FINAL REPORT

REPORTING PERIOD: 2019

Project Title: Capacity Building of Urban Local Bodies in Rajasthan on Integrated Urban Water Management (IUWM) to support Sustainable Development Goals

Programme Duration

Overall Duration (months) 12 Months
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By:

ICLEI-Local Governments for Sustainability South Asia

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Brief Summary of the Project

The increasing variation in the intensity and frequency of rainfall and temperature has impacted the water availability in state of Rajasthan. Poor management of basic services (water, waste water and solid waste management) has also affected the water availability and impacted traditional local water sources. With mounting water scarcity, the priorities for the water agencies of the state have broadened from mere water development to encompass water allocation and water resources management. But, the institutional capacity of the agencies responsible for water resources and services management hasn't kept pace with the changing times. There is a need to mobilize resources and skills for creating awareness on water management especially to help cities transition away from conventional approaches to integrated water management approaches. This includes generating awareness among local institutions and augmenting technical skills in staff engaged in water resources management and water-related services. It must be the focus of the state and central governments water agendas to build human resource base, with trainers, researchers and water management professionals with multi-disciplinary skills.

ICLEI South Asia in collaboration with India Water Partnership (IWP) initiated "Integrated Urban Water Management Planning and Implementation" project in Rajasthan to achieve sustainable water management approach by promoting integration, coordination, participation and innovation. The project is funded by Global Water partnership and aims to instigate integration in the municipal line of functions through the capacity building of local water managers using IUWM toolkit developed by ICLEI South Asia.

Under the project, a tailored training program was conducted on 23rd of September 2019 in Jaipur to build the capacity of engineers from Public Health and Engineering Department. The one day Integrated Urban Water Management Training Program (IUWMTP) focused on 1) IUWM concepts and principles, 2) Essential tools from IUWM Toolkit developed by ICLEI to fast track water sector reforms at city level. 3) Good practices in IUWM sector. The training program encouraged local water managers to take part in the overall water management system rather than working in silos and improve grassroots, community involvement at all stages, which will help them to subsequently operate and maintain systems sustainably. The training program was attended by 15 participants from 6 cities and officials from Water Supply and Sanitation Organization (WSSO) in Rajasthan.

The training program has successfully promoted the need for rules and regulations for water management that looks at adopting integrated and collaborative approaches for developing plans and preparing designs for water management. The importance of using IUWM approaches for city level planning of water resources and the significance of developing soft skills among local engineers to promote collaboration and partnerships were also highlighted through the program. The WSSO and PHED engineers as well as the city engineers have recognized IUWM as an important part of city's water plans and requested for further trainings on this issue to other cities as well in the state.

ACKNOWLEDGEMENT

This Report is an output of collaboration between India Water Partnership (GWP India) and ICLEI-South Asia. This project would have not been successfully implemented without the support and guidance of Water Supply and Sanitation Organization (WSSO), Jaipur and Public Health and Engineering Department Engineers from Jaipur, Bundi, Ajmer, Alwar, Kishangarh, and Barah cities of Rajasthan.

The aim of the project was to build the capacity of the local authorities in Rajasthan to undertake water sector reform by implementing integrated urban water management (IUWM) principles. The project was supported by Global Water Partnership (GWP-India) under core activities Goal 2 – generate and communicate knowledge.

We gratefully acknowledge the support of Shri Arun Srivastava, Director, WSSO, Rajasthan and Mr. Anil Jain Additional Chief Engineer and Mr. H.K Aggarwal, WSSO Jaipur and Programme Officer for their continuous support to conduct the training programs.

The project would have not been possible without the generous support of all the concerned departments from the state level and city level. We extend our sincere gratitude towards all those who were part of the implementation of the project and preparation of the project report.

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EXECUTIVE SUMMARY

ICLEI South Asia in collaboration with India Water Partnership (IWP) has been strengthening the capacity of local bodies in Rajasthan through the implementation of **"Integrated Urban Water Management Planning and Implementation" project, funded by Global Water Partnership (GWP)** under Goal 2 – generate and communicate knowledge. The aim of the project is to bring awareness and build capacity of local urban bodies and water managers on integrated urban water management (IUWM) Principles and methods based on IUWMtoolkit developed by ICLEI SA.

An Integrated Urban Water Management Training Program (IUWMTP) was conducted under the project on 23rd of September 2019 with the support of Water Supply and Sanitation Organization (WSSO) in Jaipur on IUWMtoolkit. The IUWMTP focused on integrated and collaborative water management planning and designing in cities of Rajasthan and shared success stories from project cities- Kishangarh and Ajmer as well as cases from around the world on Integrated Urban Water Management. The training program was attended by officials from Public Health and Engineers Department from Jaipur, Bundi, Ajmer, Alwar, Kishangarh, Barah and WSSO officials. During the training program IUWM concept and its principles were discussed and need to apply the integrated approaches was identified. Hands on training was provided to the participants on IUWM toolkit which is designed to help municipal corporations to strengthen decision making in water sector.

IUWMTP was intended to fast track the implementation of IUWM based projects and help cities understand integrated approaches and their implication on local water environment. IUWM Toolkit was implemented in Kishangarh and Ajmer in the year 2017 and 2018 and the learnings from the projects suggested that more cities in Rajasthan require training on sustainable ways for water management.

I. PURPOSE

The main objective of the project was to support development of smart and sustainable growth in cities by prioritizing water agenda. It also aimed to create, enable, institutionalize and promote inclusive governance mechanisms by considering IUWM approaches and principles. It aimed to build the capacity of urban local bodies to undertake water sector reforms to close the urban water loop that will help in conservation of Lake/water bodies in long term.

The Training Program was conducted to familiarize the city level water managers to the concept and principles of IUWM and state level dissemination of IUWM initiatives undertaken by ICLEI SA and IWP. The training modules based on rapid version of IUWM toolkit developed to successfully implement the IUWMTP. The training module is a step by step guide to implement IUWM based approaches and ease the decision making in water sector. The training module is supported by number of best practices and success stories on IUWM. The training program also supported peer to peer learning.

II. RESULTS

IUWMTP for capacity development on integrated urban water management delivers two types of capacity development for IUWM through I) Training and engagement: during the training program discussions with city and state level officials was conducted to enhance the understanding on IUWM principles and approaches to gathering information on new ideas on IUWM practices and promote peer to peer learning II) discussions and dissemination: Sharing the best practices and cases around the nation benefited the participants on knowledge of local experts and collaborative local actions to achieve a common goal to secure water resources. Rajasthan is well known for its water conservation methods and traditional rain water harvesting methods. During the training program the city of Bundi and Ajmer also shared experience and highlighted the traditional water management practices in their cities and its impacts on overall water system. This not only helps in dissemination of a local practice but also help other cities from Rajasthan to understand importance of locally adaptable IUWM approach through their peers. This opens up the opportunity to scale up actions and share experiences rapidly across the cities and regions. During the training program participants also addressed emerging issues responding to local demand, especially during the exercise on water balance mapping. The IUWMtoolkit helps in demand responsive approach and ensures both relevance and impact.

The three main outcomes of the training program are

- Capacity development – improvement of the capacity of individuals, city managers and city authorities for sustainable management of water resources. More than 15 water managers from 6 cities from Rajasthan are the direct beneficiaries under the project.
- Strengthening peer learning – develop the capacity of local authorities like PHED engineers(9) municipal engineers (6) to make better outreach and to collaborate on effective delivery of capacity development; and
- Knowledge management – ensuring access to the new international and local knowledge through the documentation 10 case studies and best practices (Annexure 1)

i) Narrative reporting on results:

Rajasthan covers 10.5% of the country's geographical area but shares only 1.16% of its water resources. It is the driest state with nearly 70% (two-third) of the area classified as arid and semi-arid region. Rajasthan has always been a water deficit area with an average rainfall of 531 mm against national average of 1200 mm while desert areas have an average of 380 mm (GoR, 2010d). Due to the harsh climate, water harvesting is deeply rooted in the social fabric of Rajasthan traditionally. In recent times, however, these water harvesting systems have fallen into disuse or are being degraded by the march of industrialization and urbanization. There is an urgent need for awareness and capacity building of local authorities especially water managers and decision makers on sustainable water management approaches. It is the need for the hour to adopt integrated water management approaches to regenerate and revive these ancient systems which are especially suited to the requirements of specific areas.

The Integrated Urban Water Management Training Program (IUWMTP) is an innovative program designed to provide training to water managers in local authorities/Municipalities on implementing integrated water management approaches to overcome water management issues. The IUWMTP proposed to develop the soft skills as well as technical skills on IUWM that teaches, simple decision making approaches to break institutional silos while addressing core water supply issues such as water availability, low efficiency, non-revenue losses and operational challenges. To adopt the IUWM approaches, an integration assessment exercise was conducted to make city engineers understand the level of integration in their cities and identify prominent issues hindering the water cycle loop. The water balancing exercises was conducted to promote 'sectoral' integrated approach and map out the water usage pattern and flow. An action planning exercise was conducted to help the participant's strategies actions needed at the city level and develop an implementation plan.

The IUWMTP strengthened the capacity and knowledge management helps successful delivery of capacity development. The IUWM Module helped to train professionals to undertake integrated decisions in the sector and prioritize actions in their cities.

The training program also included components of monitoring and evaluation of the water supply system. The IUWM toolkit helps to consider all dimensions for monitoring output, outcome and potential impact of capacity development and strengthening and knowledge management generated. The IUWMtoolkit provides systematic guidance for conducting periodical monitoring while providing feedback to the on-going delivery process of capacity development. It helps authorities to understand the available local knowledge and importance of involving communities in decision making.

ii) Outcomes:

This project identified a wide range of capacity building needs in the area of IUWM. In general, the results showed that IUWM is an engagement and decision making problem, rather than a technical problem. The solution lies in systemic thinking – an ability to bridge gaps among departments, to bring different practices and cultures together and broker dialogue and partnerships. The main outcomes of the project can be listed at two levels:

1) At City Level:

Given the nature of the regional environmental and socio-economic features the participants were interested to understand the application of IUWM principles for the desert region. Supply of adequate and safe drinking water round the year is the major problem in the cities as of now.

- The training program conducted in Jaipur directly benefited 15 PHED engineers and officials who attended the workshop
- It helped cities understand IUWM principles and approaches supported by best practices.
- The capacity building of 15 local engineers and water managers will promote use of IUWM principles in the 6 cities (Jaipur, Ajmer, Alwar, Kishangarh, Bundi, and Barah) to become more water secure. This will benefit more than 3,881,022 of population in these five cities.
- The training helped city water managers to map urban poor and women as highly vulnerable actors in the context of water scarcity.
- All cities mapped the water supply system and identified major areas for interventions.

A list of possible integration targets was developed. These integration targets can be taken forward by the cities to develop an IUWM based action plan that will ultimately support:

- Development of ‘soft' skills (e.g. engagement, change management, etc.)
- Competencies and aptitudes used within and between cities (e.g. processes, networks, etc.)
- Target stakeholders with decision-making responsibilities
- Include audiences from other sectors (than the water sector), such as urban planning.

Cities	**Integration Targets**
Alwar	• Water treatment and reuse of water
Ajmer	• Rejuvenating local wager bodies and use water for secondary and recreation purposes
Bundi	• Rainwater harvesting and reviving old rainwater harvesting structures
Barah	• Water reuse and recharge of groundwater
Kishangarh	• Waste water treatment and reuse of water for agriculture

Jaipur	• Ground water recharge and rainwater harvesting

2) At State level:

The presence of Water & Sanitation Support Organization (WSSO), ensured that the training program directly benefited the State level Water & Sanitation Mission. The IUWMTP provided guidance for managing urban water cycle in a sustainable manner. At the state level, the following issues were identified by the WSSO and PHED officials as important to achieve IUWM after the training:

- Awareness on multi-disciplinary nature of integrated urban water management (IUWM) and need to involve number of different stakeholders while developing policies on water sector.
- Awareness on importance of vertical institutional integration to achieve long term water security
- Addressing issues with internal communication and collaboration across departments at state level and support required from senior officials.
- Efforts on individual capacity and concentration on 'soft like lleadership skills, communication, work ethic, flexibility/adaptability, interpersonal Skills rather than purely technical skills like water data analysis, hydrological analysis, designing of water pipelines and documentation and Water management plans
- Potential in shifting/expanding target groups
- Greater collaboration with key players in the industry and other national or interstate capacity building programs.

ICLEI South Asia will be using the results and outcomes from the project to align existing and develop new capacity building activities and will focus on effective partnerships to ensure reach and collaboration efforts are strengthened and an integrated approach is pursued where interstate capacity building programs, research institutions and other stakeholders pool resources together and complement each other's skills and strengths

iii) Outputs:

A Training Module: A Training Module (Annexure 1) was designed for the delivery of IUWMTP for government staff at local and state level, practitioners, institutions, NGO, etc. as they are often important people in terms of the fulfilment and implementation of integrated urban water management approaches. It is also designed to be flexible in its use so it can be tailored to suit specific city circumstances depending on the needs of the local government and stakeholders. The IUWM Training Program worked as an informative and/or hands-on practice on **IUWM framework** and provided practical tools and methodologies to assess the present level of integration and gaps, current water cycle in the city and major issues faced by the cities.

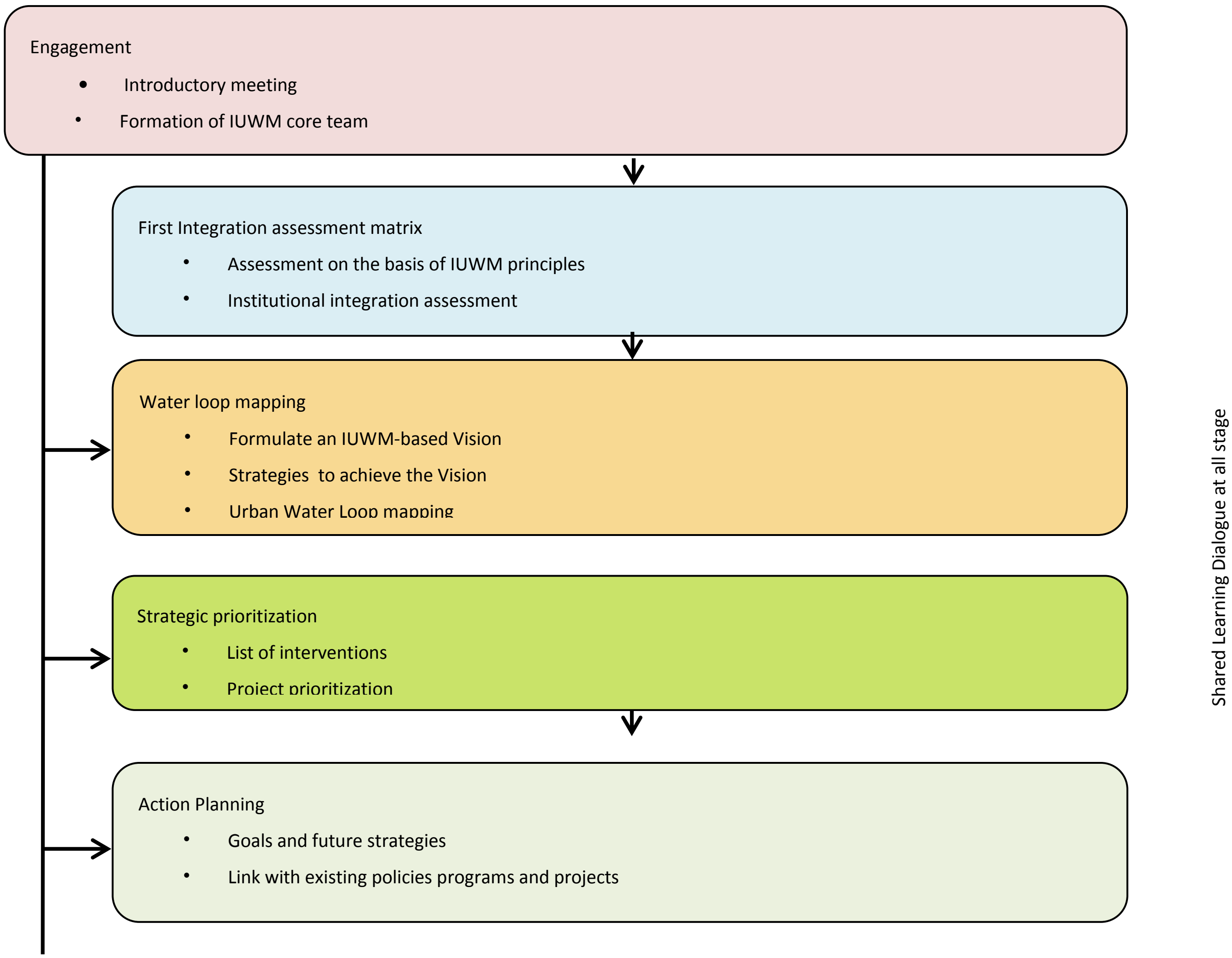


Figure 1 IUWM Framework

The IUWMTP helps in implementing IUWM approaches in fast-track to demonstrate ground level actions. The steps adopted in IUWMTP are:

1. **First Integration assessment matrix:** The tool helps water managers to assess their cities based on IUWM principle and identify the weakness, strengths and quick improvement areas within water and its allied sectors. This section also helps in understanding the few key concepts of IUWM (IUWM principles, Hydrological cycle, water cycle loop, integration targets etc.)
2. **Water balance mapping:** The tool helps to understand the overall water scenario in the city. This helps in conducting water audits in terms of water use and water loss to understand demand and supply gaps. The potential list of strategies is developed to achieve integration targets.
3. **Project prioritization tool and action planning**: This tool helps in prioritizing the strategies identified on the basis of environment, social and financial feasibility of the strategies. An action plan is developed to implement these strategies in best possible way with timeframe. A monitoring framework is also developed to keep track of implementation of strategies. These strategies are assessed on the basis of indicators in terms of:

- Technical soundness
- Social inclusiveness
- Financial feasibility
- Environmental sustainability

B. Case study Matrix: A booklet documenting best cases and approaches on integrated urban water management is developed. These case studies gives ideas for potential interventions by cities. It is also beneficial for knowledge transfer. The cases studies (Annexure 2) selected under the project for dissemination are IUWM methodologies and approaches adopted by different cities across the country. These cases includes

National Level

- Solapur: Recharge of abandoned bore well through rainwater harvesting
- Ichalkaranji: Waste water treatment and reuse in community toilet
- Kishnagarh: Water reuse, recycle and recharge in a slum school
- Jaisalmer : solid waste management and reviving traditional water structures
- Hauz Khaz Lake, New Delhi: Anoxic Bioremediation
- Auroville, Tamil Nadu: Integrated Water Management
- Nagpur, Maharashtra :Reuse of Waste Water
- Surat, Gujarat: NRW Reductions & Management in Water Supply Distribution System
- Jamshedpur, Jharkahand: Integrated Urban Water Management with focus on NRW reduction
- East Devadhanam, Trichy, Tamil Nadu: Community Based Sanitation and Slum Development (CBSSD) Project
- Udaipur, Rajasthan: Conservation of lakes through citizen participation
- Jodhpur, Rajasthan :Rain Water Harvesting in Umaid Heritage Township

III. EXPLAIN, IF ANY DELAYS IN IMPLEMENTATION, CHALLENGES, AND LESSONS LEARNED & BEST PRACTICES

The project was delayed for 2 months due to state level elections. During this period it was difficult to communicate with the state officials to nominate cities, and provide comments and suggestion for the training workshop.

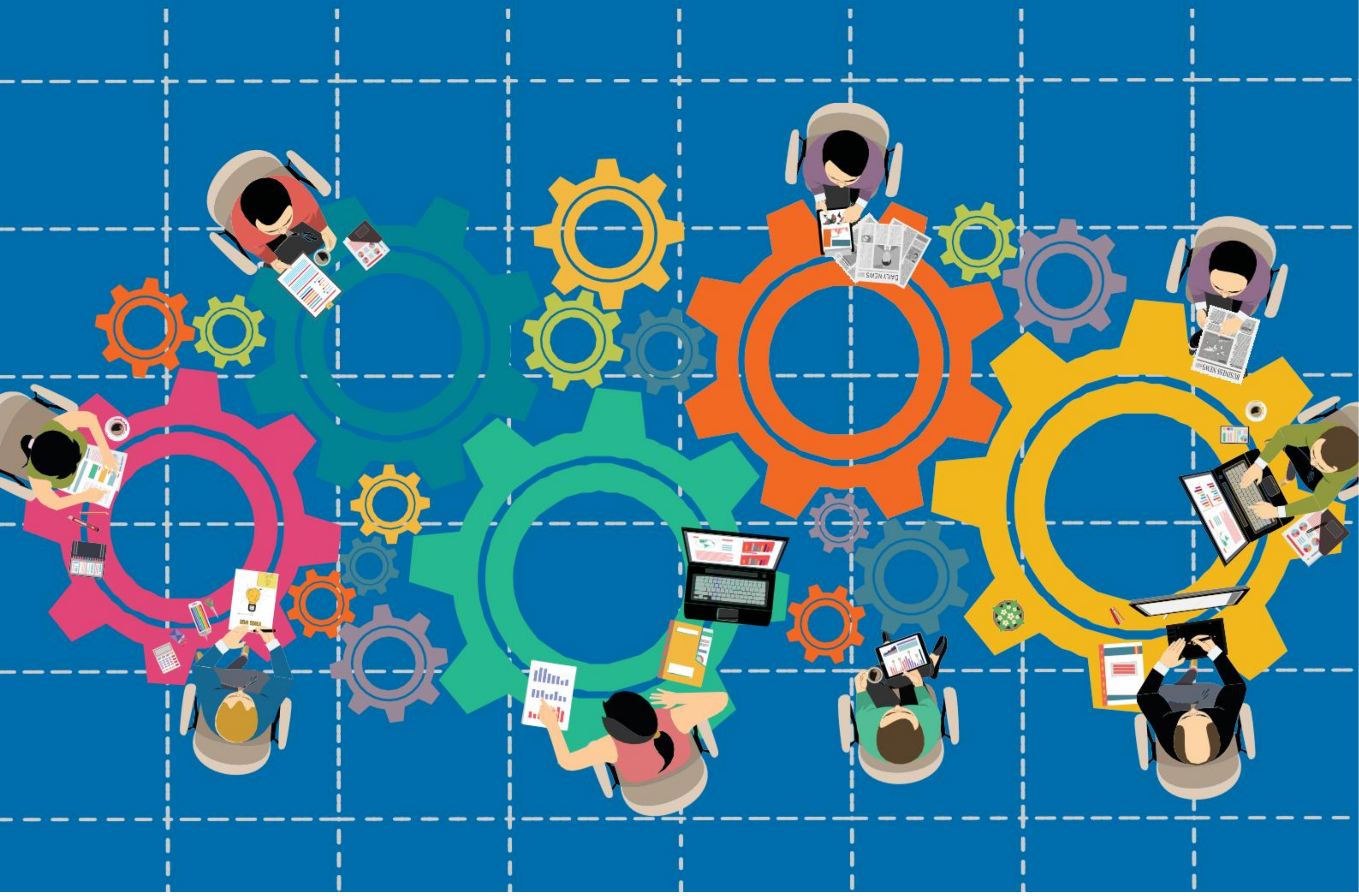
IV. MONITORING ARRANGEMENTS

The concepts used in the Training Program is expected to be used by the cities in their own planning and developmental projects on water sector. Since ICLEI South Asia continues to work with cities in Rajasthan, a continuous engagement will be carried out with the participating cities to understand if they are actually using the information shared in the training program.

ANNEXURE 1

Integrated Urban Water Management Planning and Implementation in Rajasthan

TRAINING MODULE



Global Water Partnership South Asia

India Water Partnership

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Table of Contents

Introduction

Water forms the basis for all life; it is a resource that requires a regulatory and strategic outlay for its management, distribution and utilization as it flows across boundaries and is a basic necessity for all. Traditional mechanisms of planning and management of water, wastewater and storm water as separate sectors without any coordination has led to institutional silos and a fragmented approach towards management of water. These business as usual approaches do not provide or strengthen the resilience required especially at times when climate change threats are staring at our cities. The availability of water for cities in the catchment is shrinking due to land-use changes, demands for irrigation and energy, environmental degradation, climate change, and development of new urban settlements upstream. Often there is not enough water to satisfy all users.

This training manual on integrated urban water management (IUWM) planning and implementation is an initiative of IWP and ICLEI South Asia aimed at strengthening integration of various sources of water and its uses to ensure a sustainable management of the available resources in the cities of Rajasthan. The objective of the project is to build capacity of urban local bodies to undertake water sector reforms for closing the urban water loop by understanding the IUWM principles and approaches.

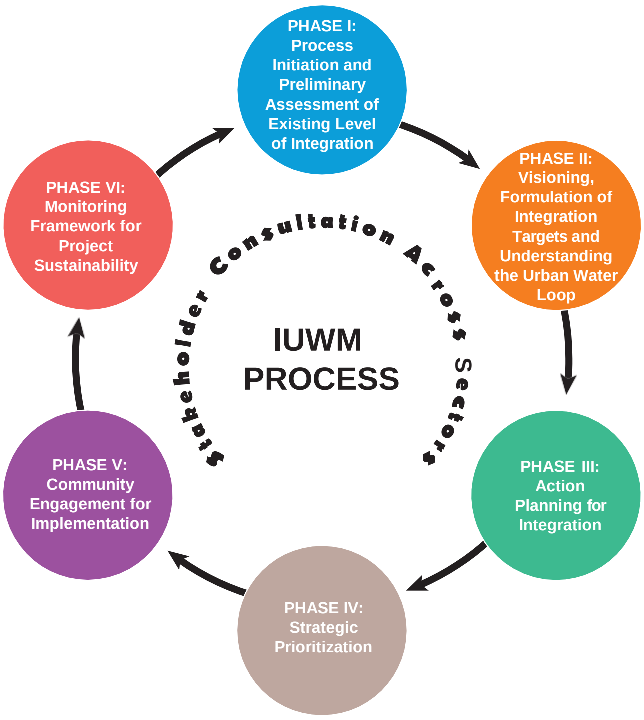
Objective

The training module aims to strengthen the skills of municipal officials to implement IUWM approaches for improved water security. It will help the officials understand the benefit of collaborative approaches, engage with community to improve their awareness and participation in water management, and understand cross cutting issues related to water resource management such as gender and social inclusion. The ultimate goal is to ensure sustainable planning and management of water resources at the local scale.

The IUWM Toolkit

The training modules are based on the Integrated Urban Water Management (IUWM) Toolkit for Indian Cities designed by ICLEI South Asia in association with Flemish Cities and Municipalities (VVSG) and ICLEI European Secretariat as a part of the European Union funded project on Adopting Integrated Urban Water Management in Indian cities (AdoptIUWM). IUWM toolkit is a step by step guidebook to plan and design integrated management strategies of urban water sectors (water supply, wastewater and storm water).

The IUWM Toolkit has 6 phases



Phase 1: Process Initiation and Preliminary Assessment of Existing Level of Integration

This phase helps cities to understand the existing level of integration among water, waste water and storm water sectors within the cities.

Phase 2: Visioning, formulation of Integration Targets and understanding the Urban Water Loop

The second phase helps the cities to formulate an IUWM-based Vision and to set Integration Targets to achieve this Vision. Urban Water Loop mapping exercise enables stakeholders to understand the flow of water to, within and from the city.

Phase 3: Action Planning for Integration

The third phase provides the critical and potential areas for each Integration and identifies a long-list of projects for implementation in the city.

Phase 4: Strategic Prioritization

The fourth phase helps to scrutinize the long-list of projects for criticality, technical and financial feasibility and for any inherent risk to select some of them for implementation as the IUWM Action Plan.

Phase 5: Project Detailing and Community Involvement

This phase helps to create an institutional framework for implementation of the IUWM Action Plan.

Phase 6: Community Ownership

This phase includes tool that help to define the roles and responsibilities of stakeholders and the O&M framework for the IUWM Action Plan.

Training Modules

Module 1: Conceptualizing Integrated Urban Water Management

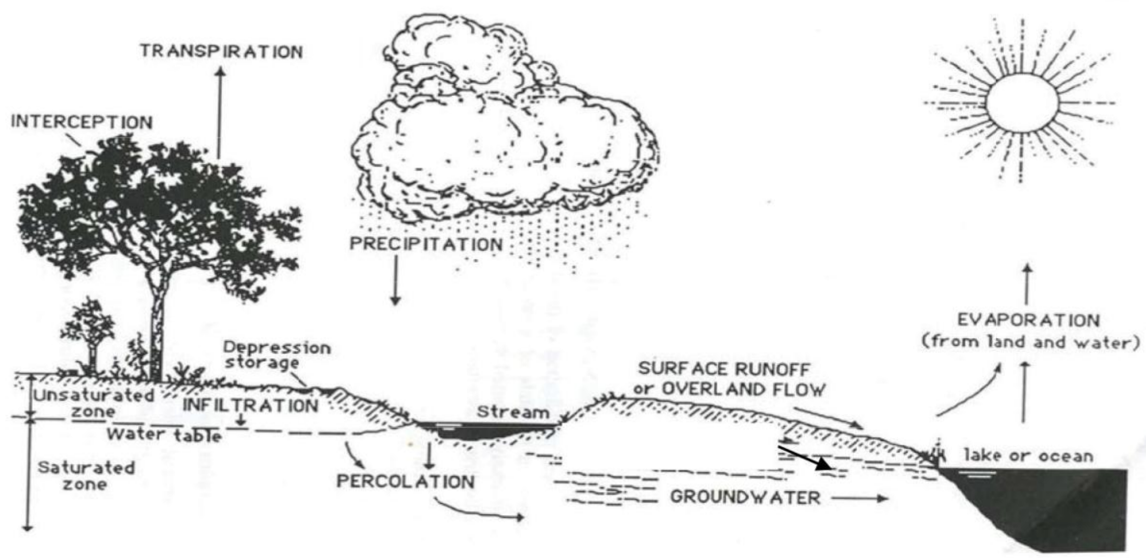
General Objective	Assessing the level of integration among water, waste water, storm water and other related sectors using the first integration assessment matrix tool.
Training Contents	Water as a resource and infrastructure, The Hydrological Cycle and Principles of IUWM
Exercise	City First Assessment Matrix
Methodology	Short Presentation, Group work, Q&A session
Intended Learning Outcomes	Well developed understanding of the IUWM indicators, approaches and concept

Introduction

Water supply, wastewater and storm water can broadly be termed as the most significant components of the urban water cycle in cities across the world; and interlinkages exist within and across these sectors. Conventional centralized approach to management and planning does not address these interlinkages adequately and often deals with these sectors separately. IUWM approach to management of water resources takes into account the interlinkages and uses them in a sustainable manner.

Hydrological Cycle

Water on the surface of earth moves in a cycle from one form to another. Water is temporarily stored in streams, lakes, soil and groundwater and is taken up for use by humans, plants, animals, etc. Heat from the sun evaporates water from the oceans and this water is carried by winds over continents in the form of clouds; leading to precipitation (rainfall/ snowfall) when conditions are favorable. Precipitation is intercepted by the vegetation cover (interception) or falls directly over land. As rain/snow falls on land, a part of it percolates into the ground to form ground water (infiltration) and some of it is retained in the soil by capillary forces. Once the infiltration capacity of the soil is exceeded or the soil store is full, water flows over the surface in the form of runoff and is stored in water bodies. From these water bodies, some portion is evaporated and reaches back into the atmosphere; and some percolates to recharge ground water. Stored water (in water bodies or in groundwater aquifers) moves towards the ocean from where evaporation carries this moisture back into the atmosphere. Evaporation from the surface of land, plants, water bodies and oceans leads to return of water vapour in the atmosphere and thus the hydrological cycle is completed.



Source: Gordon et. al, 1992

Hydrological processes operating in a catchment

When the soil moisture increases sufficiently, it replaces old soil water, which then either moves horizontally through the topsoil or percolates vertically into the groundwater zone. In both cases, this replaced water contributes to base flow in water bodies during summers.

Impacts of Urbanization on Local Hydrological Cycle

Runoff generation pattern of a catchment changes with urbanization as surfaces under impervious cover increase and surfaces available for percolation decrease. Precipitation falling on impervious surfaces, leads to faster and higher runoff generation (upto 3 times more than non-urbanized catchment). Runoff travels faster through hard surfaces and causes frequent flooding and water logging due to the inability of urban drainage systems to respond to sudden peaks generated by precipitation (Butler et al., 2000).

Some of the key adverse impacts of change in hydrological regime of a catchment due to urbanization are:

- Sudden runoff generation translates into sudden hydrograph peaks which can contribute to flash floods downstream
- The amount of runoff generated is higher and hence, lower groundwater infiltration
- Low recharge leads to depletion of water table and can reduce base flow in water bodies during summers
- Pollutants like oil, grease and solid waste are carried by runoff to water bodies
- Development on floodplains limit nutrient exchange with the water body and this can lead to reduced soil fertility in the catchment area

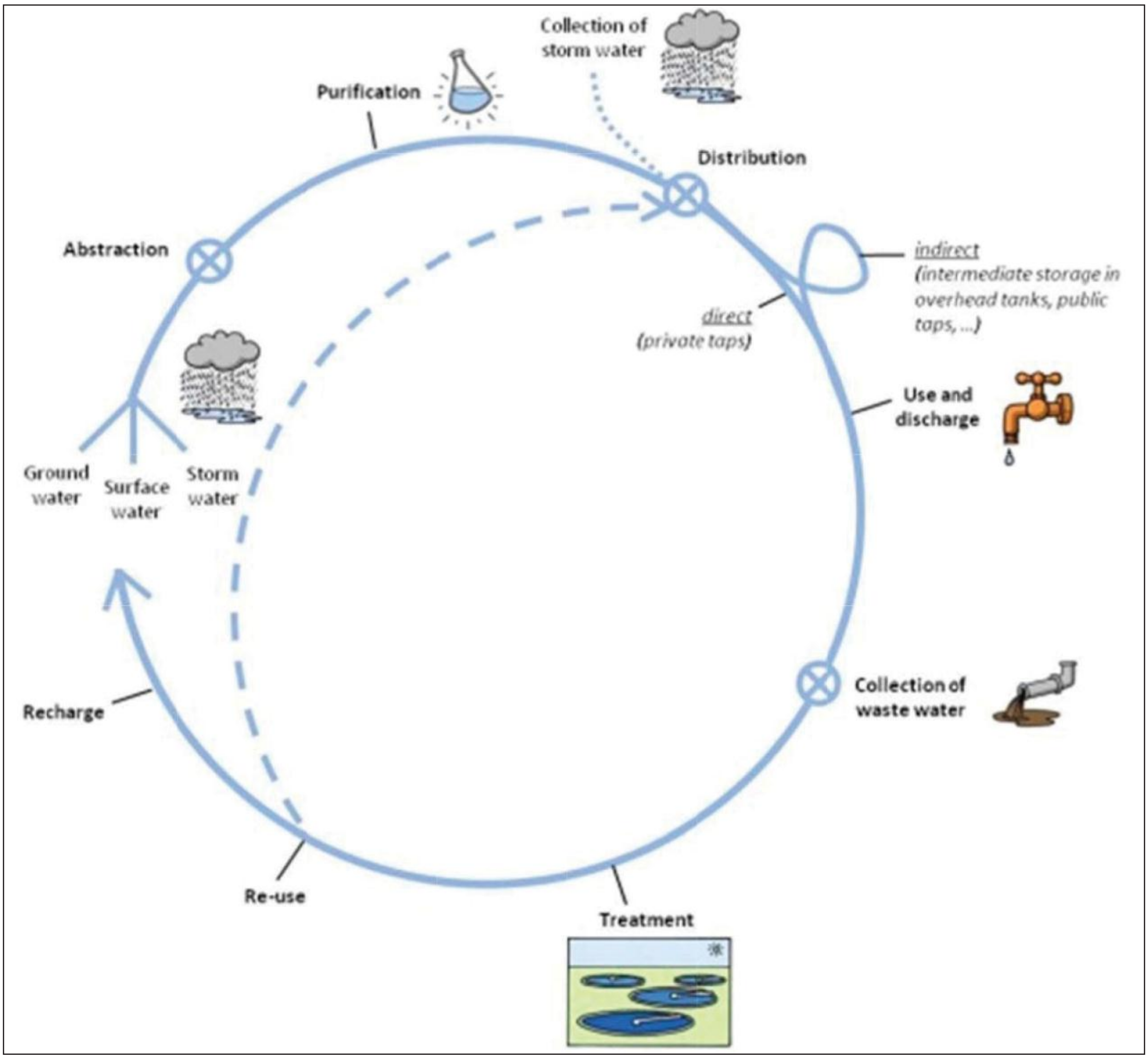
Principles of IUWM

1. Considers all parts of the water cycle, natural and manmade; surface and subsurface as an integrated system
2. Addresses all water requirements: anthropogenic as well as ecological; all urban and non-urban users that are dependent on the same water source.
3. Recognizes the significance of the local context and addresses it from environmental, social, cultural and economic perspective.
4. Includes all stakeholders in planning and decision making.
5. Enables using different quality of water (surface, recycled, reclaimed) for different types of uses (drinking, irrigation, etc)
6. Recognizes water storage, distribution, treatment, recycling and disposal as part of the same resource management cycle.
7. Seeks to protect, conserve and exploit water resources at source
8. Encompasses alternative water sources
9. Recognizes linkages between water, land use and energy
10. Aligns formal institutions (organizations, legislation, and policies) and informal practices (norms and conventions) that govern water in and for cities.
11. Aims at sustainability, efficiency and equity; while balancing environmental, social and economic needs (and sustainability) for short, medium and long term.
12. Acknowledges decentralization and balance between demand and supply management as potential solutions
13. Recognizes impacts of climate change and helps in building resilience
14. Gives utmost importance to human wellbeing
15. Recognizes need to empower and engage stakeholders

Close the Water Cycle Loop

Closing the loop of urban water cycle emphasizes the need to reduce the amount of water entering the system as well as that leaving the system by using water in varied forms, from varied sources and for varied purposes. In addition efficiency can be increased through the implementation of alternative solutions, along with traditional infrastructure such as:

1. Innovative technologies planned around new urban clusters,
2. Decentralized infrastructure, and
3. Diversification of water sources.



EXERCISE 1: First Integration Assessment Tool

First Integration Assessment Matrix is a self-assessment tool that contains questions, based on principles of IUWM, to assess the existing status of integration of water, waste water and storm water sectors in the city. Each question has been provided with possible responses that can reflect the situation in the city with a score from '15' (indicating best scenario) to '0' (indicating worst scenario). Negative scores have also been given for some responses (-5 to -15) to highlight the negative impacts of the indicator.

How to do the exercise:

1. In your team, discuss and tick the most appropriate answer and put in the score for that answer against each question.
2. At the end, add up all the scores
3. All indicators with a score of '15' are the Strengths of the city.
4. Indicators with a score of '10' and '5' are the Quick Improvement Areas where with minimal intervention; the city can make improvements in the level of integration. These Quick Improvement Areas would be further discussed in the Toolkit.
5. Indicators with a score of '0' or negative marking would correspond to Weaknesses of the city. These are critical areas that the city should focus on

S. No.	Indicators	Criteria Scoring		
		Criteria	Scale	Score
1	**Water Abstraction**			
		Water abstraction from source(s) within Municipal boundary	15	
		Water abstraction from source(s) located less than 20 km from the city	10	
		Water abstraction from source(s) located less than 50 km from the city	5	
		Water abstraction from source(s) located more than 50 km from the city	0	
		Abstraction from distant sources leading to marginalization of other uses/users	-5	
		Abstraction from distant sources leading to conflicts at local level	-10	
		Abstraction from distant sources is leading to conflicts at regional level	-15	
2	**Participatory process**			
		Multi stakeholder platforms created and institutionalized to bring stakeholders together for planning and decision making from the beginning of water related projects	15	
		Multi stakeholder platforms are created on need basis for consultations on most projects	10	
		Stakeholder consultations only for large scale projects/ comments invited after preparation of final plan	5	
		No involvement of stakeholders, plans and projects are prepared by government departments without consultations	0	
3	**Grading of uses**			
		Varied quality of water is used/reused for varied purposes as part of city level supply systems like: Dual water supply lines, SUDS	15	
		Varied quality of water supplied/reused at local level through decentralized loops like housing cluster level loops	10	
		Single grade supply at present but initiatives being taken to match differential quality of treatment with use	5	
		All water treated and supplied to potable quality standards and no willingness or awareness to adopt differential use of water	0	
		Centralized single grade supply leading to neglect of local level water resources	0	
4	**Water Portfolio for supply to the city**			
	Source(s) of water			
		Multiple sources of water for supply to the city (more than 2)	15	
		More than one major source of water for supply	10	
		Dependent on single source of water (surface water)	5	
		Dependent on single source of water (ground water)	0	
	Transmission and Distribution losses			
		Less than 15%	15	
		15 to 25%	10	
		25 to 35%	5	
		More than 35%	0	

S. No.	Indicators	Criteria Scoring		
		Criteria	Scale	Score
	Existing Water Portfolio			
	Surface water / groundwater use for supply (annually)	Conjunctive water use (mix of groundwater and surface water) is undertaken in a sustainable manner	15	
		Predominantly based on surface water	10	
		Predominantly based on groundwater abstraction without focus on sustainable recharge	5	
		Solely based on groundwater abstraction without focus on recharge	0	
	Reuse (annually)	More than 30%	15	
		20 to 30%	10	
		10 to 20%	5	
		Less than 10%	5	
		No reuse	0	
	Summer Water Deficit Status			
		Water deficit managed through existing Municipal infrastructure	15	
		Water deficit managed in partnership with external service providers	10	
		Private tankers are hired by users directly during summers to solve scarcity issue	5	
		Frequent droughts impact life	0	
		Extreme adverse social and environmental impacts (like negative impacts on livelihood, livestock, vegetation)	-5	
		Seasonal migration due to water scarcity	-10	
		Area(s) abandoned due to water scarcity	-15	
	Future water security (for next 10 to 20 years)			
	Planned source(s) of water	Multiple sources of water for supply to the city (more than 2)	15	
		More than one major source of water for supply	10	
		Dependence on single source of water (surface water)	5	
		Dependence on single source of water (ground water)	0	
	Planned Reuse (as % of projected water demand)	More than 40%	15	
		20 to 40%	10	
		Upto 20%	5	
		No reuse planned	0	
	Planned Surface water, groundwater mix	Conjunctive water use (mix of groundwater and surface water) is undertaken in a sustainable manner	15	
		Predominantly based on surface water	10	
		Predominantly based on groundwater abstraction without focus on sustainable recharge	5	
		Solely based on groundwater abstraction without focus on recharge	0	
		Not planned	0	
	Future Planning for demand and supply balance			
		Measures for demand reduction are taken before securing supply for future	15	
		Demand and supply balance and sustainable abstraction considered while planning for future	10	

S. No.	Indicators	Criteria Scoring		
		Criteria	Scale	Score
		Water demand calculations used as sole basis for future water abstraction	5	
		Adhoc projects undertaken for supply provision	0	
5	**Municipal Wastewater Discharge**			
		Municipal wastewater is recycled and reused after treatment as per standards	15	
		Municipal wastewater as per standards is treated and discharged into freshwater sources/ open areas	10	
		Inadequately treated wastewater is used for irrigation	5	
		Inadequately treated wastewater is being discharged into water bodies	0	
		Wastewater being discharged without any treatment	-5	
		Untreated wastewater discharge leading to localized pollution of water/soil	-10	
		Untreated wastewater is polluting water resources leading to spread of diseases	-15	
6	**Water pollution**			
	Conservation of natural drainage channels and catchment area of water bodies			
		Planning and urban development are undertaken while conserving natural drainage channels and catchment area	15	
		Considered in planning but not adequately conserved due to lack of enforcement	10	
		Not adequately considered in planning or enforcement	5	
		No consideration, drainage channels and catchment area are prone to encroachment	0	
		Why does Municipality have to look at the catchment? That is not in our scope of work	0	
	Link between water and energy			
	Energy	Link between energy and water is realized and measures towards this are taken (like use of Renewable Energy or RE, energy efficient pumps & motors)	15	
		Link between energy and water are realized and measures are planned	10	
		Link is realized but no measures being planned	5	
		Link not recognized, measures not taken	0	
	Sludge	Sludge is utilized for energy generation or farming through Municipality	15	
		Municipality is disposing off the sludge and this sludge is taken up by individuals for reuse	10	
		Sludge is not reused but is disposed of safely	5	
		Improper management of sludge is leading to pollution of water resources	0	
	Institutional mechanism			
		Institutionalized Integration of departments working in water and allied sectors (Existing institutional framework ensures that all water and allied departments collectively undertake planning and management of water and allied sectors)	15	
		Separate organizations dealing with water and allied sectors but interact before finalizing all projects/programmes related to water	10	

S. No.	Indicators	Criteria Scoring		
		Criteria	Scale	Score
		Separate organizations with interactions only for finalization of project/programme	5	
		No interaction before project planning or implementation	0	
	Role of informal institutions and practices			
		Informal institutions recognized and integrated with formal institutions	15	
		Informal not yet integrated with formal but plans being developed for integration	10	
		Informal not integrated but role of informal sector is recognized	5	
		Role of informal sector not recognized	0	
	Decline in groundwater level in recent past (last 10yr)			
		Less than 1m decline	15	
		Less than 5m decline	10	
		5 to 10m decline	5	
		More than 10m decline	0	
	Climate change and water resources			
		Impacts of climate change on water resources are recognized and adaptation measures are taken (like Climate Adaptation Plan) at local level	15	
		Regional level impacts are known and measures are being taken at regional level	10	
		No measures being taken to reduce adverse impacts of CC on water resources but need for same is recognized	5	
		Impacts of climate change leading to negative impacts on water related sectors but need for measures not recognized	0	
	Instances of water or vector borne diseases (Malaria, Typhoid, Jaundice, Hepatitis)			
		Not common	15	
		Occasional occurrence in some areas	10	
		Occurs every year in some areas (like slum areas)	5	
		No information	0	
		Outbreak of epidemic in recent past but is not common	-5	
		Outbreak of epidemic is common (occurs annually/seasonally)	-10	
		Water borne diseases leading to fatality	-15	
	Capacity (skills, resources, awareness, willingness) of Municipal staff			
		Institutionalized capacity building cell in place. Also provides training towards integration to all new and existing staff	15	
		No permanent cell but all new staff are oriented on aspects including integration at the time of joining (at all levels)	10	
		Staff trained at work on integration aspects but not much capacity in the existing system to undertake inter sectoral integration	5	
		No knowledge on aspects of integration	0	

Outcomes

- Once you have the scoring for the city **the Strengths, Weaknesses and Quick Improvement Areas can be identified** from column 'C' of Tool.
- In the following table, list out the key strengths (aspects with '15' points) and weaknesses (aspects with '0' or negative marking) across water and allied sectors.

Strengths of the city (15 points)	Weaknesses ('0' or negative points)

- Based on the total score of the city, the following table will give the ranking/status of integration in the city.

Score	Status	Implications
Above 600	Excellent	Good level of integration in place at most levels, city needs to continue existing measures
450 to 600	Good	Good level of integration but certain sectors might require attention
		Additional measures towards integration can improve situation
300 to 450	Average	Some level of integration across sectors
		Measures towards integration should be taken to solve the water related issues being faced
150 to 300	Poor	Hardly any integration
		Need for immediate measures towards integration across sectors
Below 150	Critical	No integration across sectors
		Immediate measures towards integration
		City needs to rethink the planning and management concepts for redesigning the urban water cycle

Module 2: Water Balance and Formulating the Vision

General Objective	Water demand and supply gap and formulating a vision for the city.
Training Contents	Water balancing, Vision development
Exercise	Urban Water Balance Tool
Methodology	Short Presentation, Group work
Intended Learning Outcomes	Improved understanding of the existing demand supply gap in water sector and setting of specific objectives as per a vision on IUWM

Introduction

Water balance modeling gives us a better understanding of the components of the hydrological cycle so as to develop appropriate management options for addressing its changes. Understanding the water balance of the city/catchment/region helps to understand whether or not the city/region/catchment has the water resources to meet the required demand.

City Water Balance

The balance between inputs and outputs is known as the water balance or water budget. The water balance can be shown using the formula:

Precipitation (P) = stream flow (Q) + evapotranspiration (E) +/- changes in storage (S)

$P=Q+E +/- S.$

The water balance affects how much water is stored in a system. At city level it can be measured based on water availability from the source to the sink or house hold level, thereby calculating the city water supply and demand gaps.

EXERCISE 2.1: Urban Water Balance Tool

It is important to know whether the resources required to meet the existing and future demand are also available at the regional level. This can be undertaken using the following matrix.

S. No.	Scale	Parameters	Numbers	Estimated Utilizable Capacity (MLD)	Total (MLD)
1	City level	Surface water sources			
2		Water supply to the city (Present)			
3		Water demand (Present population * 135 lpcd)			
4		Water demand (Projected population * 135 lpcd)			
5		Amount of water reused in the city (present)			
6		Amount of water reused in the city (Future – as per plans)			
	Water balance (Present) at City level = (1 + 2 + 5) - 3				
	Water Balance (Future) = (1 + 2 + 6) - 4				

Outcomes

At the end of the exercise, the city will understand the gap in demand and supply that may arise in a business as usual scenario in future.

Creating a Vision

A vision is a concise description of a desired future state, containing the broad goals that give the overall direction for strategic planning purposes. Without agreement on a common goal, different stakeholders will continue to work according to their individual, and sometimes conflicting, agendas. Under such circumstances, integration – and thus more sustainable water management – is almost impossible to achieve.

Before a new vision is developed, it is necessary to take stock of potentially already existing visions for other urban sectors, local development as a whole or even others developed in certain areas at the national level. Making sure that the vision for water ties in with other similar processes is an early opportunity to increase integration across sectors and potentially also different levels of government.

Setting Objectives

Objectives are a more detailed and concrete breakdown of a vision into sub-goals. The vision is deliberately written in a clear and concise style without going into the details of the change that is required. This detail is in the objectives. Reaching each aspect of the vision – such as having universal access to sanitation or healthy rivers and lakes – will potentially require the achievement of several objectives. The objectives specify what changes in state need to be achieved for the vision to become reality.

Indicators and Targets

Indicators are tools to measure and/or visualise progress towards objectives (and thus the vision). Targets are aspired indicators and have to be associated with a timeframe.

In order to measure this achievement, indicators have to be defined that reflect progress towards the objective. Indicators are associated with a target which is the result to be achieved in order to meet the objective. For example, if the objective is to use biogas generated from wastewater sludge digestion for cooking gas, the indicator could be the number of households using biogas stoves. The target could be a minimum of 5,000 households using biogas stoves by 2020. The indicators and targets therefore aim to measure the results of programmes and actions that are implemented to achieve the objectives and ultimately the vision.

Objectives typically relate to the condition of the urban water system (its state). Indicators on the other hand can measure:

- The change to the system itself (its state);
- The change to the factors that influence the system (the pressures);
- The implementation of actions aimed at improving the system or mitigating the pressures (the response).

Indicators are selected based on different criteria. This is mostly a combination of the level of information they provide and the ease with which they can be measured. Key questions to consider are:

- Is the indicator relevant for the objective?
- Can the indicator be compared with baseline data?
- Can the indicator be easily collected at an affordable cost?
- Can the indicator be easily interpreted at an affordable cost?

Example

Objective	Example indicators	Associated targets
To restore natural groundwater levels	⌘ Volume of groundwater abstracted ⌘ Percentage of impermeable surfaces that prevent infiltration of rainfall runoff ⌘ Domestic per capita consumption of potable water	⌘ Average groundwater abstraction to not exceed X Ml/d over a period of 5 years starting at year X ⌘ Average per capita consumption reduced to X liters per person per day by year X ⌘ Area of permeable surface increased to X% by year X

EXERCISE 2.2: Developing the vision and setting objectives

The vision can be developed through the following steps:

- Identification of the main water issues that the city is facing
- Prioritisation of the identified issues;
- Reflecting on the priority issues and turning them into a desired state
- Break up the vision into sub-goals to identify at least 2-3 objectives
- For each objective, identify concrete measureable actionable indicators that can reflect the change over time.
- For each indicator, identify a target with a specific timeframe

At the end of the exercise the teams will have a vision for the city

City Name	Vision	Objectives	Example indicators	Associated targets

Module 3: Action Planning for Integration at City and Community Level

General Objective	Formulating an IUWM action plan and a monitoring framework
Training Contents	A list of Strategies, project prioritization based on cities interest, an action plan
Exercise	Project prioritization tool, Action plan
Methodology	Short Presentation, Group work, Q&A session
Intended Learning Outcomes	

Introduction

In this module, an IUWM action plan will be developed, which includes strategies to achieve the vision of the city. These strategies should be developed giving due consideration to the existing vulnerabilities in the city, particularly with regard to water and sanitation in specific areas or challenges faced by specific vulnerable populations. These strategies will be linked to ongoing programs and government initiatives to ensure the sustainability of the action plan. The plan will have a timeframe to implement the strategy and identify available financial and other resources.

In order to rule out any strategies/ projects that do not demonstrate integration, an exercise is to be undertaken with the stakeholders to identify projects that have positive impacts on at least 2 of the 3 sectors (water, wastewater and storm water). Projects that have positive impact on only one of the sectors, should be filtered out as they do not demonstrate integration.

EXERCISE: Formulating an Action Plan

The following steps need to be taken to develop the action plan:

- For each objective, identify strategies that will meet these objectives, covering at least 2 sectors, and giving special considerations to vulnerable areas and populations
- For each strategy, identify a realistic time frame within which it can be implemented.
- For each strategy, identify any available budget
- For each strategy, identify any ongoing programme of the government to which it can be linked up

Vision for the city	Objectives to attain the vision	Associated targets	Prioritised Strategy to attain objective	Timeframe Next 5 years (short term), next 10 years (medium term) and next 20 years(long term)	Availability of the budget	Linkages with the on-going programs
Vision	Objective 1	1	Strategy 1			
		2	Strategy 2			
		3	Strategy 3			
	Objective 2	1	Strategy 1			
		2	Strategy 2			
		3	Strategy 3			
	Objective 3	1	Strategy 1			
		2	Strategy 2			
		3	Strategy 3			

Outcome

At the end of the exercise, the city will have a fully developed action plan, with a list of possible interventions that support IUWM.

Project Prioritization

There are 4 key parameters which are the prime determinants of the sustainability of a project. These parameters are:

- Social benefits/feasibility
- Economic benefits/feasibility
- Environmental benefits/feasibility
- Participatory approach

Stakeholders will give scores on a scale of 1 to 4 to each project for social, environmental, economic feasibility/benefits. The total score would be an average of the scores for these 4 sectors.

EXERCISE: Project Prioritization

Interventions	Integration across sectors (A= W+WW+SW+SWM)				Does the project involve incremental / holistic approach towards integration of urban water cycle (B) (yes = 1, no = 0)	Grading by stakeholders				Average Score (C= {S + EC + EV + P}/4	Rank D = A+B+C
	Mandatory (min 2)			Other		Social benefits/feasibility (on a scale of 1 to 4) (S)	Economic feasibility/ benefits (on a scale of 1 to 4) (EC)	Environmental benefits/ feasibility (on a scale of 1 to 4) (EV)	Participatory approach (on a scale of 1 to 4) (P)		
	W (yes = 1, no = 0)	WW(yes = 1, no = 0)	SW(yes = 1, no = 0)	SWM (yes = 1, no = 0)							
Project 1											
Project 2											

Outcomes

At the end of the exercise, the city will have a list of projects that are ranked as per their IUWM potential.

Contact

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ANNEXURE-2

IUWM Case Studies

Global Water Partnership South Asia

India Water Partnership

I.C.L.E.I Local Governments for Sustainability

Table of Contents

Introduction

Rajasthan covers 10.5% of the country's geographical area, but has only 1.16% of its water resources. It is the driest state, with nearly 70% of the area classified as arid or semi-arid. The state has always been a water-deficit area. It receives an average rainfall of 531mm, against the national average of 1200mm, while the desert areas have an average of 380mm (GoR, 2010d).

The situation of surface water resources in the state is precarious. Except in the canal command area in the north, the surface water potential is very low in the central, western and southern parts of the state (CAZRI, 2009). Although the whole state is categorised as being water scarce (having per capita water availability below 1000m3 year-1, Narain et al., 2006), the condition in its western part is more critical. The west-central part of western Rajasthan doesn't have any drainage network and has scanty surface water resources.

To make matters worse, short monsoon spells coupled with erratic and scanty rainfall make Rajasthan the most water-deficient state in the country. The major issues in the water sector are with regard to water quality, quantity, demand and extraction, as well as waterlogging, pesticide contamination and the impact of construction and pollution in the catchment areas of water resources.

The Integrated Urban Water Management (IUWM) Planning and Implementation is an initiative of India Water Partnership (IWP) and ICLEI South Asia, supported by Global Water Partnership (GWP), to strengthen the integrated urban water management approach in the cities of Rajasthan.The project's objective is to build the capacity of urban local bodies to undertake water sector reforms, for closing the urban water loop by understanding the IUWM principles and approaches.

This document provides the details of a few of the best case studies that were implemented in Indian cities by the government and private organisations, taking into account the principles and approaches of integrated urban water management at various levels. These case studies will be useful for municipalities, practitioners and researchers to understand the broad approaches of IUWM and its methodologies to streamline the present water management practices.

Water Resources Management through Community Participation and Construction of Johads

Introduction/ Existing Scenario

Alwar district is one of the driest areas in Rajasthan. The levels of the groundwater table and the surface water are very low here due to over- extraction and the absence of groundwater recharging structures. Piped water supply is the only source of drinking water here.

How It is Addressed

The main strategy for tackling the water scarcity in this district was the renovation of old earthen dams or johads, which had been traditionally used for recharging groundwater. But in the modern era, people had only exploited the groundwater. So, in this case study, old and traditional earthen dams were renovated.

About the Project

Tarun Bharat Sangh, an NGO, took steps to improve the catchment area and to revive the Arwari River with the help of johads. The reconstruction of the johads helped the villages to have plenty of water. The main factors that changed the game here were the community involvement and the reconstruction of johads. The initiative was launched first in Gopalpura village in Alwar district.

Vision & Goal: To revive the Arwari River and surface reservoirs, and to reconstruct johads to replenish the groundwater

Implementation Agency: A Non-Government Organisation Tarun Bharat Sangh initiated the revival of johads in Alwar district

Implementation status: Completed in the year 1985

Integration Across Sectors: Water and stormwater

Tools/ Technology Used: Planning and renovation of old earthen dams was the main tool

Key stakeholders: Tarun Bharat Sangh and the people of Alwar district

Cost: NA

Process

The project was implemented in three phases: preparatory; planning and design; and implementation. In the preparatory phase, the NGO team motivated the local community for the renovation of these earthen dams, because that was necessary to manage the johads. The dams had been traditionally used to recharge the groundwater in the district. They required renovation so that they could be functional and help recharge the groundwater. This renovation was achieved before the onset of the monsoon, with the help of community engagement. Following the monsoon, the nearby wells got recharged and there was plenty of surface water. The level of the groundwater table also increased. Water parliaments were formed in the villages to monitor the johads in the future and to decide the use of water.

Output/ Outcomes

Currently, there are more than 3000 water harvesting structures in 650 villages of the district. Following the success of this project, the villages have started cultivating multiple crops at the same time. Earlier, they could grow only one crop in a season due to water scarcity. The renovation of the earthen dams have also helped to revive the Arwari River due to the increase in the surface water supply. The villagers have stopped using diesel pumps for extracting groundwater, leading to reduced farming costs and making agriculture more profitable. The activities undertaken by Tarun Bharat Sangh in the villages have also imparted knowledge and raised awareness on the need to conserve rainwater.

Reasons for Success

The success of this water management project can be attributed to the involvement of the local community and the revival of traditional water harvesting techniques. The project exemplifies the efficient management of water resources through community participation and the renovation of johads.

Advantages & Limitation

The success story of Alwar district has inspired many villages in Rajasthan to replicate this model, involving the revival of traditional rainwater harvesting structures. This initiative helped to increase awareness among the people about the importance and benefits of water conservation. They were motivated to renovate their traditional water harvesting structures, which led to the recharge of groundwater, and consequently dry wells. This approach reduced the load on the fresh water supply or on a single source. It helped to integrate the water and stormwater sectors at the township level through an incremental approach towards IUWM. Initially, the NGO had to face some issues as the people had to be motivated and convinced about the formation of johads and to change their approach from exploiting water by using diesel pumps to helping in the recharge of the groundwater table. It is an initiative that takes time, and needs more financial sources and government support before it can be replicated at a mass level.

Anoxic Bioremediation in Hauz Khaz Lake, New Delhi

Introduction/ Existing Scenario

The Hauz Khas Lake in Delhi was getting polluted due to the treated and untreated sewage being discharged into it from a sewage treatment plant in Vasant Kunj. The lake used to receive treated sewage of approximately 3MLD daily. The situation deteriorated when untreated sewage also started being discharged into the lake sometimes. This caused a strong odour to emanate from the lake, posing a nuisance to the neighbourhood.

How It is Addressed

The Hauz Khas Lake was revived by bioremediation technology, which took a few months to implement. The process involved the use of Persnickety® 713 -- a product developed by JM Enviro technologies Pvt. Ltd. -- which reduced the pollution in the lake. This technology is effective in controlling foul odour and in reducing the amount of Total Suspended Solids (TSS), BOD and oil or grease accumulation in polluted waters.

About the Project

The project involved natural in-situ treatment and Persnickety® 713's anoxic bioremediation technology (ABR), which uses selected anaerobic and facultative microbes. The technology involves manipulation of the environmental parameters to allow microbial growth and degradation to progress at a faster rate.

Implementation Agency: Delhi Development Authority (DDA) and JM Enviro technologies Pvt. Ltd.

Implementation status: Implemented successfully and operational since 2007

Integration Across Sectors: Water, wastewater and stormwater

Tools/ Technology Used: Anoxic Bioremediation Technology and Persnickety®713 product

Key stakeholders: Delhi Development Authority (DDA); JM Enviro technologies Pvt. Ltd.; communities dependent on the lake for their livelihood

Cost: Capital costs of Rs. 5,72,500 for the designed capacity of 128ML and for an area of 15 acres, and O&M of Rs. 2.8 lakhs/acre/year.

Process

The treatment was carried out in two phases. Initially, high shock doses were given to stabilise the system for a few days, followed by low dosing once the bacterial strains entered the regeneration phase. Then, six to 24 hours prior to the dosing, the concentrate is mixed with an activator and diluted in chlorine-free water in the ratio of 1:40. Dosing is done at specific points that are generally closer to the inlet/ starting point of the sewage flow.

Output/ Outcomes

This technology of allowing microbial growth and degradation to proceed at a faster rate proved to be effective. As a result, the BOD and pH levels of the treated water fell within the first month of treatment. The BOD fell from 50 mg/l to 14 mg/l and from 70 mg/l to 21 mg/l at two different dosing points. The pH level also reduced from 9 to 8. In addition, the technology was effective in reducing the dissolved oxygen (DO) to satisfactory levels, leading to a cleaner lake environment and reviving the aquatic life in the lake.

Reasons for Success

ABR, which is a low-cost and no-maintenance technology, proved favourable to the success of this project. Moreover, it virtually doesn't require any power since the process is based on the principle of using naturally occurring bacteria or fungi for degradation of contaminants into lesser toxic forms. Following the success of this project, it has been replicated at other sites, including at Kushak Drain in New Delhi.

Advantages

This project provided eco-technology as an option for wastewater treatment in drains, lakes and STPs, among other sites. Another major advantage of this project is its low cost. It doesn't require additional infrastructure or new construction. It reduced the DO to satisfactory levels without using aerators that consume a large amount of power. The microbial consortia used in this process are capable of exhibiting growth at a wider temperature range too. The implementation of this project also led to reduced groundwater pollution. The treated water can be reused for irrigation or other purposes, since it matches the desirable standards of reuse, hence decreasing the load on freshwater sources.

Integrated Urban Water Management with focus on NRW reduction in Jamshedpur, Jharkhand

Introduction/ Existing Scenario

There is rising demand for water in Jamshedpur. At the same time, the city suffers water loss, which can be as much as 36%. The presence of a large number of illegal connections further reduces the efficiency of the piped water network.

How It is Addressed

The JUSCO model is based on an integrated 'river-to-river' management concept. The integration of water and stormwater was achieved by reducing non-revenue water (NRW) and by improving efficiency by expanding the piped water coverage, thus decreasing the load on groundwater. The water sources were augmented by utilising the surface runoff through rainwater harvesting structures built in residences and public buildings. A stormwater management plan for the city has also been prepared. In the water and sewerage sector, sewage was collected and treated by an activated sludge process (ASP) and extended aeration process. A portion of it was reused in industries and the remaining was discharged downstream. A portion of the solid sludge was also sold in rural areas for agricultural use.

About the Project

Jamshedpur Utilities & Services Company Ltd. India (JUSCO), the only private company involved in providing civic services in India, took the initiative of closing the water cycle loop by integration across sectors and by deploying monitoring technologies. The JUSCO model is known for its financial mechanisms and efficiency measures, such as reduction in NRW.

Vision & Goal: Integration of sectors and services; better quality services and increase in the efficiency of services

Implementation Agency: Jamshedpur Utilities & Services Company Ltd. India (JUSCO)

Integration: Across sectors (water, wastewater, stormwater)

Tools/ Technology Used: SCADA for treatment plants, energy audits, metering and flow monitoring, ground penetrating radar, hydraulic modelling and GIS-based systems

Key stakeholders: JUSCO in co-ordination with PHED, service providers and citizens

Cost: NA

Process

The project was implemented by JUSCO over three phases. In the preparatory phase, the focus was on generating public awareness about water conservation through water-themed marches, seminars and workshops. These were very important for bringing about attitudinal change, raising accountability and for encouraging payments for the use of municipal services. Metering and metering policies were advocated through media campaigns and public exhibits. Intense discussions and workshops were held by JUSCO for community engagement and other stakeholders' involvement.

In the next phase, one pilot DMA and various DMAs were created for measuring and analysing leakages, monitoring the zone and for assessing illegal connections. DMA managers were trained in leakage detection and analysis. A 24x7 water supply policy was implemented and rainwater harvesting structures were built in schools and colonies. Citizens were offered free water for the first three months after meters were installed as an incentive to assess their consumption patterns. The meter rental costs and tariff structure were also reduced. MoUs were signed for a unique cost-sharing model for the expansion of piped water coverage to those still uncovered by it and also low-income households that were dependent on groundwater. JUSCO made the investment required for treatment, pumping and conveyance of water to the nearest water tower, while the cost of local networks was divided between the consumers.

In the implementation and O&M phases, the NRW reduction programme was carried out, including the installation of DMA meters, conversion of illegal connections to authorised ones and leakage monitoring for DMAs. The NRW in the rising mains and distribution networks was checked and analysed every month. Leakages were detected with the help of leakage detection equipment and by conducting 'walk-through surveys. Electromagnetic meters with frequent data checks were used for monitoring and supervision. A minimum night flow technique was also used to identify physical losses. SAHYOG Kendra, a 24-hour helpline, was established for resolving complaints and grievances.

Output/ Outcomes

Physical and commercial losses were reduced due to reduction in leakages. The NRW fell from 31% to 8% within a year in the pilot DMA, which was scaled up further. There was an overall NRW reduction from 36% to 9.9% during the 2005-09 period. The per capita water consumption fell from 193 lpcd to 170 lpcd due to demand management. The project also led to prevention of over-exploitation of groundwater through expansion of piped water services, under which an additional 13,000 new connections were added.

Reasons for Success

The key reasons that enabled the success of this project included JUSCO's proactive network monitoring and leakage detection. An intensive awareness generation drive for community engagement and participation was also crucial. The deployment of modern technology for service management also ensured transparency and efficiency in the project.

Advantages & Limitations

With this project implementation, JUSCO was transformed from being a unit under Tata services to becoming a private agency responsible for integrated services. It also became a utility service provider through PPP and management contracts in cities such as Kolkata, Haldia, Mysore, Bhopal and Indore. The technological knowhow it had enabled the company to handle the drive better, as compared to urban local bodies. JUSCO has managed to bring about behavioural changes among citizens towards metering and piped connections through various meetings and workshops. They also devised a cost-sharing model after consultations and engagements with community stakeholders.

However, financial sustainability was an issue as the project was handled by a private company. Political interference and opposition from the public with regard to metering and illegal connections in the initial phase also hampered the project.

Reuse of Wastewater in Nagpur, Maharashtra

Introduction/ Existing Scenario

Nagpur, a city of about 2.5 million people, is in Maharashtra in central India. The water supply system in this city is regulated by the water works division of the Nagpur Municipal Corporation (NMC). The city is experiencing a growing water demand, with new water sources being located far away. The harnessing of these sources will require a lot of capital and energy consumption. There is already a scarcity of resources and funds to be spent after augmentation of water sources.

How It is Addressed

The NMC undertook a pilot project, involving the reuse of 110 MLD of wastewater on a PPP basis, with Mahagenco, a power generation company in the city. The aim was to address the water scarcity and to increase the financial viability of the treatment plants. The NMC signed a statement of support with the relevant state department and signed an MoU with Mahagenco for the construction and O&M of the plant. The reclaimed water shall be used in processes such as ash handling and in the cooling towers of Mahagenco, while freshwater to the tune of 110 MLD is being conserved.

About the Project

The project followed a holistic approach, involving the integration of water and wastewater sectors at a city level, through an incremental approach towards IUWM.

Vision & Goal: Augmentation of the water supply through exploration of alternative sources of water.

Implementation Agency: Nagpur Municipal Corporation (NMC), with technical assistance from USAID.

Implementation status: Construction of the STP has been completed

Integration Across Sectors: Water and wastewater

Tools/ Technology Used: PPP between Mahagenco and NMC on a BOT basis; micro-filtration technology for the treatment of wastewater

Key stakeholders: NMC, State and Central governments and Mahagenco

Cost: NA

Process

The project was implemented by the NMC over four phases: preparatory; planning and design; financial arrangements; and implementation. In the first phase, the support and co- ordination of various departments such as urban development, water supply and sanitation, environment and water resources was secured for the 'statement of support for water reclamation'. The financial viability of wastewater reuse was calculated on the basis of the average cost of freshwater versus the cost of reclaimed water.

In the second phase of planning and design, the available technologies were evaluated by comparing conventional technologies with newer technologies. Within power plants, the application with the required water quality was assessed. The potential users and uses for the reclaimed water were identified. The uses comprised industrial use in power plants, special projects like MIHAN (a cargo hub), irrigational purposes and use in landscaping in the Greater Nagpur region. For financing arrangements, a grant of 70% of Capex under JnNURM (shared 50% by GoI, 20% by the state government as grant and 30% by the NMC) was made. The NMC's capital expenditure share of 30% was to be borne by Mahagenco. It was also decided that the O&M would be done by Mahagenco for a 30-year concession period and that a water tariff @ Rs 1.5 / KL would be paid to the NMC. In the final stage of implementation, Mahagenco was given the responsibility of constructing, operating and maintaining the STP (secondary and tertiary treatment) with its own funds, and with a grant of Rs. 90 crores received from JnNURM. The NMC gave the land for the STP to Mahagenco.

Output / Outcomes

With the successful implantation of this project, freshwater to tune of 110 MLD was saved, sufficient to meet the needs of about 0.8 million people. It also provided an economical and reliable alternative source of water supply to power plants. The project also led to reduction in the costs of water augmentation and energy, besides generating additional revenue for the NMC.

Reasons for Success

The key reason for the success of this project can be attributed to the pro-activeness of the NMC and its vision for achieving sustainability in water management. The funds from the Central and State governments helped in leveraging the financial feasibility of the reclaimed water. The agreement reached with Mahagenco on reusing the treated wastewater was also crucial.

Advantages & Limitation

The project led to the exploration of alternative sources of water to augment the water supply for the future, instead of relying on freshwater augmentation. It completed the water and wastewater loop through the reuse of wastewater, which is usually discharged into water bodies. It also led to the reuse of wastewater, thereby reducing the load on freshwater sources and reducing the need for electricity to pump water from newer sources.

The major limitation of this project was the reluctance of the public to accept treated wastewater as an alternative. As a result, the use of reclaimed water was restricted to non-potable purposes, due to the high cost of the process as well as the mindset of the people.

Rainwater Recharging Through Borewells in Surat, Gujarat

Introduction/ Existing Scenario

Surat is located on the banks of the Tapi River and witnesses high tides of five to six metres in the western part of the city. This phenomenon intensifies in the monsoon period and often leads to inundation of the settlements located along the tidal creeks, resulting in flooding and waterlogging. Surat is dependent on surface water, mainly from the Tapi River, as well as groundwater to meet its growing water demand. However, the supply of water in both sources is getting depleted and hence not enough to meet the demands of a growing city.

How It is Addressed

In order to address the depleting groundwater issue and to tap the runoff leading to waterlogging, Surat has come up with a plan for rainwater harvesting to recharge borewells and installed structures across the city.

About the Project

The project was implemented by the Surat Municipal Corporation (SMC) with technical inputs and guidance from PANAM Consultancy. The project was funded under the Gujarat State Government's 'Swarnim Jayanti Mukhyamantri Shaheri Vikas Yojana' scheme.

Vision & Gaol: To reduce the load on freshwater sources and to utilise rainwater as an additional source of water for potable and non-potable uses

Implementation Agency: Surat Municipal Corporation (SMC)

Implementation status: Implemented and operational

Integration Across Sectors: Water and stormwater

Tools/ Technology Used: Primary surveys, feasibility studies

Key stakeholders: SMC, PANAM Consultancy, contractors

Cost: NA

Process

The project was implemented by the SMC in two phases. In the preparatory phase, the area was surveyed, analysed and divided into three zones: Varachha, Athwa and Rander. All the areas that suffered waterlogging were surveyed and mapped for determining the locations of the boring structures and to prevent waterlogging in the future. These recharging structures were spread across the city, installed mostly in public buildings / places like schools, hospitals, gardens and libraries. The location of each of these recharging structures was finalised after consultations and visits of the SMC engineer to the site. Implementation and supervision were carried out in the next phase. Specific guidelines were laid down for the contractors for the sequencing of the pipe assembly. The contractor was also required to make the required diversions and connections to use the roof-top/terrace water runoff, if the surface runoff was unavailable. A total of 45 structures have been installed in a phased manner in the three zones: 15 in Varachha; 20 in Athwa; and 10 in Rander. The sites were visited again after drilling and completion of work.

Output / Outcomes

After the implementation of the project, variations were observed in the water level inventory. The water levels in the recharge wells in Varachha Zone fell from 12m to the dry well section. This change is attributed to change in lithological formations as well as monsoon periods, and the dry section of the recharge wells indicated the rainwater level. Similar changes were observed in the other two zones as well. Excessive runoff leading to flooding during the monsoon has often occurred in Surat, with the 2006 floods being one of the instances. This project also attempted to recharge rainwater through boring, bringing several benefits such as prevention of excessive runoff that could lead to flooding, as well as groundwater recharge.

Reasons for Success

A careful selection of locations for the recharge structures after surveys of the waterlogged areas and studies by the SMC and private organisations were useful for determining the appropriate sites. The installation of rainwater harvesting structures in public buildings allowed the tapping of stormwater, a potential additional source of water for the city. Technical inputs from private organisations and complete funding from the state government were crucial factors in the successful implementation of the project.

Advantages

The implementation of the project led to prevention of excessive runoff, thus preventing flooding, besides aiding groundwater recharge by storing rainwater. The load on freshwater sources was reduced with the utilisation of rainwater as an additional source of water for potable and non-potable uses. Stormwater was integrated with water management and became a potential additional source of water for the city.

NRW Reductions & Management in Water Supply Distribution System in Surat, Gujarat

Introduction/ Existing Scenario

The rapid growth of urbanisation in Surat has led to an increasing demand for water, with an estimated demand of 2331 MLD till 2014. Meanwhile, the sources of surface water in the Tapti River are scarce.

How It is Addressed

The Surat Municipal Corporation took an incremental step to increase the efficiency of the water distribution system and to reduce water losses with the help of technical inputs from various private agencies.

About the Project

The Surat Municipal Corporation established an NRW cell in the city and devised a mechanism for regular supervision and monitoring of the supply system. From the IUWM perspective, the project followed an incremental approach to reduce losses in the water distribution system and increase efficiency, thereby reducing water consumption through alternative sources such as groundwater.

Vision & Goal: *To* increase efficiency and equity in the water distribution system

Implementation Agency: Surat Municipal Corporation (SMC), with technical inputs from private agencies; funded under the JnNURM scheme

Integration Across Sectors: Water and stormwater

Tools/ Technology Used: Water distribution system mapping on GIS; metering and leakage monitoring technologies; SCADA system for WTP; energy audits and other engineering technologies

Key stakeholders: SMC and private agencies for contracting technical works

Cost: NA

The Process

The reduction in NRW and the concept of SCADA were implemented through the phases of institutional arrangements, planning and implementation and O&M of the system. In the initial phase, the focus was on capacity building of the municipal staff and the establishment of an NRW cell headed by the deputy engineer, SMC. Their roles and responsibility were assigned to increase systemic efficiency and reduce losses through leakage mapping and detection. Period checks that suggested re-routing and re-structuring were done through data monitoring to achieve equity in the distribution system. The practices of volumetric metering, devising metering polices and methodology, analysing tariff structure and rationalising tariffs were also undertaken to achieve financial recovery.

In the planning and implementation phase, a comprehensive water audit was carried out. Regular water audits were contracted to private agencies to understand the water losses in district metered areas (DMAs) and to prepare leak reduction strategies. Metering in the city was scaled up through volumetric metering based on connection sizes and purposes (such as residential and commercial), and by using different meters, such as electromagnetic meters for industrial connections and mechanical meters for commercial connections. DMAs were established in the city to map and measure leakages. Losses in the distribution network were mapped with the installation of flow meters, bulk meters and valves. Leakages of chlorine gas were checked and remedial measures were taken on a daily basis, based on leakage mapping and corrective measures such as changing of faulty valves and pipelines. The replacement of pumps and other facilities was done based on energy audit reports to enhance energy efficiency.

In the next phase of the O&M System, SCADA (Supervisory Control and Data Acquisition) was installed. It is a centralised system for accounting of plant unit operations. Water quality monitoring was carried out at various stages of generation and distribution at definite frequencies, in compliance of CPHEEO and WHO standards. A GRID System was established for interlinking of the water works and the water distribution systems, which also helped the city to restore the water supply system during the floods in August 2006.

Output / Outcomes

The implementation of the project led to improved service delivery and water distribution efficiency. After the leakage mapping, there was 32% reduction in leakages and complaints about contamination of water. There was an increment in revenue due to rationalisation of the types of meters being used for different purposes, such as replacement of mechanical meters in industries and the use of electromagnetic meters. A massive savings of Rs 6.36 crore per annum was achieved through energy-efficient measures, wind energy generation and route re-engineering. Effective communication strategies were devised in the form of campaigns and workshops, among other measures, to increase awareness about water conservation.

Similar strategies to reduce NRW with focus on administrative reforms were also undertaken in Pimpri Chinchwad, Maharashtra. The aim was to increase efficiency through water augmentation, metering, GIS mapping of zones and implementation of the SCADA system, besides raising public awareness through effective communication strategies, among other objectives.

Reasons for Success

The measures were successful because of the involvement of private agencies that provided technical knowhow, the active supervision and success monitoring by the SMC, and the available funding under JnNURM schemes.

Advantages and Limitation

The major advantages achieved under this project were increased efficiency of the water distribution system and reduction in water losses through technical inputs provided by various private agencies.

Integrated Water Management in Mulbagal, Karnataka

Introduction

Mulbagal is a Class III town in the Kolar district of Karnataka, spread over 9.8 sq.km. The town population was close to 50,000 in 2008 when the project was initiated, with about 31% of the population living in slums. It lies in a region with no viable source of surface water and was totally dependent on ground water for its drinking supplies. The waste water is disposed through septic tanks since the town does not have any sewerage system. Open defecation is prevalent and the open waste flows into storm water drains, and flows into water bodies contaminating them.

How It is Addressed

A four-year, multi-phase initiative of Arghyam was carried out in the Town Municipal Council (TMC) of Mulbagal that enabled the town to manage its water requirements through introduction of IUWM principles. Several engineering, scientific, and social studies were carried out to assess the water situation in the town, including a groundwater study, water quality study, an energy audit, a household survey of water and sanitation assets, and GIS mapping of all households without toilets in the town. Based on the results, IUWM actions were proposed and undertaken with the support of the TMC of Mulbagal and local stakeholders. State level agencies were also involved to generate interest for replication in other areas.

About the project

The project was carried out in five phases. First was the preparatory phase of engaging the local and state government stakeholders and developing partnerships. This was followed by the foundation phase which involved a series of studies to identify issues and setting up the Project Support Unit (PSU). Third was the Planning and design phase to identify and prioritise appropriate interventions for implementation. The fourth phase of implementation involved guiding the local actors in implementing a few targeted interventions. The final Operations and Maintenance (O&M) phase involved building local capacities and strengthening institutional or community structures to manage the implemented interventions.

Vision & Goal: Increasing integration across all sectors (water, wastewater, storm water and solid waste)

Implementation Agency: Arghyam

Integration Across Sectors: Water, wastewater, storm water and solid waste

Tools/ Technology Used: GIS audit of ground water, water quality assessment, energy efficiency audits, surveys

Key stakeholders: Mulbagal TMC and local stakeholders, Directorate of Municipal Administration of Karnataka

Process

The project set up institutional mechanisms of a state level coordination committee to regularly meet and discuss the project progress as well as to resolve any issues arising from its implementation. The Directorate of Municipal Administration served as the nodal office for the initiative. The TMC and its staff were also very supportive to the entire process. To implement the project, a Project Suport Unit was set up in the town. Community was mobilized by forming Ward Neeru Mathu Nairmalya Sanghas (WNNS) was done.

A ground water study was conducted to understand the availability and quality of ground water in the town and assess the feasibility of using ground water as a continuous source in the town. It was seen that the core area had shallow borewells, but with poorer quality, possibly from the contamination from septic tanks, while the peripheral areas had deeper borewells, with better quality of water.

An energy audit was conducted to assess the efficiency and performance of five pumping stations supplying water to the town. The audit showed that an energy efficient water system could reduce the production cost of water supply by almost Rs. 2 per kiloliter, saving Rs. 31 lakhs annually for the TMC. A complete audit of the water supply system (including the pipes, valves, pumps, and all the other assets) was carried out and a GIS map of the entire grid was created.

The studies helped to identify five main tracks as areas for intervention – energy efficiency in pumping stations, rainwater harvesting in schools, community toilets, individual toilets under the Government of India (GoI) Integrated Low Cost Sanitation (ILCS) scheme, and solid waste management. These interventions were embedded in existing programmes/schemes, approval and funding for which came from the DMA. These activities were seen as ways to address tangible issues faced by the town's population. The IUWM principles of sustainability, good governance, and empowerment of local government were implicit in the design of each activity.

Output / Outcomes

Twelve defunct community toilets were repaired and their ownership was transferred to the TMC by the Slum Board that had originally built them 10 years ago. In one of these, decentralized wastewater treatment technologies were adopted. Four community toilets were brought back to use with a community-managed model. In one of them, a caretaker has been employed by the community and is sustained by the fees paid by the households. This led to successful maintenance of the toilet block.

A locally customised solid waste management initiative has been designed and is running successfully in 750 households. Formal resolutions were passed by the TMC to create the Nirmala Balaga group to run the programme and ban plastic bags. Wet and dry waste is segregated and collected by this group that takes responsibility for daily collection and disposal of the wet waste.

A defunct rainwater harvesting structure in a local school was also repaired and made functional. Leaking taps in public areas were replaced; Sanitary seals were constructed on 15 bore wells to prevent groundwater contamination. Applications for toilets for 240 households under the ILCS scheme were developed, approved by the local authority, and submitted to the Government of India (GoI).

Close engagement with the Karnataka Urban Water Supply and Drainage Board (KUWSDB) led to several important design changes in the ongoing underground drainage system and the planned wastewater treatment plants. TMC was advised to adopt a decentralized wastewater treatment system rather than conventional centralized method.

Revival of an ancient temple tank 'kalyani' through community participation which was defunct for 40 years was a major breakthrough for the visibility of project. It helped create ownership among the communities; Local champions like District Collector and Shramdaan from Municipal staff and other local groups played important role in motivating others.

In addition to efforts towards reducing water consumption and increasing efficiency in the supply system, efforts to augment water supply through rainwater harvesting, removal of open defecation, and prevention of groundwater pollution, led to cleaner drains and reduced water logging.

Reasons for Success

The Change Management Approach offered a rational and feasible way to help Mulbagal move incrementally towards IUWM. It involved connecting with the leadership and key stakeholders, providing guidance on implementable solutions and facilitating their execution through training and mentoring. This brought about an attitudinal change in the stakeholders as they realised the possibilities of improvement and realized their potential as change agents.

Advantages and Limitation

The major advantage achieved through the project was to showcase a successful IUWM model in a small city. However, limited conceptual understanding of IUWM posed certain limitations to the effective application of the IUWM principles.

Community Based Sanitation and Slum Development (CBSSD) Project in East Devadhanam, Trichy, Tamil Nadu

Introduction

East Devadhanam is a peri-urban slum in Tiruchirapally, Tamil Nadu, which was plagued by lack of basic water and sanitation facilities. There was poor access to safe drinking water, lack of safe sanitation facilities leading to open defecation, and lack of sewage treatment facilities leading to health hazards. Clogged drains and open drains flowing into River Cauvery was causing pollution.

How It is Addressed

The slum is an exceptional example of private-public cooperation supported by active involvement and participation of all stakeholders to improve the sanitation situation and unhygienic practices. East Devadhanam was selected for implementing a pilot on decentralized wastewater and solid waste system and has successfully demonstrated a sustainable system managed by communities and slum dwellers.

About the Project

The Trichy Community Based Sanitation and Slum Development (CBSSD) project was implemented in a phased manner consisting of preparation, planning & designing, implementation, and operation and maintenance.

Vision & Goal: Improving living conditions of poor settlements in peri-urban areas through promotion and establishment of decentralized sanitation solutions, cultivating good hygienic practices, treating wastewater and reusing in irrigation.

Implementation Agency: Implemented by Trichy City Corporation (TCC) in joint collaboration with Exnora International, Chennai and CDD Society, Bangalore; funding support by BMZ and the overall guidance by BORDA (marginal funding by SHGs)

Integration Across Sectors: Wastewater, storm water and solid waste

Tools/ Technology Used: DEWATS technology

Key stakeholders: TCC, Exnora International, CDD, BORDA, self-help groups, community and citizens

Cost: DEWATS unit cost was estimated at Rs.7,00,000 for treatment capacity of 9 cum (treating effluent from 20 toilets in 2 sanitation blocks, serving about 460)

Process

All 658 slums in the city were mapped and East Devadhanam was selected for the project based on the assessment of the status of basic services along with socio-economic information about the residents collected through surveys and Focus Group Discussions (FGDs).

In East Devadhanam, feasibility studies for constructing community toilet complexes were done using tools like community mapping, Venn diagram, transect walk, timeline analysis and problem tree.

A Decentralized Wastewater Treatment System (CBS-DEWATS) was designed to serve 384 EWS families. Sewage from the public toilets was meant to be reused in irrigation, biogas would be used for heating water and lighting and sludge would be used as fertilizers. Biogas settler, anaerobic baffle reactor and planted gravel filter were used for treatment. Awareness building and information dissemination were an most important step for attitudinal change amongst communities particularly for using the by-products after treatment. Street plays, community mobilization through social and cultural activities, discussions for awareness raising were organized.

The community was instrumental in selection of technical options for treatment, providing labor for construction of complexes, spreading awareness regarding treatment and its benefits and also carrying out operation and maintenance. In addition, sanitary complexes built by city corporation were handed over to the Self Help Groups (SHGs) for operation and maintenance to create a sense of ownership and improve sustainability of the complexes. SHG members from agricultural background supported the idea of reusing wastewater for irrigation and were successful in lobbying with TCC for acquiring a plot adjacent for farming and generating an additional income. A 2 member Social and Health Education (SHE) team was responsible for regular checks of sewers, removal of floating particles from ABR, etc. Fixed user charges of Rs. 0.50 per use was levied to cover operation and maintenance of the DEWATS system.

Output / Outcomes

The treatment system helped to reduce BOD and COD to levels that conform with Central Pollution Control Board norms for agricultural use of water. The BOD level of 179 mg/l and COD level of 896 mg/l were reduced to 26 mg/l and 184 mg/l respectively. There was drastic reduction in health hazard from waste water or open defecation was reduced in the slum. The biogas generated was used in cooking, heating water and lighting biogas lamps in the toilet complex whereas the by-product from sludge was used as manure. There was also a behavioral change in slum dwellers regarding hygiene, thereby improving social, economic and environmental conditions.

Reasons for success

The major reason for the successful implementation and sustainability of the system was the involvement of the community in the entire process of implementation and management of the project. Their involvement ensured that the solutions adopted were acceptable and benefits were shared.

Awareness raising activities carried out through the project also helped to generate acceptability of the project. Successful participatory appraisals helped in building a good rapport with the community and encouraged people to get involved in process. There was active participation of all stakeholders involved in taking up responsibilities.

Advantages and Limitation

The primary benefits from the project were the management of waste water and improvement of health, hygiene and sanitation practices in the slum area of the city. The project, through the decentralized treatment of waste water, generated several benefits of biogas and biofertilisers that were used by the community directly. There was no energy requirement and low maintenance of DEWATS system could be borne by the community. The city corporation supported the construction of toilet complexes and provided land for farming which generated income for the community as well.

The major limitation was a lack of public sector funds to be used in the East Devadhanam slum, since it was not a registered slum. However, with support of the city corporation this limitation could be overcome.

Conservation of Lakes through Citizen Participation in Udaipur, Rajasthan

Introduction

Udaipur, also known as the city of lakes, faces major issues regarding pollution of its lakes and encroachment of smaller lakes. Despite notifications from government and interventions by the High Court of the state, the situation has not improved. Untreated sewage flows into the lakes, deteriorating their water quality and causing eutrophication and sedimentation. Being a tourist city, there are a large number of hotels, and their garbage is deteriorating the catchment area of the lakes. This is adversely affecting the water quality and quantity in the city.

How It is Addressed

Jheel Sanrakshan Samiti (JSS), an NGO based in Udaipur took initiatives for conservation of lakes and persuaded the government through many initiatives, petitions, and campaigning to undertake interventions for pollution reduction. Lake conservation measures have been implemented in Udaipur through active citizen participation and handholding of JSS throughout the process.

About the Project

The project was implemented by JSS in Udaipur with funding support from the Government of Rajasthan. It was implemented through different steps, including preliminary assessment of the existing situation, designing of pollution abatement interventions and institutional arrangements for maintenance of the systems.

Vision & Goal: Environment up-gradation and conservation of lakes and its catchment in Udaipur to enhance tourism

Implementation Agency: Implemented by State Government and Udaipur Municipal Council with support of Jheel Sanrakshan Samiti (JSS) and funded under NLCP by Government of Rajasthan.

Integration Across Sectors: Water, wastewater, storm water and solid waste

Tools/ Technology Used: Biological control of water hyacinth through Weevils (N. eichhorniae & N. bruchi) and grass carp fishes; community engagement.

Key stakeholders: Jheel Sanrakshan Samiti (JSS), Municipal Council, PHED, Community and citizens.

The Process

JSS carried out hydrological and limnological studies to analyze the present status of lakes. Awareness generation was carried out to educate communities about the need for conservation of ponds and its catchment areas, its impacts on the tourism industry and the importance of water and forests, through workshops, puppet shows, street plays in local language.

Centralised sewerage system was built around the lakes of Udaipur and sewage treatment plants developed to stop lake pollution, funded by the National Lake Conservation Plan (NLCP) scheme under Ministry of Environment and Forests of Government of India. An oxidation pond was designed for Sisarma village located upstream of Pichhola by JSS along with the feasibility reports and detailed project reports under NLCP. Limnological conservation works, including biological control of water hyacinth which can remain viable for as long as 20 years was done through two types of Weevils - *N. eichhorniae* & *N. bruchi* obtained from ICHR, Bangalore. Catchment conservation of Pichhola water shed consisting of 16 villages and area of 12702 ha was carried out. Water augmentation plans have been developed to reduce the load on groundwater which forms 28% of supply currently.

"Jheel Samverdhan & Vikas Society" (JSVS), a lake conservation society chaired by Divisional Commissioner, Udaipur along with Secretary UIT (Urban Improvement Trust) as their Secretary General was formed in 2000 to look after the conservation activities.

Output / Outcomes

The project created awareness and involved citizens for lake conservation initiatives. A number of projects and interventions were undertaken by the government like conservation of small ponds, ecological restoration of lakes due to engagement by the JSS. The length of the plant and the biomass were reduced by 50-80% in one week by the addition of weevils.

Reasons of Success

The major reason for the success of the project was the handholding support of JSS and the formation of institutional mechanisms with administrative and financial powers for conservation of lakes which helped to sustain the initiatives. There was funding available under NLCP for the conservation of lakes of Udaipur. Initiatives and handholding support throughout the whole process by a local NGO – JSS helped to guide the entire project. Formation of a Lake Development Authority (LDA) ensured that conservation initiates are not stopped once JSS moves out.

Advantages and Limitation

The major advantages of the project were to develop integrated and biological approaches for conservation of water that addresses groundwater and lake pollution. The only limitation faced was lack of funds due to which some actions could not be completed.

Rain Water Harvesting in Umaid Heritage Township Jodhpur, Rajasthan

Introduction/ Existing Scenario

Jodhpur city is the second largest city of Rajasthan with a hot and semi arid climate. The city faces a scarcity of water, particularly for green area development. The case study shows the use of rain water for horticulture and landscaping purposes.

How It is Addressed

The project involved the creation of a rain water storage tank or step well that collects and saves the rain water for use in green area development. The project developed the model using old techniques of rain water harvesting. Local architects with knowledge on traditional rain water harvesting structures were used in the development of the bawari.

About the Project

The "Birkha Bawari" was constructed in an elite township named Umaid heritage Township. It serves both as a storage site for rain water and is also used as recreational space. It showcases the value of conservation of water. As the city lies in semi-arid region, the rainfall is less. The storage tank provides water for landscaping purposes in the dry city.

Vision & Goal: To reduce the dependence on water supplied by municipality and to use and conserve rain water. A vision to create a cultural heritage related to step wells or bawaris.

Implementation Agency: Royal Family of Jodhpur

Integration Across Sectors: Water and Storm Water

Tools/ Technology Used: Planning and Implementation of rain water harvesting at township level to reduce pressure on fresh water supply.

Key stakeholders: Ess Gee Real Estate Developers (EGREDPL) and the Royal Family Jodhpur

Cost: 80 million INR

The Process

The project developed a plan for rain water harvesting in the Umaid Heritage Township in order to reduce the dependence on a single source of water supply. The entire residential complex of 110 acres was taken into consideration for rain water harvesting and the lowest lying area was picked to develop for the construction of the bawari or step well. The rain water reached the storage tank through storm water drains and open channels. The total capacity of the bawari is 17.5 million liters.

The concept was inspired by rain water harvesting structures that are traditionally used in the state of Rajasthan.

The rain water harvesting model in the township was developed by the architects of the Ess Gee Real Estate Developers (EGREDPL) and the ownership lies with the Royal Family of Jodhpur. A Jodhpur native and national award-winning architect Anu Mridul was involved in the designing of the bavari.

Output / Outcomes

The rain water harvesting captures around 17.5 million liters of water which reduces the dependence on municipal water supply. There are major economic benefits to the township as the water costs have reduced. There is visible change in the behavior of community towards the conservation of water. Ground water extraction at very low rate also benefits the environment. Recreational space demonstrates the value and need of conservation of water. It is now serving as an example for other large township to integrate rain water harvesting.

Advantages and Limitation

Annual savings of 2.36 million in the township, creation of recreational space and change in community behavior towards water are some of the advanges. Moreover, 50% of water for landscaping and horticulture is taken from this storage tank. The challenge is in maintenance of the tank, since the cleaning is done manually.