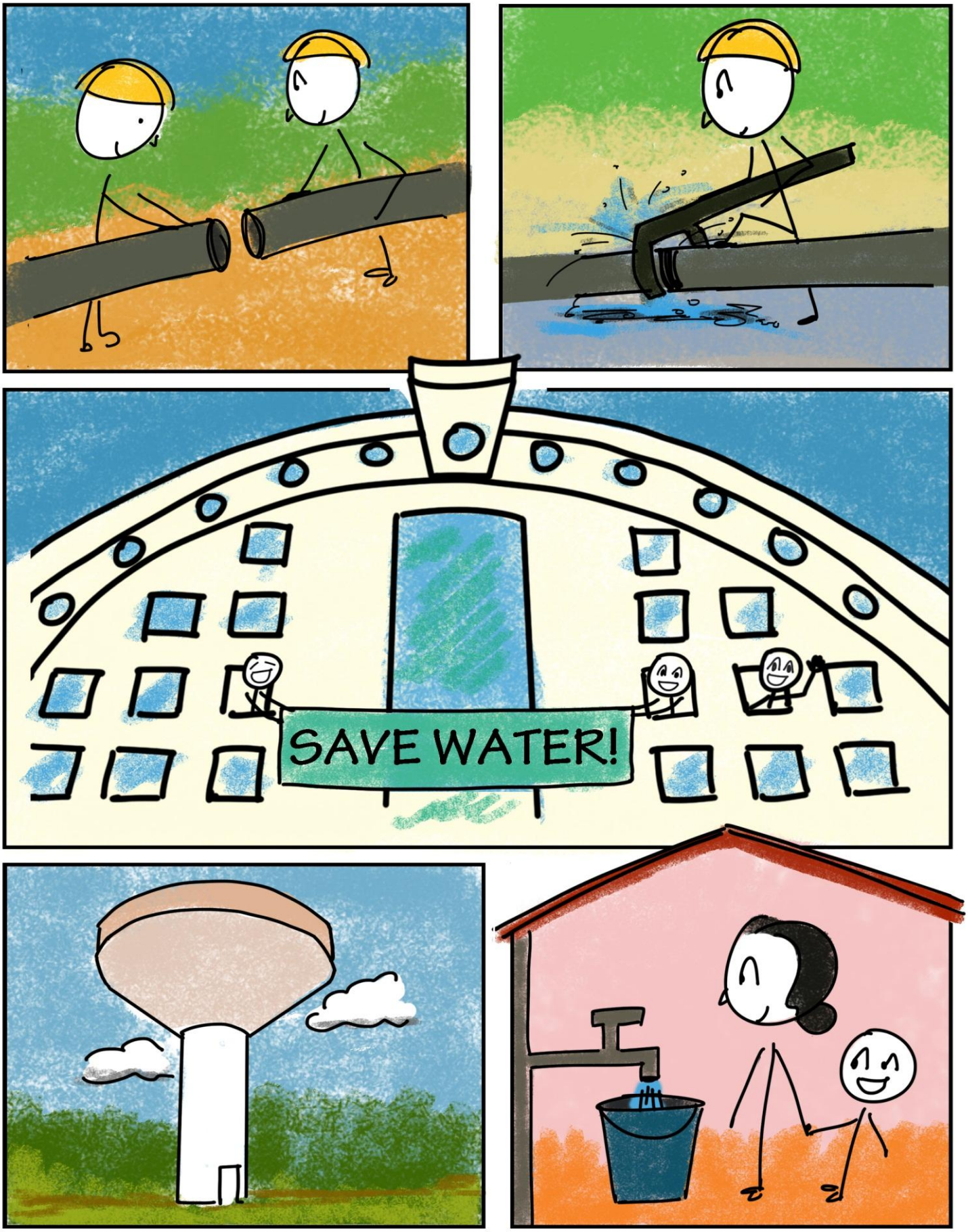
Urban Water Supply & Sewerage Management in Karnataka

A Guidebook for Urban Local Bodies

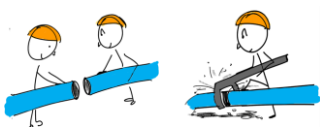


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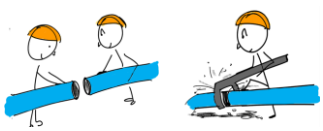
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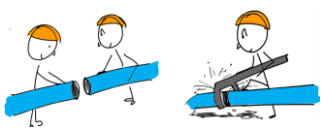


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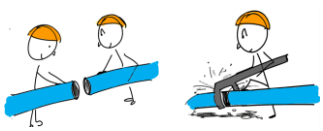
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Foreword

The 74th Constitutional Amendment in 1992 has mandated the devolution of select rights and responsibilities to Urban Local Bodies (ULBs) – the third tier of governance. A number of schemes and initiatives, by both state and central governments, have been launched since then to fulfill the objective of creating empowered and financially sustainable ULBs. The Jawaharlal Nehru Urban Renewal Mission, (JNNURM) is an initiative introduced by the Ministry of Urban Development, in 2005, to strengthen urban service delivery in towns and cities. With an outlay of Rs. 66,000 crore spread over a 7 year period, it remains a far-reaching initiative undertaken by the government to empower ULBs.

Despite this increased emphasis on empowering ULBs to deliver efficient, sustainable and affordable urban services, the status of urban infrastructure and service delivery in Indian cities remains far from satisfactory. Government of India statistics reveal that water supply is grossly inadequate with only 64% of the urban population being covered by individual water supply connections. The duration of water supply is observed to range from 1 to 6 hours for a majority of the households. Due to inefficiencies in distribution, 50% of water production is non revenue water. This poses a serious threat to the financial viability of water utilities. The level of water recycling and reuse is extremely low; only 21% of the waste water generated is treated and over 94% of the cities/towns in India do not have even a partial sewerage network. With respect to solid waste, while waste collection coverage ranges from 70% to 90% in major metropolitan cities, less than 30% of the waste is segregated and scientific disposal is almost never practiced.

The High Powered Expert Committee on Indian Urban Infrastructure and Services identifies the lack of capacity among ULBs to design, implement and govern projects as being a critical contributor to the persistence in the infrastructure and service delivery gaps.

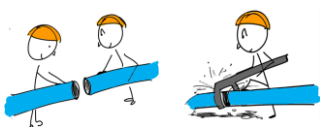
This recognition has created a renewed focus, among governments and within policy circles, on the need for targeted capacity building interventions at the ULB level. Several initiatives such as the creation of regional capacity building hubs and promotion of centres of excellence/innovation in urban policy are being designed and implemented by state and central governments alike to empower ULBS to respond to the rising demands of urban infrastructure creation and service delivery.

This guidebook seeks to contribute to the ongoing process of building capacities among ULBs and provides a set of simple tools and guidelines to enable ULBs to fulfil their functions more effectively. It seeks to provide municipal representatives, specifically the commissioners, with a set of actionable strategies to improve service delivery and enhance participatory decision making.



S. Narayan, IAS (Retd.)

President, Athena Infonomics



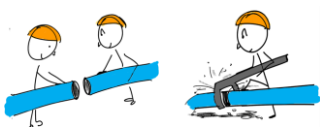
Preface

This guidebook is the outcome of an ongoing engagement with the British High Commission that seeks to explore the potential of public private partnerships to fulfill the investment and innovation gaps in the delivery of critical urban services and empower urban local bodies to deliver their responsibilities more effectively. A number of surveys and workshops were held across the country as a part of the engagement to understand existing gaps in urban service delivery and identify suitable policy responses.

The insights generated from the primary surveys, stakeholder interviews and secondary research have been consolidated and presented here in the form of a set of tools and processes to enable municipal representatives to make effective decisions on different aspects of urban service delivery starting from estimating demand to identifying the mode of procurement, managing stakeholder expectations, engaging community representatives and monitoring project outcomes.

These tools and processes have been customized for four project states namely Karnataka, Andhra Pradesh, Madhya Pradesh and Tamil Nadu, with a focus on urban water supply in the first two and municipal solid waste management in the other two states.

This guidebook focuses on informing and empowering ULBs in the state of Karnataka to improve the effectiveness of service delivery in the urban water supply and sewerage sector. The information presented here was developed over a period of six months and in two phases. In the first, a number of interviews and discussions were held with senior state government representatives, ULB functionaries, citizen groups, private concessionaires and academics on challenges and concerns in urban water supply within the state. The information generated from this process were analysed, key areas of concern in the state were identified and a set of policy and operational responses were developed in the form of a set of guidelines. These guidelines were presented to diverse stakeholder groups, at a workshop in Bangalore in the second stage and were further deliberated upon. The rich discussions and suggestions emanating from the workshops were then incorporated into the final framework, which is presented here.



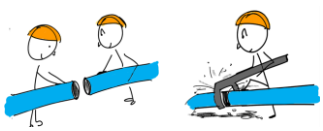
Acknowledgements

This guidebook would not have been possible without the cooperation of experts and practitioners in the Urban Water Supply and Sewerage Sector of India. Their willingness to share their experiences has helped us ground this book in practical insights.

In particular, we would like to thank Shri P. N. Srinivaschary, Secretary to Government, Urban Development Department, Government of Karnataka for being a pillar of support and helping us in organizing and delivering the Capacity Building Workshop titled 'Strengthening Participatory Approaches in Urban Water Supply & Sewerage', held in Bangalore on 29th November, 2012. We thank Dr. A. Ravindra, Urban Affairs Advisor to the Chief Minister, Government of Karnataka for participating and contributing to the workshop. We are also grateful to Mr. Rabindra Sahoo, PPP Expert (Asian Development Bank), and all the municipal commissioners and engineers for attending the workshop and providing their insights and feedback on the structure and content of the guidebook.

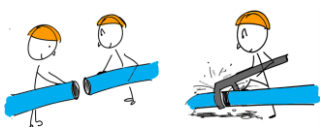
We owe special thanks to our advisor Dr. Ashwin Mahalingam, Professor, IIT Madras for having guided us in developing the idea. We are also grateful to Dr S. Narayan, our President and Mentor, Ms. Revathy Ashok, CEO and Founder, Iris Consulting and Mr. S. Parthasarathy, Former Director, ICRISAT for their constant advice and support throughout the assignment and in making this Guide Book possible.

We would also like to extend special thanks to the British High Commission for their support for carrying out this study. In particular we thank Ms. Aarti Kapoor, Programme Manager, BHC, New Delhi for her continuous encouragement and support during the project.

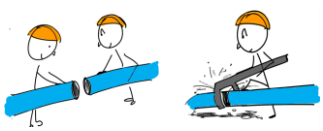


List of Abbreviations

BOT – Annuity	Build – Operate – Transfer Annuity
BOT – Toll	Build – Operate – Transfer Toll
BPL	Below Poverty Line
BWSSB	Bangalore Water Supply and Sewerage Board
CapEx	Capital Expenditure
CBO	Civil Body Organisation
CPHEEO	Central Public Health & Environmental Engineering Organisation
DBFOT	Design – Build – Finance – Operate – Transfer
EPC Contract	Engineering Procurement Construction Contract
FGD	Focused Group Discussions
GIS	Geographical Information System
GoTN	Government of Tamil Nadu
IBT	Increasing Block Tariff
IEC	Information Education Communication
IUWM	Integrated Urban Water Management
KLD	Kilo Litres per Day
KUIDFC	Karnataka Urban Infrastructure Development and Finance Corporation
LMC	Latur Municipal Corporation
MIS	Management Information System
MJP	Maharashtra Jeevan Pradhikaran
MLD	Million Litres per Day
MNP	Malkapur Nagar Panchayat
MoUD	Ministry of Urban Development
NGOs	Non - Government Organisations
NRW	Non Revenue Water
O&M	Operations & Management/ Maintenance
OpEx	Operations Expenditure
PPP	Public Private Partnership
PSU	Public Sector Undertaking
RWA	Residential Welfare Association
SCADA	Supervisory Control and Data Acquisition
SICS	Social Intermediation and Communications Strategy

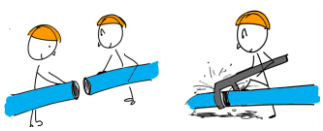


SLB	Service Level Benchmark
SPV	Special Purpose Vehicle
STP	Sewage Treatment Plant
TMC	Town Municipal Council
TNUDF	Tamil Nadu Urban Development Fund
TUFIDCO	Tamil Nadu Urban Finance & Infrastructure Development Corporation
UFW	Unaccounted for Water Losses
ULB	Urban Local Bodies
WtP	Willingness to Pay

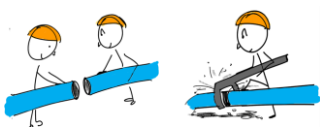


Glossary

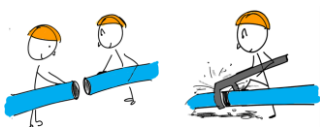
Accountability	The obligation of an agency to account for its activities, accept responsibility and disclose results in a transparent manner. As for this guidebook, it refers to the water utility being answerable to the citizens and other stakeholders involved in the project, for its own actions
Annual Maintenance Contracts	An agreement between two or more agencies outlining the terms and conditions of quality control and functioning of the infrastructure assets
Billed Authorised Consumption	Amount of water that is consumed and accounted for and is also billed
Biological Oxidation	Process in which domestic and industrial sewage consisting of biochemical decomposition is purified by emulsifying micro-organisms such as bacteria that feed on them to discharge energy
BOT Annuity	Build - Operate - Transfer - Annuity A type of a public private partnership model in which the private player builds and operates the infrastructure assets as agreed upon and mentioned in concession agreement. The private player also finances a minimal amount of the project cost. In return to the services provided, the contracting authority pays an annual lump sum amount. These cash flows determine the number of years required for the private player to recover its investments. Upon completion of the project, the assets are transferred to the contracting agency.
BOT Toll	Build - Operate - Transfer - Toll A type of a public private partnership in which the roles of the private player and contracting agency are the same as that of BOT Annuity. The difference between the two models is that the private player recovers its investment via generating revenue from user charges collected. These user charges are regulated over the time period of the project by a regulating body.
Bulk Water Connection	A water connection at the level of transmission, distribution or others which is not at the end user/ consumption level
Revenue Collection Efficiency	Current annual revenue collected, expressed as a percent of the potential operational revenue
Commercial Establishments	Non - residential consumers/ customers such as hotels, schools, hospitals, etc
Commercial Losses	Amount of water that is consumed but is not accounted for due to poor audits, illegal consumption, etc
Comparative Advantage	Ability of the agency/ body to produce a set of outcomes at a lower marginal or opportunity costs than the other
Continuity of Water Supply	Average number of hours of pressurised water supply per day. It excludes the hours of water supply where the pressure is below the minimum requirements.



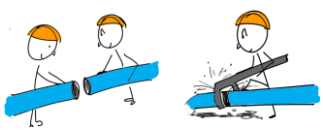
Contract	An agreement in which two or more parties voluntarily enter into a legal obligation with certain terms and conditions mentioned in it
Conventional Sewerage	An underground sewerage system, where waste water is collected at the source of generation via sewage connections, is further transported to a treatment facility where in after treatment, the re-cycled water is transmitted to the respective consumers for further re-use
Cost Recovery	Annual operations revenue collected as a percent of total annual operations expenditure
Coverage of Water Supply	Households with individual tap connections as a percent of total households in the city. The emphasis here is on the tap connection and not other sources of water such as tube wells, hand pumps, public stand posts, etc.
Coverage of Sewage Generation	Number of individual properties with a sewerage connection as a percent of total individual properties in the city
Cross - subsidisation	Differentiated tariff structure in which one type of consumer subsidises the tariff paid by the other through a higher tariff payment
Customer Connection	A water connection in the form of tap connection provided on an individual/ group basis to customers of all types, including residents and non - residents
Customer Service Centre	A customer service unit within the water utility that is responsible for managing relations with all the customers for water supply and sewerage facilities. It receives complaints and applications for services from the customers via a certain media, such as online forms, telephonic registrations, kiosks, etc. and ensures that reliable services are provided.
DBFOT	Design - Build - Finance - Operate - Transfer A type of public private partnership model similar to a BOT. The private player is allocated an additional risk of design.
District Metered Areas	Discrete area of a distribution system usually created by the closure of valves or complete disconnection of pipe work in which the quantity of water entering and leaving the area is metered
Energy Audit	An activity performed to understand the consumption of energy in a given time period and assess energy saving opportunities so as to reduce costs
EPC Contract	Engineering - Procurement - Construction Contract A type of public procurement in which the public sector contracts out the construction works to a private engineering firm and pays a fee upon completion
Extent of Metering	Total number of functional meters as a percent of total meters in the water supply system. These meters include the ones installed at the bulk and customer level irrespective of the type of connection
FGD	Focus Group Discussion An activity that gathers together a group of people from similar backgrounds or experiences to discuss a specific topic of interest. It is guided by a moderator



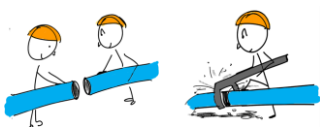
Flat Tariff/ Uniform Tariff	A type of tariff which is a single fixed fee charged to all users/ beneficiaries in return for a service provision
GIS	Geographical Information System A system designed to collect and capture information of all geographical locations. It provides details of the location of infrastructure assets and properties and also helps in spatial designing of construction works.
Grit Removal	A process in which inorganic material such as sand and gravel is removed
Hydraulic Modelling	A computer program/ software that regulates flow of water and sewage
IEC	Information - Education - Communication Strategies or tools used by an agency to interact with the community to inform, create awareness and educate them about the project
Illegal Connections	Customer connections in the water supply system through which water is consumed without the knowledge and approval of the water utility
Implementing Agency	An agency that is implementing a project. Examples include state water board, urban local body that may either self - implement the project or contract it to another party.
Management Contract	An agreement between two parties, (in this case, between the implementing agency and the private player) where the government is responsible for policy regulation and monitoring and the private operator is mandated to operate and manage the water works to provide services as agreed upon and mentioned in the contract
Marginal Cost of Water	Incremental production cost of per unit of water
NRW	Non - Revenue Water Total amount of water produced and distributed for consumption purposes that does not generate any revenue to the water utility. It is measured as the difference between the total volume of water entering the system after treatment and the amount of water for which revenue was collected
On - site Decentralized Sewage Treatment	A sewerage system in which sewage is collected and treated at the source of generation. The operations and management of the system is heralded with the local citizens or a private contractor. The treated sewage is then reused by the same citizens for gardening, flushing toilets, car – washing, etc.
OpEx	Operations Expenditure Total annual cost incurred by the water utility for operating and maintaining the water supply and/or sewerage works. These include salaries to staff, costs incurred on power, chemicals, repairing leakages, etc.
Participatory Urban Appraisal	Appraisal of urban projects through participatory approaches, i.e. upon consultations with the community
lpcd	Litres per capita per day supply of water Ratio of total water supplied at the consumer end and the total population served



Performance based Management Contract	A Management Contract where payments to the private operator are linked to achievements, with (not always) an application of penalties and bonuses
Physical Losses	Loss of water due to leakages or bursts in transmission and distribution mains, pipelines, reservoirs, water tanks
PPP	Public Private Partnership Government of India defines Public Private Partnership as '*An arrangement between a government / statutory entity / government owned entity on one side and a private sector entity on the other, for the provision of public assets and/or public services,through investments being made and/or management being undertaken by the private sector entity, for a specified period of time, where there is well defined allocation of risk between the private sector and the public entity and the private entity receives performance linked payments that conform (or are benchmarked) to specified and pre-determined performance standards, measurable by the public entity or its representative*[i]'
Procurement	Process of acquisition of assets and services by an agency
Public Procurement	Process in which the acquisition of goods and services remains with the public sector/ government
Quality of Sewage Treatment	Percent of sewage samples that meet or exceed the specified waste water treatment standards, as defined by the CPHEEO.
Quality of Water	Percent of water samples that meet or exceed the specified potable water standards, as defined by the CPHEEO. The samples include those drawn at both points – after treatment and at the consumer end.
Raw Sewage	Fresh sewage at the source of generation
Redressal of Customer Complaints	Total number of water supply and/or sewerage related complaints that are redressed within 24 hours of receipt of complaint, as a percentage of total number of complaints received in the given time period
Respondent	Individual interviewed by the surveyor
Reuse & Recycling	Process of treating/ recycling sewage to the extent possible for reusing it for industrial purposes, gardening, flushing toilets, etc.
Revenue Water	Amount of water for which revenue is generated
Risk Allocation	Process of allocating roles and responsibilities to the stakeholders of the project, each bearing a minimal amount of risk
SCADA	Supervisory Control and Data Acquisition Computer controlled system that collects and monitors data on the services of the water supply and sewerage system
Screening	Process of removal of large solid objects from the sewage using a screening bar
Secondary Sedimentation	Filtration of solids in the sewage after biological oxidation and before the liquid is discharged for tertiary treatment
Sewage Collection	Measured as the quantum of sewage collected by the sewerage system as a

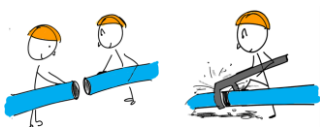


Efficiency	percent of the total sewage generated in the city
Sewage Treatment Adequacy	Measured as the capacity of the STPs to treat sewage as a percent of total sewage collected
Skilled Moderator	An individual within the implementing agency or the local partner with a certain set of skills such as communicative skills, knowledge of the sector, etc and is responsible for moderating the FGDs
SPV	Special Purpose Vehicle A subsidiary company with an asset/liability structure and legal status that makes its obligations secure even if the parent company goes bankrupt
Sustainable Livelihoods Approach	An approach that addresses and identifies the complexities of poverty, the inter linkages in the factors affecting it and creates action plans to overcome it
System Input Volume of Water	Amount of water entering into the water supply system after treatment
Technical Proposal	A proposal consisting of the details of project scope, approach and methodology to meet its objectives and the work plan for performing the activities
Tertiary Treatment	An advanced level of treatment that can decrease the level of suspended solids and biological oxygen demand to approximately one percent of what was present in the raw sewage prior to primary treatment
Transect Walks	A transect walk is a systematic walk along a defined path (transect) across the community/project area together with the local people to explore the water and sanitation conditions by observing, asking, listening and looking
UFW	Unaccounted for Water Losses Sum of physical and commercial losses of water
Unbilled Authorised Consumption	Amount of water that is consumed and accounted for but is not billed
Variable Charges	A type of a tariff which is not uniform or fixed for all users; but is based on consumption of the services and/or type of customer
Volume-cost Analysis	A simultaneous analysis of components of non - revenue water in terms of volume of water and its cost of production, treatment and distribution
Volumetric Tariffs	A linear tariff structure where in the user fees increase on a per unit consumption of service
Water Audit	A qualitative and quantitative analysis of water consumption to identify ways of reducing usage, reusing and recycling water
Water Utility	Agencies responsible for providing water and sewerage services. These may include state water boards, ULBs, private operators, etc.
Work Plan	A plan that details the list of activities to be performed, provides timelines for the same and allocates responsibilities along with the estimated man days



About the Guidebook

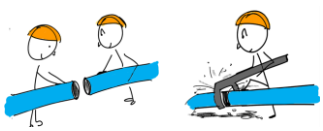
Objectives	This guidebook has been created with the objective to: ▪ Provide Urban Local Bodies (ULBs) with a set of guidelines to effectively identify, implement and execute projects in urban water supply and sewerage ▪ Strengthen participatory approaches by engaging citizen representatives at different stages of project implementation and governance ▪ Acquaint ULBs with a few best practices in the delivery of water supply and sewerage service
Target Audience	The guidebook is designed to serve as a reference manual to ULB representatives (commissioners, executive engineers, planners) responsible for implementing urban water supply and sewerage projects in Karnataka.
Structure	The structure of the guidebook follows the value chain associated with identifying and executing projects in the urban water supply and sewerage sector namely: ▪ Project identification ▪ Project procurement ▪ Project monitoring Only functions that are of relevance to ULBs at these stages have been covered in this guidebook.



Section I: Overview of UWSS in Karnataka

Issues

Responses

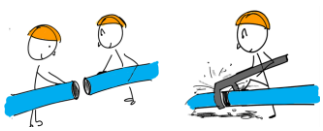


I.1 Urban Water Supply & Sewerage In Karnataka: Issues

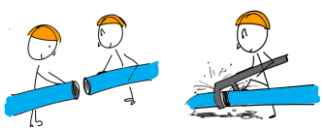


With 38% of its population residing in urban areas, the State of Karnataka is among the most urbanised states in India. This is further expected to increase to 45% by 2025. With increased urbanisation, the state's annual water usage is anticipated to rise up to 40% by 2025, placing greater pressure on state and local governments to meet the rising demands of service delivery in critical sectors such as water supply and sewerage.[ii] Interviews held with various municipal authorities and other stakeholder groups in the state revealed the presence of a number of challenges, some of which are outlined below:

Low Coverage	Of 214 ULBs, only 25% of the ULBs supply the set per capita water requirements, and just 11% of the ULBs have a functioning sewerage system
High Inefficiency	Most ULBs have low distribution efficiencies and unaccounted for water losses that tend to range between 30% and 70%
High Dependence on 135 Litres per Capita per Day (Lpcd) of Water Requirement	Conventionally, the total demand for water is assessed based on the total population and the number of households which leads to an over – estimation of the demand for water, resulting in poor project design
Non Revenue Water (NRW)	At present, the assessment of NRW is done by merely subtracting the amount of revenue water from the total bulk water supplied. This practice does not provide a break up of NRW into various components and prevents ULBs from designing effective NRW reduction strategies
Irrational Tariff Structure	Most ULBs levy a flat user charge with zero metering dis-incentivizing efficient use of water. For example, there are flat rates in the form of property taxes in cities like Raichur and Shimoga, whereas cities such as Udupi have increasing block tariffs. The tariffs are rarely revised and are not indexed to power consumption or inflation. This in turn affects the recovery of annual operation costs and places greater pressure on the finances of the municipality/ state.



Inadequate Engagement with the Community/Citizens	Lack of adequate emphasis on creating awareness on the implications (financial and otherwise) of metered consumption by the concessionaire (in the case of private sector participation) and the local governments and inadequate emphasis on accommodating the interests of citizen representatives is seen to contribute to implementation delays and project failures.
Poor Emphasis on Monitoring	Most ULBs do not have a monitoring mechanism to oversee the performance of water supply and sewerage projects. Thus project outcomes in most cases remain unmet or under-met.

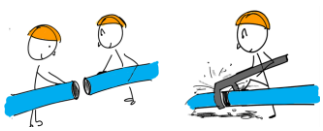


I.2 Responses to Issues in UWSS in Karnataka

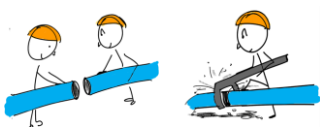


In order to address the rising challenges associated with delivering efficient yet affordable services in sectors like water supply and sewerage, the state is seen to have developed innovative models, schemes and policy frameworks. A few responses made at the state level in the last decade for improving urban water supply and sewerage services in Karnataka include the following.

Policy Framework	The State Government has formulated the State Water Policy 2002 and the Karnataka Urban Drinking Water and Sanitation Policy 2002. These policies emphasize the need to: ▪ Plan and implement water resource management programs ▪ Encourage participatory approaches by the local bodies to operate and manage systems ▪ Create awareness among citizens on decentralised user participation in decision making, implementation and management of water resources projects ▪ Enhance private sector participation and introduce corporate management, wherever feasible in improving efficiency and accountability to users ▪ Revise and fix water rates for various uses in a phased manner to cover operational charges
Financing Mechanisms	1) A Karnataka Water and Sanitation Pooled Fund (KWSPF) Trust has been created to raise funds from the market. This fund is used for Cauvery Water Supply (CWS) and Under Ground Drainage projects. The KWSPF is a Special Purpose Vehicle (SPV) that monitors these bonds. 2) North Karnataka Urban Sector Investment Program is financed by the Asian Development Bank for urban service reforms in 25 towns. Under this program, few cities have been opted for implementing 24*7 water supply performance – based management contracts, each with a project cost of approximately Rs. 20 crore.



Administrative Reforms	1) A number of ULBs in Karnataka rely on property taxes as a means to cover water supply Operations and Maintenance (O&M) costs. With the implementation of AASTHI, a Scheme funded by the Directorate of Municipal Administration, Karnataka; scientific assessment of property tax collection such as Geographical Information System (GIS) has been introduced. This will make it efficient to track properties and administer taxes. Moreover, the state has made provisions to increase property taxes by 15-30% once in every 3 years. 2) District Urban Development Cell has been established under the Deputy Commissioner in each of the district head quarters to act as a nodal agency to monitor the functioning of the ULBs in the district.
Guidelines	The Urban Development Department of the State has recently issued the 'Draft Manual on Construction & Maintenance of Under Ground Drainage Lines and Septic Tanks'. This manual will act as a ready – reckoner with regard to safety procedures and standards for the workers involved in construction and maintenance of underground drainage and septic tanks and provide comprehensive solutions to various departments such as Bangalore Water Supply & Sewerage Board, Karnataka Urban Water Supply & Drainage Board and ULBs.
Innovative Models	Karnataka is among the first few states to have experimented with innovative models to improve urban water supply and sewerage systems. The Karnataka Urban Water Supply Improvement Project is one such model implemented in the cities of Hubli-Dharwad, Gulbarga and Belgaum. The project, funded by the World Bank with technical assistance from the Karnataka Urban Infrastructure Development and Finance Corporation along with approval from the ULBs of the three cities was implemented as a Management Contract. A private player was selected to carry out the rehabilitation works of the distribution mains and service connections and operate it for 3 years. The Department of Municipal Administration is now considering undertaking such management contracts in 16 other cities of Karnataka. The funds for these projects are expected to flow from the State or Central schemes or other agencies.





While these initiatives and policies have helped create a useful framework within which improvements in water supply and sewerage service may be delivered, the absence of adequate capacities among municipal authorities is observed to be a key inhibiting factor preventing the state from fully reaping the benefits emanating from them. In order to support ULBs overcome this critical gap, this guide book seeks to lay down a set of guidelines at every stage of the value chain, i.e., from conceiving a water supply/sewerage project to its implementation, delivery and governance. These guidelines are designed keeping in mind the needs of urban local bodies and is targeted at empowering ULB representatives involved in operating and maintaining water supply and sewerage projects. The key segments covered in the guidebook are presented in Exhibit 1.

Exhibit 1: List of Focus Areas in the Guide Book

1 Project Identification

- Current demand for water supply and sewerage services
- Assessment of infrastructure (Non Revenue Water) and service delivery
- Strategies for reduction of non revenue water
- Methods for cost recovery
- Assessment of Willingness to Pay
- Technological options for sewage treatment
- Selection of operational model (Centralised and Decentralised)

2 Project Procurement

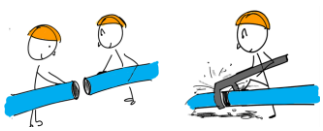
- Types of procurement modes: features and limitations
- Selection of the procurement mode

3 Project Monitoring

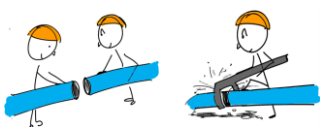
- Formation of project monitoring committee
- Formation of customer service forum
- Identifying measurable targets
- Creating monitoring mechanisms

4 Community Involvement

- Degrees of community involvement
- Participatory decision making process
- Community – managed projects
- Community – led monitoring



Assessment of Demand for Water Supply	Non Revenue Water	**Section II: Project Identification**
	Cost Recovery	Assessment of Sewage Generation
Extent of Sewage Treatment	Choice of Technology	Operational Model



II.1 Assessment of Demand for Water Supply

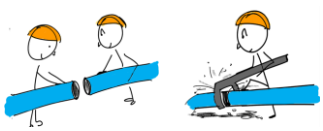


This section outlines the various approaches of estimating water demand and briefly outlines the advantage and limitations of each approach. However, irrespective of the method, the key factors that must be considered before estimating demand include:

- Number and size of households
- Income distribution
- Quantity of current water consumption
- Various household requirements of water and their respective quantities
- Current resources of water and the existing deficit (if any)
- Cost of water supply

II.1.1 Conventional Method

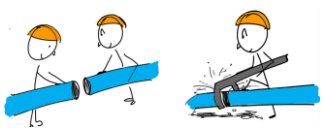
When to Apply?	▪ Quick estimate of demand for water ▪ Existence of bulk metering
Methodology	**Step 1:** Calculate the size of the population **Step 2**: Use the norms of water demand as given by MoUD or CPHEEO **Step 3**: Calculate, Total Demand for Water = Population Size × 135 lpcd **Step 4:** Calculate amount of water produced, through water audits at the stage of sourcing and production **Step 5:** Using steps 3 and 4**,** calculate Incremental Water Required = Water Supplied – Water Demanded A similar incremental water requirement, can be calculated as per size of households **Step 1**: Estimate average size of households **Step 2**: Total Demand for Water per Household = Total Demand for Water/ Average Size of Households
Limitations	▪ The water supply norm may not be the **'actual'** amount of water that is demanded/ consumed (the water demanded by the households and commercial estates may vary from city to city)



	▪ Doesn't allow customers to provide their preferences about the quantity of water required ▪ The deficit calculated through water audit at the stage of sourcing may not be the actual water supplied (due to NRW)

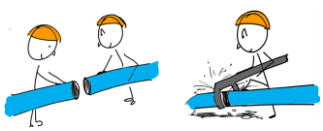
II.1.2 Stated Preference Survey[iii]

When to Apply?	▪ Estimate the demand for water for different purposes and accommodate the preferences of households/ commercial establishments ▪ Obtain answers to the following questions: ✓ What are the sources of water? (piped, bore well, hand pump, public stand post) ✓ How much water is consumed from each source? ✓ What is the quality of water? ✓ What is the water drawn from each source used for? (e.g., drinking, cooking, laundry)
Methodology	**Step 1**: Create a questionnaire for the stated preference survey **Step 2**: Engage with local NGOs, schools and colleges to gather volunteers to carry out the survey **Step 3**: Test the survey in selected wards or households **Step 4**: Modify the questionnaire (if required) **Step 5**: Use the modified questionnaire to conduct surveys in the rest of the city **Step 6**: Collect and analyse data **Step 7**: Calculate the actual demand for water **Step 8**: Calculate actual incremental water required using estimates from step 7 and total water sourced
Limitations	▪ Poorly designed and administered survey may produce misleading results ▪ Policy decisions taken at the state/ national level may pay little or no attention to the results produced by the survey ▪ Process is deemed to be fairly complex and is usually carried out by an external agency



II.1.3 Revealed Preference Approach[iv]

When to Apply?	▪ Estimate demand for water based on the changes in consumption as influenced by various factors such as increase in tariffs, reduction in water supplied, etc ▪ To accurately monitor water supply using hydraulic modelling or similar advanced technology ▪ Requires high extent of metering for conducting water audits at the consumption level
Methodology	The economic behaviour of the consumers is studied using the water audits and data on consumption patterns to capture the actual demand for water supply. Some of the data that may be collected and empirically tested under this framework include: ▪ Change in the quantity of water consumed by households due to changes in prices (elasticity) ▪ Reduction in water consumption by industries due to technological improvements ▪ Increase in the number of commercial establishments (hotels, malls) ▪ Number of consumers more reliant on bottled water for drinking
Limitations	▪ Does not accommodate community preferences ▪ Does not accommodate factors that may affect future demand



II.2 Non Revenue Water

Questions to be Addressed

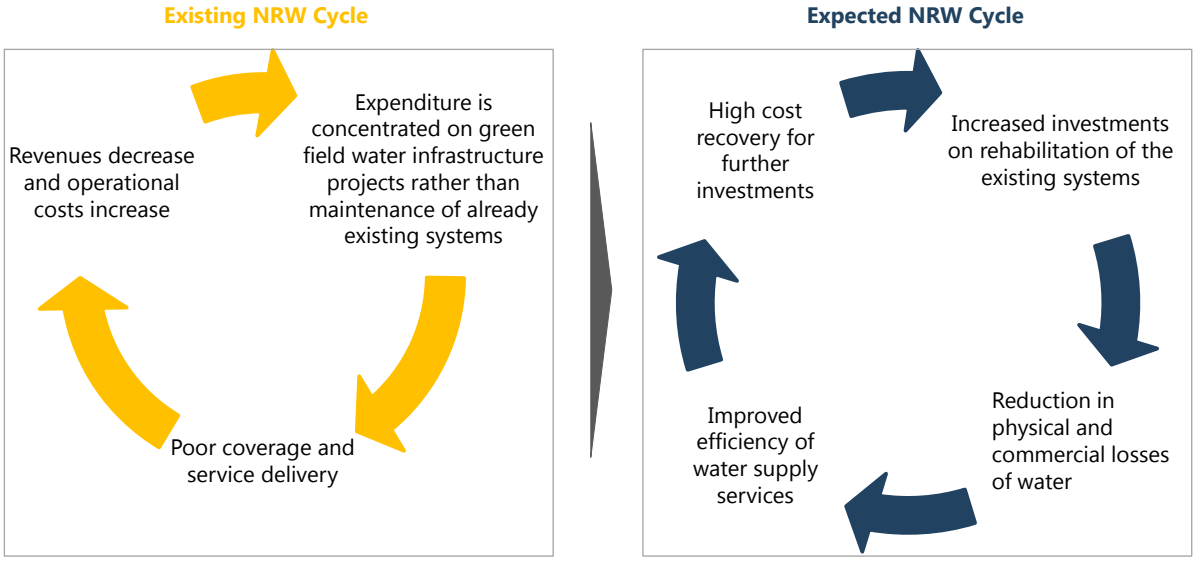
- **Why** should the issue of NRW be addressed?
- **What** is Non Revenue Water?
- **How** to assess Non Revenue Water?
- **How** to reduce NRW? **How** to maintain these strategies?



The large amount of NRW causes a vicious cycle of low investments in operations and maintenance, poor coverage and services and hence, low returns/cost recovery. Exhibit 2 depicts the NRW management trap on the left while the virtual or the required flow of NRW management is illustrated on the right.

In order to attain the latter, we first begin with the components of NRW and then identify the strategies to reduce and optimise it.

Exhibit 2: Non Revenue Water: Existing and Expected Cycles

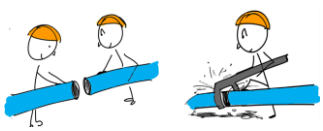


II.2.1 Non Revenue Water: Definition & Components



Non revenue water is the difference between the total amount of water transmitted after treatment for consumption purposes (system input volume) and the amount of water on which costs are recovered (revenue earned from billed authorised consumption). It is arrived at by subtracting revenue water from the total water that enters the system.

Total NRW = System Input Volume of Water – Revenue Water



Assumptions

This method provides an easy and quick estimate of NRW to the water utility managers and is based on the following assumptions:

- Meters at the water treatment plant are accurate. There is no error in calculating the outflow of water.
- The water utilities are aware of the amount of water that is billed.

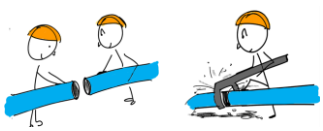
NRW is caused by infrastructure deficits, operational inefficiency and managerial incompetence. However, for any utility to create strategies to reduce NRW, it needs to identify the proportion of various components that contribute to NRW. These components cover the entire volume of water in the system, beginning from its outflow from the treatment plant to the consumer end. This mechanism of breaking down the volume of water supply into various components helps utilities to achieve a water balance. The International Water Association (IWA) identifies two main components of NRW:

I. Unaccounted for Losses

- Indicates the amount of NRW caused due to deficit in the infrastructure and/or mismanagement of the water supply system.
- Based on these deficiencies UFW is further broken down into two sub – components

Physical Losses

- Also called as technical or real losses, these are actual losses of water caused due to leakages in the entire water supply system. Leakages in the transmission and distribution mains are often caused due to breaking of pipelines or large bursts. Most of these leakages are unreported as they remain invisible. But the pressure of water is very high at these mains and any small leakage may cause high loses.
- There may be leakages in the overhead tanks or storage reservoirs that cause over flow of water.
- Losses may also arise owing to leakages in the service connections. This type of physical loss is more frequent but can be easily reported and corrected due to its visibility.



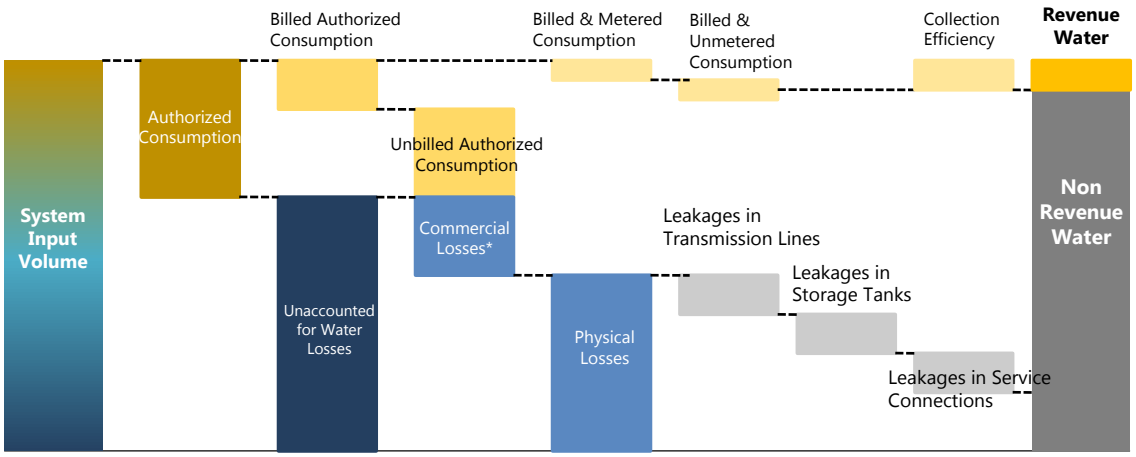
Commercial Losses

It is also termed as 'apparent losses'. It is the amount of water consumed that remains unaccounted due to:

- Poor water audits
- Illegal consumption
- Metering inaccuracies
- Data handling errors

Exhibit 3 provides an overview of the various components of NRW. Utility managers and water service providers must use this chart of water balance to determine the points where losses occur and devise ways to increase the actual revenue.

Exhibit 3: Water Balance/ Components of Non Revenue Water



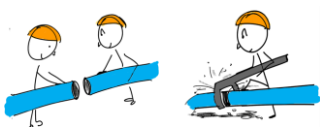
Source: International Water Association and Athena Research

II. Accounted for Losses

This is the amount of water that has been accounted for (i.e., the volume of water that has reached the consumers and audits for the same have been undertaken), but does not generate revenue due to the following reasons:

Unbilled Authorised Consumption

- The amount of water that is consumed and accounted for but remains unbilled.
- It includes water supplied by the utility through public stand posts, tube wells and bore wells which is legal but provided free.
- It may also include the water used for commercial purposes such as fire fighting, street cleaning and watering public parks.



Inefficiency in Revenue Collection of Billed Authorised Consumption	▪ This component is the amount of water that is authorised for consumption and is billed, but does not recover full costs. ▪ It is the amount of water that differentiates actual revenue from potential revenue and may occur due to several factors such as lack of effective metering for volumetric tariff
Billed Authorised Consumption	▪ This refers to collection/operational inefficiency of the staff to administer lump sum water charges and errors in handling household data, among others.

II.2.2 Assessment of NRW

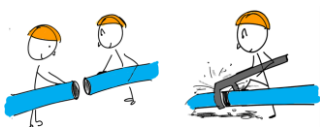


The factors that contribute to estimating NRW is the accuracy of the production meters, customer meters and their reading and billing. A more detailed method of calculating the components of water balance and consequently estimating NRW is given by *Liemberger & Partners' WB – EASYCAL* (See Annex – A.8).

The indicators listed in Exhibit4 need to be measured for each component of NRW. These indicators must be measured in these units: 1) Cubic meters per kilometer of main per day, 2) Litres per service connection and 3) Currency (Rs.).

Exhibit 4: List of Indicators for Measuring Non Revenue Water

	Indicator	Limitations
Physical Losses	$\frac{\text{Leakages in transmission lines}}{\text{Total Physical loss}}$ $\frac{\text{Leakages in distribution lines}}{\text{Total Physical loss}}$ $\frac{\text{Physical Losses}}{\text{Unaccounted for Water Loss}}$	▪ " Invisible" small leaks ▪ Direct relationship between network pressure and leakages ▪ Calculation of water losses based on frequency of water supply and consumption ▪ Is usually calculated using number of leaks repaired as a proxy
Commercial Losses	$\frac{\text{Functional Production Meters}}{\text{Total Number of Meters}}$ (at various levels – bulk water, transmission and distribution mains, service connections) $\frac{\text{Commercial Losses}}{\text{Unaccounted for Water Loss}}$	▪ Usually the date of meter turning inaccurate is unknown ▪ Lack of metering may result in unaccounted commercial losses



	$\frac{\text{Physical Losses}}{\text{Commercial Loss}}$	
Authorised Consumption	$\text{Extent of Metering} = \frac{\text{Metered Service Connections}}{\text{Total Service Connections}}$ $\text{Collection Efficiency} = \frac{\text{Revenue Collection}}{\text{Operating Revenue}}$ $\text{Potential Revenue Water} = \frac{\text{Billed}}{\text{Total Water Produced}}$	▪ Errors in meter system are unknown ▪ Lack of household data, accounting mechanism, inefficient billing system ▪ Cities may have a high volume of water supply services that are accounted for but unbilled. In such a case, strategy for non – revenue water is not applicable as there may be no willingness to charge/pay.

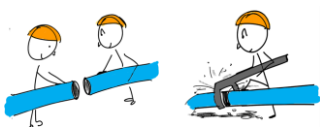
Upon completion of the assessment of these indicators, the utilities should now be able to perform a volume-cost analysis, which will help ULBs:

- To identify the points of physical and commercial losses and enable ULBs to prioritise the activities of NRW
- To calculate the cost of water lost. This will enable ULBs to understand which of the specifications of NRW cause maximum amount of loss of revenue

For example, if many leakages are detected in the distribution lines of a zone which causes large volumes of water to be lost and hence a significant revenue loss, then the ULBs must aim to repair them immediately. In brief, the volume – cost analysis enables the ULBs to logically plan NRW activities. Exhibit 5 presents a simple volume – cost matrix, with the amount of water lost and the related costs that remain uncovered due to this loss.

Exhibit 5: Volume- Cost Analysis of Non Revenue Water

Volume of Water (in Litres)	Marginal Cost of Water (Rs. per litre)		
	High	Medium	Low
High	Leakage in transmission and distribution main	Unauthorised consumption	…
Medium	Leakage in storage tanks Replacement of customer meter	Customer metering, data handling errors	Pressure management
Low	Leakage in customer service connections	Unbilled consumption	Reservoir over flow



II.2.3 Strategies to Reduce Physical Losses



Different types of leakages need to be managed differently based on their location and the pressure of water:

- **Leakages in transmission and distribution lines** are usually invisible and hence take time to be reported. However, due to the high amount of pressure at that stage of water supply, the loss of water here tend to be significant.
- **Leakages in service connections** are easily visible and usually small in size with comparatively lesser quantities of water getting lost.

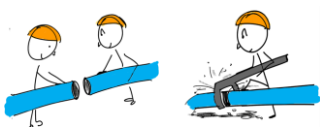
Based on these characteristics, the four important strategies to reduce physical losses are:

Active Leakage Control

- The management of leakages can be divided based on the District Metered Areas (DMAs). Please refer to Box 1 for more details. Regular monitoring of the flow of water into the zones and repair of the number of leakages can be done via effective metering and leakage detection mechanisms.
- Meters should be installed at the level of transmission of water, bulk supply into the zones and at the customer connections. The further the metering system is decentralised, the greater would be its effectiveness in identifying the amount of water lost through leakages at a particular point.
- A few equipments that are used for pin pointing leakages are noise loggers, leak noise correlators, ground microphones and sounding sticks.

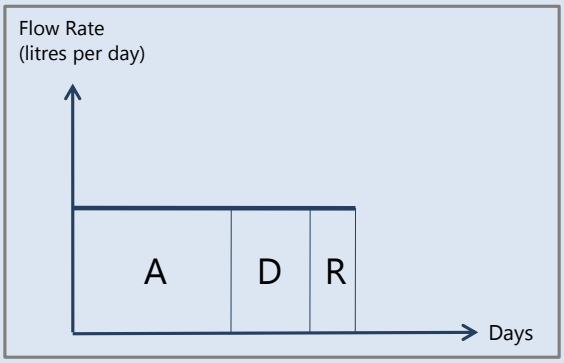
Pressure Management

- The rate of leakage in the pipeline system depends on the amount of pressure applied by water pumps. Moreover, there is a direct relationship between the volume of water lost from a leakage and the amount of pressure of water flow.
- For effective pressure management, the ULBs should recognise the location of placing valves based on the demand for water and the type of customer.



Speed & Quality of Repairs of Leaks

- Apart from the pressure, the time taken to realise, detect and repair leaks and bursts is another factor that determines the volume of water lost. The graph below shows the relationship between the volume of water lost and the number of days taken for awareness, detection and repair of the leakage.

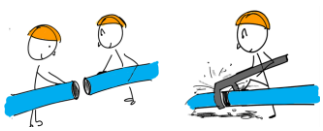


A: Awareness D: Detection of Leakage R: Repair of Leakage

- The identification of the leakage depends on the location and its repair depends on the costs associated with it. As reported bursts and visible leaks require less time for detection, the water lost through it will also be less. Skilled staff equipped with the appropriate tools and an organised method for repairing the leaks can effectively contribute to reduction in water losses.

Asset Management

- Annual maintenance of the water supply infrastructure such as the storage tanks, reservoirs and pipelines must be done to manage the assets.
- With the aging of the piped networks, valves, meters, distribution main, etc., arrangements for its replacement has to be undertaken.
- The frequency of this process depends on the quality of the existing assets, the depreciation rates, the records of bursts and leakages, among others. This also helps in prioritisation of the rehabilitation works.

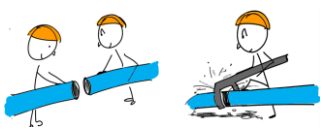


II.2.4 Commercial Loss Strategy



ULBs should aim for a maximum commercial loss of 4-6% of the total NRW. Reducing commercial losses requires minimal investments and can be undertaken immediately. But, it requires strong commitment, skilled staff, political will and community support. The three essential strategies for reducing these losses are:

Improvement of Accuracy of Meters	▪ Install meters properly: Utilities should purchase meters on behalf of customers and install them where readers can easily locate and read them ▪ Train staff: Staff should be trained to handle meters and detect non – functioning meters ▪ Monitor water quality: Poor quality of water due to some construction works in pipes may cause sediments to seep into the internal parts of the meters ▪ Monitor intermittent water supply: Sudden increase in pressure can damage the meter's components ▪ Size meters properly: The preference survey can help in understanding the nature of water consumption by different customers. This information helps in determining the proper size of meters for households and businesses
Removal of Illegal Connections	Illegal connections involve the usage of water without the knowledge and approval of the ULB. The utility has to detect them through surveys and resolve the issues with the customers
Reduction of Data Handling & Accounting Errors	Although the data collected depends on the accuracy of meters, it is important to reduce the errors in handling the water audits, when performed manually. The staff must be trained and provided with the right equipments to read meters and collect data on water consumption.



Box 1: District Metered Areas

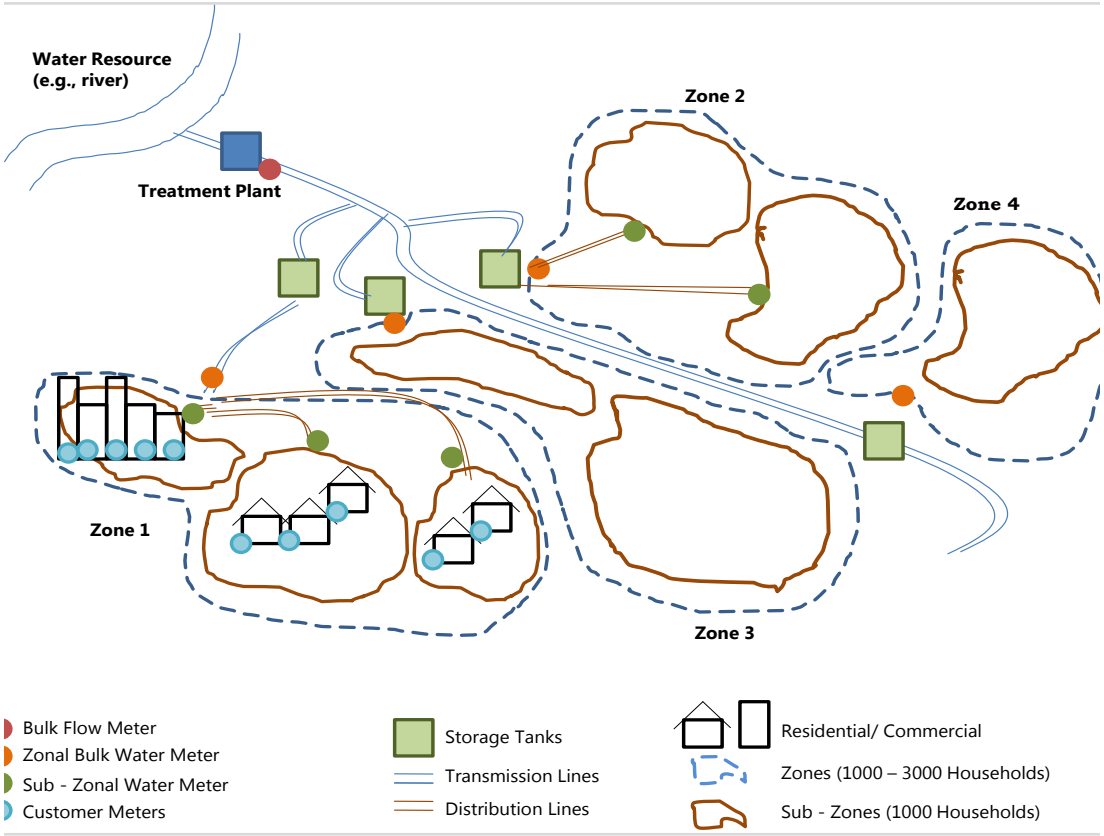
IWA defines a District Metered Area (DMA) as a discrete area of a distribution system usually created by the closure of valves or complete disconnection of pipe work in which the quantity of water entering and leaving the area is metered. This implies that a large open system of water supply in a city is hydraulically divided into several districts/ zones (as shown in diagram below). The DMA is designed based on following criteria:

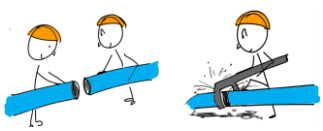
- Number of connections per DMA (IWA recommends 1000 – 2500)
- Number of valves that must be closed to isolate the DMA
- Number of flow meters (bulk, district/ zonal, sub – zonal and customer)
- Ground – level variations and pressure requirements (flat lands require less pressure for water flow)
- Easy visibility of topographical features such as drains, roads, highways, etc

The ULBs or the water utility operators must ensure that all the valves within the network system of a DMA remain closed and the flow of water is metered. A team can be assigned to each DMA with an operational manual as a reference material.

The advantages of having a DMA include:

- Systematic and easy administration of water flow and pressure management
- Increased accuracy in data collection and water audits
- Prompt detection of leakages and tampered meters



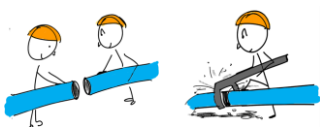


II.2.5 Strategies to Improve Billing & Collection Efficiency



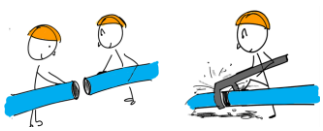
While the reduction of unaccounted for water losses is more infrastructure intensive, the ability to improve the existing billing and user charge collection methods is predominantly driven by administrative reforms. Some of the most common forms of billing and collection inefficiencies include incomplete customer databases, delivering bills to wrong addresses, unpaid bills by consumers, inaccurate water audits, etc. These reasons are directly linked to further mismanagement of the water supply services. Inefficient billing contributes to:

Inadequate Revenue	Consequently, there is a lack of funds to improve/ rehabilitate/ maintain pipelines and meet increased urbanisation requirements.
Lack of Credit Worthiness & Bankability of Projects	Poor cost recoveries make it challenging for ULBs to tap the financial market, raise capital from financial institutions and the public.
Weakening of Accountability of the Customer to the ULB	Households tend to be discouraged when wrong/overrated bills are delivered



Following methods can be adopted to improve billing efficiencies and overcome these challenges:

Billing System	▪ **Implement a monthly billing cycle:** provides adequate time for ULBs to validate and raise bills and collect user charges ▪ **Use a computerized system:** easy, efficient and reliable way to collect and update customer data bases, keep a track of water consumed in each area/zone and amount of revenue to be generated ▪ **Implement a rational tariff:** efficiency of the billing system also largely depends on the type of tariff. Although flat tariffs or property taxes are easy to administer; volumetric tariffs, though cumbersome to implement, incentivise responsible use of resources
Automatic Meter Reading	▪ Use of data loggers rather than manual reading and noting of water consumption, enables accurate recording and billing. This can be implemented in two ways: ▪ Spot billing: Here meters are read and bills are generated to the customers on the spot ▪ Batch billing: Here meters are read and automatically fed into the master database, to be later generated into bills and delivered to customers
Regular & On – Time Payment	▪ Provide employee incentives based on the number of bills distributed and revenue collected in a given month by each employee ▪ Provide customer incentives. For example, allow customers (especially urban poor) to pay in instalments, or offer discounts for quick payments ▪ Adopt a disconnection policy. Although this is politically challenging, ULBs may opt to do so



Box 2: Improvement in Collection Efficiency in Bangalore

The Bangalore Water Supply & Sewerage Board (BWSSB) is among the first utilities in India to implement a volumetric tariff structure (increasing block tariff) and to have achieved cost recovery of 98% (in 2010). Some of the strategies adopted by BWSSB include:

- **Employee Incentives**: The entire one month cycle of billing and tariff collection in Bangalore is divided into two phases. The first includes billing wherein each meter reader, as assigned by the divisional executive engineer, is responsible for reading and collecting data on water consumption of 1000-1500 connections. Once this data is collected and bills are designed within the first three days of the month, the second phase of tariff collection begins. The executive engineer provides incentives to these meter readers to collect the tariffs from every household. These incentives are based on the current tariff collection plus a percent of arrears from previous bills.
- **Connections to Poor Population:** In order to remove illegal connections and prohibit unaccounted usage of water, BMWSSB, in 2000-02, with funding support from AusAID, initiated a pilot project of providing water tap connections to the population in three slums of the city - Cement Huts, Chandranagar and Sudhamanagar, where subsidized connections or group connections were installed. Based on the success of this pilot project in these demonstration zones, the scheme has been upgraded to about 6000 connections in 46 slums of the city. These households have been receiving regular bills and are making payments for improved and reliable services.
- **Customer Conveniences:** BMWSSB has made provisions for kiosks, electric clearance services and Bill Junctions to make bill payments more convenient for the customers. As of today, there are 70 kiosks where water bills are produced and payments can be made through cash, cheque or demand draft. The board has tied up with banks where bills are sent and payments are credited from respective accounts. Moreover, the state government has initiated Bill Junctions for payment of all utilities. Around 1000 – 1500 water bills are paid via this option.

II.2.6 Outsourcing NRW Reduction Activities



The concept of reduction of NRW can be divided into several phases and activities. The ULB can choose to take up each of these in a phased manner by themselves, based on their capacity and capability or contract it out to private players. Breaking down the entire value chain of NRW into various tasks helps the ULB to identify issues and solve them one by one. This particularly helps when funds are low and/or issues in NRW are limited in nature. Exhibit 6 below gives a potential list of outsourced activities that aim to reduce NRW. An example of one of these projects has been briefly discussed in the Box 3.

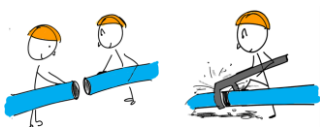
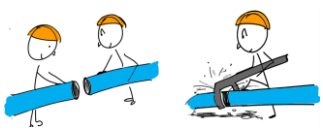


Exhibit 6: Private Sector Participation for Reduction of NRW

S/N	Type of Contract	Description	Examples
1	Leak Detection	Survey to detect leaks in the distribution pipelines and repair of the same	Chennai, Bangalore
2	Metering	Installation of meters at various levels – raw bulk water, ward wise distribution, consumption	Chennai
3	UFW Reduction	Focus on one component of NRW: usually used when physical losses are very high	Sao Paulo, Brazil
4	NRW Reduction	Phased approach on reducing various components of NRW (leakages, metering, revenue collection)	Indore, Bhopal
5	Performance based Management Contracts	Performance based payments to the private sector for reduction of NRW, extent of metering, sewage and water supply coverage. Payments made as a % of achievements	Hubli – Dharwad, Nagpur, Algiers
6	Target Contracts	Pre-determined targets set for the private sector; applicable to penalties and bonuses	Integrated Management Contracts in Uganda



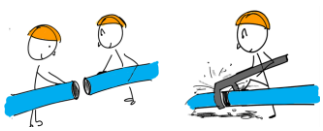
Box 3: NRW Reduction & Efficient Water Supply in Malkapur

Malkapur, initially a village in Maharashtra experienced a population increase at the rate of 58% in 1981- 91 and 275% in 1991-2001. The piped water supply scheme that was commissioned and implemented in the village in 1988 was designed to cater to an expected population of 14000 in 2010 on the basis on 40 lpcd. However, in 2001 itself, the population rose to 23000, thereby placing immense pressure on the existing water supply system. Due to acute shortages in water, the Gram Panchayat (GP) operated the system all day whenever electricity was available. Despite this, water was available only for 2-3 hours of water per day; forcing the citizens to rely on other sources such as tankers and bore wells. In order to meet the demand, in 2006, a project was approved with a budget of Rs. 12.3 crore, to provide 70 lpcd to 67000 people by 2030. Consequently, in 2008 the Malkapur GP was converted to Nagar Panchayat, signifying a transition from rural to urban. The approved project was launched in 2010, and is being undertaken by the Malkapur Nagar Panchayat (MNP) and MJP. It was supported under GoMAH scheme of Accelerated Rural Water Supply Programme (ARWSP).

The project is an entirely government (ULB with support from MJP) led model and entails a combination of systematic interventions which included management reforms, staff training, new technologies, financial support, citizen's engagement and improved revenue model. The key features of the project include:

- **Technical Innovations:**
  - Use of WaterGEMS software to build the hydraulic model of the entire network of pipelines from the source to the distribution and finally consumer connections. This model uses information on the use of water at different times during the day along with the spatial information of the Geographical Information System (GIS).
  - Automatic meter reading system introduced for monthly billing and cost recovery.
  - Computerised billing and customer friendly services such as SMS alerts for registering complaints, etc.
- **Awareness Campaigns:** IEC campaigns were organised to reach out to all citizens of the town, explaining the objective, strategies and benefits of the project including promotion of water conservation. Extensive discussions were held with media, welfare associations, and prominent citizen groups for regular project consultation.
- **Financial Model:** Of the total project cost of Rs. 13 crore, 90% was funded by the MJP and the rest by MNP through a surcharge on property tax. The Exhibit below gives a list of success indicators of the project:

Indicator	Before	After
Continuity of Water Supply	1-3 hours every alternate day	24*7 hours
Coverage	Partial	100%
UFW	>40%	12%
Services to Poor	Dependent on public stand posts & water tanks	Individual tap connections at subsidised rates
Saving of Power	19-20 hrs of pumping	13-14 hours of pumping
Cost Recovery	60%	80%
Extent of Metering	Nil	100%



II.3 Cost Recovery

Questions to be Addressed	
	▪ What are the characteristics of an optimal tariff structure? ▪ What are the different types of tariff structures? ▪ What are the factors responsible for setting tariffs? o Willingness to pay o Subsidies o Project costs o Extent of metering

II.3.1 Characteristics of an Optimal Tariff Structure

An efficient tariff structure is one that ensures economic efficiency, social equity and environmental sustainability.

Economic Efficiency

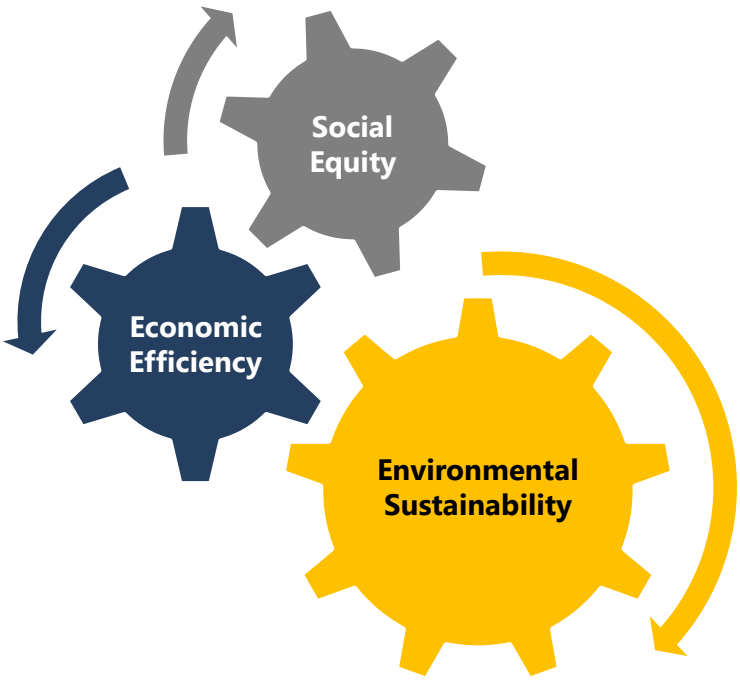
- ✓ Cost Recovery
- ✓ Reflect the willingness of the consumers to pay for services

Social Equity

- ✓ Treat similar consumers equally
- ✓ Ensure equitable access to all
- ✓ Acceptability by all classes of consumers
- ✓ Designed in a transparent manner

Environmental Sustainability

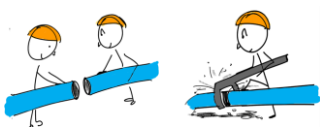
- ✓ Ensure efficient use of water
- ✓ Encourage re-use of waste water
- ✓ Promote water conservation



An economically efficient tariff structure allows recovery of the project cost to the extent possible/ decided and lets the consumers realise the true value of paying tariffs for the service.

A socially equitable tariff is one that is designed transparently after consulting the consumers, provides equal access of water to all (quantity and quality) and takes into account the income levels of population/ affordability to pay.

A tariff that is sensitive to environmental causes is one that discourages wastage of water, and encourages re-use to the extent possible.



II.3.2 Comparative Analysis of Different Types of Tariff Structures



Flat tariff structure is usually in the form of a lump sum amount/ user charge or a fixed tax. It is easy to calculate and is based on the average cost/ marginal cost of water distribution and/or service delivery per household. Moreover, it may have a positive impact on the collection efficiency as it is easy to administer. However, such a tariff structure does not ensure social equity and may result in the economically challenged group paying as much as their counter parts. It also discourages water conservation. Quick pros and cons of flat tariffs are given below.

Pros & Cons of Flat Tariffs

Pros

- Easy to administer by a single government entity or an independent regulator
- Ensures social equity and uniform services
- Makes the process of tariff revision simpler
- Easy to implement in areas where cost of production is high

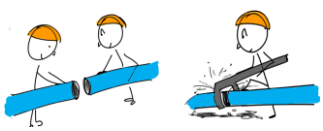
Cons

- Does not reflect the true cost of production
- May result in subsidizing high income consumers
- May also result in reduction of water conservancy (i.e., it may violate the principles of economic and environmental sustainability)

Variable water chargesare usually of three types. These tariff types are highly correlated with the quantity of water consumed and the type of consumer. Water tariffs as a percent of **property tax** is designed as per the area and value of the property of the consumers. Here, ULBs may alter the percentage of property tax, based on the type of customer. For example, commercial or similar non – residential properties may be charged higher than households. This tariff structure is being implemented in Ahmedabad.

Volumetric tariffs, on the other hand are linear in nature. They are directly correlated to the quantity of water consumed. The tariff is the average cost per litre/ kilolitre of water. The payments increase as and when the consumption increases. This allows increased economic efficiency as it improves cost recovery and also promotes minimal usage of water.

A similar type of a variable tariff is **increasing block tariff**, which is largely practiced in class I cities in India. A tariff of this type has slabs that ensure increased user charges as and when consumption increases. Different slabs can be applicable to different types of consumers, namely households, industries and commercial establishments. The tariff structure also incorporates sewage treatment charges. For example, in Bangalore, there is charge of 50%

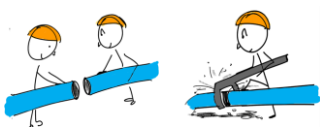


of water supply tariff for waste water discharge, collection and treatment. Exhibit 7 provides a comparative analysis of different tariff structures and Box 4 presents different tariff structures India, along with its implications on collection efficiency and cost recovery.

Exhibit 7: Comparative Analysis of Tariff Structures

		Variable Tariffs			Flat Tariffs	
		Increasing Block	Volumetric	Property Tax	Lump sum	Water Tax
Economic Efficiency	Cost Recovery	H	H	M	L	L
	Accountability	H	H	M	L	L
Social Equity	Equity and Access	L	L	H	H	H
	Acceptability	L	L	H	H	H
Environmental Sustainability	Efficient Use	H	H	M	L	L
	Re-use of Waste Water	H	H	M	L	L

High H **Medium** M **Low** L



Box 4: Tariff Structures in Select Cities of India: Practices & Implications

A variety of tariff structures are practiced in India ranging from connection – based flat tariffs to volumetric user charges. These tariffs are either implemented by the State Water Board, as in the case of cities in Kerala and Tamil Nadu or are independently designed by the ULBs as in Andhra Pradesh. The type and amount of tariff structure levied influences the collection efficiency, and consequently the cost recovery. A few examples of such current or past practices have been described below as follows:

- **Ferrule Based Flat Tariffs in Raipur, Chhattisgarh**

  Until February 2010, the Raipur Municipal Corporation (RMC) had a ferrule based flat tariff structure. The connection fee per annum for domestic customers/residential was Rs. 720 for a half inch pipe and Rs. 1200 for commercial institutions.

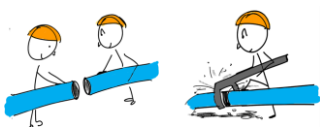
  With 85% of the customers having access to tap connections, the city had almost nil customer metering and a mere 26% cost recovery. Owing to poor cost recovery of annual O&M, RMC in 2011 revised the tariff structure by implementing an increasing block tariff structure for metered areas and flat tariffs for the unmetered.

- **Property Taxes in Ahmedabad, Gujarat**

  Ahmedabad Municipal Corporation has been levying water tariffs in the form of property taxes to be paid by residential, semi–residential and commercial institutions on a monthly basis. Although these tariffs are variable in nature they do not account for actual consumption of water. The city has zero metering with NRW of nearly 31%. The collection efficiency is 60.3% and annual O&M cost recovery is 53.9%. The tariffs are highly subsidised by the state government, which also undertakes capital works.

- **Increasing Block Water Tariffs in Udupi, Karnataka**

  Increasing block tariffs have been long practiced in the city of Udupi. However, the cost recovery ratio during the decade 1995-96 to 2007-08 had increased only from 67.79% to 73.66%. The municipal body in 2008 revised the tariff structures. The domestic and commercial rates for the first slab (for consumption up to 18 kilolitres) were increased by 66.6% from Rs. 45 to Rs. 75 and Rs. 90 to Rs. 150, respectively. Moreover, for the next slab, the rate (charged on per KL of water) was increased by three times. Further, the slabs were increased from two to four. These changes increased cost recovery to 128% during 2010 – 11.

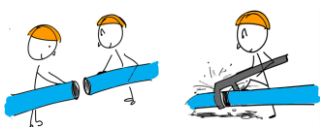


II.3.3 Factors Affecting Tariffs



Apart from understanding the different tariff structures and its respective characteristics, the ULBs must have a check list of all the factors that determine tariffs. These factors influence the level of tariff that should be charged by the ULBs and thereby determine the financial viability of the project. These include:

Composition of the Total Project Cost	▪ The total project cost consists of upfront capital investments and annual operations and management costs. ▪ Section A.3 in the annexes provides required investment estimates for distribution and O&M of water supply as well as sewage network and treatment. These estimates may be used as reference for the ULBs to further estimate the project cost and hence determine tariffs. ▪ The O&M costs consist of power costs, chemicals, staff and maintenance works such as leakage repair, new / tampered meters, customer services, etc. Usually, the power costs range from 40 – 60% of the total annual O&M expenditure. This raises the need to index water tariffs with the energy tariffs.
Percentage of Cost Recovery	The ULBs need to decide how much of the total cost incurred should be recovered. The benchmarks set by MoUD indicate that the ULBs must initiate 100% O&M cost recovery and gradually aim to partially recover capital expenditure.
Quantum of Arrears	▪ The amount of outstanding debt and the interest to be paid on it affects the level of tariff directly. ▪ However, the ULBs should choose to take a loan only if there is a sustainable revenue model.
Quantum of Subsidies & Grants	▪ The quantum of subsidies or grants available may contribute to very low user charges. But, there are certain factors pertaining to subsidies that affect the tariffs: ▪ *Type of subsidy* (*direct or cross – subsidization*): If the latter is applied then the tariffs would be differentiated (for lower and high income citizens) ▪ *Time period of subsidy:* Subsidies may be provided only during the initial phase, they may reduce over time with the expectation that the project must be financially self – sustainable.

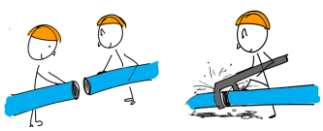


Willingness to Pay (WtP) Survey



Willingness to pay is a quotient which needs to be assessed to determine the water tariffs and involves a systematic approach. The process below gives a step by step method to carry out a willingness to pay survey.

Preliminary Tasks	▪ Identify the target population (use sampling strategies if required), for example, ✓ High income households ✓ Low income households ✓ Slum population ✓ Commercial establishments ▪ Address the financial objective of the project ▪ Identify the services that need to be charged ▪ Design a work plan for conducting the survey
Questionnaire Design	Design a questionnaire for the WtP survey (A template has been provided in the annex – Please refer to Annex A.1)
Data Analysis & Estimation of Prices	Compile the data collected from the survey and analyse it to estimate tariffs: ▪ Respondent details and income levels ▪ Ownership of water connections ▪ Requirement for water (different uses and quantity) ▪ Willingness to pay – Yes/ No ▪ Willingness to pay – If yes, how much?
Community Consultations	▪ Publish data ▪ Get inputs from the non – willing consumers through discussions and consultations
Final Tariff Structures	Incorporate inputs from the survey and community consultations and finalise the tariff structure



II.4 Assessment of Sewage Generation



The amount of sewage generated is usually considered to be at 80-85% of the total quantity of water consumed.[v] A preference survey may be used to arrive at an estimate of the water consumed.

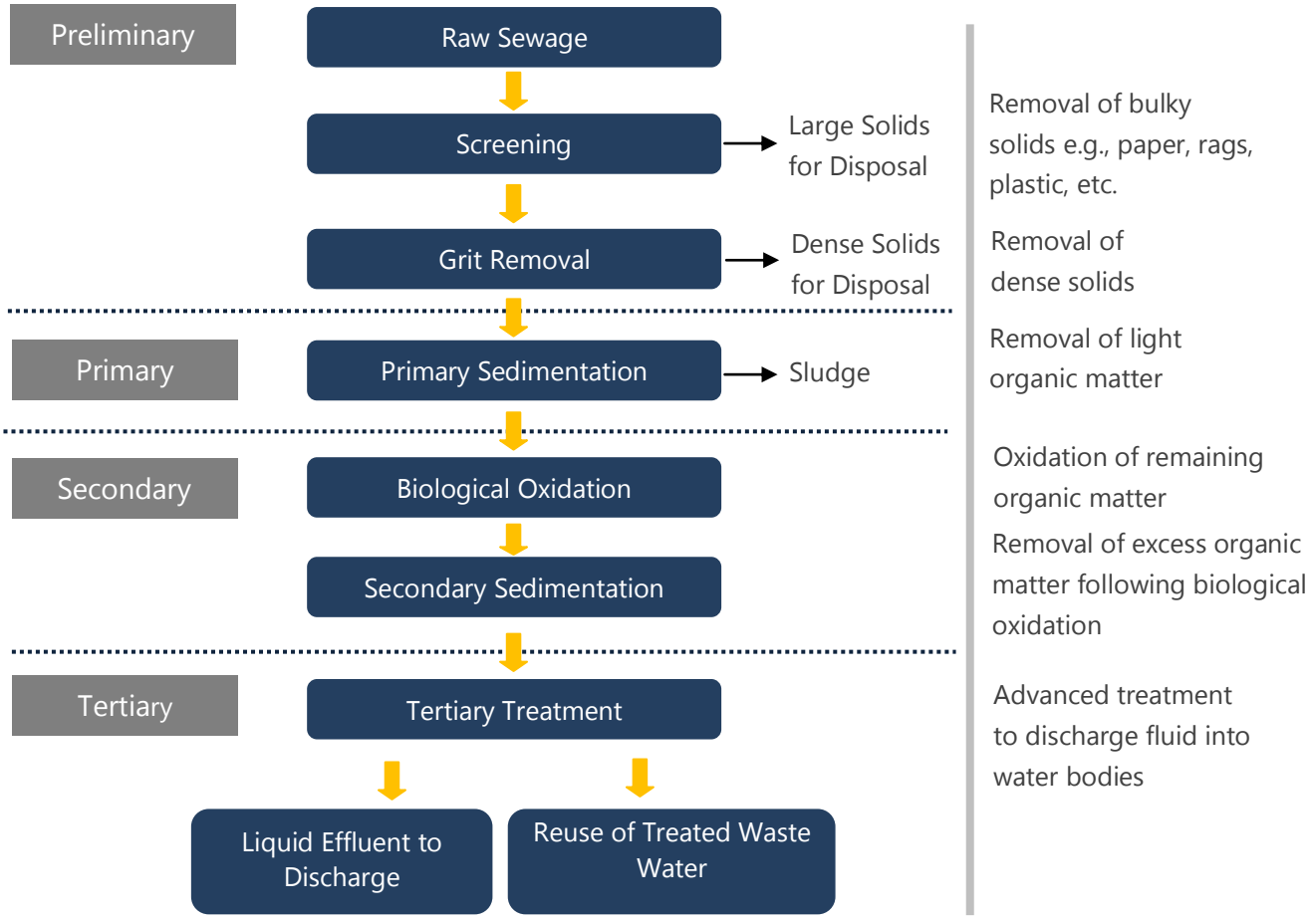
Step 1	Calculate the amount of water consumed, based on the SPS *If SPS is not used, a quick estimate would be to subtract the amount of water lost due to physical losses from the total amount of water produced.*
Step 2	Calculate 80% of the total water consumed (from step 1). This is the amount of current sewage generation.

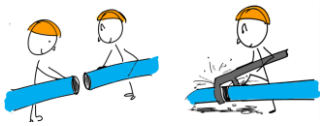
II.5 Extent of Sewage Treatment



Sewage needs to be collected, transmitted, treated and reused to the extent possible. A quick understanding of the different levels of sewage treatment is given in the Exhibit 8.

Exhibit 8: Waste Water Treatment Process



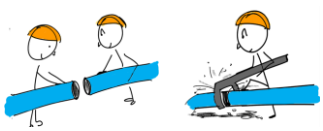


However, in order to arrive at the extent to which waste water should be treated, a few factors need to be considered. A ULB can choose to treat sewage till the primary, secondary or tertiary level. Exhibit 9 gives a list of these factors to be considered while deciding the level of treatment. The degree of sewage treatment required increases based on three basic parameters such as the legal discharge standard, extent of reuse of sewage and the quality of sewage.

The three parameters are directly correlated with the type of sewage treatment. i.e., a tertiary level of treatment may be chosen if the legal water discharge standards are high, there is a need to constantly reuse the sewage to meet increasing demands of water and the water is highly contaminated such that advanced treatment is necessary before a pollution crisis occurs.

Exhibit 9: Factors Affecting Degree of Sewage Treatment

	Preliminary	Secondary	Tertiary
Legal Discharge Standard	Low	Medium	High
	Higher the standards set by the pollution control board; the higher is the level of treatment required.		
Degree of Reuse Required	Low	Medium	High
	If the city is located in a district with scarce water resources, then there must be a greater emphasis on reuse of water.		
Degree of Contamination of Water	Low	Medium	High
	City with high levels of industrialisation may generate higher amounts of contaminated sewage, there by requiring advanced treatment.		
Existence of Market Linkages	No	Yes	Yes
	Apart from these parameters, certain other factors such as existence of market linkages and technical skills of households (for management of sewage services in case of a decentralised system) needs to be assessed. Cities with a potential market for sale of recycled sewage for various uses such as gardening, fire fighting, power generation must opt for treatment of sewage to the extent required for such purposes.		
Technical Skills Required by Households	Yes	No	No
	In case ULBs opt for a decentralised sewage collection and treatment involving management by households, then their respective technical skills for each type of technology and the treatment must be considered.		



II.6 Choice of Technology

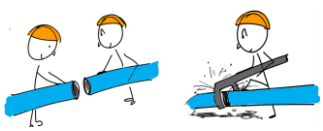


The choice of technology for waste water collection, transportation and treatment is based on the applicability of the geographical site/ location and the managerial capability of the ULBs and/or households. Exhibit 10 presents an analysis of the various technological options ranging from on–site treatment to off-site treatment.

Exhibit 10: Different Choices of Sewage Technology

	Leach Pits	Septic Tanks	Desludging Vehicle	Conventional Sewerage
Applicability	▪ Low to medium density areas (peri-urban) ▪ Enough plot to install pits and use the fecal/ digested sludge as fertilizers	▪ Partial treatment of sewage where conventional system is absent ▪ Micro-wet land to allow evapo-traspiration losses and moisture uptake	▪ High density informal settlements ▪ Used to collect and transport sullage to a treatment facility	▪ Highly urbanized areas to collect, transport, treat and dispose sewage
Management	▪ Installation done by ULB/ parastatal body ▪ O&M – households	▪ Installation and collection of septage done by ULB/parastatal body ▪ O&M – households	▪ Small – scale desludging operators (NGOs or small private entrepreneurs)	▪ Parastatal body/ ULB; some activities such as laying sewage network or operating the treatment plant may be outsourced to private sector
Limitations	▪ Households need to be educated ▪ Water may percolate the soil surrounding the pit and pollute ground water	▪ Upfront cost borne by the households ▪ Requires space for installation ▪ Regular O&M if tanks are insufficient	▪ Regulation of transportation of sewage (prohibit from disposing into open drains) ▪ Suction pumps may have low absorption capability	▪ Requires high O&M costs

On – Site → **Off – Site**



II.7 Selection of Operational Model for Sewerage System

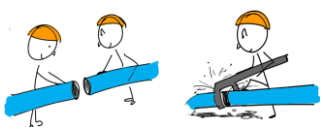
II.7.1 Comparative Analysis of Centralised & Decentralised Systems

Centralised System	Decentralised System
▪ Single system of collection, transmission and treatment of waste water from several communities ▪ Common treatment plant with high capacity and advanced technology ▪ High – cost intensive approach ▪ Usually for tertiary treatment where large volumes of waste water generated needs to be treated and reused	▪ Treatment of small volumes of water generated by various institutions (Cluster/ onsite system where waste water is treated by an individual household/ a group of dwellings located close to each other) ▪ Use of technology: septic tanks or aerobic units ▪ Low cost approach ▪ Usually used for primary treatment / sedimentation/ removal of sludge

II.7.2 Why and When to Select a Decentralised Model?

- Saves money as deciding on a preventive strategy (assessing communities needs) helps to manage waste water before a sewage crisis occurs
- Enables better water resource management by not transferring large volumes of waste water generated from different sources to a common treatment plant
- A cost-effective mode of sewage treatment for communities who cannot afford to pay for sewerage systems with advanced technologies
- Applicable in regions with low populations/ individual houses rather than highly populated urban areas with high rise buildings
- Appropriate for varying site conditions, including ecologically sensitive areas. The treatment methods can be effectively customised to suit regional conditions

Annex A.6 presents details of an on – site decentralised sewerage system

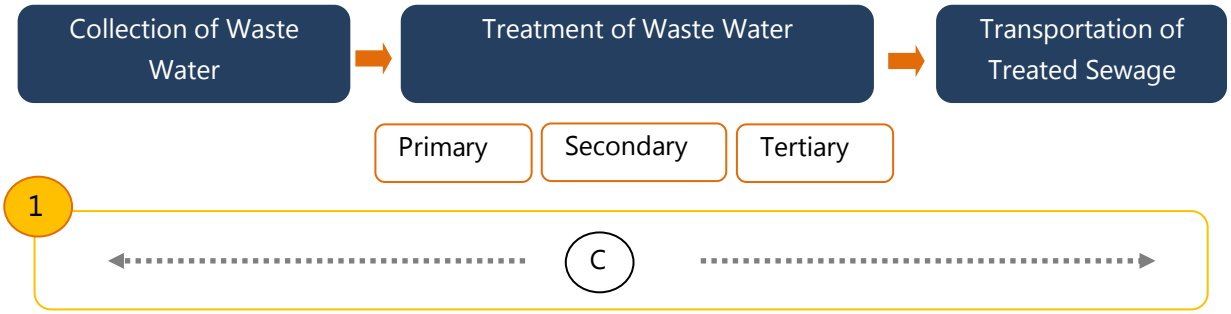


II.7.3 Combinations of Centralised & Decentralised Systems

The selection of a centralised or a decentralised system depends on three broad parameters:

Economic	Technical	Social
▪ Financial cost ▪ Income levels of community ▪ Market linkages for reuse of treated sewage ▪ sewage	▪ Geographical site conditions ▪ Parameters that influence the level of treatment and technology	▪ Population size ▪ Willingness to pay ▪ Support from community ▪ Ability of the community to manage sewage treatment

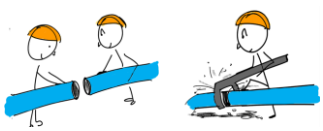
Exhibit 11: Various Models of Centralised and Decentralised System



In option 1, the entire value chain of sewerage system is operated and managed by a single entity and as a single integrated system. This single entity could be the ULB or a private player; which is responsible for collecting waste water through sewage connections and sewer mains, treating the sewage at the common site and distributing it for further reuse. Such models are conventional sewerage models, usually found in cities where there is a huge potential for sale of sewage and hence the ULBs can meet with the high costs requirements of underground pipelines, advanced treatment and technical staff.



In option 2, the collection of sewage is conducted at different locations (e.g., ward wise), by different set of entities. The collected sewage from various locations is then transmitted to a common treatment plant where a single entity is responsible for treating and distributing recyclable water.



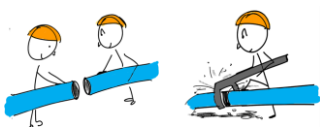


In option 3, the collection of sewage and its primary treatment is conducted in a decentralised operational mode. This approach is usually adopted in small towns where individual households are responsible for preliminary treatment of sewage by installing septic tanks. These tanks are also operated and maintained by them. The primary treated sewage is then collected from the household sites to a common treatment plant for further treatment and is then distributed to nearby industries for reuse.

In the fourth option, the collection and treatment of sewage up to secondary level is undertaken by several entities by dividing the city into several wards/ zones where as the tertiary treatment and transmission of recycled sewage is carried out by a single entity. Usually a different private player is allocated for each zone for secondary treatment of sewage after which it is transmitted into a common effluent plant, operated by the ULB or another private entity.

The last option is a complete decentralised system in which the entire value chain of sewerage system is broken down and handed over for operations to different entities at different locations of the city. Such a model includes treatment and reuse of sewage at the source of generation. Mini – sewage treatment plants are installed in apartment complexes and commercial centres where in the sewage collected is treated to the extent possible and reused for gardening, flushing toilets, etc. This model avoids constructing of underground sewerage system, reduces costs of operating and maintaining large treatment plants and keeps the water loop closed within the vicinity.

Decentralised (D) Centralised (C)



II.8 Stakeholder Management

Need

Stakeholder management at both pre and post award of project is critical for successful implementation of the project. In a socially sensitive sector like urban water supply and sewerage, the stakeholders are many with varied perceptions and interests in the way waste should be managed. Stakeholder expectations could be better managed if the decision making process is representative of these varied interest and is inclusive and participatory.

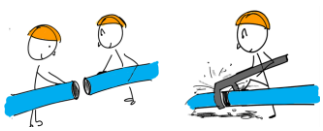
The first step for the ULB in this regard is to identify all relevant stakeholders. Exhibit 12 displays broad categories of stakeholders in UWSS projects. The second step is to identify and list expectations of each stakeholder and group together stakeholders that have common expectations. Please refer to Exhibit 13.

Exhibit 12: Identification of Stakeholders

Community	Private	Government
Informal Water Vendors	Service Provider	ULB Council
Resident Welfare Associations	Financier	Parastatal Bodies
SHGs/NGOs/CBOs		State/Central Government
Project Affected Community		

Exhibit 13: Pre and post-award expectations of stakeholders

	Community	Private	Government
Pre-Award Expectations	▪ Participatory Decision Making ▪ Project Approval ▪ Willingness to Pay ▪ Addressing Concerns	▪ Robust Procurement System – Transparent and Efficient ▪ Clarity in Project Scope ▪ Community Support	▪ Robust Procurement System – Transparent and Efficient ▪ Compliance with National Water Policy 2012 /State Policy on Urban Drinking Water ▪ Competitive Procurement ▪ Value for Money
Post-Award Expectations	▪ Efficient and Timely Service ▪ Complaint Redressal ▪ Cleanliness and Hygiene ▪ Relief and Rehabilitation ▪ ULB Support	▪ Flexible Contractual Governance ▪ Political Support ▪ Timely Payment ▪ Robust Dispute Redressal Mechanism ▪ Community Support	▪ Achievement of SLBs ▪ Robust Dispute Redressal Mechanisms ▪ Stringent Monitoring and Reporting

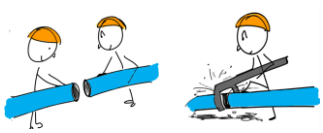


Section III: Project Procurement

Project Procurement

Procurement Options

Risk Sharing



III.1 Project Procurement

1 Identification

2 Approval

3 Financial Arrangement

4 Procurement

5 Monitoring

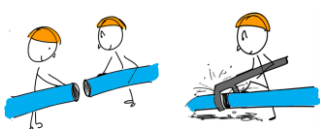
6 Post-award Governance

In the urban water supply and sewerage sector, the interplay of a large number of factors makes the choice of an appropriate procurement mode a challenging process demanding close attention. Some of the key parameters that a ULB must investigate before finalising the procurement mode are the socio-economic profile of citizens, financial health of the ULB, access to technology and environmental concerns.

This section provides a step by step approach to help ULBs adopt a suitable procurement mode.

The section begins with an overview of the two main procurement modes — i.e., public procurement and Public Private Partnerships, wherein their definition, features and limitations are listed.

Next, a set of key factors that influence the choice of a procurement mode is listed, followed by a competency framework that indicates different procurement options available to ULBs depending on their technical, managerial and financial capacity. The competency framework is supplemented by a risk sharing matrix that provides an overview of the various kinds of risks associated with different procurement options.



III.2 Procurement Options

Procurement Options

Public procurement and complete outsourcing of project through Design, Build, Finance, Operate, & Transfer (DBFOT) model of Public Private Partnerships (PPPs) are the two extreme alternatives available to ULBs. In recent times, PPPs have evolved as an important medium to meet the infrastructure or operational deficits of the ULBs. The features associated with these two modes are briefly outlined below.

III.2.1 Public Procurement



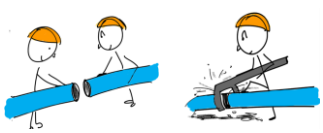
Public Procurement refers to the scenario where a ULB undertakes all aspects of project management, from project designing to project monitoring. In other words, once the project has been identified and approved, the key aspects of the project like project design, construction, financing, operations & maintenance and monitoring are done by the ULB by utilising government resources.

Features

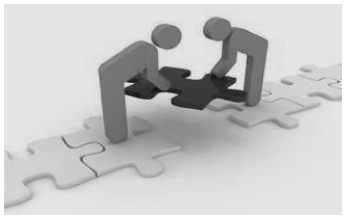
- Project cost is borne by the ULBs/ state governments
- Separate contracts awarded for different works – procurement of goods, works and service
- Higher risk retention by the ULBs
- Simple procedure/limited managerial expertise required for procurement process and project management
- Reduces the number of stakeholder consultations

Limitations

- No scope for sharing project cost
- Limited risk transfer to private sector
- Limited efficiency gains



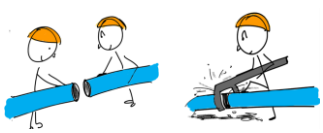
III.2.2 Public Private Partnerships



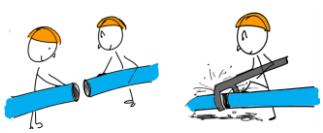
Here, the definitions of PPP as per the Draft National PPP policy and Draft Karnataka Infrastructure Development and Regulation Bill (2011) are presented.

Box 5: Public Private Partnerships

Draft National Public Private Partnership Policy, Government of India, 2011	'Public *Private Partnership refers to an arrangement between a government / statutory entity / government owned entity on one side and a private sector entity on the other, for the provision of public assets and/or public services, through investments being made and/or management being undertaken by the private sector entity, for a specified period of time, where there is well defined allocation of risk between the private sector and the public entity and the private entity receives performance linked payments that conform (or are benchmarked) to specified and pre-determined performance standards, measurable by the public entity or its representative'* [Draft National PPP Policy, GOI (2011)]
Draft Karnataka Infrastructure Development and Regulation Bill, 2011	*'Public Private Partnership (PPP) means an arrangement between government agency on one side and a private sector participant on the other, for the provision of public assets and/or related services for public benefit, through investments being made by and / or management undertaken by the private sector participant for a specified period of time, where there is a substantial risk sharing with the private sector participant and the private sector participant receives performance linked payments that conform (or are benchmarked) to specified, pre-determined and measurable performance standards.* [Draft Karnataka Infrastructure Development and Regulation Bill (2011)]



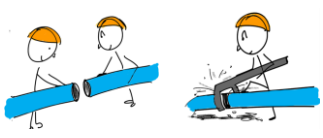
Box 6: PPP Types	
User-Fee based BOT Models	"*This refers to competitively bid concessions where costs are recovered mainly through **user charges** (in some cases partly through VGF from the government).*" [Draft National PPP Policy, GOI (2011)]
"In sectors/projects not amenable for sizeable cost recovery through user charges, owing to socio-political/affordability considerations, the government harnesses private sector efficiencies through contracts based on availability/performance payments. Implementing an annuity model will require necessary framework conditions, such as payment guarantee mechanism by means of making available multi-year budgetary support, a dedicated fund, letter of credit etc. Government may consider setting-up a separate window of assistance for encouraging annuity-based PPP projects. A variant of this approach could be to make a larger upfront payment (say 40% of project cost) during the construction period." [Draft National PPP Policy, GOI (2011)]	Annuity Based BOT Models
Performance based Management/ Maintenance Contracts	*"Under a management contract, a private party is paid a fee for managing an existing asset or business. Management contracts transfer limited responsibilities and risk to the private party. Performance based management contracts are 'output' based contracts and the payment made to private partner is measured on outputs reflecting the service quality levels. The service quality levels are pre-defined in the contract."* [Draft National PPP Policy, GOI (2011)]
"In traditional Design-Build (DB) contract, the private contractor is engaged for a fixed-fee payment on completion. The primary benefits of DB contracts include time and cost savings, efficient risk-sharing and improved quality. Government may consider a turnkey DB approach with the payments linked to achievement of tangible intermediate construction milestones (instead of lump-sum payment on completion) and short period maintenance / repair responsibilities. Penalties/incentives for delays/early completion and performance guarantee (warranty) from private partner may also be incorporated. Subsequently, as the market sentiment turns around these projects could be offered to private sector through operation-maintenance-tolling concessions." [Draft National PPP Policy, GOI (2011)]	Modified Design-Build (Turnkey) Contracts



Box 7: EPC Contract	
EPC Contract	*"An EPC agreement specifies the **required** design and performance standards and allows the contractor to design and construct the project using best practices and innovation to optimise on efficiency and economy as compared to the rigidity of the item rate contract that relies on a single design provided by the government. The contractor also has full freedom to plan the construction schedule for efficient use of its manpower, equipment and other resources while payments are linked to specified stages of construction as compared to payment for individual items/ units under the item rate contracts. Awarding contract for a **lump sum price** ensures predictability and financial discipline, both for the contractor and the government. Clearly stated obligations and risks of the respective parties help in achieving timely completion of the project while minimising the disputes."* (EPC Agreement for Construction of Two Lane National Highway Works, Ministry of Road Transport & Highways, GOI (2012)

To sum up, PPPs in general have the following features and limitations:

Features	✓ Allows ULBs to access private finance ✓ Brings together the strengths of both public and private sector ✓ Allows greater sharing of responsibilities ✓ Allows public sector to tap gains of innovation ✓ More effective risk management andcost control
Limitations	× A sustainable revenue model is a pre-requisite to incentivise private finance × Reduces accessibility as the issue of cost recovery may result in limited access to services by users × Exclusive rights to a preferred player may result in private monopoly (anti-competitive issues) × Demands highly capable governance mechanism to offer best value of services



III.2.3 Steps in Procurement

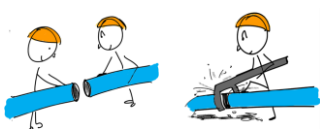


The choice of procurement is influenced by several factors. Institutional framework, political support, capacity of ULB and commercial factors are four key factors that should be considered.

To begin with, a ULB should undertake a pre-procurement analysis which includes a series of activities. These activities are described in Exhibit 14.

Exhibit 14: Steps in Pre-Procurement Analysis

Steps	Activity	Description	Reference Exhibit
1.	Review the Institutional Factors	It involves the following: ▪ Review of the National Water Policy (2012) and Karnataka Urban Drinking Water & Sanitation Policy (2002)	**15**
		▪ Setting up service standards ▪ [The Ministry of Urban Development has set service standards in the form of Service Level Benchmarks (SLB) that envisages their achievement over the long run. A ULB may prepare a road map that clearly indicates the target achievements on these benchmarks and other parameters, if any, for the short, medium and long run]	**16**
		▪ Based on the stipulations of the National Water Policy 2012, Karnataka Urban Drinking Water & Sanitation Policy 2002 and SLBs 1. Identify project features 2. Translate project features into required quantitative and qualitative resources 3. Identify gaps	**17 - 20**
2.	Assess Political Support	PPPs require strong political support. The ULB must gauge the extent of political support for PPPs in case the project requires private sector involvement	**…**
3.	Assess Competency and Risks Associated with Different Procurement Modes	Finally, the ULB should locate a suitable procurement mode based on availability / deficit of financial, technical and managerial resources	**21**

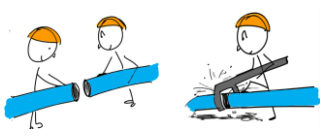


Step 1	Review the institutional factors.
Step 1.1	Review the National Water Policy (2012) and Karanataka Urban Drinking Water and Sanitation Policy (2002) to identify priorities and reforms outlined. These include orivision of 24*7 water supply, reuse of water and among others. For greater understanding of this, the Exhibit 15 gives a brief of the features of these policies.

Exhibit 15: Outline of Water Policies

National Water Policy 2012
Water to be charged after meeting pre – emptive uses of drinking and food security
Reuse of urban effluents from kitchens and bathrooms, after primary treatment, in flush toilets should be encouraged
Urban domestic water systems need to collect and publish water accounts and audit reports indicating leakages
Volumetric metering should be preferred
Water supply bills should include sewerage charges

Karnataka Urban Drinking Water & Sanitation Policy 2002
Regulation, monitoring and evaluation of the efficiency of operations
Encourage use of Public Private Partnerships
Tariffs be structured in a manner such as to disincentives excessive consumption and wastage of water, while ensuring at least a minimum "lifeline" supply to the poor
In the short term, subsidies would be provided and OpEx cost recovery should be encouraged. In the long term, ULBs must aim to cover CapEx
ULBs are encouraged to achieve 100% metering and volumetric pricing on long term marginal costs



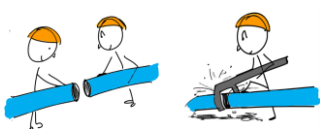
Step 1.2

Set standards for UWSS management

- The Ministry of Urban Development has set seventeen Service Level Benchmarks (SLBs) for the ULBs to achieve in the provision of water supply and sewerage services to the citizens
- Exhibit 16 lists the SLBs. Based on a realistic assessment of its strengths and constraints, a ULB could set standards to be achieved in the short, medium and long term

Exhibit 16: Service Level Benchmarks

Water Supply Parameters	SLB (%)
Coverage (individual tap connections)	**100**
Frequency of Water Supply	**24*7 hours**
Per Capita Supply	**135 litres**
Extent of Metering	**100**
Non Revenue Water	**20**
Collection Efficiency	**90**
Cost Recovery	**100**
Efficiency in Redressal of Customer Complaints	**80**
Quality of Water	**100**
Sewerage Management Parameters	**SLB (%)**
Coverage (Sewerage Connections)	**100**
Sewage Collection Efficiency	**100**
Sewage Treatment Adequacy	**100**
Quality of Sewage Treatment	**100**
Reuse & Recycling	**20**
Cost Recovery	**100**
Revenue Collection Efficiency	**90**
Efficiency in Redressal of Customer Complaints	**80**



Step 1.3

Based on stipulations of National and State Water Policy and SLBs, project features are identified, a feasibility study to estimate resource requirement for the identified project features is undertaken and the gaps to gauge the areas for interventions is identified.

Step 1.3.1

ULB should list down the project features. An indicative list of project features is provided in Exhibit 17. The project features could include all or a combination of the following aspects:

- Method of providing tap connections
- Method of reducing NRW
- Method of metering
- Performing water audits
- Providing customer services

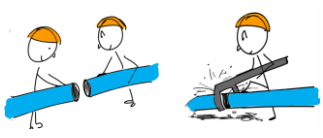
Exhibit 17: Indicative Project Features

1. 100% tap water connection
2. Remove illegal connections
3. 24*7 water supply
4. 135 lpcd water supply
5. Detect and repair leakages
6. Inclusive project – involvement of informal water vendors
7. 100% bulk and customer metering
8. Formation of district metered areas
9. Set up of customer service centre

A ULB can set project targets for immediate and short run based on resource constraints. This could be in the form of annual targets for household coverage, continuity of water supply, etc. Exhibit 18 provides an indicative template for targets to be achieved over the next five years.

Exhibit 18: Template for Immediate and Short Term Objectives

Targets	Year 1	Year 2	Year 3	Year 4	Year 5
Household Coverage (No. of zones/wards/households)	…	…	…	…	…
Frequency of Water Supply	…	…	…	…	…
Per Capita Supply of Water	…	…	…	…	…



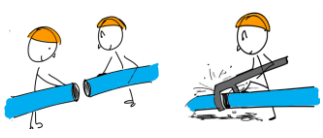
Step 1.3.2

Translate project features into the required resources.

- Conduct a feasibility study to assess the required financial (capital and O&M cost), quantitative and qualitative resources. Exhibit 19 briefly lists key quantitative and qualitative resources that would be required
- The quantitative resources would include assets, inventory and staff while the qualitative resources comprise technical and managerial skills

Exhibit 19: Quantitative and Qualitative Resources

Quantitative resources refers to availability of assets, inventory and staff Assets required for UWSS comprise pipelines, distribution networks, overhead tanks, customer services office, IT infrastructure for monitoring, sewage treatment plant, etc. Inventories required for UWSS comprise meters, leak detection machines, etc. Staff includes persons for different segments of the UWSS value chain – pumping water, managing NRW, collection of user charges, etc.	**Qualitative resources** refer to availability of staff with design, construction, operational, monitoring and financial management capabilities. Design includes technical skills to prepare lay outs for distribution lines, district metered areas, selection and use of appropriate technology for treatment of sewage and among others. Build includes the technical capability to construct appropriate infrastructure like over head tanks, repair leakages, etc. Operate includes operational planning, resource planning, regular service delivery, etc. Financial Management skills include estimation of project cash flows, revenue optimisation, improving cost efficiency, preparation of annual accounts and balance sheets, auditing, etc. Quality Control includes skills and tools to identify operational problems, monitoring of service delivery, setting benchmarks, etc. Staff Management includes human resource planning, performance appraisal, training need identification, etc.



Step 1.3.3

Identify gaps

Post assessment of the required and available quantitative and qualitative resources, a ULB may find that it needs to focus on either of the following:

1. Construct supporting UWSS infrastructure and build capacities to improve operation
2. Construct only supporting UWSS infrastructure
3. Improve only the operations

Exhibit 20 presents a snapshot of the various scenarios that ULBs may find themselves depending upon the availability of quantitative and qualitative resources.

Exhibit 20: Possible Areas for Intervention

Resources	Category	Sub-category	Resource Availability		
Quantitative Resources	Asset (A)		**Low**	**Low**	**High**
	Inventory (I)				
	Staff (S)				
Qualitative Resources	Technical Resource	Design (D)	**Low**	**High**	**Low**
		Construction (C)			
		Operations (O)			
	Managerial Resource	Financial Management (F)			
		Quality Control (QC)			
		Staff Management (SM)			
Intervention Required			**Status 1:** Construct supporting UWSS infrastructure and build capacities to improve operation	**Status 2:** Only construct supporting UWSS infrastructure	**Status 3:** Only improve the operations



Step 2

Once the ULB has identified the areas of intervention as shown in Exhibit 20, the next step is to gauge the political and community support for PPPs. If the ULB is not able to garner support from the elected representatives and the community, then the success of the project if undertaken through PPP would be adversely affected. Therefore, presence of the following enabling factors is crucial for successful implementation of PPP projects:

1. Political willingness and leadership
2. Political stability
3. Community buy-in
4. Staff support

ULBs that are likely to face resistance from staff need to have a mitigation strategy that could be in the form of relocation of staff to other services or departments.

Only those ULBs that meet the above listed criteria should consider PPPs as a possible procurement alternative.

Exhibit 21 provides procurement modes that may be selected by ULBs based on their financial, technical and managerial capability.

Step 3

This step consists of two actions.

Step 3.1

First, a self-assessment to evaluate ULB competencies must be conducted. The competency framework provided in Exhibit 21 provides a list of scenarios linking financial status (capital and operational), technical and managerial capability to procurement modes.

Second (Step 3.2), various types of risks associated with the identified procurement mode must be assessed and risk mitigation strategies must be created. (Please refer to Exhibit 22 for details).

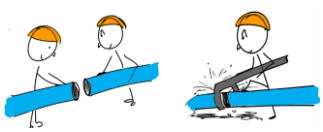
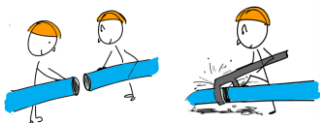


Exhibit 21: Competency Framework

Procurement Option	FUND																RESOURCES											
	CAPEX								OPEX								TECHNICAL						MANAGERIAL					
	IR		GRANT		VGF		LOANS		IR		GRANT		TAX		USER CHARGES		DESIGN		BUILD		OPERATE		FINANCE		QC		SM	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
1. PP																												
SCENARIO 1.1	■								■								■		■		■		■		■		■	
SCENARIO 1.2	■												■				■		■		■		■		■		■	
SCENARIO 1.3	■														■		■		■		■		■		■		■	
SCENARIO 1.4			■												■		■		■		■		■		■		■	
SCENARIO 1.5							■						■		■		■		■		■		■		■		■	
2. EPC																												
SCENARIO 2.1	■								■				■		■			■		■	■		■		■		■	
SCENARIO 2.2			■						■				■		■			■		■	■		■		■		■	
SCENARIO 2.3							■						■		■			■		■	■		■		■		■	
3. SERVICE CONTRACT																												
SCENARIO 3.1									■													■		■		■		■
SCENARIO 3.2													■									■		■		■		■
SCENARIO 3.3															■							■		■		■		■
4. MANAGEMENT CONTRACT																												
SCENARIO 4.1	■								■									■		■		■		■		■		■
SCENARIO 4.2			■										■		■			■		■		■		■		■		■
SCENARIO 4.3		■		■	■			■					■		■			■		■		■		■		■		■
5.BOT																												
SCENARIO 5.1		■	■			■		■		■		■	■		■		■			■		■		■		■		■
SCENARIO 5.2		■		■	■			■		■		■	■		■		■			■		■		■		■		■
SCENARIO 5.3		■		■		■	■			■		■	■		■		■			■		■		■		■		■

IR: Internal Reserves of the ULB. | Grant: A grant that is available to a ULB from external sources including state or central government | VGF: A Viability Gap Funding grant that is available to a ULB for financing only PPP projects | Loans: Loans for infrastructure projects that are available to ULBs from government/other agencies | Tax: Revenue generated by a ULB through property tax or any common tax | User Charges: Capability to generate revenue through levy of user charge or a fee in lieu of provision of UWSS services to citizens | Design: Capacity and capability to prepare plant layout, operational design, etc. | Build: Capacity and capability to undertake the required construction activities | Operate: Capacity and capability to undertake operations and carry out maintenance activities | Finance: Capability to manage financial aspects of project | QC: Quality control that includes capability to provide standard services, identify problems in advance and take remediation steps | SM: Staff capacity and the capability to manage human resources in a productive and efficient way |



1. Public Procurement

For a ULB to select public procurement as a mode of project implementation, it *must* have all the required technical and managerial resources. However, based on the ability to fund projects and availability of various financing mechanisms, it may fall under five possible scenarios.

After self assessment, if a ULB is seen to fit within scenario 1.1 to 1.5, then it may opt for Public Procurement

It is assumed that ULBs going for the public procurement mode have all the required technical and managerial capacities

Scenario 1.1

ULBs that have adequate internal reserves to meet the total project cost and also the operational expenditure during the project life

Scenario 1.2 & 1.3

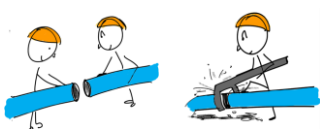
ULBs have internal reserves that are adequate to meet only the required capital expenditure and have buoyant tax revenues that would take care of the operational expenditure during the project period. The tax may be property tax or any other general tax that may or may not be levied in lieu of UWSS services provided to citizens. Alternatively, operational cost can be covered through user charges that are dedicated fee levied on citizens in lieu of provision of UWSS services. The potential cost recovery is estimated through willingness to pay surveys and takes into account the administrative capabilities of the ULB in improving collection efficiency.

Scenario 1.4

The ULBs does not have internal reserves to meet the capital and operational cost, but have access to external grants (central, state or others) to meet only capital cost. Therefore capital cost is met in the same way while the operational costs are met through user charges. The potential cost recovery is estimated through willingness to pay surveys and takes into account the administrative capabilities of the ULB in improving collection efficiency.

Scenario 1.5

ULBs do not have adequate internal reserves or access to grants to meet the project cost. Such ULBs may take loans from financial institutions provided that ULBs meet the borrowing criteria as laid by them. Here ULB should be in a position to recover the O&M cost through user charges.



2. EPC Contracts

It is assumed that ULBs adopting the EPC mode have the technical capacity only for undertaking the operations but have all the relevant managerial capacities

This option is suitable for those ULBs that possess the requisite managerial capability to operate and manage urban water supply and sewerage systems, but have a comparative disadvantage with respect to the design and construction of the same. However, the availability and source of funds for capital and operational expenditure is ULB specific. ULBs may choose to adopt an EPC contract under three possible scenarios.

Scenario 2.1

ULBs that are able to meet the capital cost through internal reserves and O&M cost through internal reserves, tax receipts or other sector specific user charges.

Scenario 2.2

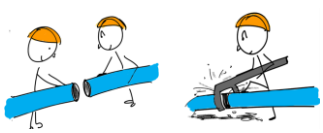
- ULBs do not have internal reserves but have access to external grants (central, state or others), e.g., JNNURM or Last Mile Connectivity Scheme
- ULBs meet O&M cost through internal reserves due to ongoing reformatory measures for cost recovery and hence have enhanced tax collection outlook
- Can meet O&M cost through user charges

The potential O&M cost recovery is estimated through willingness to pay surveys and takes into account the administrative capabilities of the ULB in improving collection efficiency

Scenario 2.3

This option is suitable for those ULBs that:

- Do not have internal reserves or access to external grants (central, state or others), e.g., JNNURM but can get loans from financial institutions.
- Can meet O&M cost through internal reserves due to ongoing reformatory measures for cost recovery and hence have enhanced tax collection outlook



3. Service Contracts

These types of contracts are suitable for those ULBs that are faced with capacity and capability constraints in operations, financial management, quality control and staff management. ULBs facing such constraints may vary in terms of availability and source of funds to meet payments that would accrue during the operations stage. ULBs may opt for service contracts under three scenarios:

It is assumed that ULBs choosing the service contract mode do not have adequate managerial capabilities and also lack technical skills required for carrying out operations

Scenario 3.1

- ULBs have internal reserves to make the fixed payments to the service operator

Scenario 3.2 & 3.3

- The ULB has high tax buoyancy or
- The potential to recover annual O&M costs through user charges

4. Management Contracts

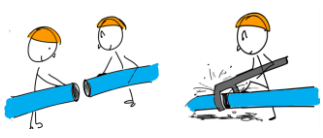
Management contracts are one of the simplest forms of PPPs which may be adopted when services rendered by the ULBs are inefficient and the ULBs do not have the capability and capacity to enhance them. They differ from service contracts for two reasons. First, it usually includes some amount of capital works such as rehabilitation of infrastructure. Second, the private operator may invest in a small proportion of the capital cost.

It is assumed that ULBs choosing the service contract mode do not have adequate managerial capabilities and also lack the required technical skills

These types of contracts are suitable for those ULBs that are faced with capacity and capability constraints in design, construction, operations, financial management, quality control and staff management. Since the scope of work may involve some rehabilitation and maintenance work, design and construction capability are required here unlike service contracts. ULBs facing such constraints may vary in terms of availability and source of funds to meet payments that would accrue during the operations stage. Accordingly, ULBs may opt for management contracts under three scenarios:

Scenario 4.1

- The required infrastructure for water supply and sewerage already exists within the city, but needs rehabilitation and maintenance
- The ULB is incapable of rehabilitating (either Brownfield or expansion) the water and sewerage works and operating and managing it



Scenario 4.2

- The ULB does not have internal reserves but has access to grants to meet capital cost
- The ULB does not have internal reserves or access to grant to meet fixed O&M cost but can meet O&M cost through internal reserves through ongoing reformatory measures for cost recovery

Scenario 4.3

- ULBs do not have internal reserves or access to grant to meet capital cost but have access to VGF (e.g., GOI) and meet the rest of the need through private finance (which is minimal in management contracts)
- ULBs do not have internal reserves or access to grant to meet fixed O&M cost but can meet O&M cost through internal reserves in future due to ongoing reformatory measures for cost recovery and hence have enhanced tax collection outlook

5. BOT Models

It is assumed that ULBs choosing the BOT mode have technical skills for project design but do not possess other technical and managerial capacities required for carrying out operations

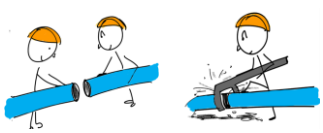
BOT models are long term concession agreements wherein the ULB lacks the capability and capacity to build and operate water supply and sewerage works. It also may not have enough financial resources to finance the entire project cost. In such a case, the ULB may invite a private entity to address the financial, technical and managerial gaps.

Scenario 5.1, 5.2 & 5.3

- ULB can source a part of capital cost through any of the three sources – centre/state grant, VGF or loan
- The remaining capital cost is financed by the private player who also brings in technical and managerial skills required for construction, operation and maintenance of the project

There are variants of the BOT mode such as the BOT Toll, BOT Annuity, DBFOT, etc. that allow greater sharing of risks with the private entity. The various kinds of risks associated with selected procurement mode are assessed through the risk sharing matrix provided in Exhibit 22.

Once a particular procurement mode is identified, a value for money (VfM) analysis is undertaken to establish the rationale for choosing PPP, if the selected procurement mode is PPP.



III.3 Risk Sharing Framework

Exhibit 22 indicates how various types of risks are shared between ULB and private sector as the nature of procurement changes from public to PPP. Under the public procurement mode, the ULB/ implementing agency bears the all risks associated with a project. An EPC contract, allows the ULB to park the construction risk with the private entity while retaining all other risks, i.e., those associated with design, innovation, project scope, operations, revenue & financial (if not contracted out), and force majeure, among others. Service contracts allow ULBs to assign operational risks to the private operator. Operational risk includes service delivery at set standards, accountability of service delivery, etc. Through management contracts, ULBs are able to broaden the scope of operational risk by including risks associated with carrying out maintenance works. In addition, the construction risk is also assigned to the private partner. As one moves further down the spectrum, through BOT contracts, ULBs can park the construction, O&M and financial risks with the private partner and only retain the political, legal, regulatory and residual risks. BOT contracts have two variants – BOT Toll and BOT Annuity. The difference between the two is that in the latter, the revenue risk (based on the demand and cost per unit) is borne by the ULB while BOT Toll allows ULBs to share even the revenue risk with the private partner.

Exhibit 22: Risks in Project Procurement

Types of Risks

Option	Procurement Mode	POL	CON	O&M	L&C	REV	FIN	FM
1	Public Procurement							
2	EPC Contract			1		1		
3	Service Contract			2				
4	Management Contract		3			4		
5	BOT Annuity							
6	BOT Toll							

Legend

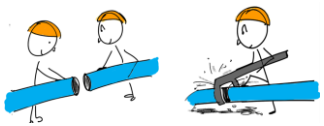
POL	Political Risk
CON	Construction Risk
O&M	Operational Risk
L&C	Legal & Contractual Risk
REV	Revenue Risk
FIN	Financial Risk
FM	Force Majeure Risk

[1] These risks are not applicable here as the procurement is not for O&M.

[2] The O&M risk in the service contract refers to operations & management and excludes maintenance.

[3] Management contracts may include a portion of capital works which is usually in the form of rehabilitation of existing infrastructure (brown field projects) or expansion of current system to meet incremental needs. Although the construction works are limited, the risks associated with it are assigned to the private partner.

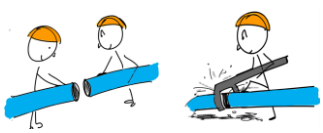
[4] In a few instances, revenue risks may be bundled with O&M risks and in such cases, the revenue risks are also assigned to the private partner. The case of Latur water supply project is one such example where Latur Municipal Corporation assigned revenue risks to its private partner.



Section IV: Project Monitoring

Importance of Project Monitoring

Methodologies for Project Monitoring



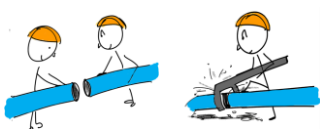
IV.1 Importance of Project Monitoring



Monitoring of the performance of the services offered by a project is essential to a host of stakeholders. The common interest for the service providers, users, financiers and government would be improved service delivery over time. The Exhibit 23 gives a list of reasons that justify the importance of monitoring and performance management and the benefits that accrue to stakeholders.

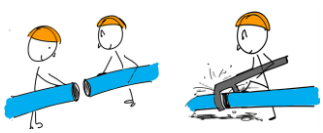
Exhibit 23: Importance of Project Monitoring for Stakeholders

Stakeholder	Importance/ Relevance
Utility/ Service Providers	▪ Provides an analytical platform for benchmarking process periodically and compare performance with other utilities ▪ Self – assessment of the performance ▪ Justification for financial assistance requests ▪ Lays down the requirement for a strategic business plan
Monitoring Agencies/Regulators	▪ Regulate tariffs and water usage from various resources ▪ Comparative analysis of service levels of various utilities
Customers	▪ Increases accountability as redressal of customer complaints is more effective
Private Developers/ Financiers	▪ Comparative analysis of performances of various utilities ▪ Focus on weaknesses, financial viability
Central Government	▪ Evaluate the performance of the sector across region, cities, states, country ▪ Provide a baseline for strategic planning



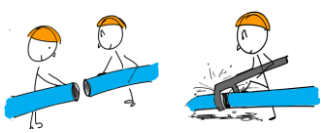
IV.2 Methodologies for Project Monitoring

Steps	Methodologies
Organise a Benchmarking Team	Establish a professional team with skills in engineering, technology, finance, utilities operations and processes
Identify Study Objectives	▪ Undertake a thorough review of the problems and opportunities ▪ Hold preliminary discussion with stakeholders to address issues in efficiency and finance
Selecting Benchmarking Methodologies	▪ Identify specific aspects of services to be benchmarked based on the extent to which data on inputs and outputs are available
Data Collection & Analysis	▪ Collect data ▪ Apply data verification procedures ▪ Check for a) missing data and b) accuracy (calculations/data errors) ▪ Perform data analysis such as developing performance indices or use of similar statistical techniques
Review Performance & Adopt Strategies for Improvement	▪ Identify weak points that hinder the utility from achieving the target ▪ Devise a plan for the next phase to achieve goals ▪ Create a mechanism for frequent review of the performance based on the indicators/parameters and their respective targets



Section V: Community Involvement

- Degree of Community Involvement
- Planning and Project Identification
- Management of Services
- Community Involvement for Monitoring





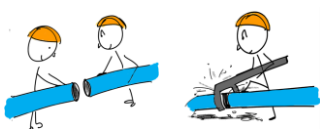
Anecdotal evidence from various PPP projects in social infrastructure projects reveals that involving the community at various stages of the project is a critical pre-requisite. For example, in the Alandur Sewerage Project, the community was involved by the local body right from the initiation stage of the project. The design, scope and expected outcomes of the project were shared with citizen representatives. Owing to the pro-active steps taken by the government to involve the community at the project conceptualization stage, the project secured an upfront capital investment of 30% of the total project cost from the citizens.

A similar initiative in Latur, Maharashtra was undertaken through collaboration between the Maharashtra Jeevan Pradhikaran (MJP) and the Latur Municipal Corporation (LMC). The two government entities contracted out the distribution and customer services aspects of water supply to a Special Purpose Vehicle (SPV) for 10 years which was owned by a private entity. A tripartite agreement among the MJP, LMC and the private entity was signed. Effective communication to the local citizens about the project need and adoption of pro–poor strategies such as providing shared household connections to slum population played an instrumental role in the success of the project. Similar strategies were also adopted by the KUWASIP model. This has established the need to develop frameworks for involving the community at various stages of the project.

V.1 Degrees of Community Involvement



There are varying degrees of involving the community in a project. This may depend entirely on project design, willingness of the implementing agency to involve people, co-ordination between them and the local citizens and capability as well as capacity of the community to be a part of the project. On the whole, there are four different degrees of community participation and it ranges from mere information dissemination from the agency to being an entirely community – driven project.



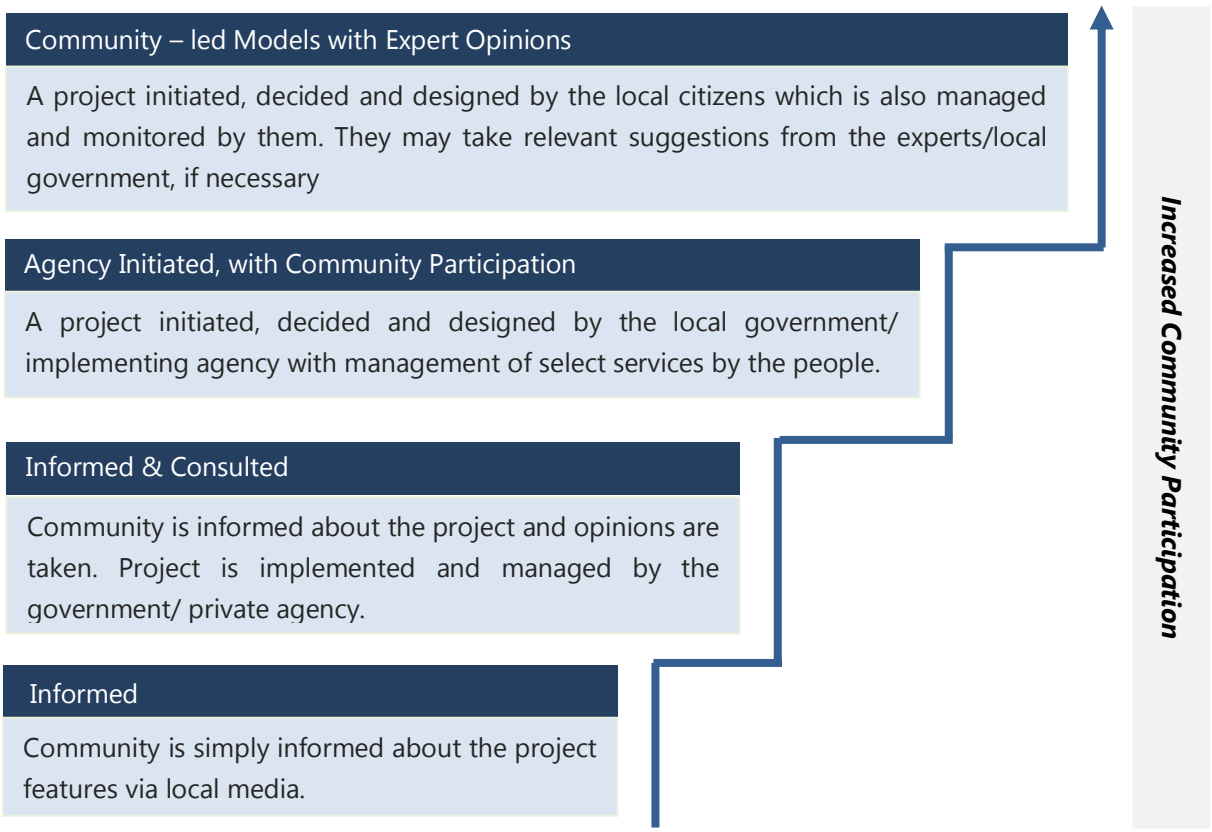


Exhibit 24 describes the flow of information between the community and implementing agency. The first step involves a unidirectional flow of information from the community to the government agency, which is in the form of complaints on services and various consultations. At the next level information may flow from the implementing agency to the community where in the agency informs the local citizens about the scope of the project and its outcomes. The last one is an interaction between parties or a two way flow of information in the form of consultations and feedback.

Based on these aspects, community involvement may be sought in the:

- Planning and design process
- Management of operations and services
- Monitoring of projects/ utilities.

The next section focuses on how to involve the community for the three identified categories, namely planning, management of services and monitoring. It also provides sample techniques and tools that are used for community mobilisation and training, accompanied by respective case studies and examples.

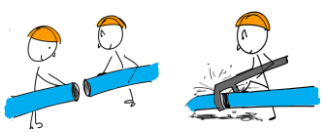
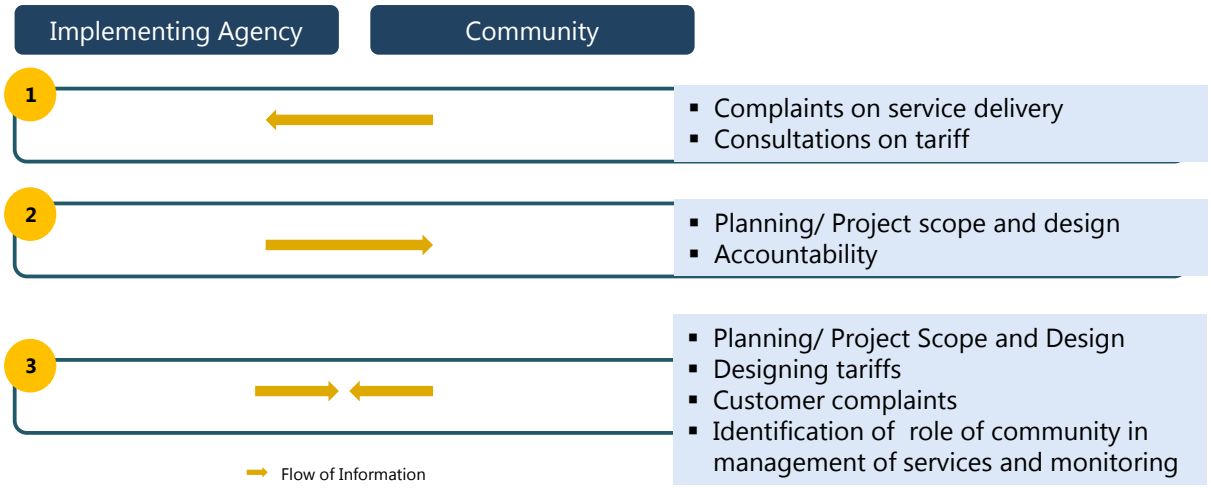


Exhibit 24: Flow of Information between Community and Implementing Body



V.2 Planning and Project Identification

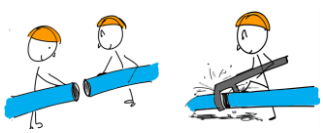


Community may be involved in this phase for getting community buy-in, establishing the need for the project by taking public opinions and for assessing the willingness to pay quotient. Following are the detailed steps to be followed to facilitate participatory decision making:

Steps	Methodologies

Initiating the Process	▪ The implementing agency must have clarity on the project features and their expectations from the community. This could involve:
	  ▪ Transfer of information about project details
	  ▪ Getting community – buy in
	  ▪ Taking opinions on project design and implementation
	  ▪ Understanding the needs of the local citizens, including the urban poor through the use of process/ tools such as focused group discussions, use of local media, kiosks, street plays, etc
	▪ Design survey templates and, questionnaires (as required)
	▪ Design a work plan to carry out the participatory planning process
	▪ Engage with a local NGO (if required)

Create Awareness	▪ Mobilize people by communicating events planned for participatory process. This could be done via posters, radio announcements, gathering community leaders involved in water supply and sanitation (if any), etc ▪ Organise formal meetings that include the citizens, community leaders, slum population and other stakeholders ▪ Disseminate information about the project. Create awareness about the need for the project, its features and expected outcomes
Get Inputs from the Community	▪ Divide the area for project implementation into wards/ divisions ▪ Perform needs assessment in every ward ▪ Identify prioritises, i.e. issues in current services of water supply that need highest attention for each ward ▪ Obtain feedback on the relevance of the proposed project

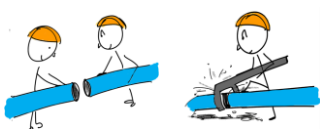


Information Gathering	▪ Gather information from the meetings and FGDs ▪ Match the inputs on the project gained from the people with the objectives that the proposed project seeks to achieve ▪ Re-design project as per needs assessment
Further Consultations & Final Decisions	▪ Discuss the re-structured projects with the local citizens to take final inputs ▪ Create a vision for the community and address the objectives and strategies of the project from both long and short term perspectives ▪ Provide an action plan to the citizens on the same

Box 8: Participatory Decision – Making Process for Urban Planning in Kitale, Kenya

Practical Action (UK and Eastern Africa) in partnership with the Municipal Council of Kitale undertook a project using the Sustainable Livelihoods Approach and Participatory Urban Appraisal. The project activities sought to help poor women, men and children living in informal settlements to identify their development priorities, and prepare spatial and settlement specific neighbourhood plans. The participatory planning process involved the following stages:

1. Community Mapping: Detailed listing of all community infrastructure facilities and services
2. Data verification and validation: The data collected and analysed from first stage was communicated to the citizens for their further feedback. This was done via house- to-house survey and focus group discussions
3. Community vision and action plan: The discussions with community regarding the issues were transformed into a short term vision, which were further converted into strategies, programmes and activities
4. Evaluation: These programmes were discussed further with community leaders to get their inputs, create realistic frameworks, look for alternative options and design the work plan



V.3 Management of Services



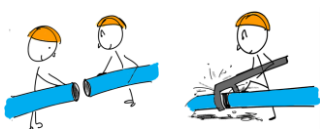
Community can participate in managing the services when a decentralised approach has been attempted in implementing the project. Community management goes beyond mere participation or consultation and engages with the citizens to:

- Enhance efficient delivery of services
- Promote greater democracy and equity in the development process
- Promote a more prominent role for women in development
- Ensure more appropriate choices of technology and service level
- Reduce the costs to agencies by making better use of local resources, skills and knowledge
- Build community confidence and capacity to undertake further development activities

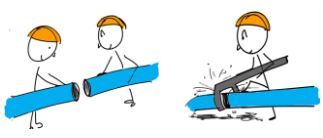
Community management usually comprises of three basic components:

1. **Responsibility**: Communitytakes ownership of the assets created and is obliged to perform services that are needful to the beneficiaries[vi]
2. **Authority**: The community is authorised to take decisions on behalf of the consumers
3. **Control**: Community evaluates outcomes and gathers opinions from the people

Based on the comparative advantage of the citizens to operate water works, areas for management need to be identified, training must be provided and mechanism for monitoring their performance must be created. The steps below provide the methodologies for the same.



Steps	Methodologies
Identification of Areas	Identify community – based organisations that are willing and capable to manage water supply and sewerage facilities and hand over specific aspects of the project to them. Some of the areas where community involvement is required include: ▪ To frequently interact with the implementing agency to ensure that the interests of the community is well represented and accommodated for in the project ▪ To organise contributions by the community, in cash or kind, towards construction, and towards operations and maintenance ▪ To manage the staff responsible for proper operation and maintenance ▪ To keep accurate records of all payments and expenditures ▪ To promote hygienic and effective use of the new facilities ▪ To hold regular committee meetings to discuss and decide on issues, procedures, and problems
Community Staff Planning	▪ Clearly state the roles and responsibilities of the community members at every phase of project implementation ▪ Identify the pre-requisites of the community staff to qualify for project management (qualifications, skilled labour, past experience, ability to read and write in local language, etc.). For example, fluency in speaking, reading and writing the local language, twelfth standard pass, basic knowledge of computers
Assess Community Readiness for Contribution	▪ Conduct a quick survey to identify the list of households willing to contribute labour ▪ Create incentives for households to increase contribution, such as: o Fixed weekly remuneration per person for doing certain works o Households may be given a discount on user charges for contributing labour o Below Poverty Line (BPL) households may be allowed to pay for water connections in monthly instalments, for contributing labour

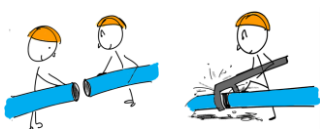


Provide Training & Allocate Roles	▪ Design manuals to equip citizens/communities with the required knowledge/tools to operate and maintain assets ▪ Conduct field visits/ on – site training where community managed projects have been successful
Monitoring & Evaluation	▪ Create a list of indicators for evaluation of performances for all community managers under each role. For example, ▪ Attendance ▪ Regularity in reporting ▪ Number of leakages fixed in a month ▪ Improvement in tariff collection efficiency ▪ Design a framework for carrying out monitoring and evaluation activities

Box 9: Community Involvement for Integrated Urban Water Management in Mulbagal

Arghyam, in 2007 initiated a project in the town of Mulbagal, Karnataka with approval from various governments and in association with several partner organisations. The project was designed and implemented, based on the principles of Integrated Urban Water Management. This approach included the features of participatory methods, source-to-sink planning and sustainable interventions. This was carried out in several phases, as shown in the annex A.4. Following were the outcomes of its implementation:

- Community toilets were repaired and management of four of these was given to the community, with rest handed over to the ULB. A care taker was trained and employed by the citizens and was paid a small fee for usage of the sanitation services.
- A new local group called *Nirmala Balaga* was formed to undertake solid waste management activities for 750 households
- A defunct rain water harvesting system was repaired and is now managed by the school
- Water transfer from the pumping station to the reservoirs was maximised with optimal consumption of energy and limited investments
- An ancient temple tank was cleaned by the citizens, which now is a source of ground water for the people



V.4 Community Involvement for Monitoring

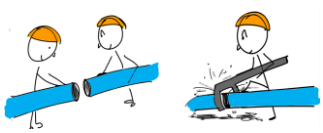


Ward level committees/ Resident Welfare Associations can be formed to monitor and regulate water supply and sewerage operations. Existing NGOs/ CBOs could be engaged too. In order to equip community groups to effectively monitor project outcomes a set of capacity building activities must be undertaken. Also to ensure that the responsibilities vested with the community are delivered well, a clear set of selection criteria to identify the right local partner must be laid, a set of performance indicators must be identified and assessment methods must be outlined. Some of these aspects are briefly described below:

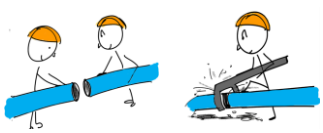
Steps	Methodologies
Identification & Procurement of Local Partners	Refer to the section on selection of a partner organization in annex A .2.

Create Local Committees	▪ Form community groups based on zones/ streets/number of households/location/etc.
	▪ To select the representative members of these community groups, the following factors should be considered:
	  ▪ Inclusion of the poor, disadvantaged and women
	  ▪ Prior knowledge and experience in identifying and tackling issues pertaining to water supply and sewage
	  ▪ Two strong leaders (for about 50 households) that are recognised by the people
	  ▪ Strong interest, commitment, acceptance by people, transparent and willingness to be accountable for providing monitoring services

Identify the Monitoring Indicators & Formulate a Work Plan	▪ Create a list of indicators that these representative members must monitor (refer to annex A.6)
	▪ Devise a work plan that must be followed by the representative members. The work plan must include:
	  ▪ Role of the leaders
	  ▪ Frequency of monitoring (once a week, twice a month, etc)
	  ▪ Methods of monitoring
	  ▪ Reporting to customer redressal unit or the ULB
	  ▪ A mechanism to convey changes or any updates from the ULB to the members

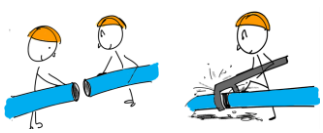


Provide Training	Design training material on methodologies to monitor the indicators. This could include: ▪ Conducting focused group discussions and meetings ▪ Going for transect walks ▪ Holding community/ door–door interviews ▪ Mapping public drinking water stations and kiosks ▪ Devising methods for data collection and analysis
Reporting	▪ The representative community members should be responsible for regular reporting of the data collected, insights generated and issues identified ▪ The leaders may take action on potential solutions independently and report it to the ULB ▪ Any public grievances, inefficiencies in service delivery, etc should be reported



A: Annexes

- Cost Estimates
- Questionnaires
- Case Studies
- Participatory Planning Approaches
- Monitorable Targets
- Mini Sewage Treatment Plants
- Water Balance Easy Calculator



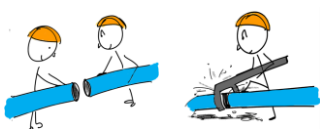
A.1 Questionnaires

A.1.1 Stated Preference Survey

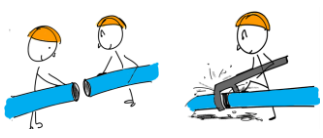
The objectives of this exercise should be to get total household water consumption details and generate answers to the following questions:

- What are the sources of water?
- How much water is consumed?
- What is it used for?

A. Details of The Respondent	Name of the Respondent: Household Family Name: Household Address: Household Contact Number:
B. Details of the Household Members	1. Name: Age: Gender: Employment: 2. Name: Age: Gender: Employment: ---------- (* number of family members)
C.1. Piped Water Connection	1. Do you have piped water connection? □ Yes □ No 2. Is it a shared connection? 3. How many tap connections are there within the house? 4. What is the frequency of water? ____ number of days per week 5. What is the continuity of water supply? ____ hours per day 6. How is the quality of water supply? □ Very Good □ Good □ Bad □ Very Bad Any Comments: _____ 7. What is the number of buckets filled (if any)? 8. What is the size of buckets filled (if any)? 9. What are the uses of water supplied?



C.2. Informal Water Vendors	1. Do you buy water from informal vendors? □ Yes □ No 2. How many litres do you buy? ____ per day / ____ per week 3. How many times a day/ week does the water vendor visit the locality? 4. Do you stand in queue for it? If yes, when and how long? 5. How is the quality of water supplied? □ Very Good □ Good □ Bad □ Very Bad
C.3. Borewell/ Tube Well/ Public Stand Posts	1. Do you rely on other sources of water? If yes, which of these: □ Borewell □ Tubewell □Public Stand post □ Others _____ 2. How many buckets of water do you fill from these sources? 3. What is the size of the bucket? _____ litres 4. How far is this source of water located? _____ kms. 5. How is the quality of water? □ Very Good □ Good □ Bad □ Very Bad 6. How long do you stand in the queue?____ hours 7. What is the frequency and continuity of water supplied? ____hours per day and ___ days per week
D. Water Consumption	What is the approximate amount of water consumed daily and from which source for each of these uses? **Amount (in litres) Source** 1. Drinking 2. Cooking 3. Washing Clothes 4. Washing Utensils 5. Bathing 6. Others (gardening, car washing, etc)
E. Comments	Other Comments by the Respondent: _____

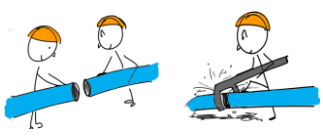


A.1.2 Willingness to Pay Survey

The Willingness – to – Pay (WtP) Survey can be an extension of the Stated Preference Survey. Both these surveys could be conducted together for each household, unless there are two different sets of sample population identified.

As for this template, sections A, B, C and a part of D remains common. Further elaborations have been made to the questionnaire.

D. Water Consumption	**SAME AS IN A.I.1 + Additional Questions** 1. Do you have enough water for the above mentioned purposes? □ Yes □ No 2. How do you manage to make up for the shortage of water supply? _____ 3. Would you prefer piped water connection to other sources? □ Yes □ No
E. Sewage Connection	1. If you have piped water connection, then is it linked to the sewage pipeline? □ Yes □ No 2. If you use other sources of water, then where is the waste water generated? □ Yes □ No 3. Do you have any mechanisms for primary waste water treatment? □ Yes □ No If yes, which of these? □ Septic Tank □ Building based Mini Sewage Treatment Plant □ Others
F. Details of Other Utilities & Facilities	1. Do you have electricity at home? □ Yes □ No If yes, how much do you pay for it monthly? Rs.____ 2. Do you have electronic appliances at home? □ Yes □ No If yes, which ones and what is the date of purchase? **Date of Purchase** 1. Television 2. Fridge 3. Washing Machine 4. Computer



1. Do you have a vehicle at home? □ Yes □ No

If yes, give details and date of purchase?

	Model	Date of Purchase
1.	Car	
2.	Scooter	

2. Do you have a Bank Account? □ Yes □ No

G. Willingness to Pay

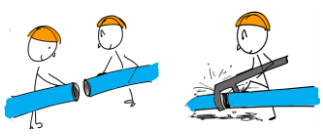
1. Can you estimate the amount spent on water consumption? Rs. ____ per month
2. What is the monthly household income?
3. If the coverage of water supply is expanded to install a piped connection in your household, how much would you be willing to pay?

Note: A slab could be provided to make this question more precise

	Water	Sewage
a)	Initial instalment (Rs. Per connection)	
b)	Water consumption (Rs. Per litre)	
c)	Reuse/ recycle (Rs. Per litre)	

	Water (Rs. Per litre)	Sewage (% of total water bill)
< 8KL	30	5
8 – 25 KL	45	10
25 – 50 KL	60	15
> 50 KL	75	20

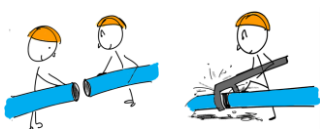
4. What are the reasons for not being able to afford the piped connection?
5. Do you have preferences other than individual tap connection?
   - □ Group tap connection
   - □ Hand pump per street
   - □ More number of public stand posts
   - □ Others _____
6. How much would you pay per month for any of the sources chosen in question 5?
7. Any other comments _____



A.2 Participatory Planning Approaches

A.2.1 Focus Group Discussions

What is a Focus Group?	A focus group is a small group of **six** to **ten** people led through an open discussion by a **skilled moderator**. The group needs to be large enough to generate rich discussion but not so large that some participants are left out.
Nature of Group	**Homogenous** group of participants is required. It reduces conflicting interests amongst varied groups and provides an atmosphere for free voices.
Time Required	The ideal amount of time for a focus group is anywhere from **45** to **90** minutes. Beyond that most groups are not productive and it becomes an imposition on participants' time.
Number of Questions	Focus groups are structured around a set of carefully predetermined questions – usually **no more than 15** – but the discussion is free-flowing. Ideally, participant comments will stimulate and influence the thinking and sharing of others.
Number of FGDs	Usually **three** to **four**! You'll know you've conducted enough FGDs (with the same set of questions) when new inputs/feedback/opinions are not generated, i.e., more discussions are adding less incremental value.



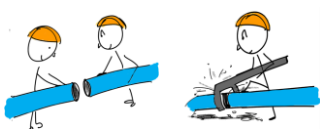
A.2.2 Selection of a Partner Organisation/ Local NGO

Issue Tender	▪ Design the scope of the work for the partner organisation
	▪ Advertise the tender via local media
	▪ The tender must contain the following:
	  ▪ Prequalification criteria
	  ▪ Project design
	  ▪ Time line of the project

Evaluate Technical Proposal	▪ The interested organisations should have submitted the technical proposals including the strategy for carrying out activities, work plan and details of the identified experts ▪ The ULB must evaluate these proposals based on criteria and assign marks for the project approach, methodology and the experts
Evaluate Financial Proposal	▪ The organisations qualified for the technical proposal must submit their financial proposal ▪ The ULBs must themselves carry out the financial assessment and prepare a shadow bid ▪ This shadow bid shall be used as a criteria to select the final

Contract Agreement	▪ Evaluation committee shall finalise the terms and conditions under the project with the selected partner organisation and sign the agreement. This shall include:
	  ▪ Scope of work and deliverables
	  ▪ Payments to staff
	  ▪ Monitoring and evaluation of the activities carried out

Monitoring	▪ A thorough monitoring mechanism must be developed by the ULB to regulate the activities of the partner organisation
	▪ A few of ways could include:
	  ▪ A ULB representative accompanying the partner organisation on field visits
	  ▪ Submission of reports by the partner organisation



A.3 Cost Estimates



The Report on Indian Urban Infrastructure and Services prepared by the High Powered Expert Committee provides estimates of investments that are required for strengthening and maintaining the water supply and sewerage works. Below are given these assumptions and the investment requirements, which ULBs may refer to based on their size while preparing the financial structure of projects.

A.3.1 Water Supply

- 80% of distribution pipelines are to be replaced in all cities
- 45 lpcd of water storage is required
- Cost of metering and connection per household is Rs. 2500
- Service life of assets is 30 years

Exhibit 25: Per Capita Investment Costs for Water Supply (Rs. 2009-10 Constant Prices)

City Class Type	Production	Distribution (Rehabilitation/ Brownfield)	Distribution (Greenfield)	Annual O&M
IA	1487	1831	2030	797
IB	1482	2679	2914	613
IC	1404	3855	4520	491
II	1357	3200	3600	491
III	1282	6755	4619	368
IV+	1282	6755	4619	245

A.3.2 Sewerage

- 100% underground sewage network for all classes
- 100% collection and treatment of sewage
- 80% of water consumed is generated as waste water
- O&M costs for treatment is upto secondary treatment
- Asset life is 30 years

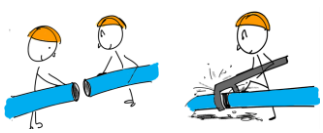


Exhibit 26: Per Capita Investment Costs for Sewerage (Rs. 2009-10 Constant Prices)

City Class Type	Network	Treatment	Annual O&M
IA	2092	1268	414
IB	2573	1268	373
IC	2338	1073	290
II	3246	2070	290
III	3637	2012	207
IV+	4636	2012	145

A.4 Performance based Management Contracts

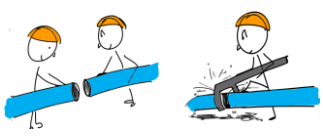
A.4.1 What are Management Contracts?

These contracts are short term managerial agreements between two parties (For example, state water board & ULB or, ULB & private operator), with defined roles and risk allocation. The contracting body acts a policy regulator and a monitoring agency where as the operator is the manager of the water service delivery. The operator is expected to bring in very minimal investments and high levels of operational expertise and offer services to the customers as detailed in the contract. The payments made to the operator in return for the services offered are linked to its performance, which are indexed to certain pre-determined targets. Bonuses or penalties may also be applied to these payments.

Exhibit 27 provides a sample organogram of a typical management contract of a water supply project. The state water board creates the capital works for sourcing, treating and transmitting water to the municipal bodies. The funds for these works flow from Transfers as determined by the State Finance Commission, once the project is approved. After this, the ULB enters into an agreement with a private operator who takes over the responsibility of distributing water and offering efficient and reliable services to the customers. The role of the private player here is to bring in managerial and technical expertise to improve the following conditions of the water supply system:

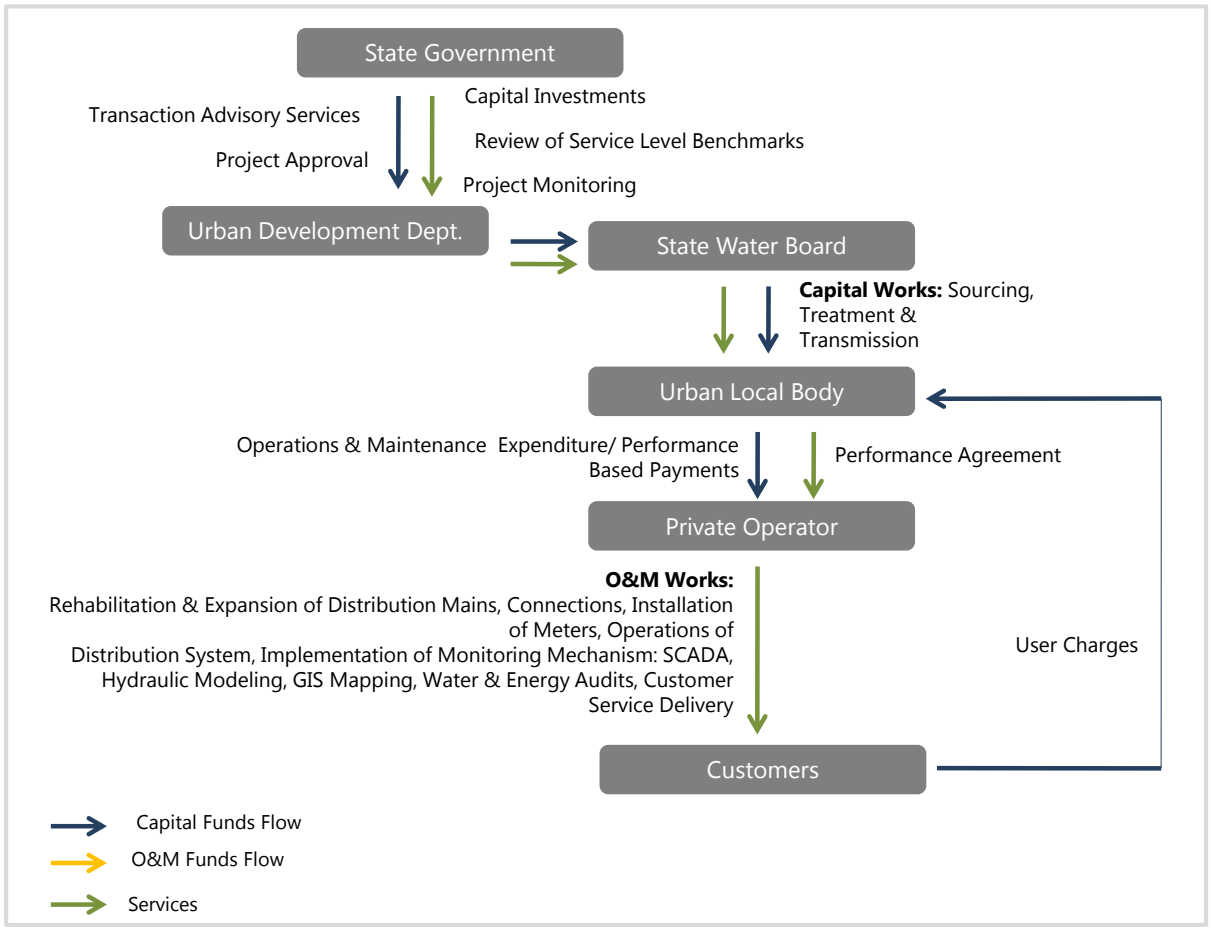
- Accuracy of water audits
- Accuracy of energy audits
- Estimation and reduction of NRW
- Rehabilitation of pipelines, tampered meters, etc
- Form DMAs with 100% metering
- 24*7 water supply
- Improve accessibility and equity
- Increase collection efficiency

Although the water tariffs are collected by the private operator, usually they are not treated as payments made to them. The revenue collected is transferred to the escrow account of the ULB, where in based on the performance and achievements of the operator as per the target set, the payments



are made. For example, for a NRW reduction target of 20%, an operator achieving more than this target, may be given a bonus. These terms and conditions are provided in the contract with the mutual consensus of all stakeholders. The initial investments for O&M may be given by the state or the ULB or the private operator may self finance it if the revenue model is attractive.

Exhibit 27: Stakeholder Model of a Performance based Management Contract

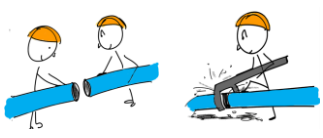


A.4.2 Key Features

Appropriate Risk Allocation	▪ Provides clarity on the roles and responsibilities of each stakeholder ▪ Risk is allocated to the party best suited to manage it ▪ The role of the ULB shifts to that of a policy maker, regulator, CapEx financier, monitor and asset owner rather than a mere operator ▪ The private operator is responsible for providing efficient and reliable services, with performance linked to payments. ▪ It allows decentralised management of water supply services with reasonable and measureable targets
Linkage with Performance Indicators	▪ Unlike other PPP models, performance–based management contract provides a direct link between annual achievements and payments to the private operator ▪ This system therefore closely monitors progress made by the operator. It further avoids monopoly profits (if any) made by the operator

Enhances Financial Viability	▪ The performance targets to be achieved by the operator also includes two important aspects:
	  ▪ Collection Efficiency
	  ▪ Cost Recovery (O&M costs to begin with)
	▪ This ensures that the water supply system becomes financially viable and sustainable over time, which reduces the dependence of ULBs on grants and funds from the centre.
	▪ Such measures also ensure tight control over the costs and revenues and therefore better financial planning and management of ring–fenced water assets

Increases Accountability & Inclusivity	▪ The contract structure accommodates both external and internal accountability. External accountability addresses the stakeholder management by the ULB including relations with the private operator and the customers ▪ Conducting house–to-house survey, providing efficient customer redressal services, etc. increases accountability, inclusiveness and transparency ▪ Internal accountability would include management of the staff, conducting performance appraisals, providing incentives for achievements, etc.



Box 10: Maharashtra Sujal Nirmal Abhiyan

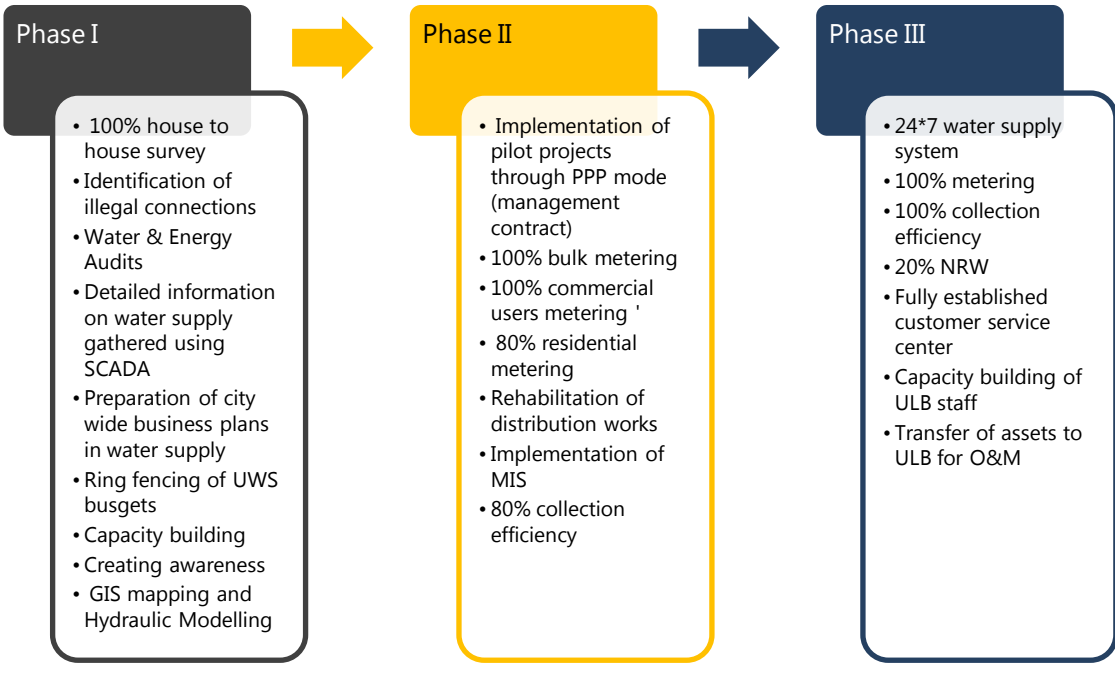
The Maharashtra Sujal Nirmal Abhiyan (MSNA) was initiated by Maharashtra Jeevan Pradhikaran (MJP), the state nodal agency for water supply and sanitation in 2010. The objective of this program is to create a shift from an activity – driven creation of water works to a reform/ performance oriented project implementation. The program led to changes in the institutional framework with the role of MJP as a policy maker, financier and project manager where as the ULB is given further financial autonomy and made accountable for service delivery.

Key Features

- 135 lpcd for corporations and Class A towns and 70 lpcd for remaining towns
- 100% O&M cost recovery and partial recovery of capital costs by 2017
- Ring fencing of water supply and sanitation budget
- Cities can choose between MJP, PPP or own service delivery arrangement
- Water tariffs indexed to cover 100% O&M costs
- 100% metering
- Reduction of NRW to 15% by 2017
- 100% collection ratio by 2017
- Lifeline consumption of 40 lpcd
- Financial support linked to achievement of reform

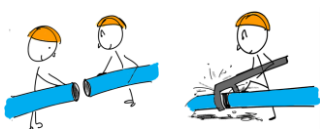
Phases of Implementation

- Every urban water supply and sewerage project identified in a ULB would be carried out in three phases



Current Status & Way Forward

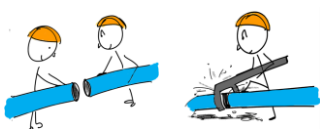
- As of 2013, 70 ULBs have approached MJP for funding and project management expertise to implement management contracts in their respective cities. Of these, about 30 projects are under construction or in the operational stage.



A.5 Case Studies

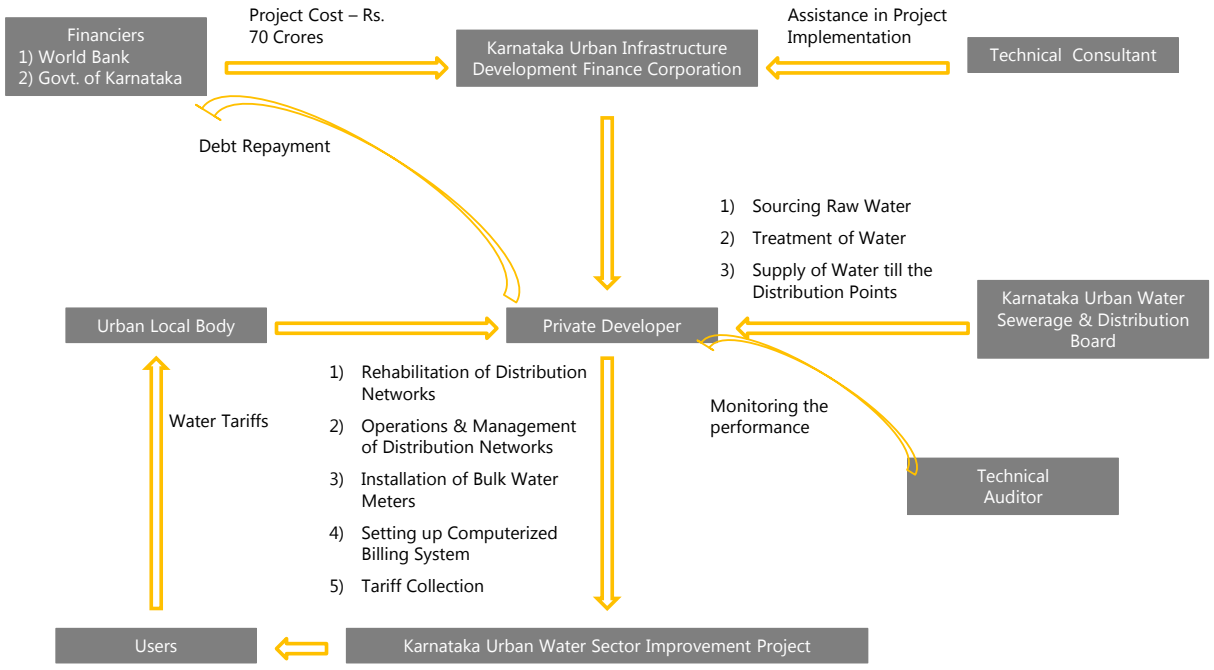
A.5.1 Karnataka Urban Water Supply Improvement Project

Type of Model	PPP: Performance – Based Management Contract
Project Scope	Rehabilitation of the distribution network in the selected 29 wards of three cities – Hubli – Dharwad, Gulbarga and Belgaum, covering 2.2 lakh population (10% of the total) **Phase I (21 weeks):** Willingness to pay survey Assess existing network of pipelines and submit hydraulic design Provide an investment plan **Phase II (58 weeks):** Construct new network of pipelines Install bulk and customer meters Establish 24*7 customer service stations **Phase III (104 weeks):** Continuous pressured supply to every connection 100% metering with monthly issuance of bills Reduce losses to 20 litres/ connection/ day
Financial Model	**Total Project Cost:** Rs. 237 Crore **Sources of Funds (In Rs. Crores)** International Bank for Reconstruction & Development – 182 Govt. of Karnataka – 55 **Uses of Funds (In Rs. Crores)** Technical Assistance – 11.75 Physical Investments: Phase II – 42 Phase III – 22.6 Priority Investments – 154.5 Project Implementation Support – 8.15 **Revenue Model**: The private player was not given the authority to design tariffs. The user charges were agreed upon by the ULBs and the implementing agencies. Although the private operator collected tariffs, payments in terms of bonuses and penalties were made to them based on the performances. **Fixed remuneration** – 60% of the total remuneration which is paid in quarterly installments throughout the project period **Performance remuneration** – 40% of the total remuneration which is



	paid in quarterly installments during the operations and management phase, only if the key performance indicators are met **Retention money –** 10% of the total remuneration which is paid on successful completion of the project
Contracting Authority	Hubli–Dharwad Municipal Corporation, Gulbarga Municipal Corporation, Belgaum Municipal Corporation, KUIDFC, KUWSDB
Contractor	Veolia Water
Contract Period	3 years 6 months
Role of the ULBs	▪ Lead the SICS Cell and assist the selected NGOs for creating awareness amongst the community about the project and conducting the willingness to pay survey ▪ Co-ordinating the state and multilateral agencies for implementation of the project
Enabling Factors	▪ Formation of Social Intermediation and Communications Strategy Cell (SICS Cell) for community engagement ▪ Adoption of a pro – poor policy ▪ Approach of a phased project

Exhibit 28: Stakeholder Map of KUWASIP



A.5.2 Latur Water Supply

Type of Model	PPP: Performance based Management Contract
Project Scope	▪ Take over existing assets from source to tap and providing operations, maintenance and repair of such resources ▪ Deploying of operations and maintenance staff, including key employees, on deputation from MJP and LMC. It would also provide adequate staff to meet network expansion requirements ▪ Providing a minimum average water supply to residents at adequate pressure and ensuring 24*7 pressurised water supply within 2 years of the contract period ▪ Increasing piped water coverage through new connections and ensuring 100% metering of existing connections ▪ Recovering cost of water supply based on tariffs fixed in the management contract ▪ Implementing a billing and collection system ▪ Creating consumer awareness and implementing a consumer redressal mechanism
Financial Model	Total project cost: Rs. 139 Crore, which is entirely privately financed. The operator is expected to make total returns of Rs. 190 Crore, with an IRR of 19.6%
Contracting Authority	Latur Municipal Corporation
Contractor	Maharashtra JeevanPradhikaran
Sub – Contractor	A Consortium 'Latur Water Management Company Ltd.' of SPML, Hydro Comp & UPL Enviro
Contract Period	10 years
Role of the ULB	▪ Transfer of its staff to the private concessionaire ▪ Regulating and monitoring the performances and targets achieved ▪ Co – ordinating with MJP and private concessionaire for provision of land, mitigating litigation risks, etc.
Enabling Factors	▪ Developing an effective communication strategy to ensue community buy-in ▪ Role of the nodal agency to facilitate smooth implementation and execution of the project ▪ Comprehensive assessment of infrastructure deficit carried out by the private developer ▪ Efficient and effective risk allocation mechanism between the public and private stakeholders ▪ Tariff structured before the commencement of the bid process thereby addressing the financial viability of the project to the private players and ensuring healthy competition at the bidding stage. ▪ Flexible project structuring: inclusions of strategies to improve water supply to slums, such as having group tap connections at low user charges

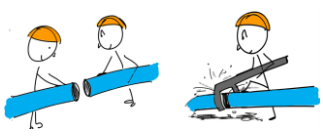
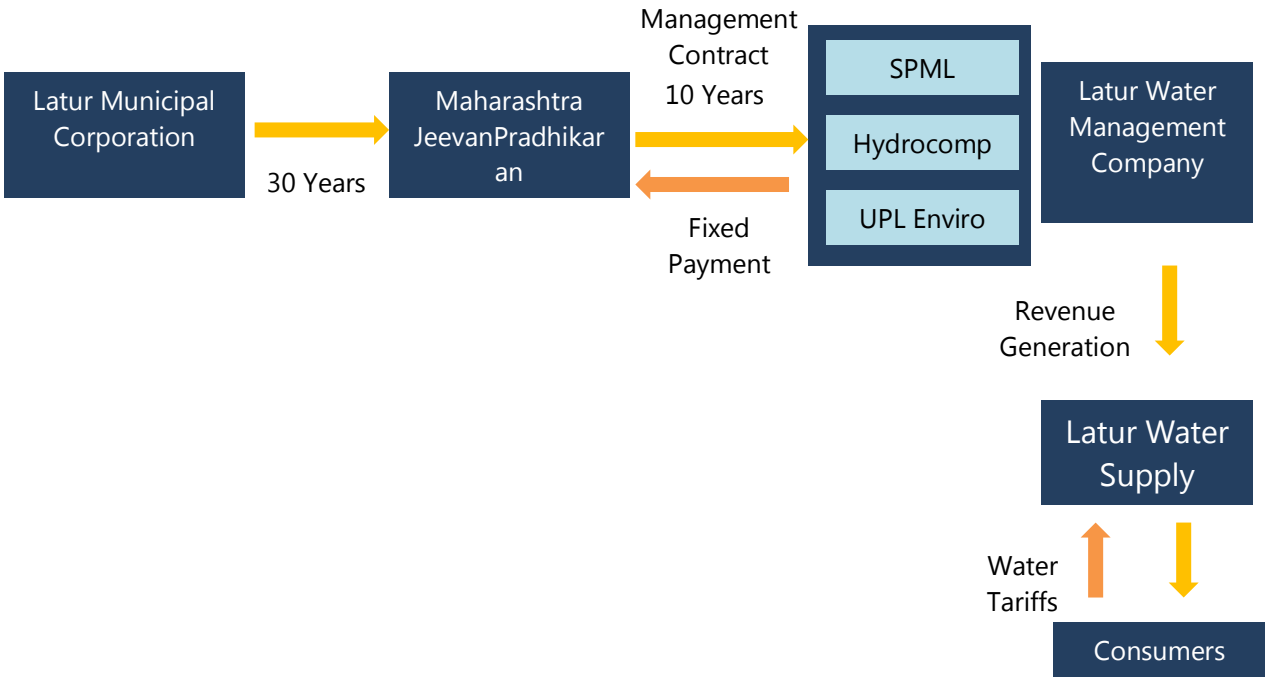
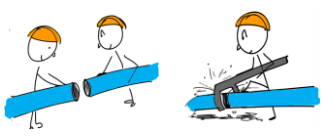


Exhibit 29: Tripartite Agreement of Latur Water Supply Project



A.5.3 Alandur Sewerage Project

PPP Type	BOT – Annuity
Project Scope	▪ Implemented in Alandur— a small town located in the outskirts of Chennai, with a total population of 1.46 Lakh (2001 Census), of which the slum population was 38,010. The estimated sewage generated was 80 lpcd. ▪ The project was implemented in two phases. **Phase I**: Main Sewer Lines – 19 Km Minor Sewer Lines – 101 Km Pumping Mains – 6 Km Pumping Station – 1 Sewage Treatment Plant – 1 of 12 MLD **Phase II**: Sewage treatment plant – 1 of 12 MLD
Financial Model	**Sources of Finance (Rs. Cr.)** Loan from TUFIDCO: 16 Loan from TNUDF: 4 Deposit Collection: 8 Gap Funding by GoTN: 3 Interest from deposits: 2 Grant fund for supervision: 1



<table>
<tr><td></td><td>

Connection Charges (Rs.)

Domestic	6,000
Commercial	10,000
Industrial	10,000

Tariff Structure (Rs. Per Month)

	Domestic	**Commercial & Industrial**
<500	60	200
500 - 1500	80	400
1500 - 3000	100	600
>3000	120	1000

</td></tr>
<tr><td>Contracting Authority</td><td>Alandur Municipality</td></tr>
<tr><td>Concessionaire</td><td>

- A consortium of IVRCL and WA Tech Wabag was formed where in the former was mandated to undertake the electro – mechanical works and the latter was responsible for civil works and O&M of the 2 STPs.
- The O&M of the sewer lines was contracted out to a third firm after the construction works by the IVRCL consortium was completed.

</td></tr>
<tr><td>Contract Period</td><td>14 years,
EPC: 3 years
O&M (for STPs): 11 years</td></tr>
<tr><td>Role of the ULB</td><td>

- Regulate tariffs and connection charges in consultation with the State Level Agencies
- Collection of tariffs and connection fees from the citizens and make regular payments to the private contractors
- Monitor O&M works

</td></tr>
<tr><td>Enabling Factors</td><td>

- TNUIFSL provided the municipality a set of options such as soft loans from TNUDF, grants from GoTN and implementation of the project on a PPP mode to address its financial constraints.
- Upfront investment made by the community that ensured the financial viability of the project
- The Alandur Mayor played a critical role and provided the much required leadership and vision
- The capability of the Alandur Municipality to develop and implement effective IEC strategies from the project initiation stage itself and get community-buy in for the project finance played an important role in avoiding implementation delays

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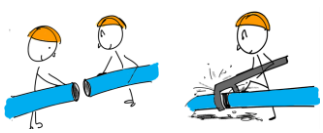
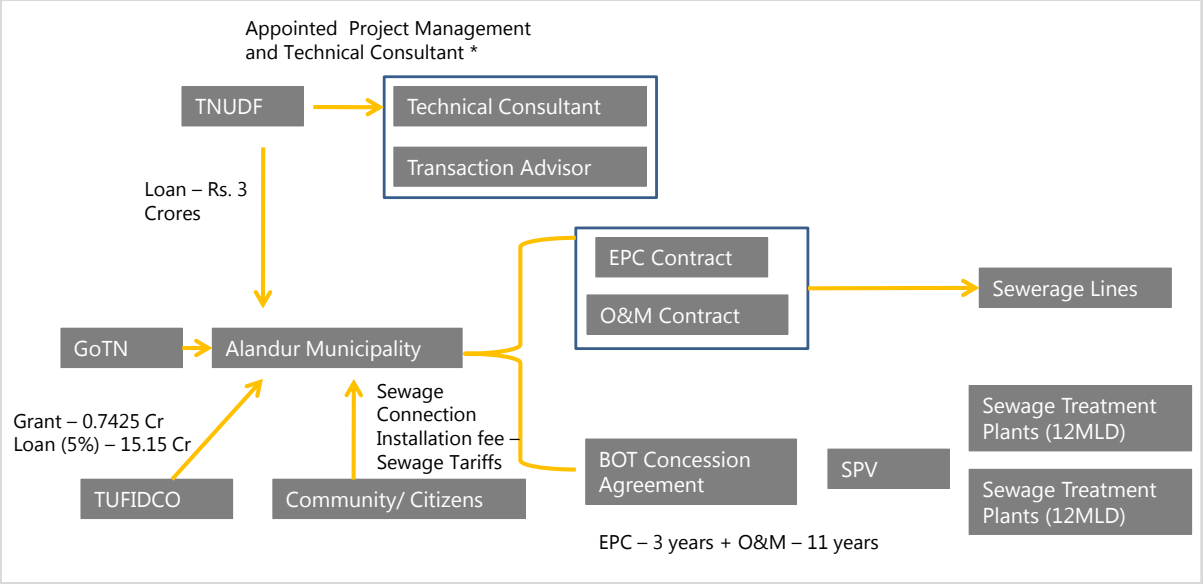
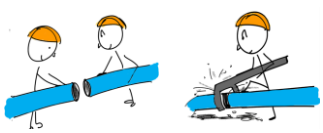


Exhibit 30: Stakeholder Model of Alandur Sewerage Project



A.5.4 Integrated Urban Water Management in Mulbagal

Model	Participatory Approach towards Integrated Urban Water Management (IUWM)
Project Scope	The project objective was to make provision of low cost and reliable water and sanitation services to all citizens of Mulbagal (a Class III town) by empowering the community and strengthening capacities amongst the local institutions. The following pilots were implemented which led to Integrated Urban Water Management (IUWM): ▪ Revival of community managed toilets ▪ Rainwater harvesting in schools ▪ Energy efficiency improvement in two pumping stations ▪ Solid waste management in three wards ▪ Revival of an ancient tank by removal of sewage ▪ Integrated low cost sanitation
Financial Model	Funding from various State Agencies such as KUIDFC and Central Schemes such as Integrated Low Cost Sanitation Scheme
Contracting Authority	Mulbagal Town Municipal Council (TMC)
Contractor/Concessionaire	Arghyam, Bengaluru
Sub – Contractors (IUWM Partners)	Indian Institute of Science – Groundwater study and water quality study Conzerve Systems – Energy Audit TTI – Water asset survey Institute for Resource Analysis and Policy – IUWM toolkits MYRADA – Social mobilisation Stockholm Environmental Institute - Water Evaluation & Planning CoG – Communications



Contract Period	4 years
Role of the ULB	▪ Retain the ownership of the assets ▪ Co – ordinate with the Project Support Unit (PSU), set up within the town for effective communication between stakeholders ▪ Receive training from the implementing agencies to operate and maintain the works ▪ Provide support to the contractor for implementing the project and mobilising community for creating awareness and enhance participation
Institutional Arrangement	▪ Directorate of Municipal Administration (DMA) – nodal office for the programme, as nominated by UDD was responsible for financing and implementation ▪ State Level Co – ordination Committee (SLCC) – comprised of representatives from all departments pertaining to water management, was to hold quarterly meetings to share progress, key lessons from the field and obtain approvals, etc ▪ Sanghas (ward level groups) with elected councillors as heads for community involvement ▪ A Project Support Unit (PSU) was set up to co – ordination between stakeholders
Enabling Factors	▪ Strengthening capacities of the local institutions ▪ Co-operation from the Town Municipal Council, Deputy Commissioner's office and DMA ▪ Structured citizen engagement and willingness to learn new techniques

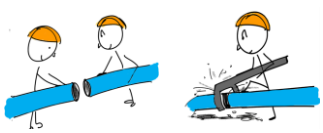
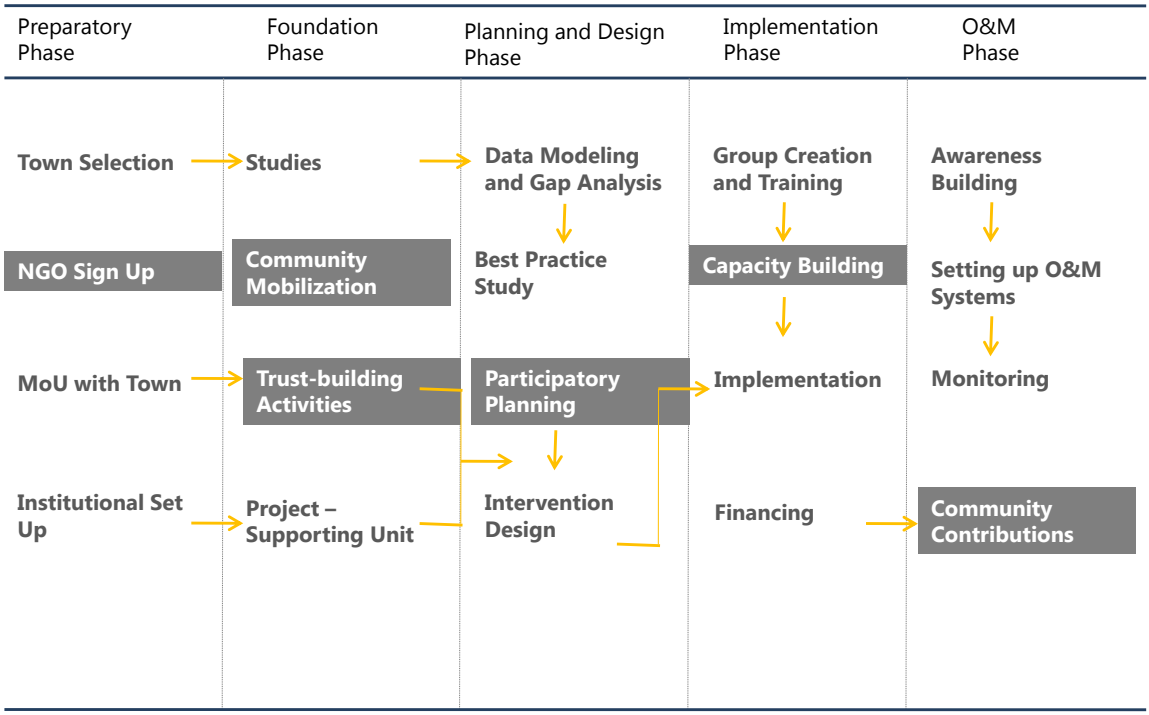


Exhibit 31: Phases of Integrated Urban Water Management in Mulbagal



Source: 'An Approach to Integrated Urban Water Management (IUWM): *The Mulbagal Experience',* Arghyam, 2012

A.6 Mini Sewerage Treatment Plants

One of the recent technologies for waste water recycling is the use of mini-Sewage Treatment Plants (STPs). Many projects have been implemented in cities and even Tier II and III towns, wherein STPs have been installed and operated in apartment complexes, industrial units, vacation resorts, hotels etc. These STPs provide low cost effective technologies that allow reuse of 50 -70% of the sewage generated from domestic usage. It requires decentralised governance with very minimal skills for operating the system. The Hyderabad Water Supply and Sewerage Board (HWSSB) is also planning to undertake such projects in various multi storied buildings of the city.

Given these capabilities, this case study describes the treatment process briefly, followed by the estimation of capital and O&M costs and then highlights the advantages of Decentralized STPs.

Treatment Process

The capacities of these treatment plants range from 10 KLD - 200 KLD (2 MLD) to treat sewage generated by households, educational institutes, hospitals, commercial establishments, hotels and resorts. The STPs are meant for treating sewage right from primary treatment to tertiary treatment and about 50 – 70% of the waste water generated is recycled into the system. Exhibit 32 presents the flow of the treatment process of these mini STPs. Raw sewage generated by households is drawn into the system for preliminary treatment, where in large solids are separated from the liquid contents and flocculation of the waste water is carried out. Post this, the waste water is allowed to float in a quiescent basin until the heavy liquids (oil and grease) float on the top and is then carried to the sludge basin.

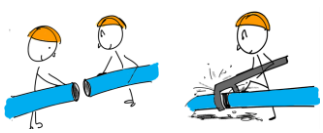
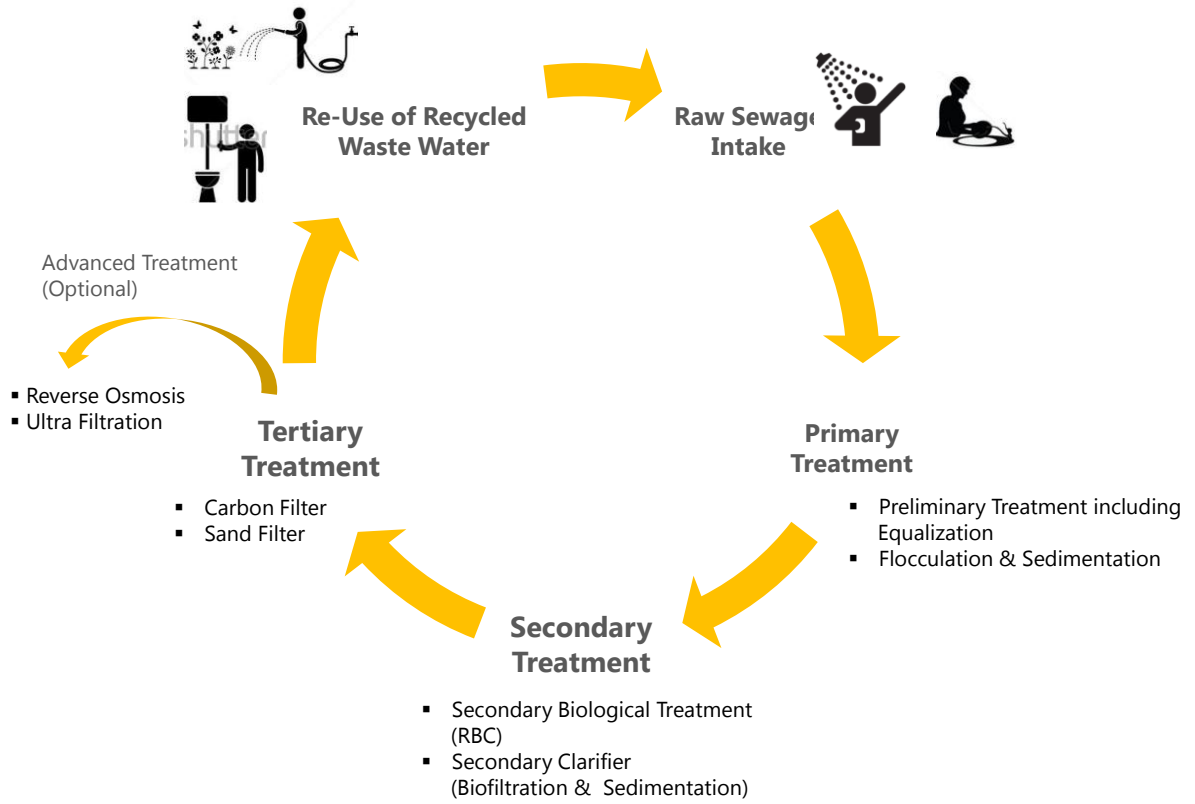


Exhibit 32: Treatment Cycle of Mini Sewage Treatment Plants



The remaining waste water undergoes secondary treatment to remove dissolved and suspended matter followed by tertiary treatment. In this phase, the waste water is treated with chemicals for its disinfection, such that it can be used for non potable purposes like irrigation, watering the parks, gardening and flushing toilets. In most cases the water is allowed to directly flow into the wetland for plantation purposes. The left over sludge is treated through anaerobic and aerobic digestion for use as fertilizers/ compost.

Costs of Installation and Operations

The capital expenditure of installing a 400 KLD plant serving 2500 residents / 500 flats or households is Rs. 50 – 60 Lakh, while the operation and management/maintenance costs depend on the capacity of the STP. Exhibit 33 below provides an estimation of these costs.

Exhibit 33: Costs of Installation and Operations of On-Site STPs

Capacity of Treatment Plant (LD)	10,000	50,000	4,50,000
Population Served[vii]	93	463	4,167
Households Served[viii]	19	93	833
O&M Costs (per litre) - 1.5 to 2 p	0.02	0.02	0.02
Total Annual O&M Costs (Rs.)	73,000	3,65,000	32,85,000
O&M Costs (per person per month)	65.7	65.7	65.7
O&M Costs (In Rs. per household per month)	328.5	328.5	328.5
Total Capital Expenditure (EstRs. Lacs)	10.0	17.0	70.0
CapEx (Rs. per litre)	100	34	15.6
CapEx (per household) in Rs. 000's	52.6	18.3	8.4
CapEx (per person) in Rs. 000's	10.8	3.7	1.7

Management of Operations

The operations and management of these sewerage treatment plants is usually carried out by the local community benefitting from it. Personnel are trained by the vendors of STPs and Annual Maintenance Contracts (AMCs) are undertaken by the contractors for trouble free upkeep.

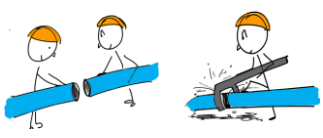
Features

An '***On – Site Decentralised Sewage Treatment and Re- Use***' has the following features:

- Minimum sludge generation
- No Stench
- Low power consumption
- Low cost of operation and maintenance
- Minimum civil work
- Compact design/ Less space requirement (ranging between 400 – 750 square feet)
- Very little operational noise
- Minimal skill requirement for operations

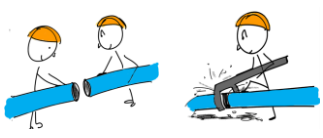
Benefits of Decentralized sewage treatment systems:

a) Local recycling of waste water ensures a sustainable water management system. Ensures that ground water is not contaminated.
b) With the growing dearth of land availability for large scale centralized treatment systems, this will be a more viable option
c) Can be installed even in existing complexes (retrofitting) and hence the need for extensive piping requirements is avoided
d) Water costs substantially reduced since this is a perennial source of water for large consumption activities such as - gardening / facilities washing and even flushing applications

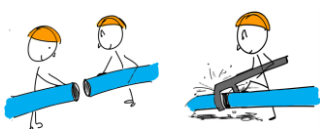


A.7 List of Monitorable Indicators

	Indicators		Quantity		Number	
			Actual	Target	Actual	Target
Water Supply Service Delivery	Water Supply Coverage (lpcd)	Households				
		Commercial				
		Industries				
	Household Connections	Tap/Piped				
		Hand pumps				
		Bore wells				
	Average Pressure (lp connection)					
	Number and Capacity of Storage Reservoirs					
	Capacity of Water Treatment Plants					
	Quality of Water Supplied (%)					
	Metering (Number and %)	Bulk				
		Consumption				
	Quantity of Water Produced					
	Quantity of Water Supplied					
	Continuity of Water Supplied	Frequency (days)				
		Duration (hours)				
	Customers with discontinuous water supply					
Non Revenue Water	Non Revenue Water					
	Unaccounted for Water Losses					
	Unbilled Connections					
	Billed Connections					
	Commercial Losses					
	Physical Losses					
	Pipe Breaks per Kilometer per Year					
Sewerage Service Delivery	Sewage Coverage	Households				
		Industrial				
		Commercial				
	Quantity of Sewage Collected					
	Quantity of Sewage Treated	Primary				
		Secondary				
		Tertiary				

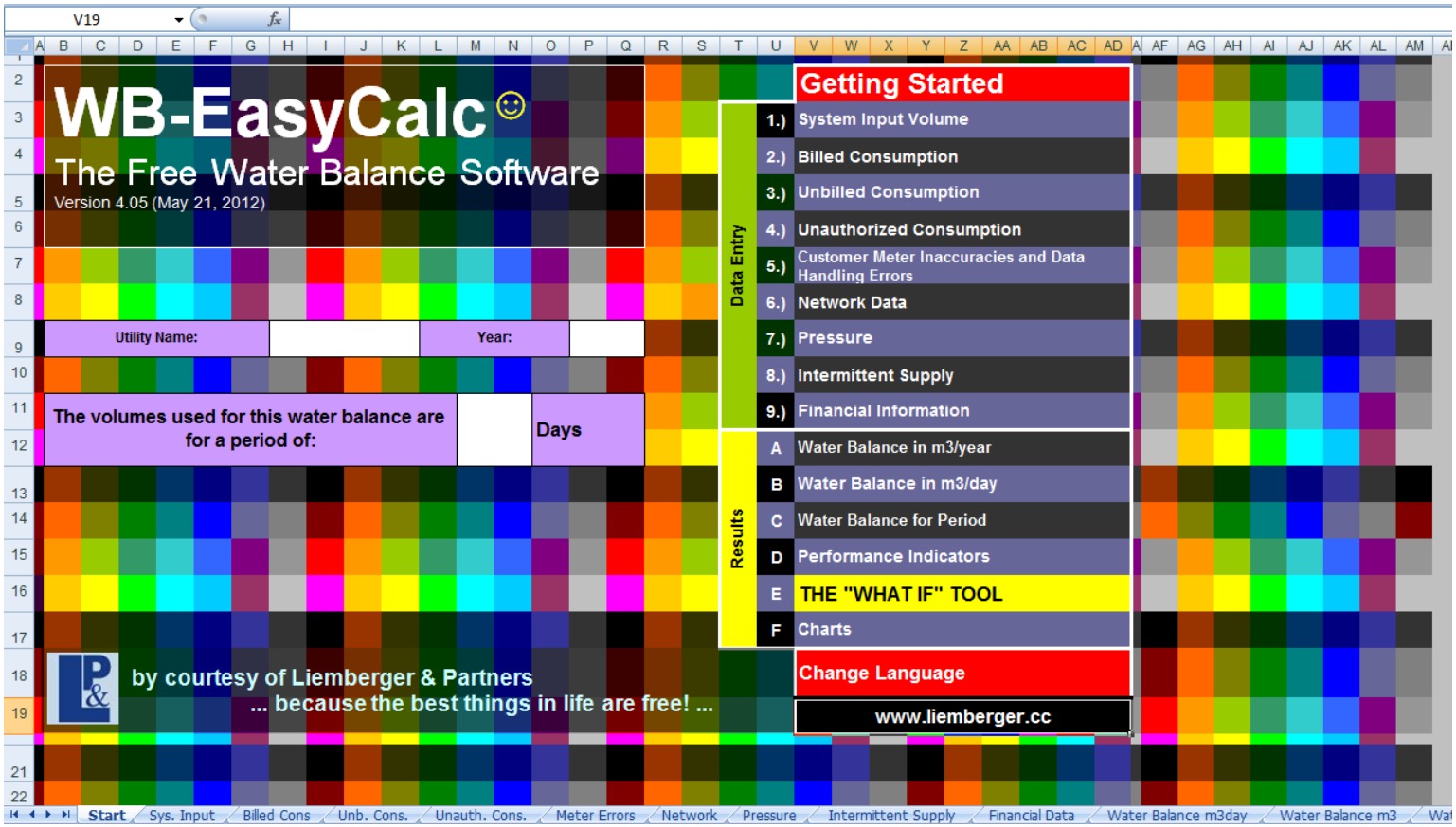


	Blockages per year in Sewage					
	Capacity of Sewage Treatment Plant					
	Reuse and Recycle					
	Quantity of Effluent Discharged					
	Customer Redressal					
Costs and Staffing	Unit Operational Cost (Rs. /m^3 produced)					
	Unit Operational Cost (Rs. /m^3 sold)					
	Operational Cost of Water Supply (as a % of total)					
	Operational Cost of Sewerage (as a % of total)					
	Staff per 1000 water connections					
	Staff per 1000 population served (water)					
	Staff per 1000 sewage connections					
	Staff per 1000 population served (sewage)					
	Labour Costs (as a % of total operational costs)					
	Electricity Costs (as % of total operational costs)					
Billing and Collection	Average Revenue (total revenue/ number of connections or water sold)					
	Revenue Generated from Resale of Treated Waste Water (Rs.)					
	Operating Ratio					
	Debt Service Ratio					
	Cost Recovery					
	Collection Efficiency					

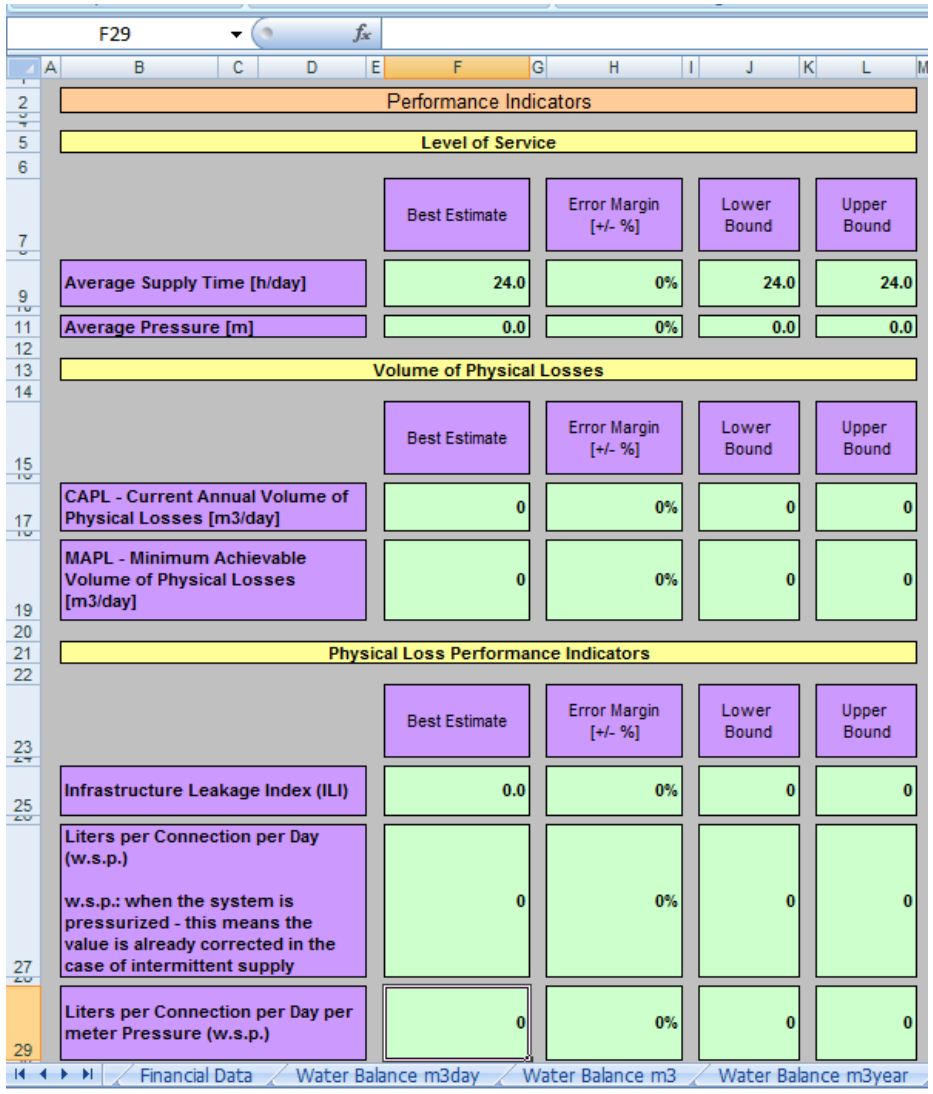


A.8 WB Easy Calc

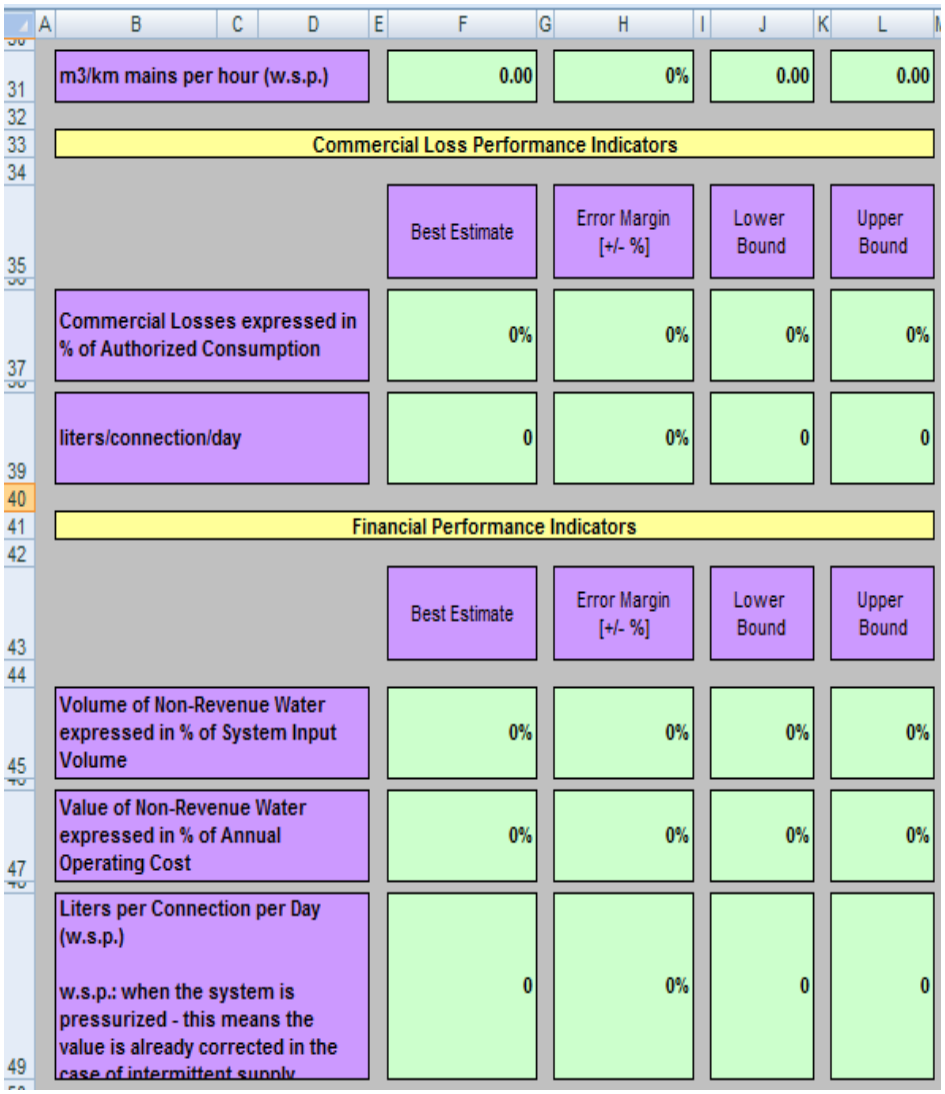
The WB Easy Calc is 'The Free Water Balance Software' developed by Liemberger & Partners and provides a dash board which could be used by the ULBs or the monitoring agencies to record and analyse water audits and indicators pertaining to non – revenue water. The software is available for free at <http://www.liemberger.cc>



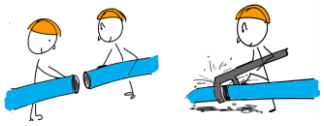




Performance Indicators				
Level of Service				
	Best Estimate	Error Margin [+/- %]	Lower Bound	Upper Bound
Average Supply Time [h/day]	24.0	0%	24.0	24.0
Average Pressure [m]	0.0	0%	0.0	0.0
Volume of Physical Losses				
	Best Estimate	Error Margin [+/- %]	Lower Bound	Upper Bound
CAPL - Current Annual Volume of Physical Losses [m3/day]	0	0%	0	0
MAPL - Minimum Achievable Volume of Physical Losses [m3/day]	0	0%	0	0
Physical Loss Performance Indicators				
	Best Estimate	Error Margin [+/- %]	Lower Bound	Upper Bound
Infrastructure Leakage Index (ILI)	0.0	0%	0	0
Liters per Connection per Day (w.s.p.) w.s.p.: when the system is pressurized - this means the value is already corrected in the case of intermittent supply	0	0%	0	0
Liters per Connection per Day per meter Pressure (w.s.p.)	0	0%	0	0



m3/km mains per hour (w.s.p.)	0.00	0%	0.00	0.00
Commercial Loss Performance Indicators				
	Best Estimate	Error Margin [+/- %]	Lower Bound	Upper Bound
Commercial Losses expressed in % of Authorized Consumption	0%	0%	0%	0%
liters/connection/day	0	0%	0	0
Financial Performance Indicators				
	Best Estimate	Error Margin [+/- %]	Lower Bound	Upper Bound
Volume of Non-Revenue Water expressed in % of System Input Volume	0%	0%	0%	0%
Value of Non-Revenue Water expressed in % of Annual Operating Cost	0%	0%	0%	0%
Liters per Connection per Day (w.s.p.) w.s.p.: when the system is pressurized - this means the value is already corrected in the case of intermittent supply	0	0%	0	0



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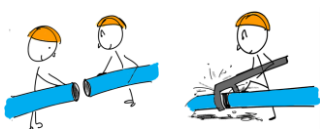
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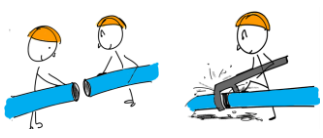
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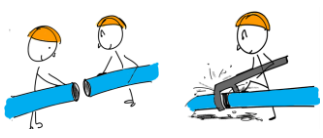
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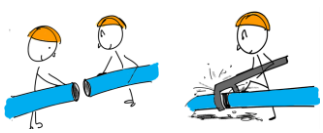
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Endnotes

[i] National PPP Policy 2011 – Draft for Consultation, Ministry of Finance, Government of India.

[ii] The Karnataka Water Policy 2002 seeks to meet the demand of the entire population. These include 55 lpcd in rural areas, 70 lpcd in towns, 100 lpcd in the city municipal council areas and 135 lpcd in city corporation areas.

[iii] A sample questionnaire for the stated preference survey is provided in annex A.I.1

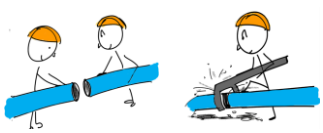
[iv] This approach requires high extent of metering to be able to map the quantity of consumed water by various beneficiaries. As the extent of metering is very poor in the state of Karnataka, this Guide Book does not elaborate on this approach.

[v] It should be noted here that waste water is not proportionate to the amount of water produced or supplied, but to the amount that is consumed by the end users.

vi In management of services, the community has a different definition. Here the community does not imply all the citizens who are likely to get affected by the project, but it refers to the groups/ bodies that are composed of select members from these citizens. These members of the community group take the responsibility of the services as per agreed upon with the ULB and/or private agency and represents the citizens as a whole. There may be contractual agreements between the community groups and the ULB/private agency.

vii The population figures are calculated based on the norm set by Ministry of Urban Development that of the 135 litres consumed by per capita per day, 80% of it is generated as waste water

viii Estimation of number of households is based on the assumption that there are 5 members per household.



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