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## Dhulikhel's Journey Towards Water Security: Insights for Policy and Practices

Dil Khatri, Kaustuv Raj Neupane and Kamal Devkota

### 1. INTRODUCTION

Lower Himalayan towns are facing growing challenge of water scarcity primarily because of rapid urbanization<sup>1</sup>, intensifying impacts of climatic change and weak governance (Flörke et al., 2018). Dwellers of the expanding towns in Nepal are striving for basic water supply. For instance, the average per capita water consumption in Nepalese towns is dismally low compared to the global standard i.e. only about 35 to 55 Liters per Capita per Day (LPCD), compared to the WHO standards of 112 to 150 LPCD (MoUD, 2017). Reports suggests the decline of both quality and quantity of drinking water supply in all urban regions (see The Himalayan Times, 2018)<sup>2</sup>. For instance, a World Bank report shows the access to water by urban residents in Nepal is 90.9 % in 2015 (AD) which has declined from 95.5% in 1990. Three major reasons are attributed as causes of such a decline. First, expansion of urban areas by merging many rural villages into the adjoining cities.

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1 Nepal is one among the ten least urbanized and fastest urbanizing countries in the world. In 2011, urban population constituted 17% of the total population in the country, which reached 18.2 % in 2014 (UN DESA, 2014) and 58.4% in 2017 (CBS, 2011). The annual urban growth rate in 2001 and 2011 were 6.5 and 4.9 respectively (CBS, 2011). Also, with the population density of 1961 per square km in 2018 (World Bank, 2018), Nepal comes under the five most populous countries in the South Asian region along with India, Pakistan, Bangladesh and Afghanistan (World Bank, 2019).

2 <https://thehimalayantimes.com/nepal/ministry-rues-poor-investment-urban-infrastructure-housing/>

Second, lower Himalayan towns are experiencing declining water flow reportedly because of the impact of climate change (Smadja et al., 2015). Third, studies also pointed out the persistent challenge of water governance (Bajracharya et al., 2015).

While growing water demand and declining water sources challenge urban water security, the Constitution of Nepal 2015 endorsed access to safe drinking water and sanitation as a fundamental right of the citizens. In line with this, the current periodic plan of Nepal (2019 – 24) aims to supply basic drinking water to all citizens and increase their access to safe drinking water. Local governments such as Dhulikhel are putting their efforts to provide basic water supply to town dwellers.

In this backdrop, this book aims to document the struggles of Dhulikhel towards urban water security which provides unique insights to other lower Himalayan towns. Dhulikhel is a popular hill-station situated at about 30 Km east from Kathmandu and has attracted both international and domestic tourists. In recent years, the water demand in Dhulikhel has sharply increased because of the influx of tourists and establishment of big institutions such as Kathmandu University and Dhulikhel hospital. Together, these add to the ever increasing demands for water for purposes beyond 'drinking' (Ojha et al., 2020b).

Dhulikhel municipality has taken diverse approaches for achieving water security including the experiences of being pioneer of community-based water management practices, skillfully negotiating with upstream communities for securing sustainable and reliable supply of water, developing diverse water management schemes for water security in rural parts of the town, extending partnership with research organizations for evidence-informed policy and actions, and taking new initiatives for sustainable water management. This book intends to document these experiences and lessons to inform local level policy and practices of water management in Nepal and beyond. Further, the book blends the perspectives of researchers and practitioners on water management and exposes some of the challenges of water security. Hence, this book can be a useful resource for national and international researchers and students, policy makers, practitioners, including local governments.

We build on the perspective that water security is not only physical access to water but also an outcome of process and politics that shape uneven access to and control of water resources. This means we see water security as a political problem (Bakker and Morinville, 2013). The town of Dhulikhel is an exemplary case for urban water security and it has rich experience and insights to offer. As we outline below, the Dhulikhel case can provide major insights on the issues of community-based water management, process of (re)negotiation with and incentivizing upstream communities for sustainable water supply, negotiating large-scale projects with adjoining municipalities, challenges of addressing gender and equity issues, future scenario of water supply in the changing climate, and collaboration with research organizations for science-informed policy and innovations.

**Table 1**  
**Overview of chapters**

<b>Chapter</b>	<b>Title</b>	<b>Author/s</b>	<b>Major focus of the chapter</b>
2	Evolution of drinking water system in Dhulikhel: Trials and tribulations	Ashok Byanju, Kushal Pokharel and Kaustuv Raj Neupane	History of modern urban water management, initiation of community-based management and some recent initiatives.
3	Opportunities and challenges of the larger-scale water supply project: Insights from Kavre valley	Moti Ram Timalina, Tikeshwari Joshi, Suchita Shrestha, Dilli Poudel and Dil Khatri	Struggle for water sources in Kavre Valley Integrated Water Supply Project (KVIWSP).
4	Upstream-downstream interdependencies and water security in Dhulikhel	Kaustuv Raj Neupane, Anushiya Shrestha and Tikeshwari Joshi	(Re)negotiations with upstream communities and incentivizing mechanisms.
5	Policy and institutional aspects of water management in Dhulikhel	Gyanu Maskey, Chandra Lal Pandey and Dil Khatri	Juxtaposes the Dhulikhel's journey of urban water management with the national policy and institutional contexts.

Chapter	Title	Author/s	Major focus of the chapter
6	Under the glass ceiling: limitations of women in urban water management systems	Rachana Upadhyaya and Suchita Shrestha	Gender and equity dimensions of water management in Dhulikhel.
7	Future climate stress on drinking water of Kavre Valley: A case of upper Roshi river	Anjit Gautam and Tikeshwari Joshi	Projection of climatic parameters and likely impact on water flow in Dhulikhel.
8	<i>Pani Chautari</i> as a tool for evidence-informed policy and practices: Experiences from Dhulikhel	Kamal Devkota, Gyanu Maskey and Dil Khatri	Experience and insights of a deliberative platform of <i>Pani Chautari</i> for promoting evidence-based planning and decision making.
9	Application of recharge ponds for water management: Explaining from nature based solution perspective	Suchita Shrestha, Kamal Devkota, Ngamindra Dahal and Kaustuv Raj Neupane	Technical innovations and nature-based solutions adopted by Dhulikhel municipality to revive its drying springs.

The book chapters are logically organized in three distinct blocks: the past experiences, current initiatives and future direction towards water security. As shown in Table 1, the first chapter deals with the past experiences that documents the evolution of modern water management in Dhulikhel and initiation of community-based water management. The current dynamics of water management are captured into a number of chapters such as policy and institutional dynamics, a detail account of the negotiation with upstream communities, initiation of a large-scale water project for Kavre Valley and gender and equity related issues of water management. Remaining three chapters focus on the projection of future water supply in the changing climate, Dhulikhel's vision and initiatives towards ensuring sustainable and equitable water supply in future through science-informed stakeholder dialogue (*Pani Chautari*), and technical innovations and nature-based solutions.

## 2. DHULIKHEL'S JOURNEY TOWARDS URBAN WATER SECURITY

The second chapter (Byanju et al., 2021) navigates the history of urban water management system in Dhulikhel including the experiences of pioneering community-based water management. As the chapter outlines, the era of modern urban water management (i.e., supply of tap water) in Dhulikhel dates back to Rana period<sup>3</sup> when nine community taps were installed which were popularly known as Judha Dhara (named after the then Prime Minister Juddha Samsher Rana). Later in 1992, Dhulikhel initiated community-managed water management with the installation of German supported municipal water management system. In the endeavor towards establishing the first community-managed system, Dhulikhel negotiated with upstream communities of Bhumidanda for sustainable water provisioning with some incentives (detail of which is captured in another chapter). In the recent years, Dhulikhel has undertaken some new initiatives on urban water management to meet the mounting water demand caused by urban expansion and growing tourism and other business. Further, chapter also capture the recent dynamics that Dhulikhel has provided leadership towards developing a large-scale project of KVIWSP which covers three major towns located in Kavre Valley, namely Dhulikhel, Banepa and Panauti. The most recent initiative of Dhulikhel municipality as outlined in the chapter is a program of 'one house one tap' to ensure water security in rural areas which were included in the municipality after restructuring of the local governments in 2017. The municipal leadership has been fostering collaboration with diverse stakeholders including research organizations towards achieving sustainable water supply.

The third chapter (Timalsina et al., 2021) documents the experience of developing the large-scale inter-municipality water supply project called KVIWSP. The authors capture the context and process of developing the project and present the governing mechanism through which the project provisions water to different parts of the three municipalities. While the new project provides a cost-effective

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3 Rana era, (1846–1951) in Nepal, the period during which control of the government laid in the hands of the Rana family.

solution to growing water problem of the towns, as the authors maintain, there are a mountain of challenges. The key challenges of such a large-scale project include: payback of loan to the donor (Asian Development Bank), governing mechanism including three municipalities and technical and management related challenges for effective functioning of the project. This chapter provides a clear message that while large scale projects are required for addressing increasing urban water demand in the lower Himalayan towns, we should also not undermine the importance of smaller scale community-based schemes which play a vital role in ensuring equitable and sustainable water supply. As Bidur's case suggests, the smaller schemes seemed to be more resilient during the time of crisis i.e. when the bigger system break due to climate-related extreme events such as flood and landslide (Ojha et al., 2020a).

The fourth chapter (Neupane et al., 2021) captures the struggle and strategies of Dhulikhel in negotiating with upstream communities to secure sustainable water supply. As the chapter documents, the socio-political relations and influence played a central role in securing and maintaining the water sharing agreement. Dhulikhel signed three subsequent agreements with the upstream communities at different times. These are: (i) agreement between then Dhulikhel and upstream Bhumidanda Village Panchayat in 1985 (ii) agreement between KVIWSP and Bhumidanda Village Development Committee in 2010 and (iii) agreement between Dhulikhel Drinking Water and Sanitation Users Committee (DDWSUC) and Bhumidanda Village Development Committee in 2011. In all these three agreements, Dhulikhel mobilized its political influences and social relations with upstream villages to (re)negotiate the agreements. These also involved financial incentives that Dhulikhel provided to the upstream communities that helped maintaining upstream-downstream relations. The relation between Dhulikhel and the upstream communities seems still delicate and Dhulikhel and upstream municipalities in Panauti are working for developing an institutional mechanism towards sustainable solution.

Chapter five (Maskey et al., 2021) examine the policy and institutional dynamics of water management in Dhulikhel where the authors explain the Dhulikhel's experience and struggle of

establishing and strengthening community-managed water management system juxtaposing with the national policy and institutional context. In doing so, the authors examine the evolution of water governance in Dhulikhel under three distinct political periods: Panchayat era, Democratic era and Federal Nepal. The major finding of the chapter is that Dhulikhel pioneered on community-managed water governance and has established itself as an exemplary case. Further, the federalism provided an opportunity for local government towards taking leadership in developing policy and institutional mechanisms for water security in Dhulikhel. The major institutional innovations that Dhulikhel has pioneered and provided successful examples are: community-based water governance; incentivizing and negotiating with upstream communities; and collaboration with wider stakeholders including research institutions towards sustainable urban water management.

Chapter six (Upadhaya and Shrestha, 2021) deals with an important and cross-cutting issue of gender and inclusion in local water governance. Authors have surfaced out the gender-related issues of water governing body capturing the key limitation of women for effective participation and engagement in water management. In doing so, the chapter narrates a story of a woman member of the committee focusing on how she experienced the hardship to nurture women's voice in the male dominated decision-making practices. Authors found that water-related policies have made a provision for women's participation in decision making bodies but the pre-existing patriarchal societal practices, stereotypical cultural expectations from women and entrenched biases against their capacity have limited the women's ability to influence decisions. The key insights from this chapter is that mainstreaming gender is a process, rather than a goal (Sandler 1997), therefore it is not an end in itself. It can be achieved only if women represent as an empowered group. It requires acknowledging and trusting their capacity as well as men in the executive to be more accepting of women's roles with a willingness to listen to a different voice.

Chapter seven (Gautam and Joshi, 2021) provides a projection of future scenario of water supply to the major water supply system of Kavre Valley Project. Based on the analysis of temperature and

precipitation data, the chapter uses 'abcd' hydrological modeling method and projects future water discharge in the Roshi River – the source of water for Dhulikhel and the adjoining municipalities. The result shows that there will be a slight increase in minimum temperature and the range of maximum temperature might be between 0.64°C to 1.91°C in different climate change scenarios. Further, it is projected that there will be a statistically negligible decrease in the mean annual precipitation in most of the time. Assessment of the future stream flow of the Roshi River shows that there will be slight increase up to maximum of 14 % in mean annual discharge in 2050. Seasonal discharge analysis shows that slight increase in the discharge in winter, monsoon and pre-monsoon but a very slight decrease in the post-monsoon season. However, no significant impact of climate change is detected in the future causing a deficit or extreme flows of the water source areas.

Chapter eight (Devkota et al., 2021) documents Dhulikhel's experience of partnering with a research organization on science-informed stakeholder dialogues and evidence informed policies and practices. Dhulikhel extended collaboration with the Southasia Institute of Advanced Studies (SIAS) and developed a tool called *Pani Chautari*. The *Pani Chautari* is described by authors as a process of evidence informed dialogue that starts from identifying policy issues, generating or consolidating credible knowledge for evidence-based policy making, evidence-informed dialogue among the key stakeholders, engagement with policy actors to translate the outcomes of dialogue into the specific policy documents and then translating that policy into practices for sustainable and equitable water management in the town. In fact, the tool of *Pani Chautari* was co-developed by Dhulikhel municipality and SIAS and the evidence-informed dialogue helped in identifying technical and managerial solutions to address the water management related problems faced by the town. The authors further detail out the process and outcomes of *Pani Chautari*. Authors claim that the key insights from *Pani Chautari* process can be useful for not only the municipalities across the lower Himalayan region but also to State and federal governments towards science-informed policy processes.

Finally, chapter nine (Shrestha et al., 2021) documents the Dhulikhel's recent experience of piloting water recharge ponds (and



trenches) for ensuring sustainable water management. As the chapter highlights, the key stakeholders in Dhulikhel realized the problem of declining water flow in local springs and worked with SIAS to pilot water recharge techniques. In this process, a series of water recharge ponds and contour trenches have been constructed with proven effectiveness towards improving the ground water recharge. The authors explain these techniques as Nature-based solutions towards sustainable water management and offer a framework through which municipalities can initiate similar solutions to address the local water-related problems. This chapter provides an important insight on how locally engaged action research (initiated by SIAS along with Dhulikhel municipality and other actors) can help developing a locally suitable nature-based solution to sustainable water management.

### **3. KEY LESSONS FOR POLICY AND PRACTICE**

Such a rich experience of Dhulikhel towards achieving urban water security provides important lessons and insights for policy makers and practitioners. Not only can the municipalities in the lower Himalayan region be benefited from these insights but also governments (federal and provincial) can draw lessons. The key lessons and insights are summarized as following.

Community of Dhulikhel has struggled to develop the local water management system through securing financial resources to find the modern water supply system and negotiating with and incentivizing upstream communities. The political leadership and collective action of community of Dhulikhel seemed to have played important role in their achievements towards water security. As Byanju et al. (2021) document, community in Dhulikhel mobilized political network for securing German government funding to establish the first community-managed water management scheme in the country. Similarly, as Neupane et al. (2021) maintain, political network was mobilized in negotiating and sustaining the agreements with upstream communities. Such political commitments and leadership have also been demonstrated in recent initiatives such as Kavre Valley project and the ambitious program of 'one house one tap'.

The Kavre Valley seemed a promising and cost-effective project to provision water in three towns including Banepa and Panauti. However, such a large-scale project can have several technical and management challenges and may not resolve all water-related problems of Dhulikhel. Realizing this, Dhulikhel is moving towards diversifying the urban water management system i.e. combining large-scale projects alongside maintaining the existing community-based ones. The water-management strategies of Bidur Municipality offer important lessons on this. As Ojha et al. (2020a) document, Bidur has taken the approach to diversity and decentralize water management scheme. The small-scale community managed water schemes in Bidur proved to be more resilient in the time of crisis (such as earthquake, COVID-19, landslide, flooding) and crucial to ensure water access to poor and marginalized people.

One important insight from Dhulikhel for other municipalities is about negotiation with upstream communities. As Neupane et al. (2021) detail out, Dhulikhel has established relation with upstream communities involving negotiation and renegotiation of water sharing agreements. The important aspect of this relation is that while Dhulikhel provides financial incentive to upstream communities to support their development, the socio-political engagement played important role in reaching and sustaining the agreements at different times. Dhulikhel case also provide important insights to the wider Payments for Ecosystem Services (PES) debate that financial incentive alone is not sufficient to sustain upstream-downstream collaboration and that socio-political engagement plays pivotal role in such processes.

Dhulikhel pioneered in development and successful operation of community-based water management through managerial, technical, and financial capacity building of water users committee, which is now independently operating the water supply system to supply water to more than 2500 households. However, since the initiation of a large-scale inter-municipality water supply project, the existence of the once successful community-based management schemes is under question as the existing water user committees are supposed to be merged into the newly constituted water management board (Timalsina et al., 2021). This create the risk of the community-based institutions and system being subsumed into

the higher-level governance mechanism. This can pose threat to the existing and emerging small scale and community based schemes (Maskey et al., 2021). Further, as noted by Upadhaya and Shrestha (2021), local water governance institutions are also facing challenges in ensuring gender equality and social inclusion. Pre-existing patriarchal practices and prejudices constrain women's effective participation and their influences in making decisions on local institutions. Hence, there is a need for interventions to empower and nurture women leadership in local water governance. We further stress that the issue of exclusion and inequality exist across other forms of marginalization based on caste/ethnicity, class and geography and the local water governance institutions need to pay attention towards making water governance inclusive and equitable.

As reported by Gautam and Joshi (2021), climate change can pose further challenge to local water security. There is not only the risk of decrease in water flow because of variation on weather parameters in future, but there can also be the risk that climate-induced extreme events can jeopardize water supply system (see Ojha et al., 2020a). This reminds us to take account of climatic parameters and forecasts in water projects as this helps to build resilience against its possible impacts through enhanced institutional flexibility and make contingency planning to deal with potential climate-related risks.

Dhulikhel also ventured collaboration with diverse stakeholders including research organizations such as SIAS to achieve sustainable water management. Since last six years, a collaborative work with SIAS has helped Dhulikhel to practice evidence-informed dialogues towards resolving local water management related problems. As documented by Devkota et al. (2021), Dhulikhel initiated evidence-based policy and planning and co-developed an innovative tool for evidence-informed dialogue called *Pani Chautari*. The key insight of this initiative is that an evidence-informed dialogue can help to create innovation, foster collaboration and build capacity to address water-related problems.

One of such innovations that Dhulikhel developed and successfully implemented is water recharge system. As detailed out by Shrestha et al. (2021), the intervention on water recharge techniques such as

recharge pond and trenches were identified from series of discussions in *Pani Chautari* process. The recharge ponds and trenches have proven successful in increasing water discharge from the existing sources and steady spring discharge. The recharged ponds were effective and uptaken by locals and in the municipal planning due to its low cost and easy monitoring. For instance, 'one ward one pond program' has been included in fiscal year 2017/2018 plan.

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