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Sustainable Urban Water Management (SUWM)

Date: Sept 28 2019

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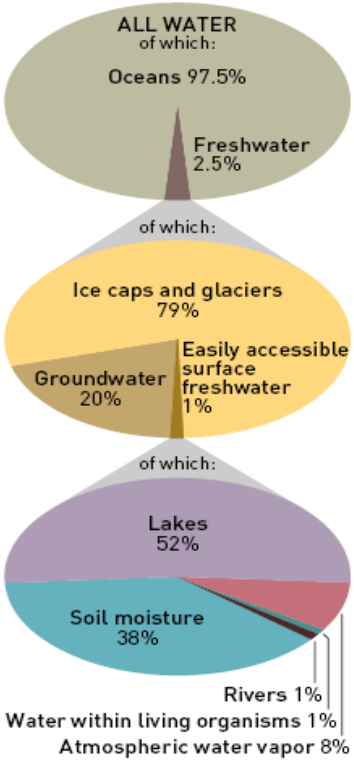
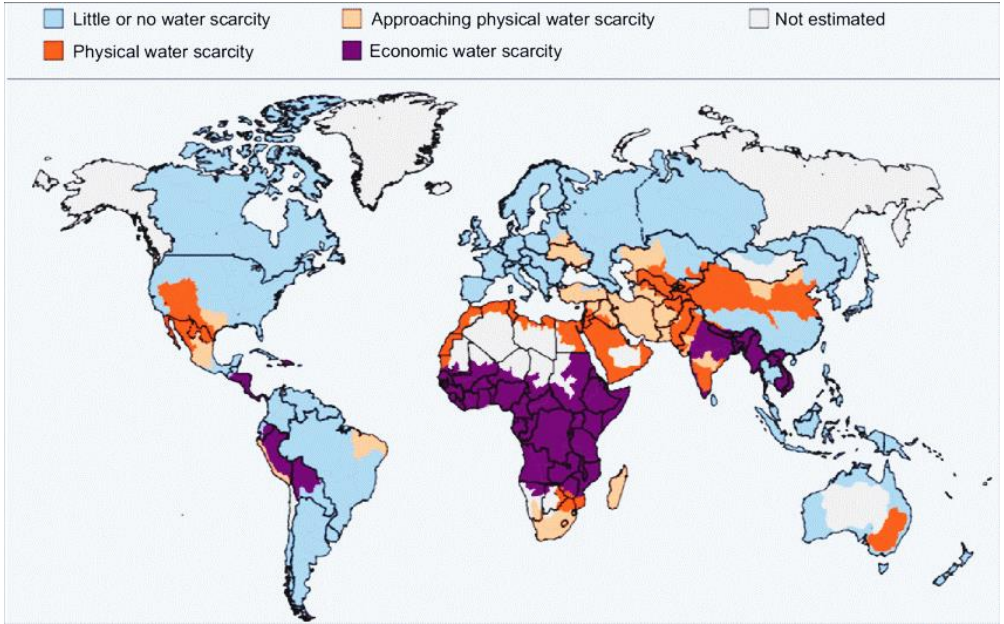
Water is a transparent, tasteless, odorless, and nearly colorless chemical substance, which is the main constituent of Earth's streams, lakes, and oceans, and the fluids of most living organisms.

Ayurveda, The Indian traditional system of medicine or '"living in tune with nature" recognizes five elements, Space, Air, Fire, **Water** and Earth, as the building blocks of all matter.

WHERE THE WATER IS



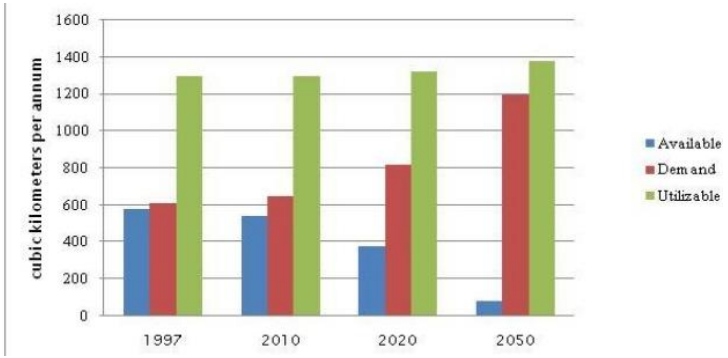
Global Facts

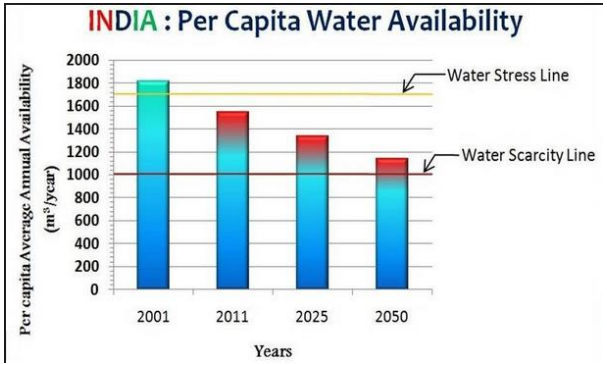


- No New water- we drink the same water that the Dinosaurs had. 85 million are added every year to share same water.
- Last century: World Population has tripled & Water demand has increased by 6 times.
- 2045 - 2/3rd population will face water scarcity (50% will face acute shortage)

(UNESCO & WWC)

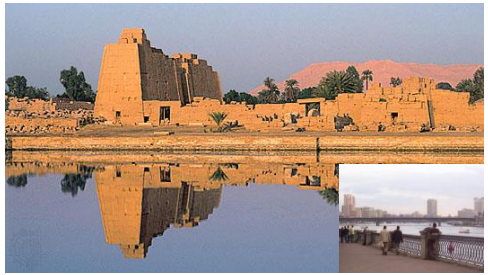
India Water Status





** Actual requirement as per norm (135LPCD = ~ 50 cum/yr/ person*

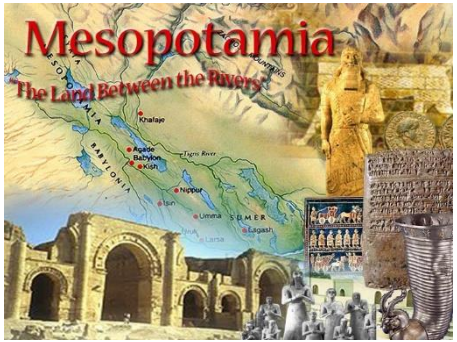
Origin of Life and tool for prosperity



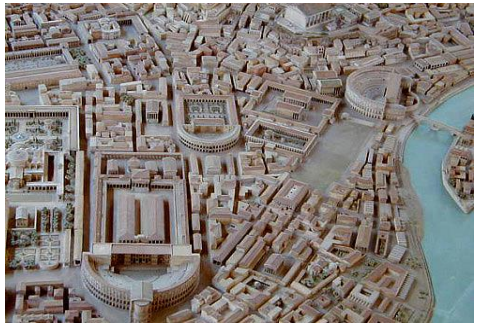
Egyptian Civilization

Mayan Civilization

Indus Valley Civilization



Mesopotamia Civilization



Roman Civilization

Babylonia Civilization

MODERN CITIES

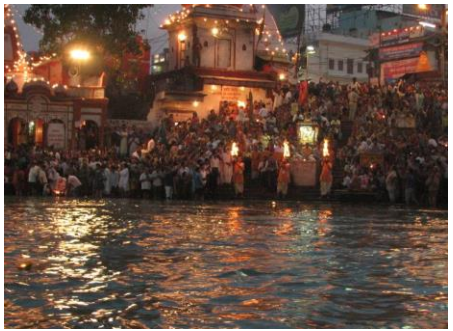
London

Venice

Paris

Agra

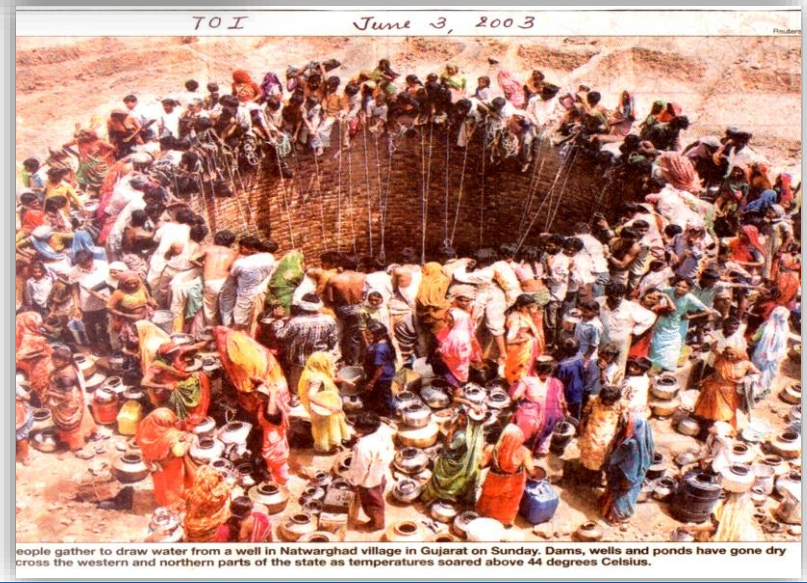
Sabarmati



Haridwar

WATER MANAGEMENT --- WHY?

Deficit



Excess

WATER MANAGEMENT --- WHY

Good System







Bad System





SUSTAINABLE DEVELOPMENT GOALS - SDG

SUSTAINABILITY FRAMEWORK

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Sustainable Urban Water Management

SUWM

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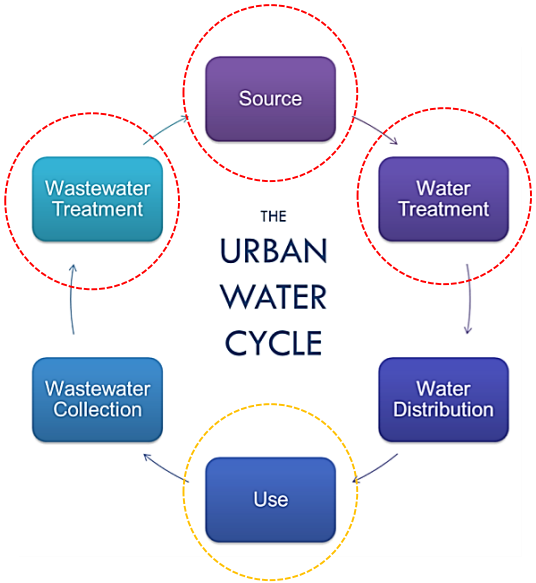
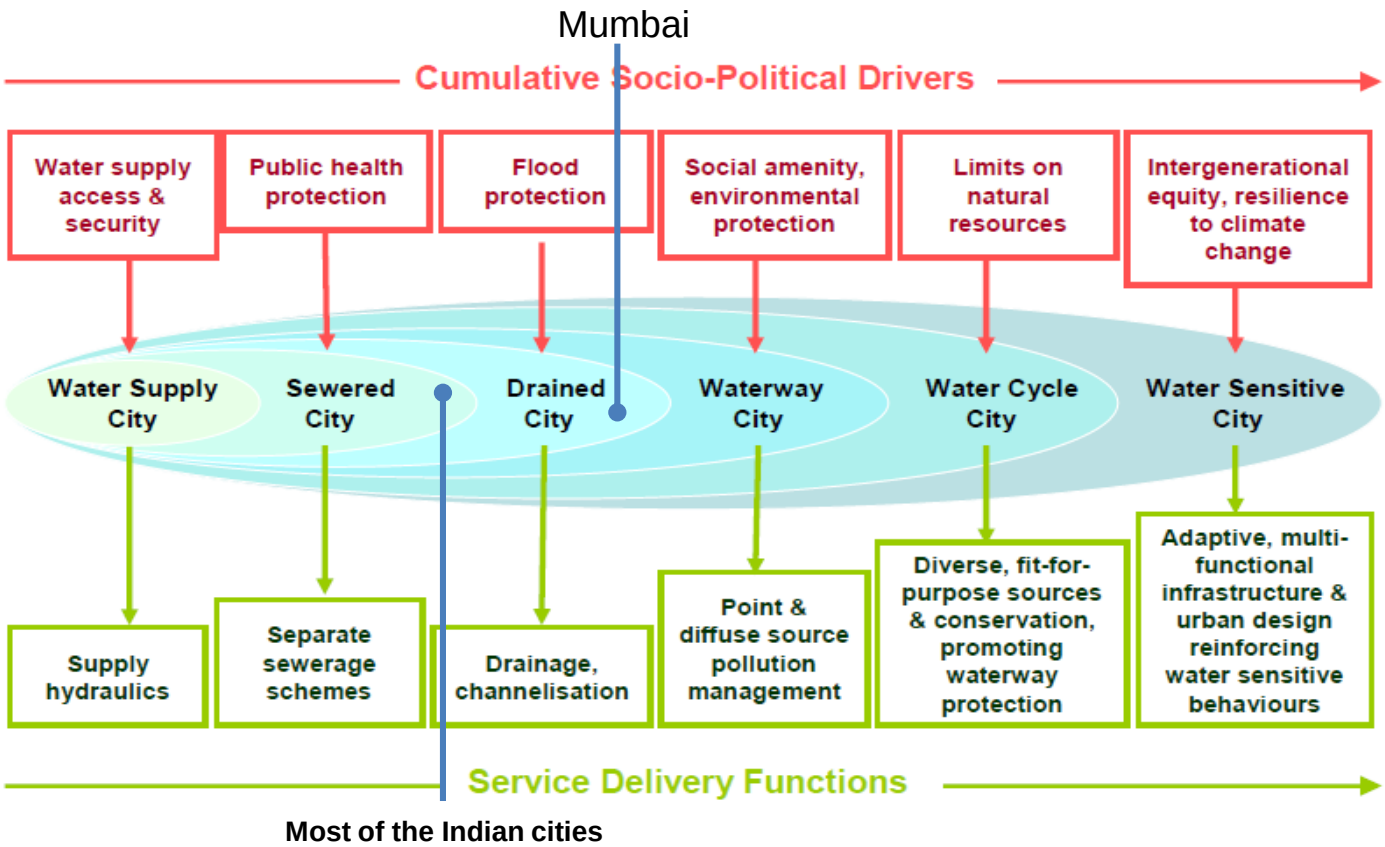
URBAN WATER CYCLE

Key Components



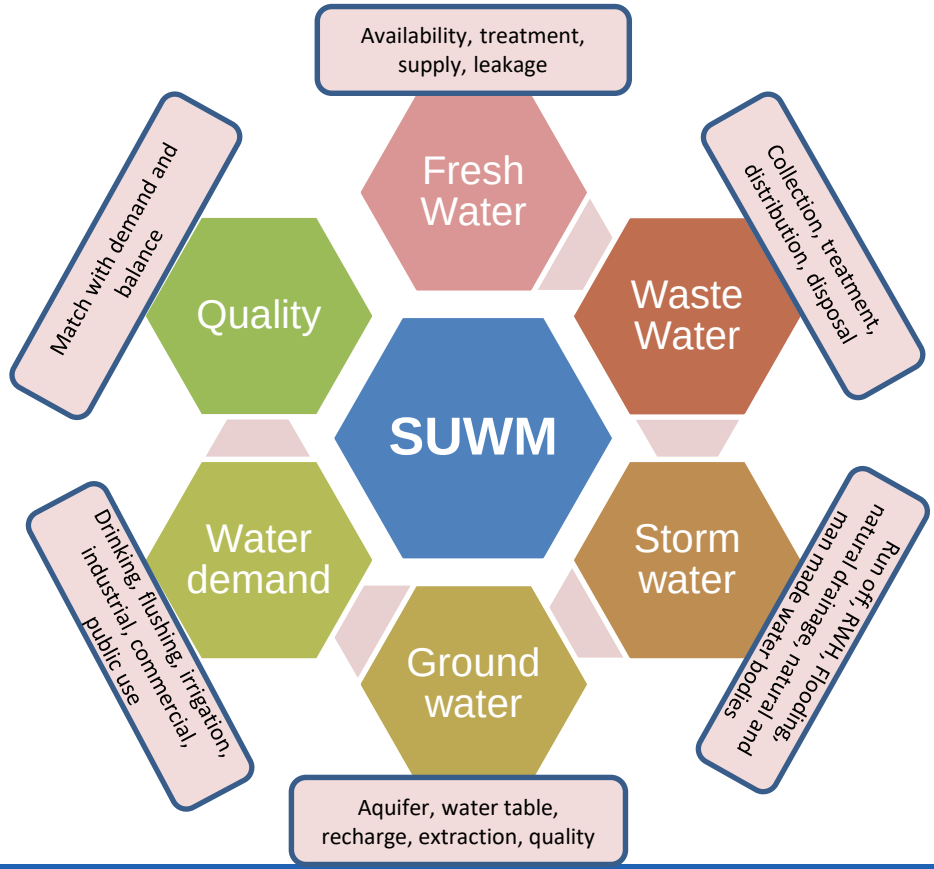
Transition Framework



Sustainable Urban Water Management

Influences:
- Hydro geology
- Geology
- Topography
- Climate
- Local and regional drainage pattern
- Water bodies

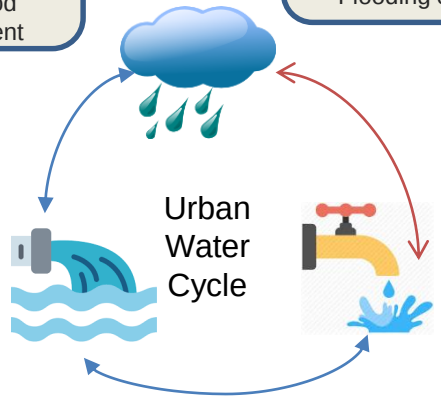
Stake Holders:
- Politicians
- Citi Officials
- Community
- Designers
- Urban Planners
- Industry
- Financers
- Communication
- Social Organisation
- Enforcement agencies



Considerations:
- **Energy**
- Maintenance
- Capital Cost
- Urban Growth Pattern and projections
- **Urban Planning**

Tools:
- Policy
- Design
- Planning
- Technology
- ICT/IOT
- Engagement & Capacity development

LINKS between Water and Other Sectors of Urban Planning



Land Use Planning
- Changes in land use changes local Hydrology and hydraulics
- Water Scarcity and flood restrict land development

Housing
- Additional water supply, water infra, disposal infra is required
- Flooding of property

Transport
- Increased surface runoff and diffused pollution from roads
- Damage to transport infra caused by flood

Health
- Watercourse pollution
- Water borne & parasite disease caused by contaminated and stagnant water

Public Spaces
- Increased water demand for irrigation
- Flooding and draught damages plants and playing fields

Waste
- Pollution of water resources & blocking of drainage
- Flooding of waste collection sites

Economic Development
- Increased water demand and increased pollution load from WW disposal
- Water Scarcity restricts economic development

Urban Agriculture
- Runoff containing fertilizer/ pesticides pollutes waterbodies
- Water Scarcity restrict production of local food

Energy
- Water & WW treatment, distribution required assured supply of electricity
- Water resources used for energy generation

SUWM - Vision Statement

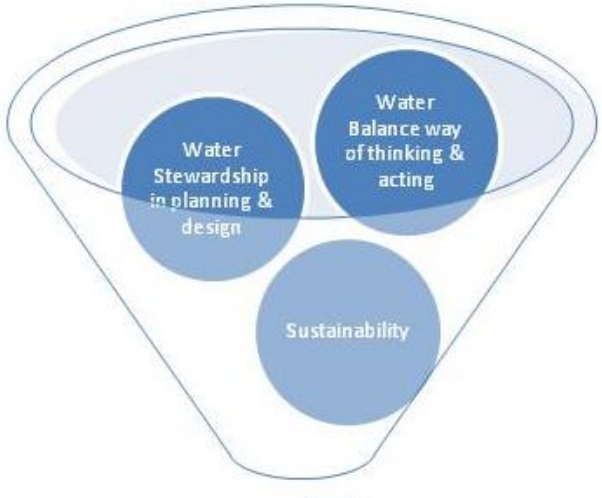
"Driving the creation of sustainable communities by developing and delivering India Specific Solutions".

Guiding philosophy

- Self sufficient communities
- Balancing Sustainability and Affordability
- Integrating traditional solutions with modern techniques
- Thought leadership and Innovative solutions going beyond certification
- Encouraging local/small scale innovators
- Advocating sustainability & spreading education and awareness

Water Centric Planning

- The development is planned around v with following goals:
  - Confirmed Availability
  - Efficient Use
  - Prudent Storm Water Management
  - Sustainable water balance
  - Minimization of cost



- A dynamic process with water stewardship that adapts to changing conditions and balances competing uses of water through efficient allocation
- Addresses social values, cost effectiveness and environmental benefits leading to better health, safety community comfort & goodwill.

Issues

- Higher concentration of population in established urban areas leading to demands for new townships
- Diminishing water availability
- Unpredictable rainfall pattern
- Deteriorating water quality
- More population to share same resources
- Increasing infrastructure cost (specially for townships)
- Functionality of infrastructure system
- Increased expectation level of end user for quality and hassle free life
- Thumb rule based designs practices

Challenges

- Providing functional infrastructure and assured water for the New Townships at affordable cost
- Increased expectation level of end user for quality and hassle free life

Water Tariff

Consumer type	MCGM	MJP
Residential customers	Rs. 3.50	Rs. 10.50
Slum dwellers (MCGM) / Rural areas (MJP)	Rs. 2.25	Rs. 5.25
Hospitals, maternity homes (MCGM), Schools, Govt. & semi-Govt. offices, hospitals and charitable trusts (MJP)	Rs. 10.50	Rs. 19.65
Commercial establishments and BEST	Rs. 18.00	
Bulk consumers e.g. Five Star Hotels, Railways, BARC, RWITC	Rs. 38.00	
Special customers: Ordnance factories at Ozar & Ambazari, & Tarapur plant		Rs. 18.70

Municipal Supply: 5 Rs. /KL

Tanker Water: 75 Rs./ KL

Treated Water: 40 Rs./ KL

Bottled Water: 10,000 Rs./KL

Increasing tanker water supply rates

Rs. 500 ….700 ……1600 …….still increasing!!!!!

What will be the limit??

SUWM – Key Components

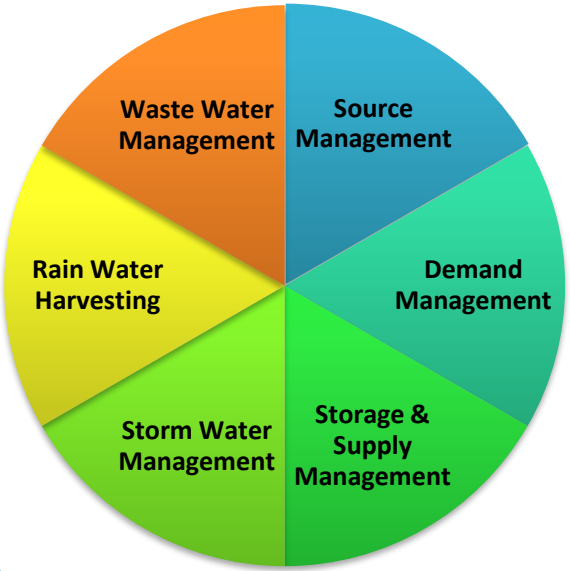
Approach

- Holistic development and management of water resources
- Comprehensively planning:
  - consider all potential water use allocations;
  - exploit multiple use options;
  - synergies between different systems (water & energy; water &waste)
  - related land and ecological aspects
  - Swift and safe disposal
- Consistent with standards and recognize economic efficiency, environmental quality and social objectives.
- Ease of implementation
- Self reliance and ensures future water security

Key Objectives

- Future water security
- Grid independent
- Minimization of fresh water consumption
- Decentralized infrastructure leading to cost optimization

Key Sectors



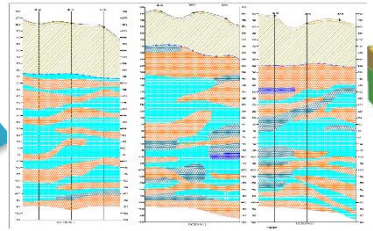
Key Themes

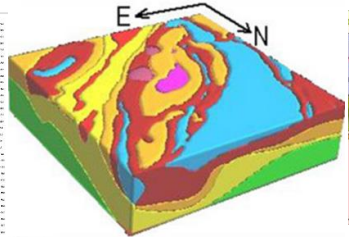
Water Budgeting and Balancing	Scientific investigations	Rain-water harvesting
Waste water recycling	Storm water management	Wastewater reuse/disposal

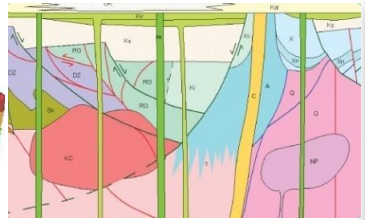
Requires the participation of all stakeholders (developers, owners, occupants, residents & facility managers)

SUWM – Source Management

Source Management







Groundwater	Surface Water	Treated Waste Water
Micro Catchment Area Analysis	Resource Mapping	Source identification
Hydrological Investigations	Rainfall Data Analysis	Volume calculations
Geological Investigation	Seepage Analysis	Quality analysis
Sub Surface Profiling	Quantity Assessment	Identification of uses
Establishment of Sustainable Yield	Quality Assessment	Collection strategies
Quality Assessment	Sustainable Resource Use Planning	Treatment Strategies
Sustainable Resource Use Planning		Reuse & distribution Strategies
		Disposal strategies
		O& M manual and guidelines

Sustainable Water source with adequate quantity & quality to meet the peak requirements

Ensured per capita per day supply to meet the primary and secondary water needs

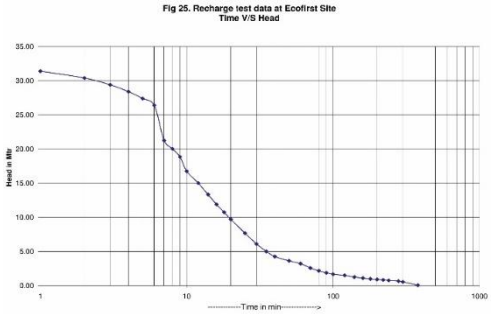
Sufficient storage and conveyance system with minimal energy and transmission losses

Efficient storm water drainage network to bypass the flood peaks

Effective rainwater harvesting system to capture all rainwater surface runoff

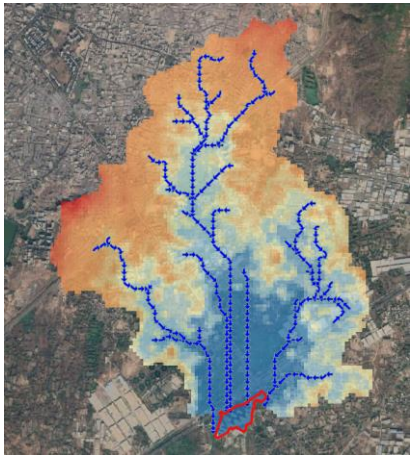
Efficient waste water collection, treatment and disposal system complying environmental standards

Storm Water Management



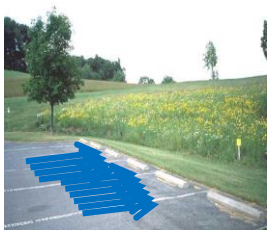
Methodology

- Mapping of catchment area
- Hydrological Analysis
- Flood peak calculations
- Review of existing profile/ drainage system
- Generate computer model
- Design drainage network system
- Optimize sizing
- Maximize harvesting
- Best Management Practices
- Encourage use of Non Structural Solutions



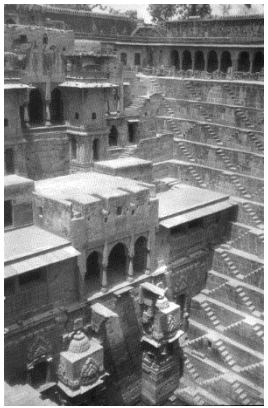
Outcome

- Safe & Hassle free (No flooding)
- Safe Disposal
- Maximum use
- Cost Effective Solution





Rain Water Harvesting



Methodology

- Subsoil investigations
- Groundwater recharge potential calculations
- Marking drainage area
- Hydrological Analysis
- Peak rainfall calculations
- Efficient collection system design
- Appropriate filtration system design
- Design of adequate and efficient recharge system
- Design of optimum storage system for reuse
- Recommending measurement mechanism to monitor water harvested.
- Operation and maintenance guidelines

How RWH can be done?

- Structural
- Non Structural
- Below ground
- Over ground
- Before or after it touches the ground
- Storage
- recharge

Structural

- Storm water Ponds (retention/ Detention Ponds)
- Infiltration Basins
- Infiltration Filters
- Filtering Systems
- Open Channel Practices

Non structural

- Natural Area Conservation
- Rooftop Disconnection
- Green Roof
- Rain Gardens
- Non-Rooftop Disconnection
- Sheet Flow to Buffers
- Open Grass Channels
- Storm water diversion Wetlands

Waste Water Management

Methodology

- Mapping of source generating waste water
- Waste water volume & fluctuations calculation
- Surface area mapping
- Subsoil investigations
- Selection of most appropriate technology for wastewater treatment
- Efficient collection system design
- Design of adequate and efficient treatment system
- Identification of optimum treated water use
- Setting up quality standards for waste water treatment system
- Enforcing mechanism to the monitor treated waste water quality standards
- Prepare operation and maintenance guidelines and User manuals

REGULATORY FRAMEWORK

- The **Bureau of Indian Standards** (**BIS**) is the national Standards Body of India working under the aegis of Ministry of Consumer Affairs, Food & Public Distribution, Government of India.
- **National Building Code of India, 2016** It is a comprehensive building code for regulating the building construction activities across the country which was first published in 1970.
- **Indian Standards Bill, 2015**
- **National Water Policy, 2012**

WATER RESOURCES

- **Central Water Commission**
- **Central Ground Water Board**
- **State Ground Water Board**
- **Irrigation Department/ Water Resources Department**
- **Public Health Engineering Department**
- **Local bodies/ Gram Panchayat***

DRINKING WATER STANDARDS

- **EU Directives relating** to the quality of water intended for human consumption (80/778/EEC) and Council Directive (98/83/EC).
- **USEPA standard** — National Primary Drinking Water Standard. (EPA 816-F-02-013 dated July, 2002).
- **WHO Guidelines for Drinking Water Quality**. (3rd Edition Vol. 1 Recommendations, 2008).
- **Manual on Water Supply and Treatment**, (third edition — revised and updated May 1999), Ministry of Urban Development, New Delhi.
- **Bureau of Indian Standards** (**BIS**): DRINKING WATER — SPECIFICATION (**IS 10500 : 2012)**

DISPOSAL WATER STANDARDS

- **Central Public Health & Environmental Engineering Organization (CPHEEO),** Ministry of Housing and Urban Affairs, Government of India
- **Ministry of Environment, Forest and Climate Change , Government of India (MOEF)**
- **Central Pollution control Board (CPCP)**
- **State Pollution Control Board (SPCB)**
- **The National Green Tribunal (NGT)**

Demand Management

Demand Mapping

Demand Pattern

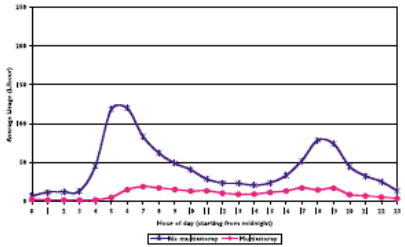


Figure 3.5 – Multi-residential Summer Hourly Profile – Total Usage

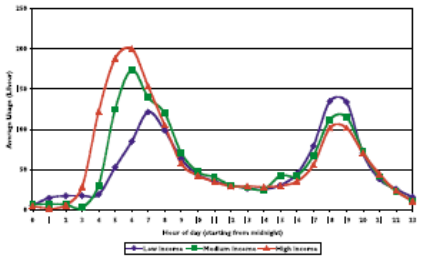


Figure 3.4 – Single Residential Summer Hourly Profile – Total Usage

INDIVIDUAL

Primary
- Drinking

Secondary
- Cooking
- Bathing
- Washing
- Flushing
- Gardening
- Cleaning
- Cooling
- Lifestyle

COMMUNITY

Common Facilities
- Community center
- Gardens
- Plantations

Cultural Events
Visitors/non residents

TOWNSHIP

Other Requirement
Institutional
- Educational
- Hospitals/ clinics

Commercial
- Market
- commercial
- Offices

Recreational
Club House
Common green, trees
Miscellaneous Demand

Management

- Planning Tools
- Design Tools
- Policy Tools
- Equipment Tools
- Information & Communication

Balancing

- Beneficial Use
- Source Matching
- Quantity Realization
- Right quality

SUWM – Demand Optimisation

1. Occupancy Factor

- Flat Occupancy (6.6%)
- Population Movement (15%)
- Building Level Diversity (10%)

2. Efficient Fixtures*

- Tap: 20%
- Shower: 20%
- WC: 30%
- Urinals: 30%
- Irrigation Methods: 20%

3. Behavioral Factor

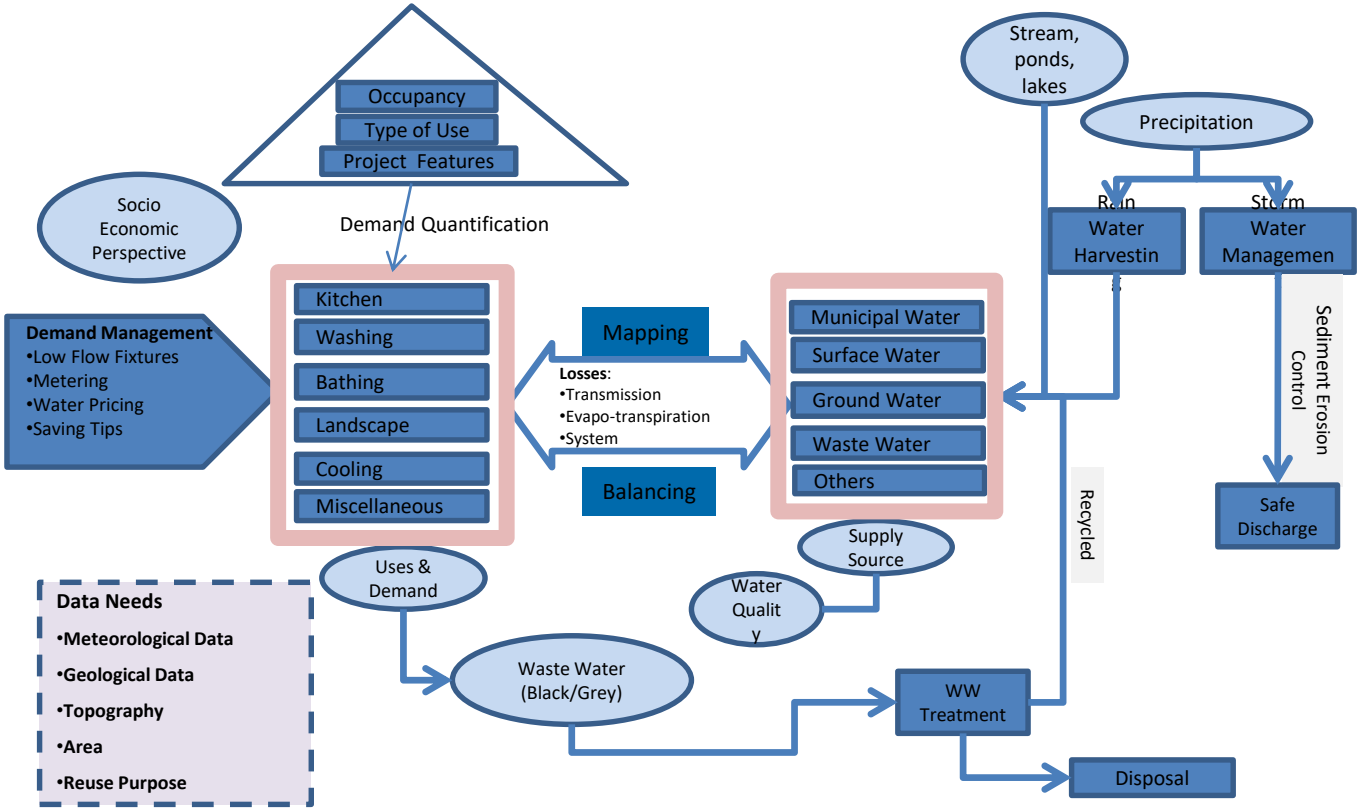
- Awareness
- Metering
- Incentives

Overall 43 % reduction

28% | 23.3% | 5%

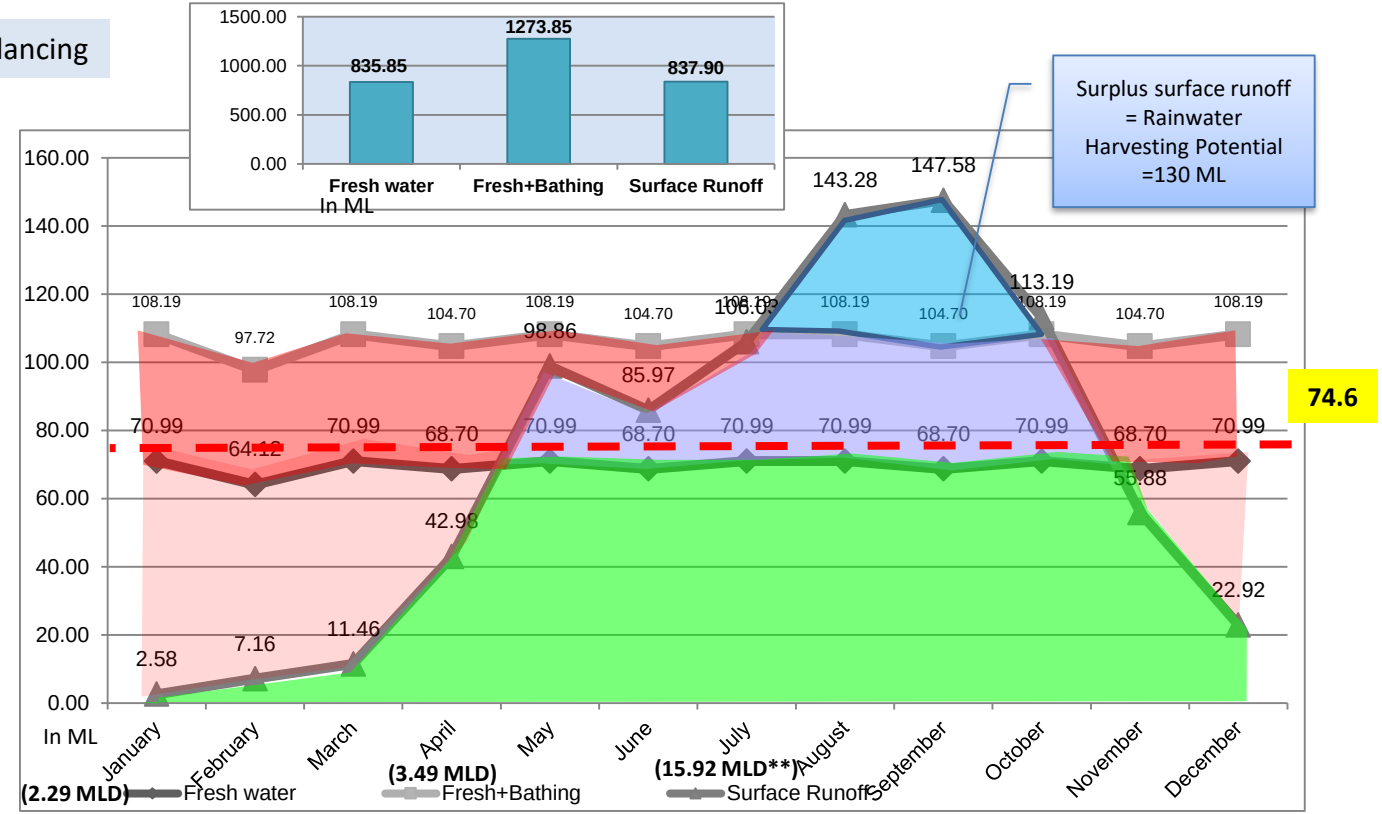
Based on flow rates of various low flow (efficient) Fixtures)

SUWM – Flow Diagram



SUWM – Water Balance

Water Balancing



Key Interventions:

- 100% rooftop rainwater harvesting by storage
- 32 ML storage capacity in water bodies

Preservation

Conservation

&

Utilization

Every drop of water


Thank You!