

Urban Water Management from the lens of Sustainability: A Case of Kathmandu (Series-II)

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Article Info

This is a Series-II of the article which is prepared in two consecutive series in relation to Kathmandu's urban water management.

- *First series (Series-I) of the article depicts current status of Kathmandu's urban water management from sustainability lens,*
- ***Whereas this series (Series-II) deals with the possible improvement measures for sustaining urban water management in cities like Kathmandu.***

This article has been prepared entirely based on author's own perceptions, experiences, with reference to the related secondary information and city dwellers' perceptions. to inform practitioners, professionals, decision, and policy makers for their understanding in managing current urbanization growth and its subsequent consequences on the sustainability aspects of Kathmandu's Urban Water Cycles. The audiences may have disagreements, critics, and entirely different views than what has been mentioned here. All are always welcome and appreciable for bestowing respect to the lens of the author in looking at Kathmandu's current urban water management scenario.

Abstract

The paper attempted to explore to address the complex challenges of urban water management in rapidly urbanizing cities like Kathmandu, emphasizing the critical linkages between urban dynamics, ongoing urbanization, and water security. The discussion underscores the necessity of understanding various service chains within the urban water cycle and highlights existing gaps in pollution control, risk management, and sustainability within the urban water cycle of Kathmandu City.

Proposed improvements include multifaceted approaches encompassing sustainability criteria, institutional enhancements, frameworks for improvement, and community engagement strategies. Key criteria for improvement cover diverse aspects such as water quality maintenance, infrastructure upkeep, wastewater treatment, stormwater management, climate resilience, governance, innovation, financial sustainability, social equity, biodiversity conservation, efficient water use, and integrated water management. These criteria emphasize the importance of integrating innovative technologies, governance frameworks, and community involvement to ensure water security across all dimensions.

The importance of balancing integration and separation of responsibilities in the institutional setup is emphasized as a crucial for urban water management along with the need for strengthening governance structures, enhancing coordination mechanisms, decision-making processes and fostering collaboration with stakeholders (incl. international organizations) to leverage knowledge and resources. Similarly, the strategies for community engagement include education, awareness programs, smart technologies, policy enforcement, crisis preparedness, and long-term planning. A framework for improvement underscores the significance of effectiveness, efficiency, and accountability, emphasizing context-specific strategies, community involvement, ongoing evaluation, and adjustment.

In conclusion, the paper advocates for a holistic and comprehensive approach integrating technological, institutional, and community-driven solutions to address the challenges of urban water management in Kathmandu, focusing on sustainability, institutional reforms, emphasizing integration, innovation, community engagement, and strategic planning as key drivers for sustainability and water security in rapidly urbanizing cities. By implementing these recommended strategic frameworks, cities like Kathmandu can work towards with a more resilient, sustainable, and equitable urban water future.

Key Words

√Urbanization, Sustainable Urban Water Cycle

√Institutional set-up, Integration, and responsibilities, integration continuum,

√Framework, policies, strategies, planning, collaboration, integration, coordination, responsibility

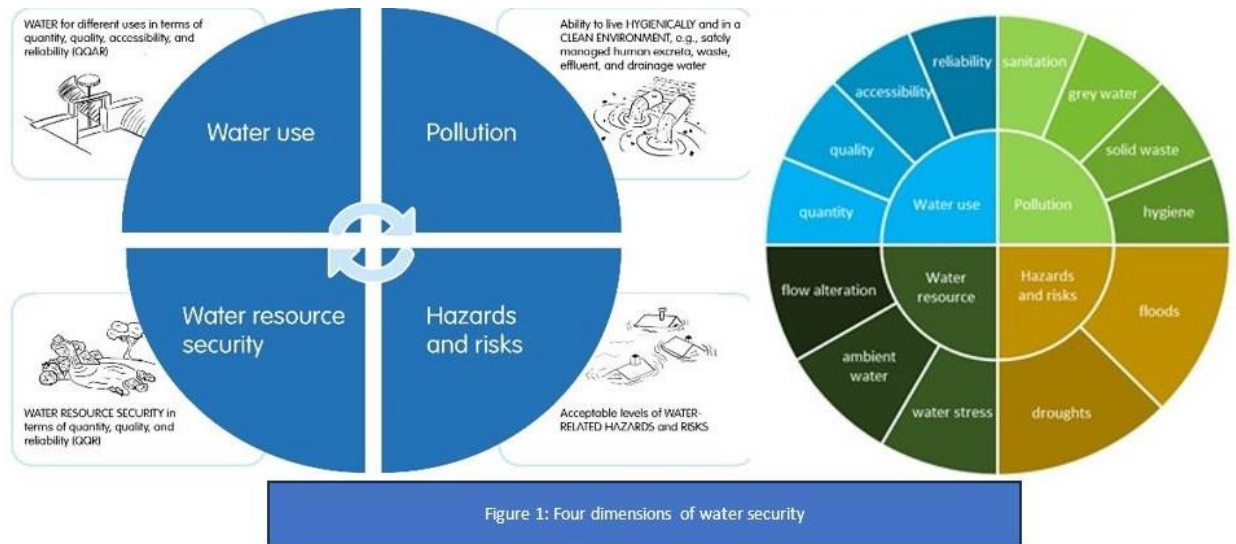
√Water management, infrastructures, conservation, community engagement, crisis preparedness,

Background Context

Urban water cycle management is governed by the prevailing urban dynamics particularly the consequences of the ongoing urbanization in the city in the broader discourse of water security. Water security, however, can be described as the reliable availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems, and production, coupled with an acceptable level of water-related risks. In the context of the urban water cycle management, water security could entail this in one hand and on the other, urbanisation puts lots of pressure on the urban basic services, infrastructures and living environment in the cities, as well as on natural resources, in particular water resources around.

This can be observed and experienced by the Kathmandu. Yet the urban city dwellers of Kathmandu generally do not consider the entire watershed where the city is located part of the urban water cycle management, as this watershed depends on many more stakeholders and larger scale processes. Therefore, before discussing on the required improvement over the existing urban water cycle management, we need to understand the different service chains in relation to urban water cycle along with the prevailing urban dynamics particularly the consequences of the ongoing urbanization in the city in the broader discourse of water security. The several service chains that intertwine in the urban water cycle are mentioned below and they are, namely:

The sanitation and solid waste chains start from the premise or user level and moves towards treatment, reuse, or disposal. These different contexts of sanitation are at best partial, polluting the living environment



1. 1. Water supply service chain – which starts with the water sources and flow towards the users; but paved surfaces are increasing water logging and decreasing water recharging for groundwater sources.

2. Sanitation service chain (sewered/ non-sewered),

3. Solid waste service chain.

4. Grey water which is also a part of the urban water cycle but is often not organized as a service.

Overall, the way we are managing our urban water cycle right now may satisfy drinking water needs to a larger extent but seems to have large gaps in terms of pollution (the ability to live hygienically and in a clear environment) as well as hazards, risks, and the sustainability of our water resources. Hence current practice does not ensure water security across all 4 dimensions as mentioned in Figure-1 above.

Improvements over the existing Urban Water Cycle Management in Kathmandu

The possible improvements of the existing urban water cycle management in Kathmandu can be discussed from the following aspects:

1. Criteria to adopt.
2. Improvement in the institutional set up.
3. Framework for the improvements
4. strategies to bring city dwellers towards a sustainable urban water cycle management.

a. Criteria to ensure sustainable urban water cycle in Kathmandu.

Understanding urban water cycle and its management in a simplified version is to allow sufficient water to meet the ever-growing demand of the city (*including its associated*

societies and city dwellers) sustaining ecosystems with credible ecological balance but without exceeding the economic costs over the opportunity cost of the city. Sustainability in an urban water cycle, therefore, involves various criteria that contribute to the responsible management and use of water resources. Following criteria, that I believe, can typically be considered as key when analysing an urban water management from the sustainability lens:

› *Diverse and Sustainable Water Sources*: Utilization of diverse and sustainable water sources, including well-managed rivers, groundwater recharge, rainwater harvesting, and other innovative sources etc. for restoration and regeneration of natural systems adopting nature-based solutions (NBS).

› *Water Quality*: Adoption of effective water treatment processes to maintain high water quality standards and reduce the presence of contaminants in drinking water.

› *Infrastructure Maintenance*: Regular maintenance and upgrading of water distribution and wastewater collection infrastructure to minimize leaks, losses, and disruptions in service.

› *Wastewater Treatment and Reuse*: Implementation of advanced wastewater treatment technologies to ensure safe disposal of treated wastewater; where feasible, promote its reuse for non-potable purposes.

› *Stormwater Management*: Implementation of sustainable stormwater management practices, such as green infrastructure and permeable surfaces, to prevent flooding and reduce environmental impacts.

› *Community Engagement and Education*: Active involvement of the community ensuring participation of women and other marginalized groups in water conservation efforts, awareness programs, and education to promote responsible water use and environmental stewardship.

› *Climate Resilience*: Planning for climate change impacts, including variations in precipitation patterns and extreme weather events, to enhance resilience and adaptability with reduced climate footprint in the face of changing conditions and its adverse impacts on water cycle, hydrology, and water flow chains.

› *Governance and Regulation*: Effective governance and regulatory frameworks that ensure compliance with water management standards, enforcement of regulations, and accountability in water-related decisions.

› *Innovation and Technology*: Adoption of innovative technologies and data-driven approaches to improve water efficiency, monitor water quality, and enhance overall water

cycle management with rethinking, from innovative lens, on urban water systems and what urban water cycle and its services look like – an example could be to adopt one water approach considering entire watershed level that encompasses city and thinking holistically from one water lens. While adopting innovation and technology, the Financial, Institutional, Environmental, Technical and Social (FIETS) criteria should be considered for sustainability.

› *Financial Sustainability*: Establishment of sustainable funding mechanisms to support ongoing maintenance, upgrades, and investments in water infrastructure and management practices. While ensuring this, one should keep in mind its accessibility, affordability, and acceptability from both the government and society.

› *Social Equity and Inclusivity*: Ensuring equitable access to water services for all segments of the population, addressing the needs of vulnerable communities, and promoting social inclusivity in water management initiatives. At one point, this also requires redistribution of the resources and power to improve water governance for equitable access of all to safely managed water ensuring GEDSI (Gender, Equity, Disability, and Social Inclusion) is mainstreamed.

› *Biodiversity Conservation for ecological sustainability*: Consideration of the impact of water management practices on local ecosystems, promoting biodiversity conservation, and minimizing negative environmental consequences thus protecting and conserving the ecosystem ensuring its sustainability.

› *Efficient Water Use*: Implementation of water-efficient technologies and practices to minimize water waste and optimize water consumption across residential, industrial, and commercial sectors. Besides this, Reducing the water needed from the source (e.g. by improving efficiency), Reusing or recovering used water (e.g. wastewater recycling)

› *Integrated Water Management*: Integration of water supply, wastewater management, stormwater control, and water conservation practices into a comprehensive and coordinated approach.

› *Adaptive Planning*: Adoption of flexible and adaptive planning approaches to accommodate future changes in population, land use, and climate, ensuring the continued sustainability of the water cycle.

While adopting this, we also should not forget a human factor, a crucial factor, particularly to build trust and create collaborative spaces with one another as a city dweller to understand diverse perspectives on the urban water cycle and take actions for conservation and improvements. Besides, we also need to look over the criteria that

contribute towards sustaining hydrology and services through socio-technical and financial aspects. Addressing these aspects and improving the institutional set-up for the urban water cycle in Kathmandu city can:



- strengthen the governance structures, enhancing coordination among relevant entities, and creating mechanisms for effective decision-making and implementation.
- create a more effective, responsive, and sustainable framework for managing its urban water cycle.
- explore opportunities for collaboration with international organizations, neighboring cities or cities with similar characteristics, and experts to leverage knowledge, resources, and best practices in urban water management.

In addition to the above arguments, the following 8Rs diagram (*Refer Fig. 2 at the right side*) for circular water and economy might be an appropriate food for thought to brainstorm the ideas to generate criteria for making an urban water cycle sustainable. This is because a circular economy is defined as “*an economic system aimed at minimising waste and making the most of resources*”. *This regenerative approach contrasts with traditional linear economy with a ‘take, make, dispose’ model of production.*

b. Improvements to consider in the existing institutional set-up (considering roles & responsibilities) for sustainable urban water management in Kathmandu.

Lastly, the institutional set-up for the urban water cycle is a means to an end. Discussions about institutional setups often involve considerations of integration, including the

bundling or unbundling of responsibilities. It's crucial to strike the right balance and form of integration and separation of duties tailored to each specific context. Decisions regarding the level of integration need to be made within a continuum which ranges from minimal interaction to comprehensive collaboration involving all stakeholders.

From an urban water cycle management perspective, the institutional setup in ensuring water security for city dwellers is very important and assessing the institutional arrangements or reforms should also equally prioritize them in urban areas. The institutional framework, therefore, should aim to ensure greater water security for all residents with the inclusion of the below mentioned aspects to foster a sustainable urban water cycle.

- Perspective on Water Management: The institutional setup or reforms should aim to improve water security in urban settings with the emphasis that the institutional setup is a means to achieve sustainable urban water management and ensure water security for all the city dwellers.

- Integration and Responsibilities: Integration or the bundling/unbundling of responsibilities is a critical aspect of institutional setup discussions. Finding the right balance between integration and separation of responsibilities is crucial for effective water management. The appropriate level of integration depends on the specific context and goals of water management in general and urban water cycle management in particular. Regarding the continuum of integration, followings can be observed:

- ◆ Different degrees of integration possible ranging from no contact to complete integration (i.e. *no contact, exchange, coordination, alignment with targets and planning, joint task forces, and everything and everybody in one big group etc. and so on*) where everyone works together.

- ◆ Different Types of Integration can occur at various levels as mentioned below. Each type of integration has its own implications for water management and governance.

- √ entity level (centralized vs. decentralized authorities),

- √ functional level (policy, regulation, operation),

- √ sectoral level (integration/disintegration of water-related sectors).

Overall, the discussion on the institutional setups for urban water cycle management in the cities underscores the complexity and requires careful consideration of various factors, including the level of integration, types of integration, and alignment with water

security goals. By addressing these aspects, urban areas can work towards more sustainable and secure water cycle management practices. For this purpose, the improvement over the existing roles and responsibilities and practices is mandatory.

Improving the roles and responsibilities for a sustainable urban water cycle in Kathmandu involves a combination of policy, infrastructure, community engagement, and technological solutions. Here are some key areas that might need attention of cities like Kathmandu to adopt for addressing various aspects of water security particularly proper conservation and management of water for enhancing the urban water cycle endeavors. Some of those key areas are briefly discussed below.

Infrastructure Development

- Ensure that infrastructure development plans shall (a) consider principle of 3As (Accessibility, Acceptability Affordability), and long-term sustainability; (b) incorporate technologies such as water recycling, rainwater harvesting, and green infrastructure; and (c) ensure equitable, equity and inclusive.
- Accordingly, investment planning should be prioritized and worked out not only looking at the return of the investment but also considering green infrastructures for its sustainability as well as in sustaining the water sources keeping them secured for future generation's use and benefits.
- Ensure operation and maintenance fund undergoing the Life Cycle Cost Analysis (LCCA) of the urban infrastructure(s) for smooth, and regular maintenance of the infrastructures. Besides, clearly defined roles and responsibilities of the concerned stakeholders shall be ensured for addressing operational issues like prevent leaks, reduce losses etc. to extend the lifespan of infrastructures and their operating systems for their enhanced & improved efficiency, and hence longer-term operational functionality and sustainability.

Managing Water Quality (WQ) Issues

- Strictly roll out the existing Water, Wastewater and Effluent quality standards that are promulgated by the concerned authority of the government. This will help to minimize the contamination and pollution of water bodies from domestic, institutional, and industrial discharges/disposal. Accordingly ensure the water quality monitoring systems with clearly defined roles and responsibilities of the concerned regulating authorities to set the examples.

- Develop WQ improvement plan along with the emergency response plans to define clear responsibilities for responding and communicating to water quality emergencies, including contamination incidents, and improvement of water bodies, particularly the water quality.
- Regulate water quality issues through periodic monitoring and sample testing as a part of strengthening the WQ monitoring systems and mechanisms and accordingly institutionalize the process and systems of monitoring and regulations.
- Local municipal government being responsible to ensure safe and sustained delivery of services should have their own accredited testing lab (if not, at least mini WQ testing lab) for regular and periodic monitoring of WQ thereby demonstrating their accountability and responsiveness.

Water Conservation and efficiency

- Public Awareness is one of the important aspects for strategic intervention in sustaining the urban water cycle particularly in changing the behavior of the people on the importance of efficient water use, conservation practices, water reuse, recycle and recharge for augmentation of water sources, minimizing the ongoing water depletion status and accordingly on the importance of reducing wastage of water.
- Together with the raising awareness for behavioral change, city authority or government institution should strengthen the regulations and enforcement mechanisms to promote water-efficient technologies, water recharge/augmentation practices, discourage wasteful practices, pollution / contamination of water bodies and adopting 3R principles to manage water thoughtfully.
- Involve local communities to ensure participation of locals not excluding women and marginalized groups in decision-making processes related to water management and infrastructure development. Establishing local water committees would be a good idea for this not only in making local communities participate in decision-making process but also in monitoring water usage to promote sustainable practices.
- Financial Incentive Mechanisms need to be introduced to establish responsibilities for creating and managing financial incentives for sustainable water practices, encouraging investment in water-saving technologies. This incentive can be awarded to city dwellers as well as agency(s) or institutions adopting such practices and demonstrated for wider replications. Besides, the one who adopts and promotes water saving technologies or

nature-based solutions (NBS), be it at HH level or at institutional level, should be incentivized or subsidized for adopting such or promoting such technologies or solutions like NBS (e.g rainwater harvesting, recharging ground water, multiple use of source (MUS), usage of water efficient appliances/techniques etc.). Not only providing incentives or subsidies, but the authority can also promote tax breaks (redemption) to the taxpayers be them individuals or institutions that invest in sustainable water practices, technologies, or infrastructures.

- Strict enforcement of water pricing should be introduced with tiered water pricing structures i.e. incremental increment blocks to encourage responsible water consumption and discourage excessive use and wastage.

Water Management in an integrated way

- The city should have an integrated water management plan giving due consideration to water security, water conservation & augmentation, and watershed protection and management. If not, the city should develop such integrated plans giving due consideration to the climate resilient approaches and initiatives.
- Once the plan is in place, RACI (Responsibility, Accountability, Communication and Informed) Matrix should be defined with clear assignments of the responsibilities among the concerned authorities and stakeholders within the government machinery to be led by respective Federal/Municipal Governments and complemented by water utilities, environmental agencies, and community stakeholders to ensure a coordinated and integrated approach to water management.
- For this purpose, there should be dedicated authority responsible for operationalizing the integrated water management plan with climate/disaster resilient initiatives to deal with the water and climate induced disasters. This is possible only by bringing together the concerned stakeholders and representatives from the government institutions (from 3 tiers of the government as relevant and appropriate), water utilities, bilateral and multilateral agencies, environmental agencies, and other stakeholders including CSOs on board for collaboration for taking the responsibilities from their ends.

Climate change adaptation: Identify and assess the potential impacts of climate change on the urban water cycle and assign responsibilities for developing and implementing adaptive measures. For this, concerned city authority or concerned government institution should define the clear responsibilities for conducting climate risk assessments (CRAs)

and ensure water related infrastructures resilient to extreme weather events and changing climatic conditions incorporating climate-resilient features.

Regulatory Framework: considering the evolving needs of the city and advancements in water-related technologies, appropriate policies need to be formulated or amended the existing one by reviewing and updating the water-related policies regularly to fit for the purpose and to align with evolving needs, technological advancements, and changing environmental conditions. This is not enough but equally important is to Enforce the Existing Regulations or enactment of newly formulated or updated polies thus strengthening enforcement mechanisms related to water management and quality.

Cross sector collaboration: Need to encourage interagency collaboration among different government agencies, NGOs, private sector entities, and research institutions to address water challenges comprehensively. To make this much more effective, an interagency task force comprising representatives from afore mentioned agencies needs to be formed to coordinate efforts and share information. This mechanism will help foster collaborative partnerships not only to data and information related to water management across sectors to facilitate informed decision-making, but also share leverage resources and expertise for sustainable water initiatives.

Implementing changes inevitably requires collaboration, effective governance, and ongoing commitment from all stakeholders involved in the urban water cycle. Regular reviews and adjustments to roles and responsibilities may be necessary to adapt to changing circumstances and emerging technologies. Similarly, continuous monitoring and adaptive management will be essential to address emerging issues and enhance the effectiveness of these strategies over time. In this way, cities like Kathmandu can work towards a more sustainable urban water cycle, ensuring the responsible use of water resources.

c. Strategies recommended to bring city dwellers with success towards a sustainable urban water cycle management in Kathmandu.

Engaging city dwellers in the transition towards a more sustainable urban water cycle management involves a combination of various strategic efforts. Some of them mentioned below might bring success:

- Initiate education and awareness programs as well as informative campaigns for city dwellers to encourage them for sustainable practices by highlighting the local impact integrating programs with recognition and financial incentives.

- Community Engagement with the involvement of GEDSI target groups through Participatory Planning to foster a sense of ownership and responsibility encouraging community-led initiatives for sustainable urban development and water management with local water monitoring programs.
- Develop, implement, and promote apps or platforms or smart infrastructure or similar innovative means for executing smart water management technologies for real time water consumption, detecting leakage, water usage, and water conservation systems adopting smart meters to enhance efficiency and reduce waste with a real time monitoring and feedback through smart water monitoring app with digitalization.
- Enforce Water use, conservation and management policy and regulations to ensure compliance and promote responsible water use and water management adopting one water approach and lens integrating sustainable water management practices through land use planning with urban zoning regulations thus promoting water-sensitive urban design. Besides, Regulatory measures should also account penalties for misuse of water and improper management of waste etc. and so on. These regulatory measures should be properly and adequately adopted through their enforcement. Then only the desired impact on behavior will be achieved as expected and desired.
- Adopt Green Infrastructure by promoting Green Spaces to enhance natural water absorption, reduce heat island effects, improve overall urban resilience; and green roof initiatives to encourage installation of green roofs, which can reduce stormwater runoff, provide insulation, and improve air quality.
- Collaboration and Partnerships among the stakeholders ranging from the government machineries, community stakeholders, private sectors and Civil Society Organizations (CSOs) including political segments of the society to foster collaborations between local governments, businesses, and community organizations. This will also aid to avoid obstructions to the effective adaptation and implementation of comprehensive water management, environment, and ecosystem management strategies in one hand. On the other, this will help to implement joint water conservation initiatives through Public-Private Partnerships as well. This will also foster collaborative approach to partner with educational institutions to narrow down the existing gap between academia, professionals, and practitioners to enhance value-based water education by involving academia in practical projects towards journey of water sustainability.

- Crisis Preparedness and Communication through emergency Planning by developing and communicating clear plans for water-related crises, such as droughts or floods, to ensure that residents are well-informed and prepared; and by regular Updating on water quality, availability, and conservation efforts to keep residents informed and engaged.
- Strengthening the city water utility/authority to regulate the water services amidst the water users to ensure illegalities are strictly controlled or brought under control with a strong punishment and award systems for those who disobeys or adopts the regulations respectively.
- One of the most important things is to ensure the sufficient actions are initiated to improve their long-standing socio-cultural habits/behavior and attitudinal changes of the city dwellers in water use endeavors as well as in bringing changes their resistivity towards paying the tariff. Of course, for this, there should be a good strategy to attract the people by setting affordable tariff and ensuring the quality of services with high level of service standards with a clear plan of accommodating the affordability of the poor, marginalized, low-income and excluded communities.
- Long-term strategy and planning with attainable Targets adopting a balance between top-down and bottom-up approaches to engage in all stages of decision making, planning and execution etc. This needs to be ensured by adopting a longer-term strategy considering long-term sustainability. This requires regulatory enforcement and restrictions, establishing collective accountability and responsive mechanism with the promotion of community feedback accountability mechanism through appropriate coordination, collaboration, and consultations with the key stakeholders.

Besides, the strategies and plans should also focus on promoting responsible practices and on fostering the importance of communities' engagement and their participation at all the levels to assure the distribution of services and resources with equity, inclusion and equality assuring prioritization from the lens of sustainability of urban water cycle management. In addition, one thing needs to be borne in mind that while adopting a strategy of executing the complex technological solutions, public understanding needs to be ensured. Lastly, the long-term strategy and plans should ensure the equitable distribution of resources to avoid the possible consequences that bring socio-economic, environmental, and political inequalities and conflicts in society.

d. Suggested Framework for the improvements

The institutional set-up is the means to achieve that sustainable urban water cycle and greater water security for all people in the city through sustained urban water cycle management. Ideally, we look at the institutional set-up through the lens of it being a means to achieve an end. Proposals for institutional reforms or improvements should consider whether and how it improves water security in urban setting. This can be very practical and hence, the following framework has been suggested below for improvement in the existing urban water cycle management in the City like Kathmandu.

Framework for Improvements

Actions for Improvement	Effectiveness	Efficiency	Accountability & Transparency
Centralized Authority for Coordinated Action	Dedicated water management authority can streamline decision-making, planning, and implementation, ensuring a more cohesive and coordinated approach to urban water management.	Centralized decision-making reduces bureaucratic hurdles, allowing for quicker responses to emerging issues and more efficient use of resources.	Clear lines of authority and responsibility enhance accountability, making it easier to identify and address any shortcomings in water management.
Enhanced Interagency Coordination	Improved communication and collaboration among various agencies enhance the overall effectiveness of urban water management initiatives.	Coordinated efforts prevent duplication of work and ensure resources are used efficiently, avoiding conflicts and delays.	Interagency coordination fosters transparency by facilitating the sharing of information and data across different organizations.
Community Involvement & Stakeholder Engagement	Involving local communities ensuring Leave No One Behind (LNOB) in decision-making ensures that policies and initiatives align with the actual needs and concerns of residents.	Community engagement leads to more effective implementation as residents become active in sustainable water practices.	Open communication with stakeholders promotes transparency keeping public informed on decision-making processes and involved in dialogue
Capacity Building	Trained personnel are better equipped to address complex challenges, implement sustainable practices, and adapt to changing circumstances.	Skilled professionals can carry out tasks more efficiently, reducing the likelihood of errors and improving the overall performance of water management activities.	Capacity building contributes to accountability by ensuring that staff members have the knowledge and skills to fulfill their roles effectively.
Data Collection and Monitoring Systems	Robust data collection and monitoring systems provide accurate information for evidence-based decision-making. The collected data ensure disaggregation from topography, economic category of the population, and their access to facilities.	Access to real-time data allows for identification and response to emerging issues and optimize resource allocation.	Transparent and disaggregated data-sharing practices build trust among stakeholders and allow for public scrutiny, ensuring accountability in data management.
Policy and Regulatory Framework	Updated policies and regulations address current challenges and align with sustainability goals, making them more effective in guiding urban water management.	Well-defined regulatory framework streamlines compliance/enforcement processes, reduce delays and promote adherence to sustainability standard	Clear policies and regulations enhance transparency by providing a clear understanding of rules and expectations for all stakeholders.
Financial Mechanisms	Adequate funding mechanisms support the successful implementation of sustainable water initiatives and infrastructure projects.	Financial incentives and partnerships attract additional resources, enabling more efficient execution of projects.	Transparent financial mechanisms ensure accountability in resource allocation and expenditure, reducing the risk of mismanagement.

Actions for Improvement	Effectiveness	Efficiency	Accountability & Transparency
Public Awareness and Education	Informed and aware citizens are more likely to adopt water conservation practices, contributing to the overall effectiveness of sustainability initiatives.	Public awareness campaigns can efficiently disseminate information to a wide audience, maximizing the impact of education efforts.	Open communication with the public promotes transparency, keeping residents informed about the importance of water conservation and the progress of water management initiatives.
Emergency Response and Contingency Planning	Well-defined emergency response plans ensure a swift and effective reaction to water-related crises, minimizing potential damages.	Clearly outlined roles and responsibilities streamline emergency response efforts, preventing confusion and delays.	Established contingency plans enhance accountability by specifying the actions and responsibilities of each agency during emergency.
Performance Evaluation and Accountability	Regular performance evaluations provide insights into the success of water management initiatives, allowing for continuous improvement.	Identifying areas of improvement through evaluations enhances efficiency of ongoing & future projects	Transparent performance evaluations promote accountability by openly communicating successes, challenges, and areas for improvement.
International Cooperation	Collaboration with international organizations and neighboring cities provides access to global expertise and best practices, enhancing effectiveness of urban water management strategies.	Shared resources and knowledge through international cooperation can lead to efficient problem-solving and project implementation.	Collaborative initiatives with international partners often involve transparent information-sharing practices, fostering accountability and openness.
Expected Results	<ul style="list-style-type: none"> ➤ Reaching all people ensuring LNOB in the city with better delivery of the services protecting water bodies against pollution, over abstraction and protecting people against water related risks/disasters. ➤ Better behavioral change of urban city dwellers through awareness raising campaigns. 	<ul style="list-style-type: none"> ➤ Better financial health of the service providers or agencies. ➤ Able to reach more areas with the same resources. ➤ Improved affordability of services with. 	<ul style="list-style-type: none"> ➤ Improved internal control systems meeting compliances with country regulations. ➤ Agreed KPIs to ensure robust fulfillment of contractual obligations and compliances. ➤ Periodic reporting with accessible reports when needed. ➤ Periodic meetings ensuring compliances & communications are properly met & channeled.

Therefore, it is essential to recognize that the success of strategies depends on the specific context, community engagement, effective communication, and ongoing evaluation & adjustment. Learning from both successful and unsuccessful experiences can contribute to the development of more effective and tailored approaches to ensure the sustainability of the water cycle in urban areas.

By combining these strategies, cities like Kathmandu can create a culture of sustainability and encourage city dwellers to actively participate towards a more sustainable urban water cycle management. This requires integration of water management into urban planning, empower resident through awareness raising, encouraging responsible

behaviour, prioritize transparent communication for longer term sustainability through collective responsibility to create a more sustainable and resilient water future adopting a smart technology aligning with digital future for real time monitoring the services.

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