for agriculture or agroforestry.

Agriculture reuse: The institutional arrangement across the sanitation-agriculture interface is important with involvement of departments of agriculture or local universities, farmer groups or civil society organisations working with the farmers. The model requires a high level of participatory planning and trust building for the recipients of the TUW as well as their customers in its safety. Guidance should be provided to farmers on types of crops cultivated which are safe for consumption and have high demand or provide revenue that meets farmers' expectations. The reuse revenue to the treatment plant comes from sale of TUW to the farmers. The treatment plant operator can also sell treated sludge (biosolids) to farmers that can serve as a soil ameliorant.

Agroforestry reuse: The institutional partnership between treatment plant operator, implementing agency and the forest department is key in this model. The reuse revenue to the treatment plant is from sale of TUW to the forest department.

In both agriculture and agroforestry end uses, there should be assured commitment from the treatment plant operator on the quantity and quality of TUW supplied. For the conveyance of the treated water, financial contribution from treatment plant, implementing agency and end user of TUW can be explored.

Auctioning of treated used water for reuse in agriculture

The model is a variation to the agriculture SRTW business model. The engagement of institutions across the sanitation-agriculture interface will be the same. The implementing agency along with the treatment plant operator auctions TUW to farmers. The quantity and quality of TUW should be assured by the treatment plant operator. The farmers can organize themselves into small bidding consortiums/groups or as individuals. The opening bid price is generally the last year's auction price, and then the bid amounts are raised gradually upwards through calling the amounts publicly. The implementing agency enters into purchase agreement with the highest bidder. The implementing agency may allow the winner of the bid to trade the reuse water with other farmers. The payment arrangement can be on a quarterly basis or as per the harvest cycle. For the conveyance of the treated water, contribution from treatment plant operator, implementing agency and end user of TUW can be explored.

Managing the transition to safer irrigation with used water in India

Many farmers in peri-urban and rural areas adjacent to urban centers irrigate their farms with used water, either treated or untreated. While there are no national estimates on land area cultivated with used water, studies by the IWMI-Tata Program in 17 locations in five States (Gujarat, Maharashtra, Karnataka, Jammu and Kashmir, and Tamil Nadu) reported more than 57,000 ha of such land.[44] The total area irrigated by used water in India is likely to be several times this number.

Untreated and treated used water from cities and housing development runs off into streams/nallahs/irrigation canals/stormwater drains, often with little dilution from freshwater. Faced with limited availability of freshwater (due to scarce and saline groundwater, no access to canal water and high diesel costs to extract groundwater from deep wells), farmers view the relatively easy access to a reliable supply of untreated/treated used water as a viable alternative to meet irrigation demand. The nutrient value of used water further reduces their costs for fertilizer.

The Framework envisages a transition towards a situation where such farmers safely irrigate with used water, treated to the requisite standard and maintaining nutrients where possible. During this transition, the Framework promotes adoption of safer irrigation practices for existing use. The following examples describe formal arrangements between municipalities and farmers' cooperatives to access TUW and cases where farmers have adopted improved on-farm irrigation practices.

- In Gujarat, farmers pay municipalities for supplying TUW; farmers in Patan municipality pay annually INR 12,000 for supply of TUW. The TUW from Gandhinagar is conveyed through a 22 km underground pipeline which is accessed at many places by the farmers. The Irrigation Department charges for this use as per prescribed rates of water lifting from a notified river. In many lift irrigation schemes across India, farmers demand the provision of used water in years of drought due to its reliable supply.
- Municipalities and villages in northern Gujarat auction TUW for irrigation. In the villages of Anadpur (Yaksh), Mota Dhavda and Sanyara, used water is auctioned annually at INR 5,000 – 11,000. In Unjha municipality, the base price for auction starts at INR 4 lakhs (5 MLD STP) and allocated to the highest bidder for three years' contract. The bidder sells TUW to farmers at INR 70 – 90 on a per hour supply basis and earns a profit of about INR 1 lakh after incurring cost for maintenance and labor.
- In Maharashtra and Karnataka, farmers have adopted on-farm safety measures like the use of settling tanks and filters before letting untreated used water into the farms to reduce solid particulates or suspended solids. Some farmers use nets to cover the tanks to overcome the problem of mosquito breeding and some filter the untreated used water to prevent debris and fouling of soil before letting it into the field. There are cases where farmers use protective gear such as boots and implement drip irrigation to avoid direct contact with crops, grow non-edible crops when using untreated used water and also dilute one part of used water with three parts of freshwater.

Risk reduction measures are not sufficiently widespread and support is needed to introduce them in the transition to SRTW. The World Health Organization (WHO) has developed sanitation safety planning (SSP) to implement guidelines on safe use of wastewater, excreta and greywater. SSP was applied in Devanahalli, Karnataka and pathogen transmission barriers were developed to safeguard the health of farmers and consumers.

Treated used water for Aquaculture

The business model is highly applicable for treatment plants with a pond-based system or where secondary treated used water is discharged to ponds or lakes. The model is applicable to both urban and rural treatment plants.

In the case of pond-based treatment system, aquaculture can be integrated in the treatment system and the treatment plant operator enters into a partnership with a private entity involved in sales and marketing of fish. In this case, the treated water can be released safely in the environment or reused for irrigation as per the agriculture reuse business model.

In the case where TUW is discharged to a pond or lake, the ULB can contract a private entity to undertake aquaculture and the revenue from this contract can be allocated for used water treatment works.

In both scenarios, the institutional arrangement requires a partnership with the department of fisheries or research institution experienced in aquaculture to provide guidance and monitor any contaminant accumulation in the harvested fish.

Water-Swap model for agriculture and industry

This business model addresses the increasing demand for urban water and to manage scarce urban water resource especially during severe periods of drought as an adaptation strategy. With the JJM providing drinking water through individual tap connections, this model will increasingly be applicable to rural areas. The model looks at reallocating freshwater from agriculture and/or industries (including construction) to urban or rural domestic use in exchange for TUW within the same basin, and it may help optimize water allocations with sector specific water quality requirements.

The main contract is between the implementing agency and the irrigation department, farmers or farmers group that have access to water rights or with access to canal water in the case of end use in agriculture, or the industry association or relevant industry development board in the case of end use in industry. The model is complex in terms of engagement with multiple partners to get their buy-in and especially ensuring end users of TUW understand

the underlying rationale. Water-swap model requires incentivizing end users of TUW to participate in the arrangement and release their surface-or groundwater for urban or rural domestic consumption. The model may require additional treatment infrastructure to address the water quality aspects as required by the end user. In addition, investments in water conveyance will be required. Contracts can be structured either for the entire year for urban and rural areas which face water scarcity and hence address freshwater supply deficit or it can be seasonal which can be invoked in times of severe drought.

The additional freshwater gained through this arrangement can then be sold at a higher price to urban consumers and the obtained revenues can support cost recovery of treatment and conveyance TUW.

Safe reuse of treated used water for improving bio-diversity and managed aquifer recharge

Treated used water can be reused for landscaping, parks, rejuvenation of wetlands, lakes and ponds to improve the bio-diversity within and around urban and rural centres. When reuse of TUW is for wetlands, lakes and ponds, the distance from the treatment plant to the location will require conveyance of the TUW. One option is for the conveyance to utilize unlined open irrigation channels. Natural filtration processes take place during conveyance in open channels and seepage into the soil leading to aquifer recharge. Over time, surface and ground water reservoirs around such a system will improve. This now becomes a source of renewed fresh water for the urban and rural area. It becomes the responsibility of the ULB or PRI to ensure appropriate management of this source of water which can be harnessed in drier periods.

In most urban towns in India, water tanker operators tap aquifers to supply freshwater to urban consumers. The implementing agency could regulate this market and monetise it for the operations and maintenance of the treatment plant.

Chennai – at the forefront of reusing treated used water.

One of the first large scale examples of reuse of treated used water in the country was implemented in Chennai, a City with a population of 8 million which is under constant pressure for sources of supply of freshwater for the growing number of residents and expanding industries. Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) is responsible for the provision of water supply and sanitation services. The City is divided into 5 zones for delivery of sanitation services and has a total installed STP capacity of 727 MLD. CMWSSB has undertaken multiple projects to reuse treated municipal used water by industries so as to free up the limited volume of freshwater for domestic consumption. As of March 2021, the reuse of treated water by industries has allowed around 90 MLD of fresh water (15% of total water supplied to the city) to be reallocated to domestic supply.

CMWSSB has been supplying secondary treated sewage from Kodungaiyur STP to industries since 1993, including Chennai Petroleum Corporation Limited, Madras Fertilizers Limited and Manali Petrochemical Limited. Initially the industries set up tertiary treatment and reverse osmosis (TTRO) plants, however since CMWSSB has set up its own TTRO plant, it has started the supply of treated used water to those industries.

CMWSSB set up TTRO plants of 45 MLD each in Koyambedu and Kodungaiyur using a Design Build Operate contract to supply treated used water to the SIPCOT industries at Irungattukottai, Sriperumbudur & Oragadam and other industries in north Chennai region including Manali and Ennore. The plan included laying of pipes for conveyance of treated used water (about 85 kms) and setting up an intermediate storage tank to manage the supply. The total project cost for both the TTRO plants and conveyance was INR 834 crores. CMWSSB and industries have an agreement on the quantity and quality of treated used water supplied and consumed under which industries agreed to draw a minimum quantity of treated used water and CMWSSB agreed to supply it at assured quality parameters. CMWSSB plans to use the profits generated from the sale of treated used water for investment in capital costs for water source augmentation and the cross-subsidization of water and sanitation service to Chennai residents.

CMWSSB is in the process of setting up pilot Tertiary Treatment Ultra Filtration (TTUF) plants at Perungudi and Nesapakkam to use the treated used water for recharging of lakes which are one of the key sources for potable water supply. The Government of Tamil Nadu has approved the budget to set up 260 MLD capacity for recharging of lakes in and around Chennai. CMWSS Board is aiming to achieve the target of about 60% reuse of treated used water after completion of all ongoing reuse projects.

Corporate Social Responsibility Model for reuse of treated used water

With the implementing agency constrained in financing of treatment infrastructure, they could approach the private sector to drive CSR models to fill the required gap. In water scarce regions, private sector CSR could invest in treatment infrastructure. Industries investing in-house treatment infrastructure for high quality TUW, may be encouraged to provide a portion of TUW for environmental purposes or to improve green spaces in the urban areas under their CSR programmes.

In the reuse of TUW for agriculture, the implementing agency could engage private companies to train farmers on practices as part of CSR so as to ensure safety of harvested goods for end consumers. The implementing agency can engage with the CSR programmes of supermarket chains to buy back crops from farmers safely cultivating products using TUW. Wholesalers, traders or supermarkets can support this process through contracts with farmer cooperatives which allow them to secure a reliable crop supply while offering inputs, training or credit.

Tradeable reuse certificates for treated used water

The objective of this trading model is to maintain commitment to reuse of TUW amongst the entities on whom the State has set targets. The model addresses gaps in supply and demand for TUW in different regions of the State[45] or where cost to supply TUW is high or a project is unviable based on limited ability of pay of end users for TUW.

The entities here will be the utilities treating the used water, ULBs or PRI, and end users of TUW. Targets may be set according to the type of end use that the State wants to promote. In this model the State issues reuse certificates to entities that implement SRTW projects or use TUW. The State creates a platform for trading of certificates. The model works when mandatory targets are set for ULBs to achieve minimum reuse targets. For entities that do not meet the required minimum targets, they can purchase reuse certificates through the platform from entities that have achieved more than the minimum target. This mechanism

can ensure cross-financing of SRTW projects to regions where viability is high and optimises the limited money available to finance such projects.

In implementing this model, lessons can be learnt from other sectors that have implemented similar mechanisms (e.g. renewable energy certificates) by designing the system to avoid unintended consequences such as enforcement of penalties, revision of targets on reuse for future demand for certificates and limited awareness of the certificates.

Onsite reuse of treated used water

SRTW has onsite applications at the same location where the used water gets treated. An objective for a treatment plant along with public and environment outcomes relates to providing a visual appeal and to meet odour standards. Landscaping by lawns and trees should be a critical feature of any treatment plant. TUW can be used to meet the water requirement for maintaining the landscape. TUW can also be used onsite for cleaning of vacuum and suction trucks, cleaning of sewers and desludging of onsite sanitation systems.

In gated colonies, apartment complexes and institutions that are required to have treatment plants, TUW can be used for landscaping and for flushing toilet water by implementing dual plumbing systems. Where dual plumbing systems are incorporated, the planning norms for per capita use of water in the building can be divided into two parts, one to be delivered by freshwater and the other by TUW.

Annex 3 Technology

In the existing plan of treating used water generated from domestic sources, which is mostly from households in the ULB, used water is treated to standards referred to as secondary treated used water (STW).

In the case of TUW for reuse projects, the quality of treated water will vary based on the type of end use and the related standards prescribed. If the standards prescribed are more stringent than those for secondary treated used water, additional treatment modules/facility will need to be developed. Figure A3 indicates the incremental technology interventions required to achieve different end uses of TUW.

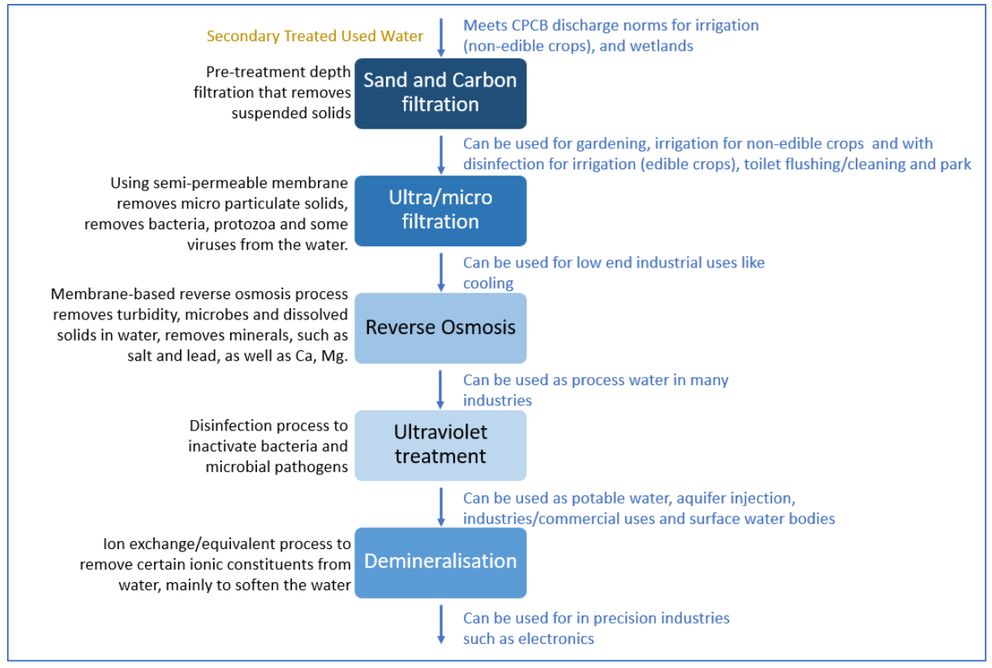


Figure A3: Incremental technology interventions to achieve end use water quality standards

CPHEEO's Manual on Sewerage and Sewage Treatment Systems (2013), provides details on different treatment technologies as applicable to a range of conditions.[46] The manual provides details on the design considerations and operating requirements for the technologies based on type of end usage of TUW.

A compendium of sewage treatment technologies and its assessment was prepared by Indian Institute of Technology, Kanpur and published by the National River Conservation Directorate, Ministry of Environment and Forests[47]. The compendium provides information on the performance of treatment technologies implemented in the country and categorizes them according to performance, costs, energy and other resource requirements and land requirement.

Technology for industrial reuse: The technology should meet industrial grade water and following advanced treatment technology are recommended:

1. Multi-grade filter, Dual Media Filter, Ultrafiltration
2. Multi-grade filter, Ultra Screen, UV system
3. Multi-grade filter, Ultra Screen, Ozonator

If the STW has higher TDS (> 1,000 ppm), Reverse Osmosis is suggested to be incorporated in each of the above system

Technology for agriculture end use: STW is suggested to disinfect with U-V or ozone. Alternately, including a maturation pond at the STP or at the farm level may also meet the requirement.

Technology for aquifer recharge: For direct injection for groundwater recharge, STW should undergo micro-filtration, followed by reverse osmosis and U-V disinfection before injecting, however for aquifer recharging through surface water spreading method, reverse osmosis can be excluded due to natural filtration processes.

In addition to above list of technologies, the Swachh Bharat Committee periodically meets to review and approve technologies concerning sanitation.

In selecting the technology, the implementing agency shall apply following principles:

- Meets the required standards based on the intended purpose of SRTW
- Low requirement of space
- Low consumption on energy
- Capital and operating cost should not make the project unviable

The State policy may recommend treatment technologies as applicable based on its contextual situation to guide the implementing agency from the list provided by CPHEEO manual, compendium on performance of treatment technologies by IIT Kanpur, additional list provided in this annexure and new technologies approved by the Swachh Bharat Committee.

References

http://cpheeo.gov.in/upload/uploadfiles/files/engineering_chapter7.pdf
https://ejalshakti.gov.in/MISC/InnovationAccrMC_Rep_S.aspx
https://nmcg.nic.in/writereaddata/fileupload/15_Technologies%20Involved.pdf

Annex 4 Eligibility conditions to access funding for SRTW from national programmes

The State shall be eligible to access the funding for SRTW from national programmes under the following conditions:

- States have an approved State specific SRTW policy with measures taken for its implementation.
- States have clearly delineated roles and responsibility on regulation, implementation and monitoring of compliance of SRTW projects.
- States shall apply the funds primarily for tertiary treatment and distribution infrastructure.
- National funding is available for infrastructure improvement in existing STPs to meet the required reuse standards. It is not available for new STPs except for those in towns with a population less than 30,000 and with reuse incorporated.
- National funding is available to cities that meet the minimum required Service Level Benchmarks in sanitation as defined by MoHUA.
- National funding is available if the State can demonstrate that the minimum cost recovery principles as per the feasibility study report is achieved and projects that independently have the potential to achieve full cost recovery should be implemented without financial support from national programmes.
- There will be a maximum total amount that any one State can utilize from the national funding to ensure budget effectiveness and to incentivize uptake of SRTW across the country.
- State shall contribute and demonstrate 50% funding which can include funds from private sector. However, for North Eastern states, Jammu and Kashmir and Hill States, funding will be available up to a maximum of 90% and 100% for Union Territories.

Annex 5: No-freshwater zone

This annexure provides guidance on implementation of no-freshwater zones. The States may use these measures to encourage promotion of SRTW. The measures should not discriminate against existing users of TUW and should be developed through a participatory process. The State shall consider the local context including extent of water stress in devising the rules for implementation.

A 'no-freshwater zone' demarcated by the State or ULB or PRI is to promote TUW and it shall have following features:

- The strict usage of TUW shall be applicable in the demarcated zone for industry, energy generation, construction, municipal uses and agriculture end use only. The usage of freshwater shall be for potable consumption only or other uses where a demonstrated need has been agreed.
- The restriction on usage of freshwater shall not be applicable for households in the zone. There will be a penalty to households that sell freshwater extracted from the zone.
- Crops cultivated by farmers in the zone will be strictly regulated based on water availability and food safety considerations
- Where it has been agreed for viability reasons that freshwater is supplied in the zone, it will be priced higher than the regular price (except for households and other justifiable cases) and the pricing of TUW will be either based on pricing principles set out in the Policy or there may be incentives of lower pricing initially to make TUW attractive.
- The implementing agency shall assure provision of an agreed quantity and quality of TUW. If the implementing agency is unable to assure required quantity and quality of water, it shall be responsible to provide freshwater to the end users of TUW
- Groundwater and surface water permits will be issued and strictly monitored on their usage. The zone shall be applied to regions where groundwater is overexploited

Endnotes

[1] https://www.wqa.org/whats-in-your-water/emerging-contaminants
[2] Defined in the FSSM Policy 2017
[3] http://cpcbenvis.nic.in/cpcb_newsletter/sewagepollution.pdf
[4] http://cpcbenvis.nic.in/cpcb_newsletter/sewagepollution.pdf
[5] http://cpcbenvis.nic.in/cpcb_newsletter/sewagepollution.pdf
[6] https://www.unwater.org/app/uploads/2017/05/UN-Water_Analytical_Brief_Wastewater_Management.pdf
[7] CPCB –Guidelines for Techno-economic feasibility of implementation of Zero Liquid Discharge (ZLD) for water polluting industries, Draft Jan 2015, also referenced at http://www.indiaenvironmentportal.org.in/files/file/Final-ZLD%20water%20polluting%20industries.pdf
[8] For example, in Singapore, the term NEWater is used.
[9] CPCB report, March 2021 accessed from https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvMTIyOF8xNjE1MTk2MzIyX21lZGlhcGhvdG85NTY0LnBkZg==
[10] https://nrcd.nic.in/writereaddata/FileUpload/NewItem_210_Inventorization_of_Sewage-Treatment_Plant.pdf , or http://www.sulabhenvis.nic.in/Database/STST_wastewater_2090.aspx
Of this amount 26% is estimated to be reused by industry after taking into account an efficiency loss, meaning that approximately only 6% of used water is currently reused.
[11] World Bank. Water and Sanitation Program (WSP); International Water Management Institute (IWMI). 2016. *Recycling and reuse of treated wastewater in urban India: A proposed advisory and guidance document*. Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE). 57p. (Resource Recovery and Reuse Series 8).
[12] https://mohua.gov.in/pdf/627b8318adf18Circular-Economy-in-waste-management-FINAL.pdf
[13] https://www.wri.org/news/2019/08/release-updated-global-water-risk-atlas-reveals-top-water-stressed-countries-and-states
[14] 54% of India's groundwater wells have shown a drop in groundwater levels between 2009 and 2015 with 16% declining by more than 1 m/year, data from WRI Aquastat.
[15] This information is available from water composite index report: https://niti.gov.in/sites/default/files/2019-08/CWMI-2.0-latest.pdf
[16] Chhattisgarh (undated), Gujarat (2018), Haryana (2019), Jammu and Kashmir (2017), Jharkand (2017), Karnataka (2017), Madhya Pradesh (2017), Maharashtra (2019 draft), Punjab (2019), Rajasthan (2016), Tamil Nadu (draft 2019), Uttar Pradesh (draft 2018)
[17] Policy Working paper Annex 3, Table 1
[18] https://www.iea.org/articles/introduction-to-the-water-energy-nexus
[19] In considering the designation of mandatory use and no freshwater zone provisions, the requirement for potable water and high-quality treatment processes for some industries needs to be taken into consideration.
[20] Discussions are underway on the scope of some of the Government's missions and any changes will be reflected in the text once they have been formalized.
[21] The SRTW framework covers treatment and reuse of domestic sewage. The treatment and reuse of industrial effluent is covered under a separate policy process.
[22] A related initiative being undertaken by SEIP program under Indo-German Development Cooperation. The status of the policy on industrial water reuse and ZLD will be clarified including status developing guidelines on industrial reuse by CPCB.
[23] Soil-Aquifer Treatment method can be considered for recharging the aquifer using secondary treated sewage effluent. In this method secondary treated wastewater is injected into specially designated recharge basins, where residual contaminants are removed by natural filtration through sand and adsorption on the aquifer's solid skeleton, by upper soil aeration and by long retention time in the aquifer it naturally filtrates. To avoid contamination, there is complete separation between the reclaimed effluents introduced and aquifer water, which is achieved by controlling the shape of artificially created water level depression, which creates hydrologic trough that prevents the reclaimed water from spreading. However, specific methodology for reducing salinity ingress through TUW recharge to Ground Water would need to be determined by States during the finalisation of their respective policies

[24] Reuse in this context includes reuse by the environment provided it has demonstrated beneficial outcomes. Discharging into a river where no assessment has been made of its utility is not considered to be a beneficial use.

[25] Directive by Ministry by Power, Government of India. Letter Reference No. 11/1O4/2015-Th-II (C. No. 2287522) dated 5 March 2020

[26] Handbook of Service Level Benchmarks, CPHEEO, MoUD, Govt of India

[27] National Building code of India, 2016, Bureau of Indian Standards.

[28] Masterplan for Artificial Recharge to Ground Water in India (2013), CGWB, Ministry of Water Resources, Govt of India.

[29] Guidelines to regulate and control Ground Water Extraction in India (With effect from 01.06.2019), CGWA, MoWR, RD, GR, dated 12.12.2018, effective June 2019.

[30] For example WHO Sanitation Safety Plan, 2016 and USEPA Guidelines for Water Reuse, 2012.

[31] *Manual on Sewerage and Sewage Treatment Systems*. CPHEEO, Government of India, 2013.

[32] The specified limits of BOD are currently 10 mg/L for edible crops and 20 mg/L for non-edible crops.

[33] Such as WHO standards/ USEPA Guidelines/EU Regulations

[34] The USEPA provides norms for the reuse of reclaimed water to recharge the aquifers which are used for potable and non-potable uses.

[35] CPCB ENVIS Report: Water Quality Management in India, 2008 (http://cpcbenvis.nic.in/envis_newsletter/ENVIS_NEWSLETTER_1.pdf)

[36] CPCBE NVIS Report 2001 (http://www.cpcbenvis.nic.in/scanned%20reports/PCL%204%20Environmental%20Standards.pdf)

[37] The SRTW Policies of Gujarat, Haryana and Karnataka specify that the BOD and TSS of TUW for supply to different users, except for rejuvenation of water bodies or used in agriculture/irrigation, shall not be more than 10 mg/l.

[38] For example, treated wastewater delivered to high water consuming industry in a water scarce region.

[39] For example, where the new TUW is apportioned between existing farmers and higher value users, a cross-subsidy could be included to enable farmers to adopt higher efficiency irrigation methods and maintain production levels with less water. Pricing models would consider how safer and more efficient production of high value produce from TUW would, over time, lead to an increased ability to pay for TUW among farmer groups.

[40] A model agreement can be part of guidelines to be formulated at national level

[41] The model can cover a single universal treatment process – from primary to tertiary level to be more cost effective

[42] For CSR financing, SRTW is considered under the general heading of sanitation

[43] Can be for dispersed end users and also for cluster end users, e.g. in an industrial cluster, sometimes there might not be financial strength within the industries to fund the distribution infrastructure

[44] Shah, T., Verma, S., Durga, N., Rajan, A., Goswami, A and Palrecha, A. 2016. Har Khet ko Pani (Water to every farm): Rethinking Pradhan Mantri Krishi Sinchai Yojana (PMKSY). IWMI-Tata Policy Paper, June. Available online: http://www.iwmi.cgiar.org/iwmi-tata/PDFs/iwmi_tata_pmksy_policy_paper_june_2016.pdf

[45] Consideration could also be given to a system of tradable reuse certificates at national level.

[46] Chapter 7 of part A

[47] https://nmcg.nic.in/writereaddata/fileupload/15_Technologies%20Involved.pdf

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