SEWAGE TREATMENT AND REUSE OF TREATED SEWAGE

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SEWAGE: COMPOSITION AND CHARACTERISTICS

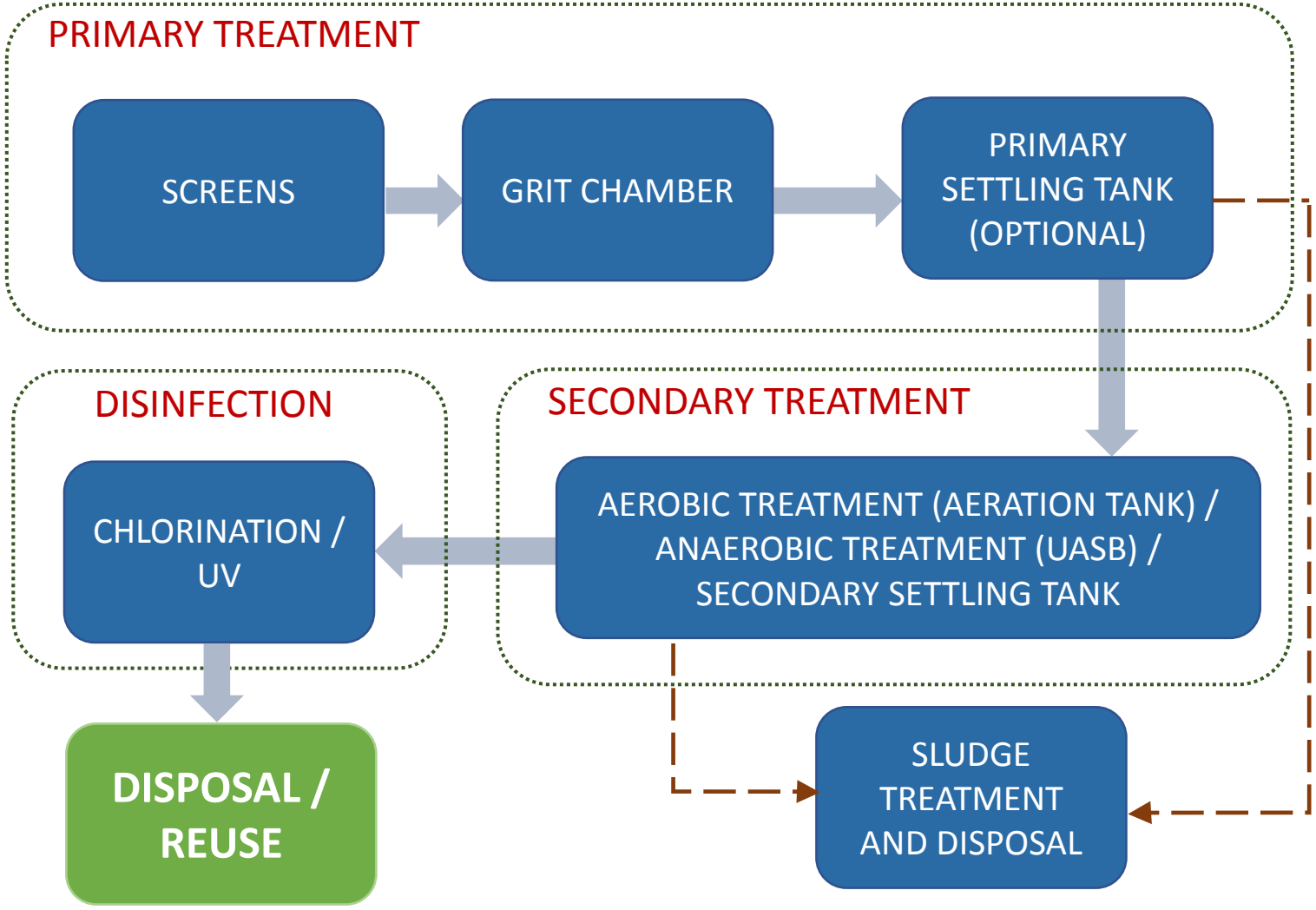
Sewage is a liquid waste originating from toilets, urinals, kitchen, bathrooms, basins and such other domestic activities from residential, commercial, institutional or industrial area.

SEWAGE TREATMENT PLANTS - PURPOSE

- Discharging raw sewage into water bodies leads to degradation of water quality. Therefore, establishment of STPs helps in reducing water pollution and thereby maintain and improve health and hygiene of the environment.
- Adequate treatment shall aid in reuse of treated sewage for various applications like irrigation/farming, industrial use, fire extinguishing, lake restoration and such other applications; reducing fresh water demand and increasing availability of fresh water for future needs.
- **Design standards for Sewage Treatment Plants:**

Parameters	Typical Inlet Parameters	Outlet Parameters CPHEEO Latest Manual, 2013	Outlet Parameters as per NGT order 2019
BOD	250 mg/l	< 10 mg/l	< 10 mg/l
COD	500 mg/l	< 50 mg/l	< 50 mg/l
Suspended Solids	400 mg/l	< 10 mg/l	< 20 mg/l
pH	6.8-7.2	*	*
Ammn. Nitrogen	35 mg/l	*	*
TN	50 mg/l	< 10 mg/l	< 10 mg/l
Dissolved P	7 mg/l	< 2 mg/l	< 1 mg/l (Total)
Fecal Coliform	1 x 10^5 MPN/100 ml	<230 MPN / 100 ml	<230 MPN / 100 ml

CONVENTIONAL TREATMENT TRAIN



TREATMENT BRIEF

UNIT	PURPOSE
Screens	Removal of floating impurities
Grit Chamber	Removal of grit- sand, silt etc.
Primary Settling Tank	Removal of inorganic suspended solids, organic and residual inorganic solids, thereby reduce load on Aeration Tank
Aerobic/ Anaerobic Treatment	Formation of sludge (Biomass) containing organic suspended solids / Digestion of organic matter
Secondary Settling Tank	Removal of sludge formed in Aeration Tank and release of clear supernatant
Chlorination	Disinfection purpose- removal of micro organisms (fecal coliform)
Sludge Treatment Units	Sludge Digestion (Aerobic/Anaerobic), Thickening and Dewatering of Sludge

TREATMENT BRIEF

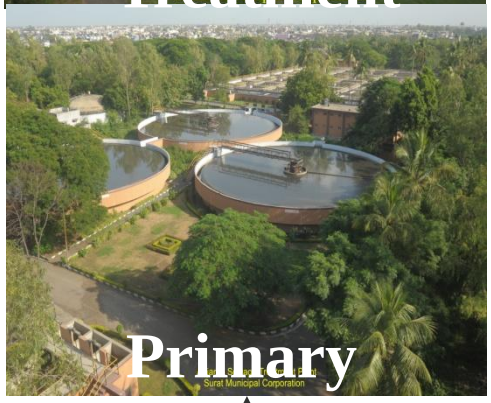
Sewerage Network

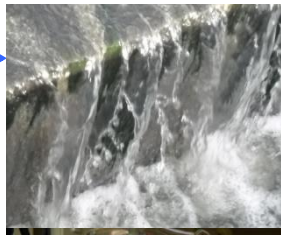
Trunk Main Sewer

Sewage Pumping Station

Rising Main

Sewage Treatment Plant





Secondary Treated

Primary Treated

Raw Sewage

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TREATMENT BRIEF

Inlet Chamber

Mech. Screen

Pr. Settling Tank

Aeration Tank

TREATMENT BRIEF

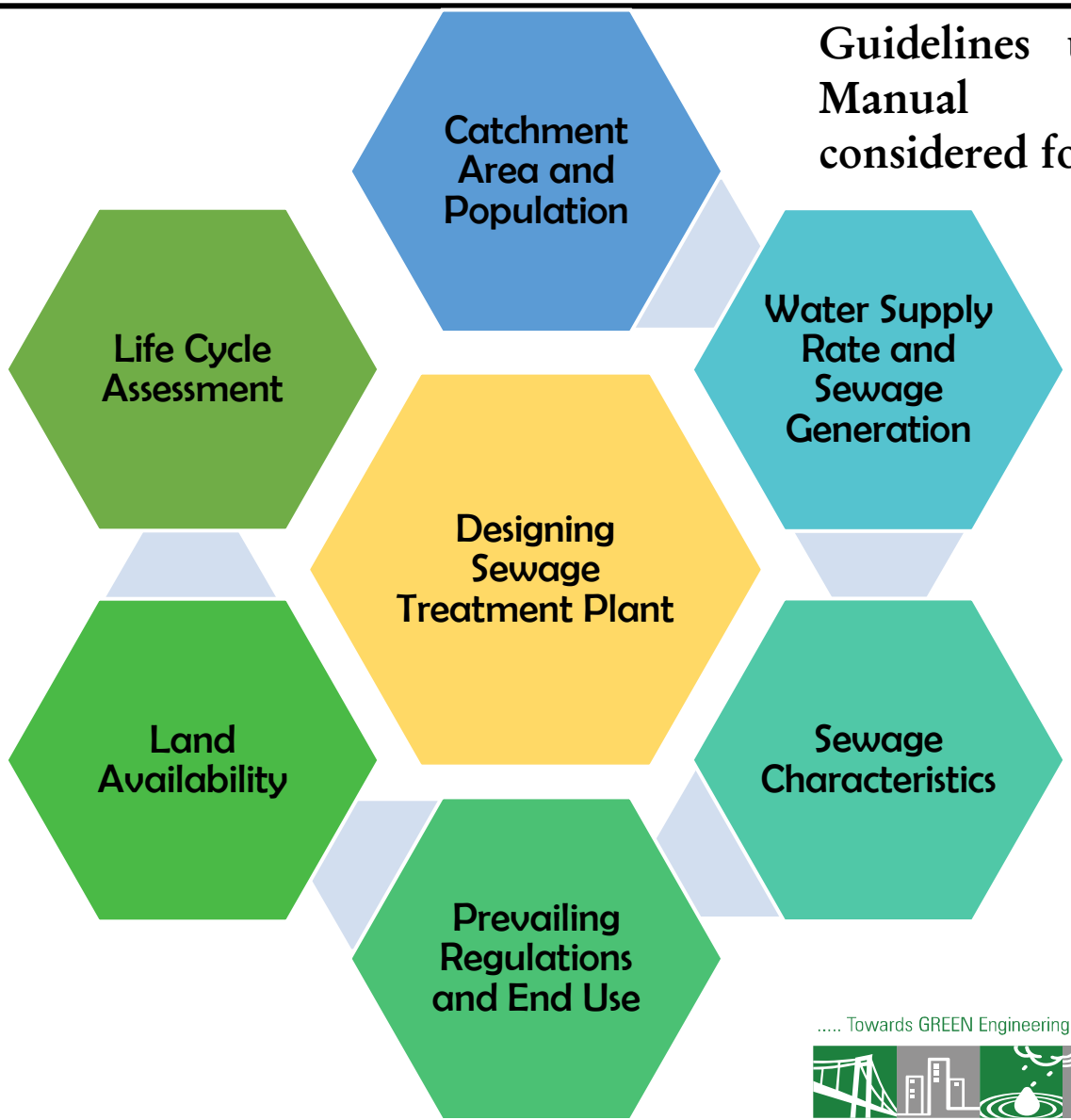
Sec. Settling Tank

Chlorination Tank

Sludge Digester

Centrifuge

DESIGN BASIS



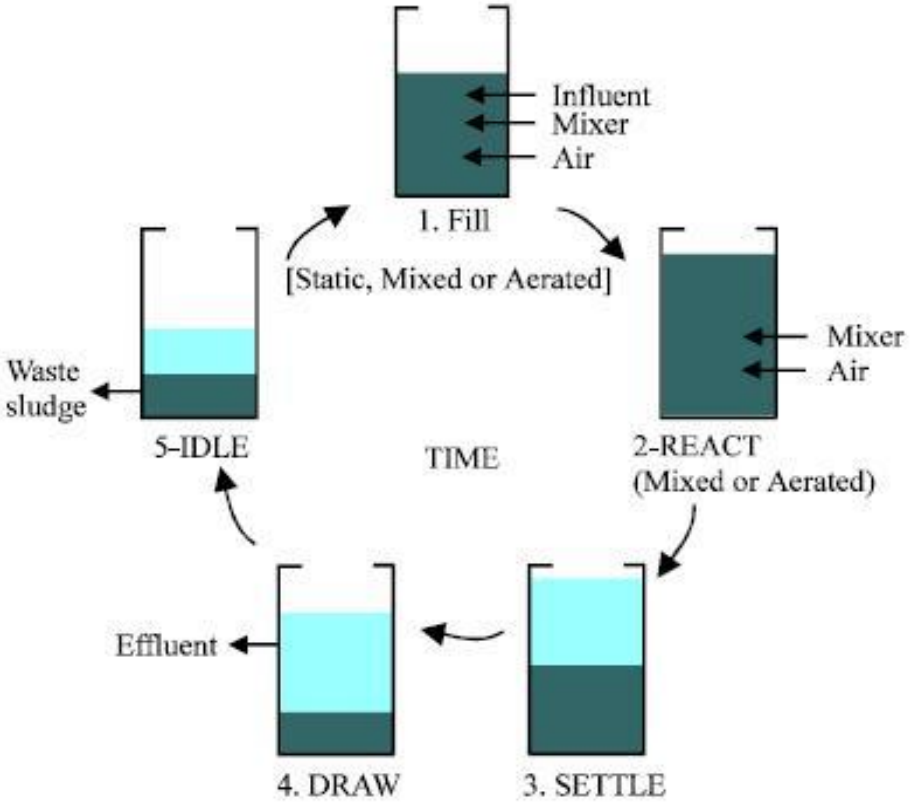
Guidelines under CPHEEO Manual is generally considered for design purpose

TECHNOLOGY EVOLUTION

- Since the emergence of treatment and disposal of sewage, myriad of factors have been evolved that has led to advancement in treatment technologies.
- To name a few factors- population rise and increased sewage generation, pollution load on disposal sinks, stringent law and regulation, increasing fresh water demand, reuse / recycle of treated sewage etc.

Technology Elevation		
Before 1970	**Till 2000**	**Current Scenario**
• Stabilization Ponds • Aerated Lagoons • Conventional Filtration System	• Conventional Activated Sludge Process (ASP) • Up-flow Anaerobic Sludge Blanket (UASB) • Trickling Filter (TF)	State of the art technologies like • Sequential Batch Reactor (SBR) • Membrane Bio Reactor (MBR) • Moving Bed Bio Reactor (MBBR) • Integrated Fixed Film Activated Sludge (IFAS) • Oxidation Ditch (OD)

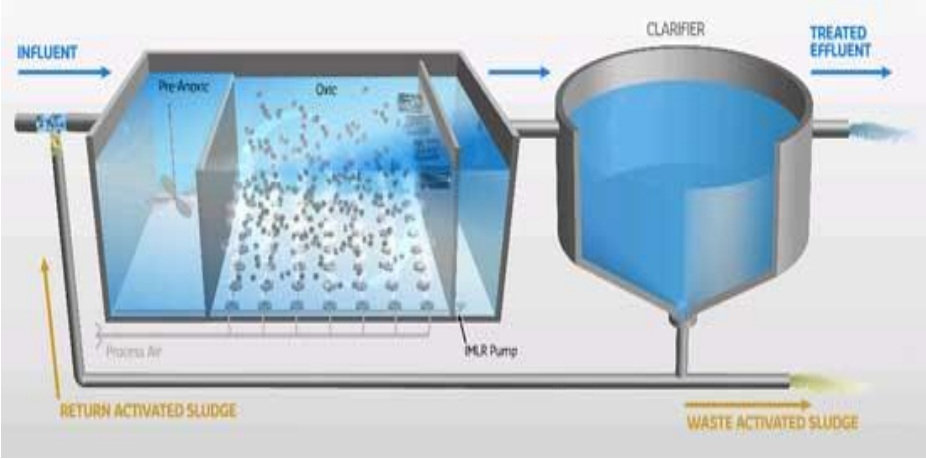
SEQUENTIAL BATCH REACTOR

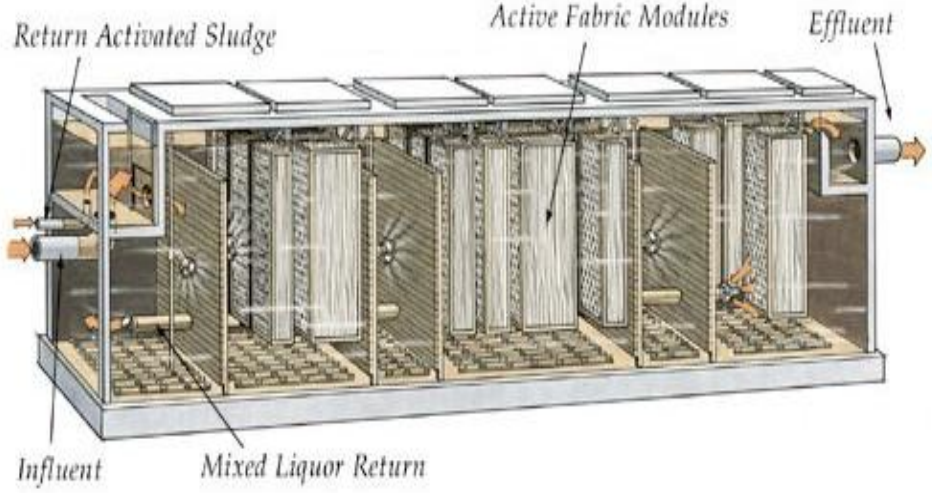


- **Group of Even number of Reactors**
- **Modified Activated Sludge Process (ASP)**
- **Reduction of BOD, SS, TN**

- Equalization, primary clarification, biological treatment and secondary clarification can be achieved in a single reactor vessel - Requires small space - Minimal footprint
- Controlled react time and quiescent settling.
- High BOD & nutrient removal capabilities.
- Filamentous growth elimination

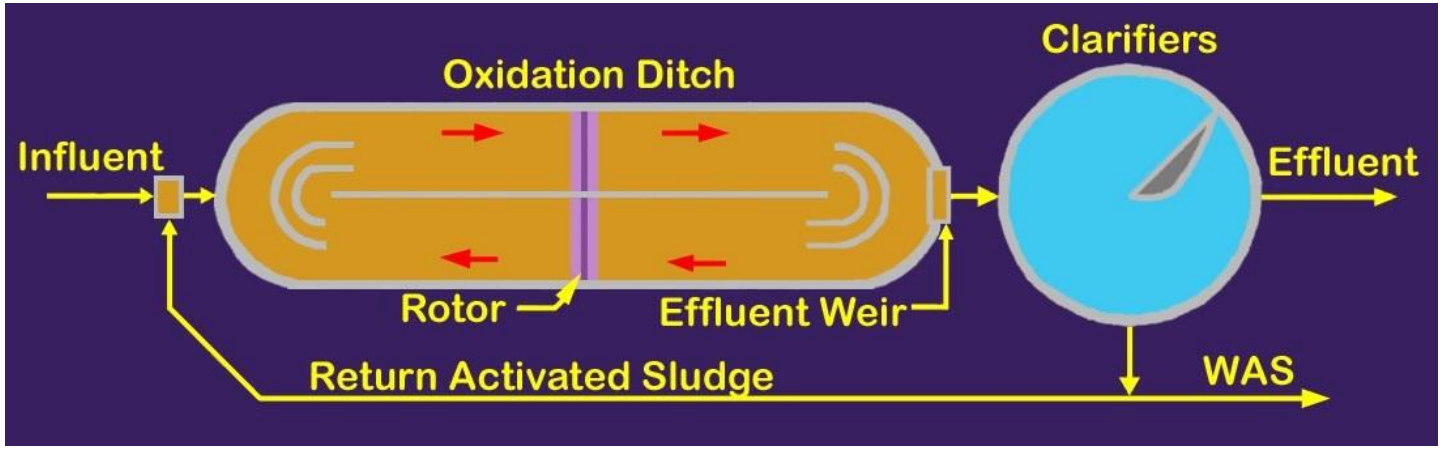
INTEGRATED FIXED FILM ACTIVATED SLUDGE / MOVING BED BIO REACTOR





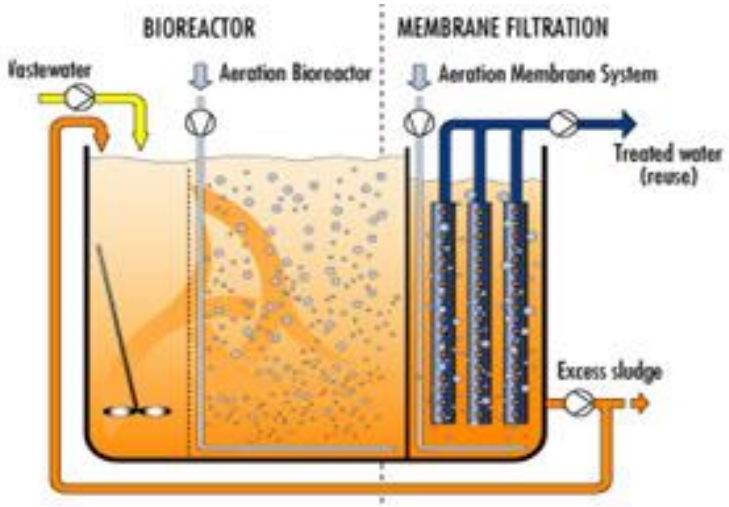
- **Modified Activated Sludge Process (ASP) with biofilm carrier elements.**
- **Reduction of BOD, SS, TN**
- Successful technology for retrofitting and upgradation of existing plant as addition of media increases the total available surface area without increasing volume of Aeration Tank.
- Increased capacity without increasing load to clarifiers.
- Resistant to wash outs.
- Bio mass responds to loading fluctuations.

OXIDATION DITCH



- **Modified Activated Sludge Process (ASP)** • **Reduction of BOD, SS, TN**
- The constant water level and continuous discharge, which lowers the weir overflow rate and eliminates the periodic effluent surge, make the technology reliable over other biological processes.
- Its long hydraulic retention time and complete mixing reduces the impact of a shock load or hydraulic surge.
- Because of its extended biological activity during the activated sludge process, the oxidation ditch produces less sludge compared with other biological treatment processes.
- The process is energy-efficient.

MEMBRANE BIO REACTOR



- Modified Activated Sludge Process (ASP) with membrane filtration
- Reduction of BOD, SS, TN

- Retention of all suspended matter and most soluble compounds within the bioreactor leads to excellent quality capable of meeting stringent discharge requirements and opening the door to direct water reuse.
- The feed wastewater only needs to be screened to remove larger solids that damages the membrane, eliminating other pre and post treatment.
- Possibility of retaining all bacteria and viruses results in a sterile effluent, eliminating extensive disinfection that would be required otherwise.
- Results in more compact systems reducing plant footprint.

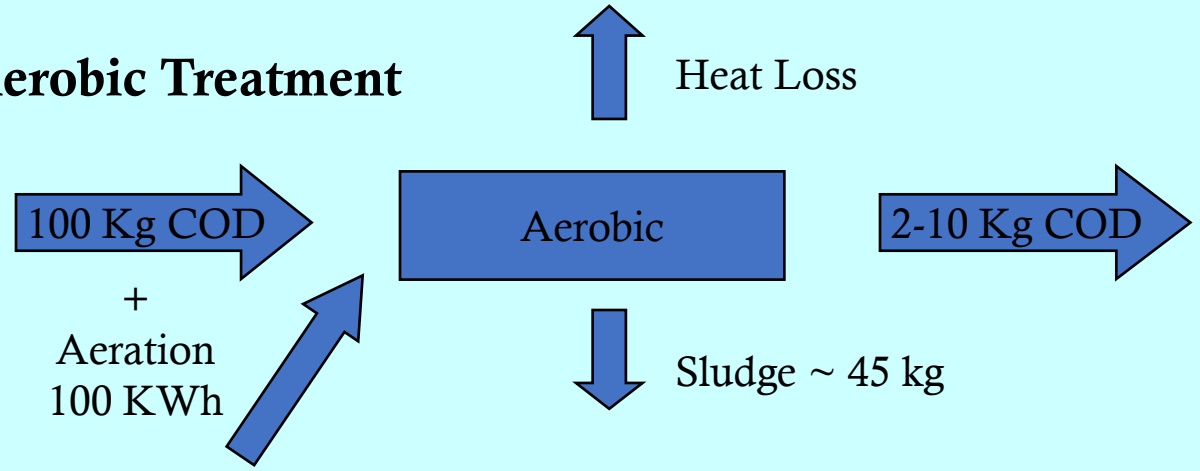
TECHNOLOGY COMPARISON - SELECTION

Factors	SBR	IFAS/MBBR	MBR	OD
Application	Reduction/ Removal of BOD, SS, TN*	Reduction/ Removal of BOD, SS, TN*	Reduction/ Removal of BOD, SS, TN*	Reduction/ Removal of BOD, SS, TN*
Settling Tank Requirement	Not Required	Required	Not Required	Required
Foot Print	Compact	Compact	Least	Higher
Retrofitting in existing plants	Technically non- viable	Technically viable	Technically viable	Technically non- viable
Operation and Maintenance	Higher than OD	Higher than OD	Highest	Lower
Power Consumption	Higher than OD	Higher than OD	Highest	Lower

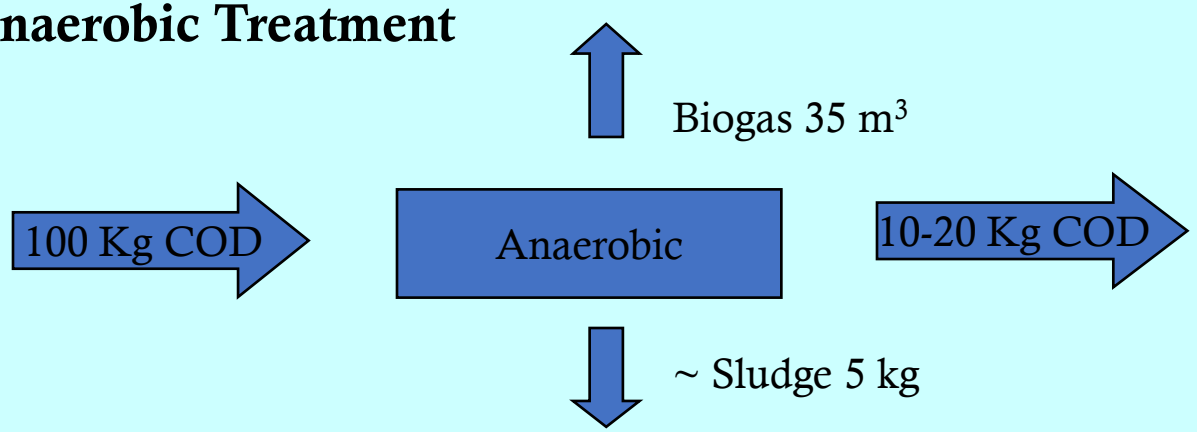
*For enhanced Biological Nutrient Removal, Anoxic and Anaerobic Tanks shall be provided.

TECHNOLOGY COMPARISON - SELECTION

Aerobic Treatment



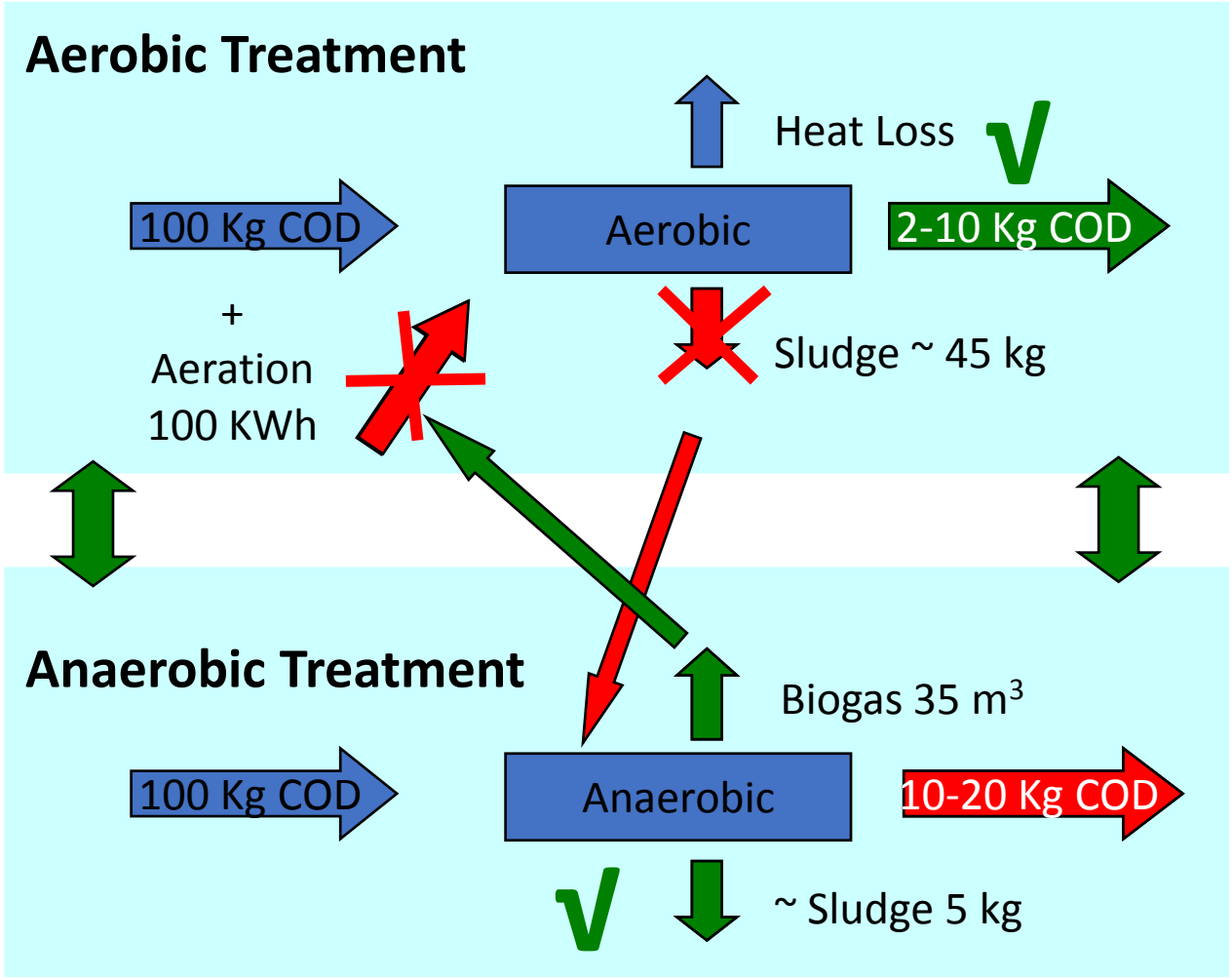
Anaerobic Treatment



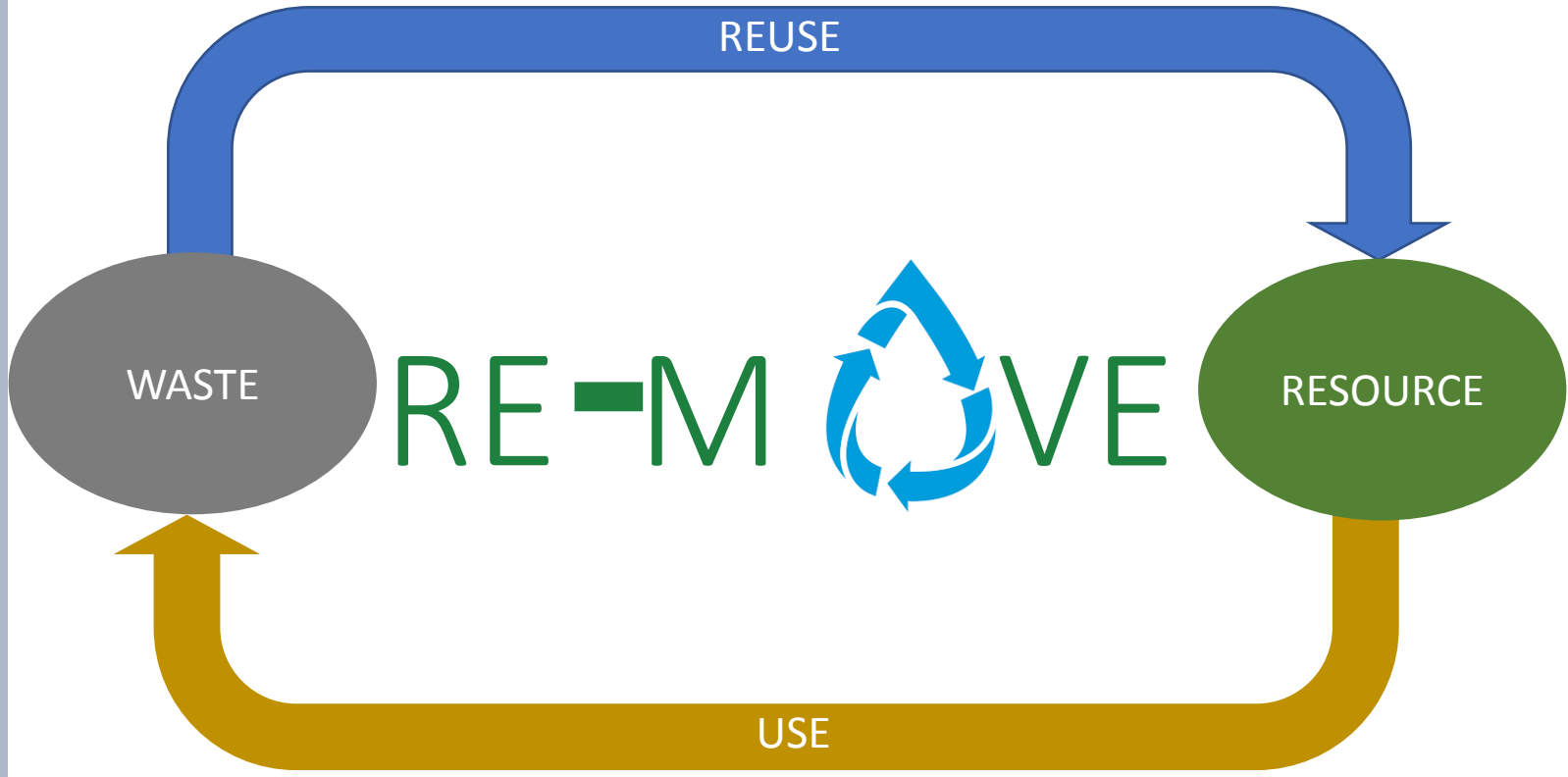
TECHNOLOGY COMPARISON - SELECTION

Parameter	Aerobic	Anaerobic
Energy Requirement	High – 150 KWh/MLD	Low – Almost Nil
Degree of Treatment (For Domestic Wastewater)	High (> 95%)	Moderate (~50%)
Sludge Production	High	Low
Process Stability (To toxic compounds and load changes)	Moderate to High	Low to Moderate
Start up time	2 to 4 weeks	~ 4 months
Odor	Low	Moderate
Biogas Production as Energy	No	Yes – 110 KWh / ML (from Sludge digestors

TECHNOLOGY COMPARISON - SELECTION



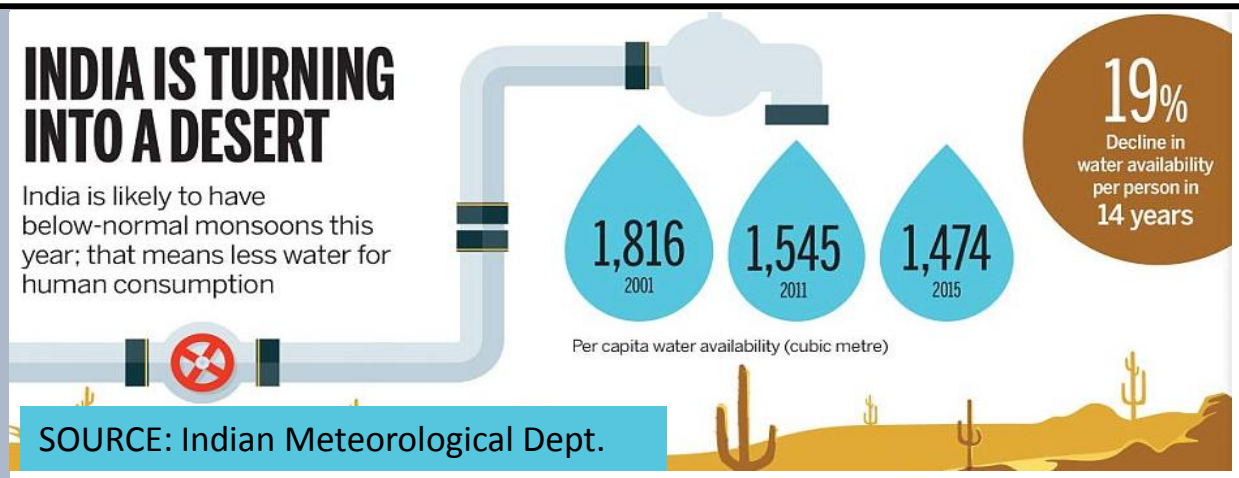
REUSE OF TREATED SEWAGE



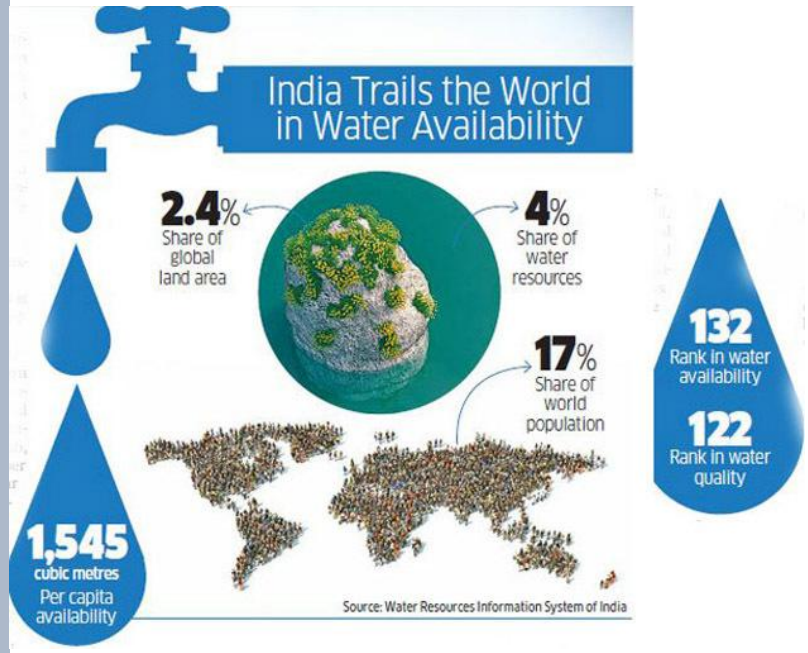
Adding monetary value to the waste turns it into a RESOURCE.

Treated Sewage is a Value-Added Resource.

REUSE OF TREATED SEWAGE



SOURCE: Indian Meteorological Dept.



- Rising population and urbanization - increase in cumulative water demand. (household, commercial, industrial)
- This has increased stress on fresh water resources.
- Planning and approach for water and wastewater management needs a paradigm shift.
- The need of the hour is to amalgamate water and wastewater management and proceed towards sustainability.

REUSE OF TREATED SEWAGE

- Government of Gujarat launched a Policy on 'Reuse of Treated Wastewater' on 28th May 2018.
- The policy lays time bound and systematic plan of reusing Treated Wastewater fully by 2030.
- Therefore, it shall be mandatory in near future to reuse the sewage collected.

VISION

The policy envisions maximizing the collection and treatment of sewage generated, and reusing the treated wastewater on a sustainable basis, thereby reducing dependency on fresh water resources; and to promote treated wastewater as an economic resource.

REUSE OF TREATED SEWAGE: BENEFITS

- Reduces use of potable grade water and thereby conserves potable water for future.
- Reduces pressure on water resources in the city.
- Net potable water saved, may be diverted for the drinking water purpose.
- Reduces diversion of drinking water for non-potable purposes.
- Dependence on bore-wells and private tanker operators may be eliminated.
- Assured water supply and assured revenue generation.
- Conserve valuable ground water resources for future generation.
- Assured resource during scarcity.
- Reduces estuary/river pollution load.
- Improvisation of the river ecosystem.
- Techno-economically, most feasible option for water conservation.
- Reduces overall cost and energy.
- Facilitates recycling of wastewater - an environmentally sound and progressive advance practice.

THANK YOU

INTEGRATED WATER MANAGEMENT

PRESENTATION FOLLOWS

INTRODUCTION

- Current Scenario: India
- Current Practices
- Hydro-social Cycle

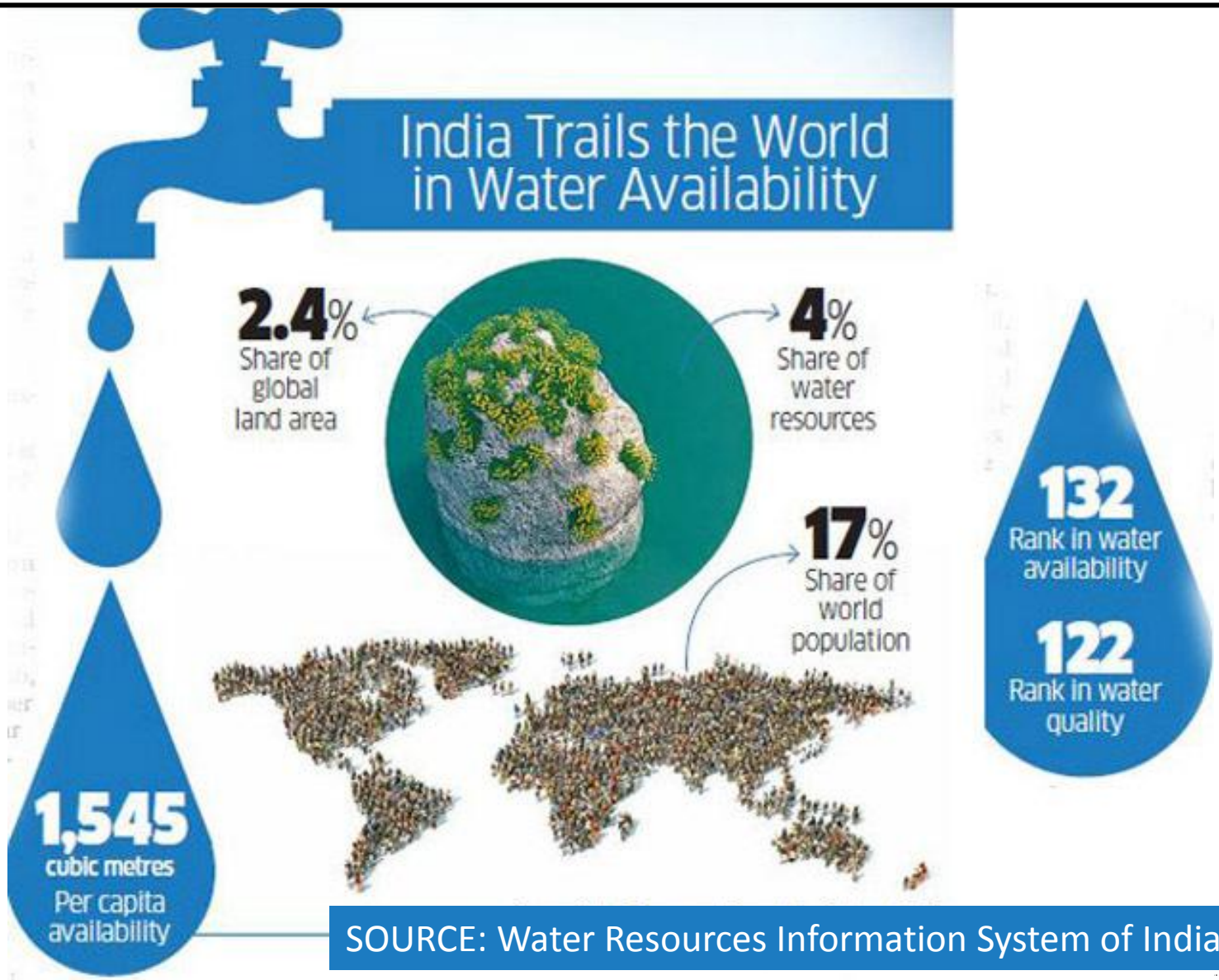
INTEGRATED WATER MANAGEMENT

- IWM: Meaning
- Need for Integrated Approach
- Integrated Approach: Meaning

APPROACH & METHODOLOGY

- Water Conservation
- Engineered Water Cycle
- Water Management: Counting the Waterdrops

CURRENT SCENARIO: INDIA

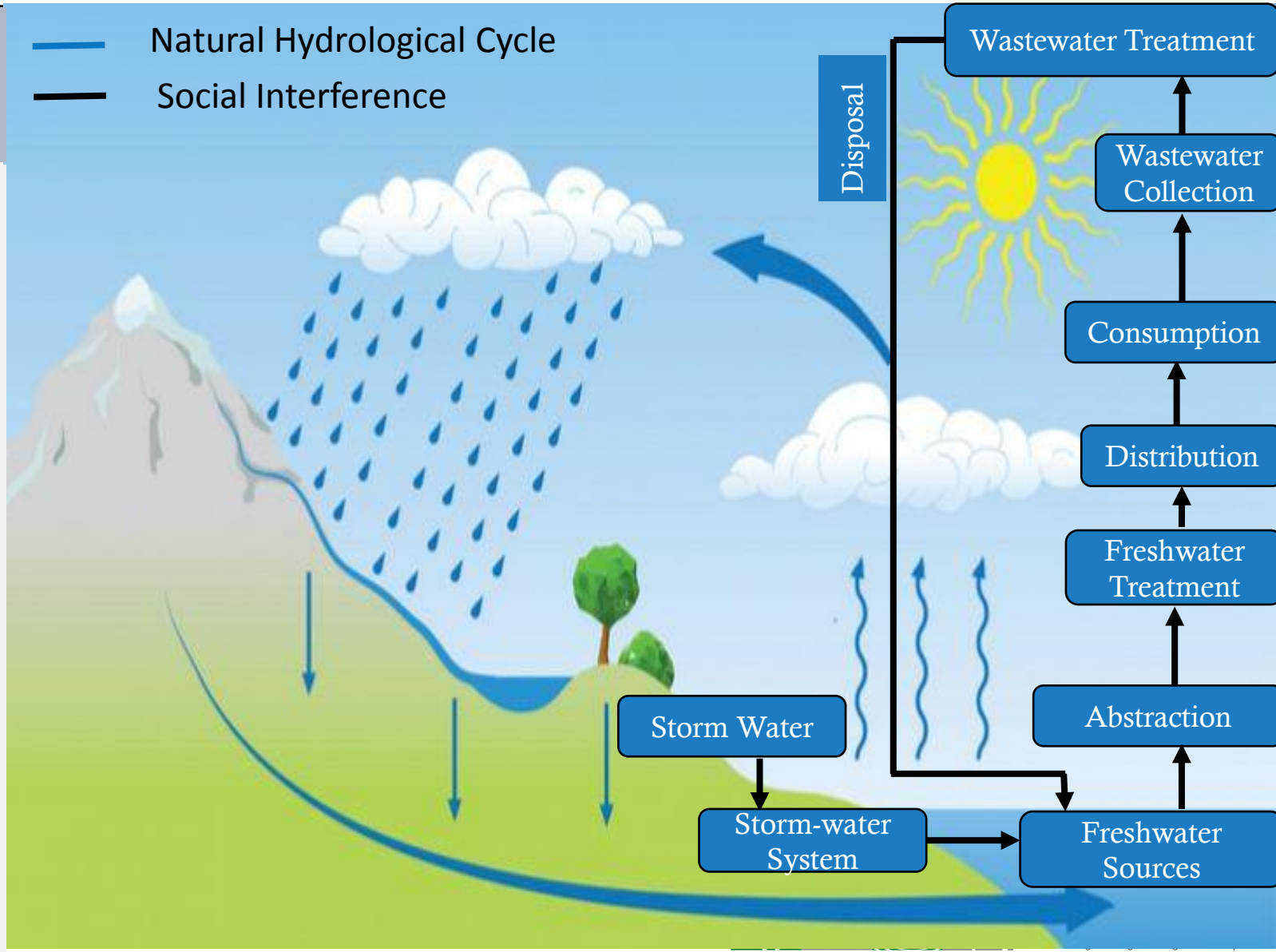


SOURCE: Water Resources Information System of India

CURRENT PRACTICES

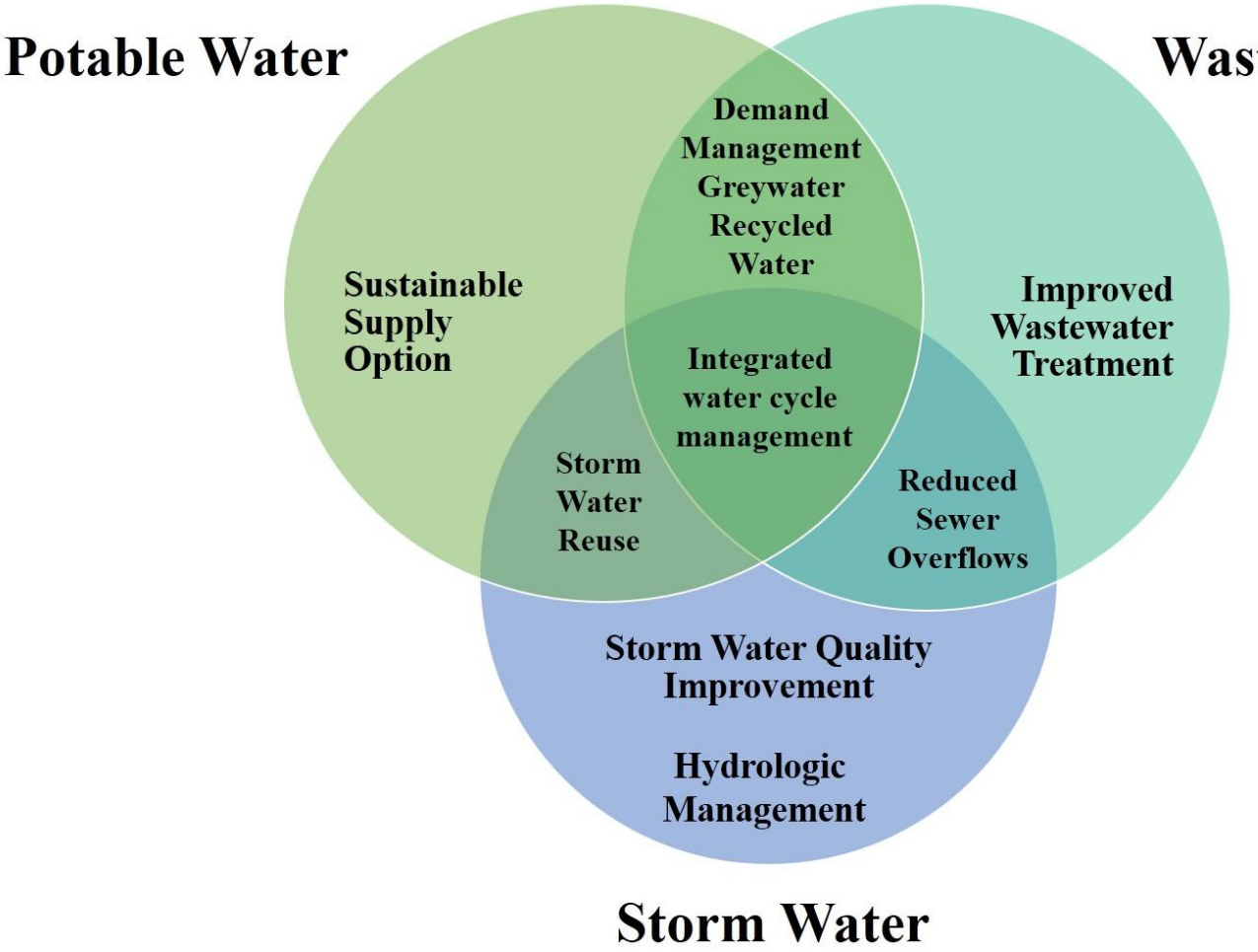
- No Integrated water management policy
- Treating all water abstracted to drinking water standards when only 1-5% is used for drinking and cooking. Using water of drinking water standard to wash cars, irrigate gardens and flush toilets.
- Missing - Long Term Planning goals
- No Need-based budgeting, No self-financing
  - Standalone Water Supply and Wastewater System projects
  - Withdrawing fresh surface water and disposing wastewater - untreated / partially treated – ignoring the downstream users
- No standard policy – Now recently launched in May 2018
- No Integration of National and Transboundary water management
- Inappropriate and ineffective water management results in:
  - wasted money
  - wasted water
  - reduced availability of and access to water
  - reduced economic and social development

THE HYDRO-SOCIAL CYCLE



INTEGRATED WATER MANAGEMENT

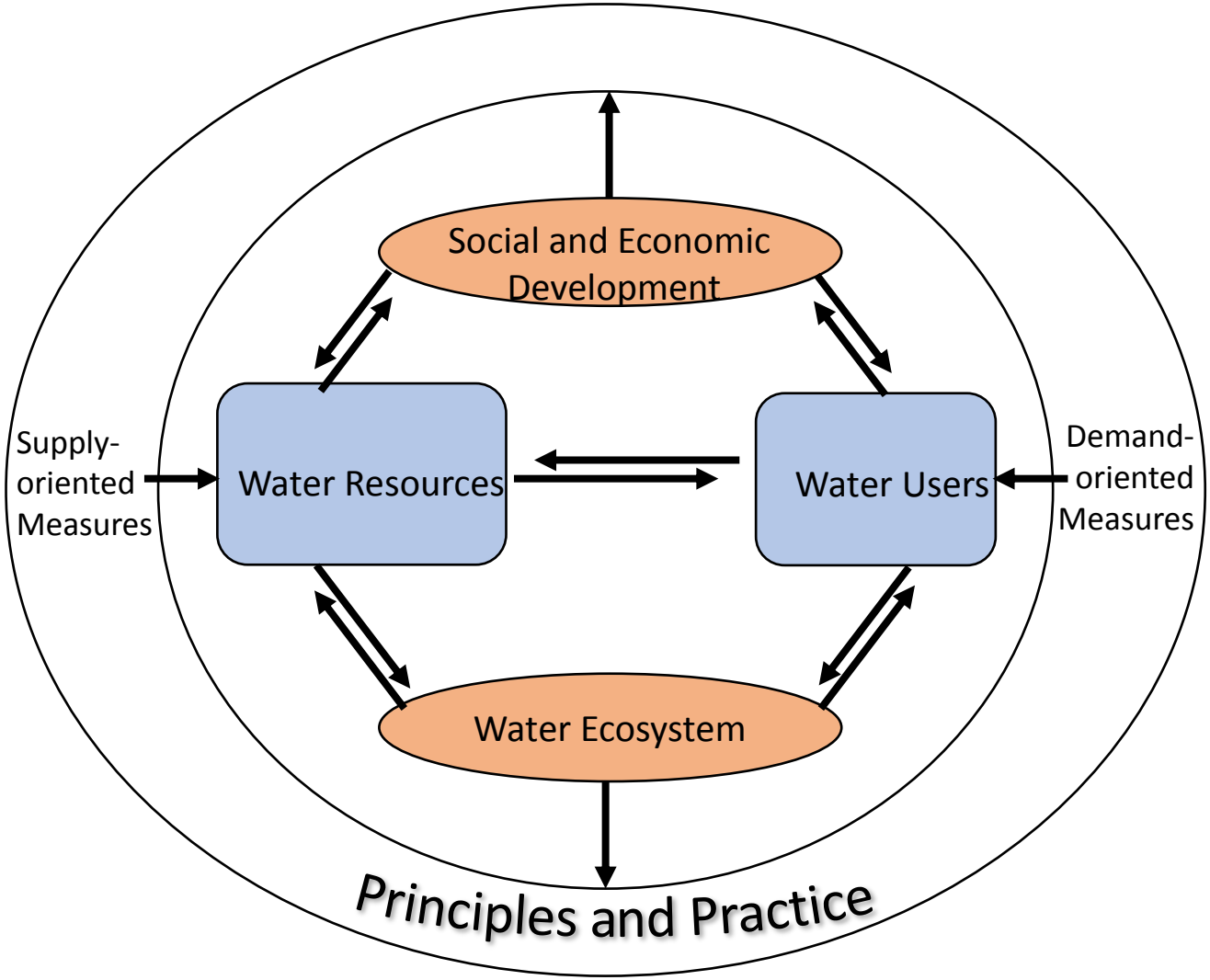
Integrated Water Management (IWM) is a strategy that brings together all facets of the water cycle — water supply, water treatment, storm water management and sewage management, in a cost effective manner.



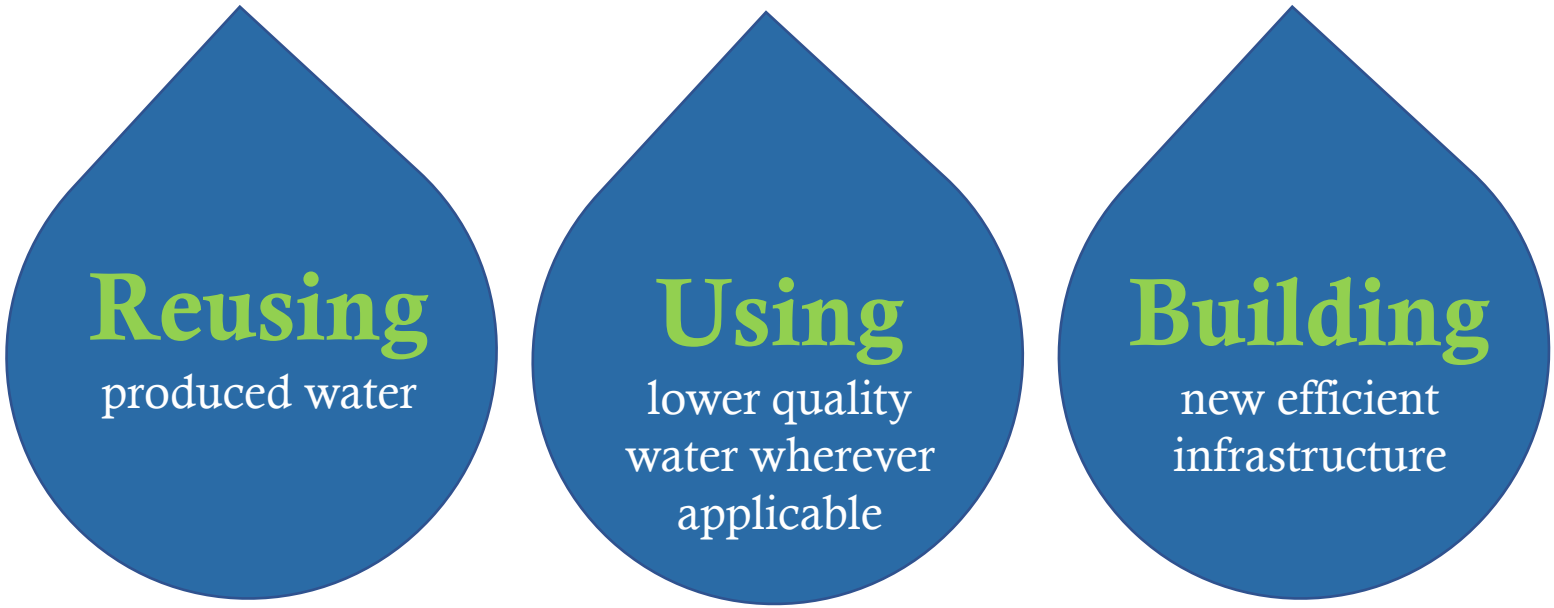
NEED FOR INTEGRATED APPROACH

- By 2050, India's total water demand will increase by 32%. Industrial and Domestic sectors will account for 85% of the additional demand (Ref: Vineeth Menon, Lakshmi Poti)
- Rising population and urbanization has led to increase in cumulative water demand. (household, commercial, industrial)
- This has increased stress on fresh water resources.
- Moreover, lack of planning and sustainable approach has accelerated water pollution and such other related issues.
- Planning and approach for water and wastewater management needs a paradigm shift.
- The need of the hour is to amalgamate water and wastewater management and proceed towards sustainability.

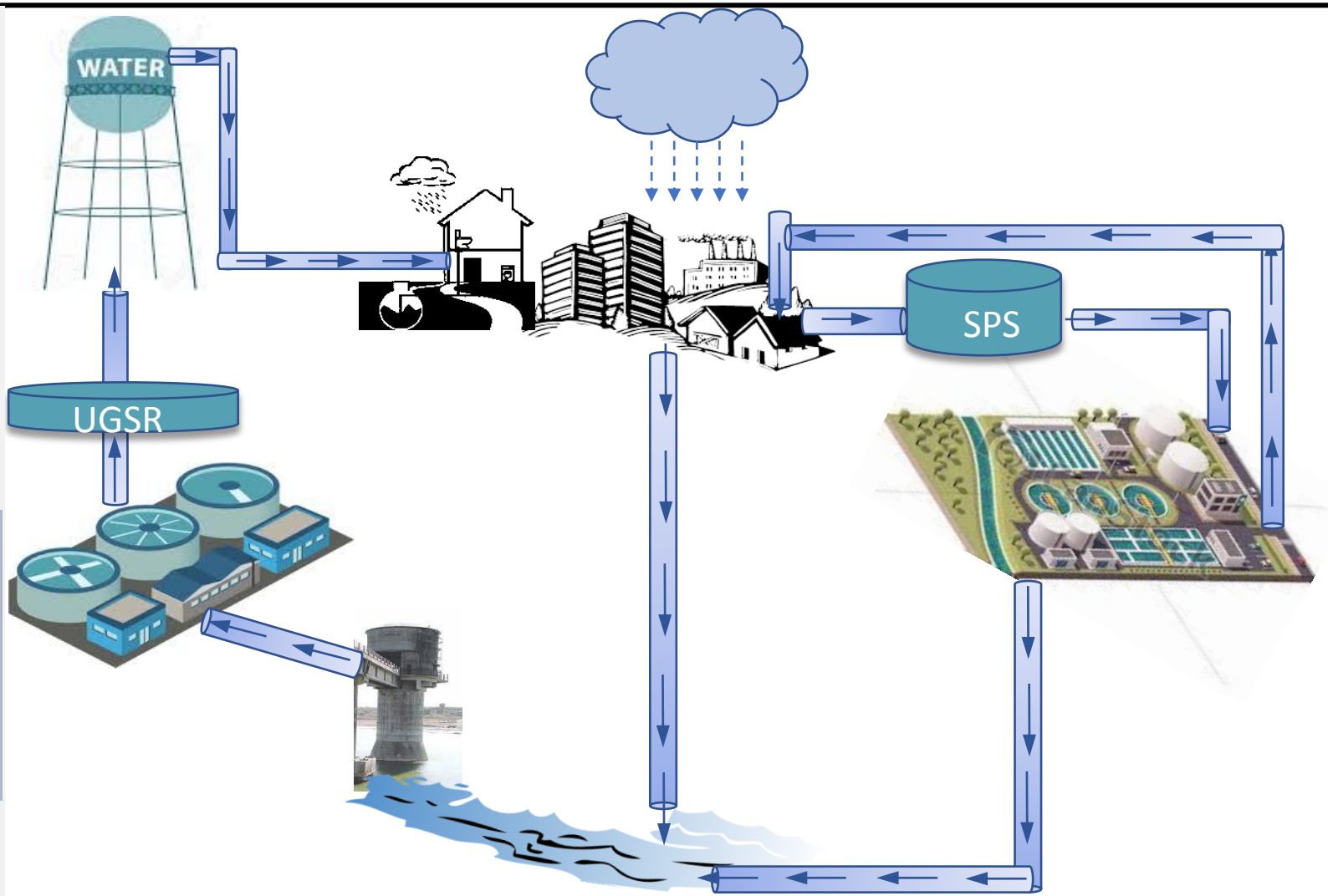
INTEGRATED APPROACH: MEANING



WATER CONSERVATION



ENGINEERED WATER CYCLE



WATER MANAGEMENT : COUNTING THE WATERDROPS

Establishment of Dual Plumbing System at every resident in the city. This system has two water supply lines: one for potable water supply and the other for reclaimed water.

The reclaimed water is the wastewater that has been treated to remove solids and chemical impurities, making it suitable for reusing the water for toilet flushing, gardening and such other uses except for drinking / cooking / bathing purposes.

This shall lower the fresh water demand as well as save water for future needs.

WATER MANAGEMENT : COUNTING THE WATERDROPS

Introduction of decentralized Tertiary Sewage Treatment Plants (TSTPs) for the sewage generated by the villages to generate treated water that can be used for irrigation purposes in nearby farms.

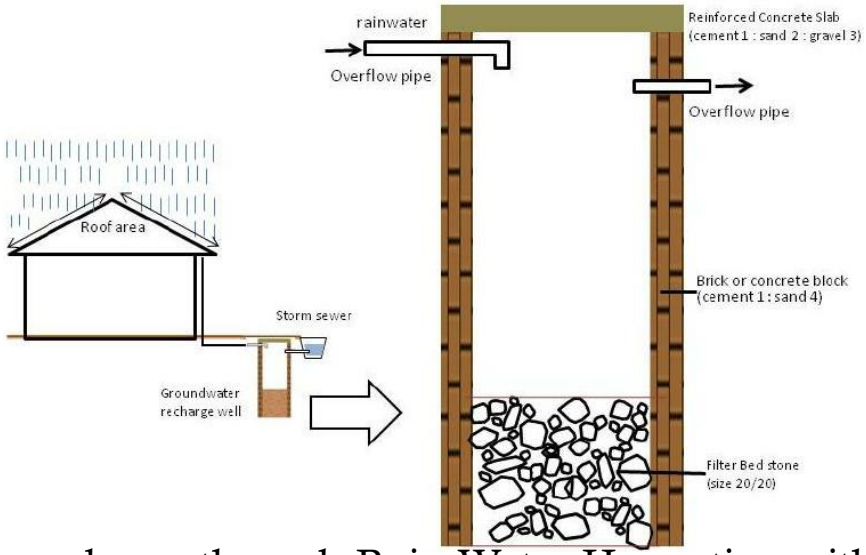
The percentage of potable water used up for irrigation is quiet high. Therefore, by this scheme, huge amount of reduction can be made in the fresh water supply for irrigation purposes thereby saving the overall fresh water for future needs.

WATER MANAGEMENT : COUNTING THE WATERDROPS

The Sewage Treatment Plants run by the government can be up-graded and the sewage shall be treated up to Industrial Grade Water. The recycled water can thus be supplied to various water intensive industries to meet their water requirements. This can cut off the fresh water requirements by the industries, reducing load on the water resources.

Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Bamroli, Surat to generate Industrial Grade Water and transmitted to Pandesara GIDC.

WATER MANAGEMENT : COUNTING THE WATERDROPS



Ground water recharge through Rain Water Harvesting with a scientific approach is one of the efficient way to increase the storage quantity of potable water.

Through engineered piping networks, rain water shall be transported to the underground water- bearing permeable strata / aquifer. As per necessity the water can be extracted back from the aquifer through water wells.

Harvesting at individual house level is not very efficient and there is a need to plan rain water harvesting at the city level. If rain water harvesting is done at city level, we can get large quantities of water that can supplement other available water resources.

A few sustainable alterations can help us fight against the ever rising water demand challenges. A change in the thinking attitude can lead to major winnings.

THANK YOU