Multiple Use Water Services in Nepal
Scoping Study

Supported by

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This report was prepared by:
Govinda Basnet and Barbara van Koppen

Under the direction of:
Barbara Van Koppen
Title: Project Manager

Editing and layout:
Terry Clayton

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Cover Page Photograph: A woman washing clothes in an irrigation canal in Chherlung, Palpa. Photo: Govinda Basnet

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Abbreviations and acronyms

ADS	Agriculture Development Strategy
APP	Agriculture Perspective Plan
CBS	Central Bureau of Statistics
CIP	Community Irrigation Project
DADO	District Agriculture Development Office
DDC	District Development Committee
DOA	Department of Agriculture
DOI	Department of irrigation
DOLIDAR	Department of Local Infrastructure Development and Agricultural Roads
DSCO	District Soil Conservation Office
DSCWM	Department of Soil Conservation and Watershed Management
DWSS	Department of Water Supply and Sewerage
IDE	International Development Enterprises
IWMI	International Water Management Institute
LDF	Local Development Fund
LILI	Local Infrastructure for Livelihood Improvement
MDG	Millennium Development Goal
MLD	Ministry of Local Development
MOAC	Ministry of Agriculture and Cooperative
MOFSC	Ministry of Forest and Soil Conservation
MOI	Ministry of Irrigation
MPPW	Ministry of Physical Planning and Works
NITP	Non Conventional Irrigation Technology Project
NEWAH	Nepal Water for Health
PAF	Poverty Alleviation Fund
RVWRMP	Rural Village Water Resources Management Nepal
RWSSFDB	Rural Water Supply and Sanitation Fund Development Board
SAPPROS	Support Activities for Poor Producers of Nepal
SWC	Social Welfare Council
VDC	Village Development Committee
WASH	Water, Sanitation, and Hygiene
WECS	Water and Energy Commission Secretariat
WSS	Water Supply and Sewage
WUMP	Water Use Master Plan

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Executive summary

Global MUS innovation is most advanced in Nepal. In the middle hills, two robust MUS modalities have been conceptualized and implemented at certain scale. First, in the early 2000s, Winrock and IDE introduced piped gravity flow systems that provide sufficient water for domestic uses and vegetable cultivation at homesteads. Water efficiency is improved by drip irrigation. Other components of the market-led supply chain, such as marketing, are addressed as well. Over 200 of these domestic-plus systems have been implemented, partly in collaboration with the Non-Conventional Irrigation Project of the Department of Irrigation. Learning alliances were established to document and exchange these experiences, and policy interest was raised. NEWAH/WaterAid increased its system design norms. NEWAH, SAPPROS, CARE and other NGOs also diversified, for example, by adding fish ponds. There is a strong potential for further scaling piped gravity flows on the 875,000 ha of arable land that are not irrigable with conventional irrigation and that the government seeks to develop. Given the high rates of male outmigration and the feminization of agriculture in the middle hills, women are an important target group. Domestic-plus aligns well with women's stronger roles in homestead-based cultivation. The WASH sector is especially interested in income from productive uses to improve the ability to pay for scheme sustainability. However, a rigorous consolidation of past experiences is still lacking. Such **consolidation** is recommended as evidence-based lessons for further advocacy and scaling up.

Second, in the late 1990s, well before the notion of 'community-based MUS' was coined, Helvetas introduced that modality, called the water use management plan or 'WUMP'. It has been widely applied at village level by the Rural Village Water Resource Management Project, supported by the Finnish government. Different WUMP modules adjust to available project resources. WUMPS were applied by a few other organizations, but only for the single uses of their domestic or irrigation mandates. WUMP will soon be scaled up to district level. This will fully align with the restructuring of government under the peace process. Government and development partners emphasize decentralization and devolvement of resources and decision-making power to the lowest village development committees and district development committees. Again, past experiences have not been consolidated as yet. It is recommended to **conduct such consolidation** and identify a robust WUMP.

Two other potentials for scaling MUS were identified that need to be **explored in further depth**. The multi-donor Poverty Alleviation Fund applies the World Bank's Community-Driven Development approach. Funds are directly channeled to communities according to their priorities. Water projects are reported, but it is unknown as yet whether and how the possibility of integrated design for multi-purpose infrastructure has been tapped. Further, there are various soil conservation and watershed management initiatives. They seem disconnected from service provision. A study of current and potential linkages would identify the scope for people-led sustainable water development and management.

A main barrier to scaling MUS is top-down single-use standard design by engineers from the lowest levels of local government up to highest management levels of single-use earmarked donor funds. **Engineers' training for participatory design for multiple uses from multiple sources** is recommended.

The recommended consolidation of past experiences with piped gravity flow systems and with WUMP; the exploration of MUS in the Poverty Alleviation Fund and of current and potential linkages between water conservation and water services initiatives; and the MUS training for engineers should be guided by a **national MUS network**. This network should be composed of the above-mentioned partners and also include potential irrigation-plus champions and agencies that already promote self-supply for micro power plants, ecosan, roofwater harvesting, and biogas, grafted on to water provision. This network would take up further policy advocacy and strategize on new pilot projects. The report concludes with recommended key stakeholders for this network.

1 What is MUS?

Multiple-Use water Services (MUS) is a participatory approach that takes the multiple domestic and productive needs of water users who take water from multiple sources as the starting point of planning, designing and delivering water services. The MUS approach encompasses both new infrastructure development and rehabilitation as well as governance.

MUS emerged in the early 2000s when professionals from the water sub-sectors, in particular the domestic water, hygiene and sanitation (WASH) sector, and the irrigation sector began to see the untapped potential of providing water beyond the confines of conventional single-use mandates (Moriarty *et al.*, 2004). Cross-sectoral action-research documented in more than 100 cases of MUS innovation in over 20 countries (www.musgroup.net; Van Koppen *et al.*, 2009), economic analysis (Renwick, 2007), and policy dialogue in national and international forums, such as the World Water Forums in Mexico (2006) and Istanbul (2009), have confirmed this potential (Figure 1). Focusing on where sub-sector interests overlap leads to single-use sectors better achieving their own mandates while generating additional benefits. MUS offers three main advantages compared to single-use water service delivery models: 1) more livelihoods improvements, 2) more environmental sustainability, and 3) strengthened integrated water resource management (IWRM).

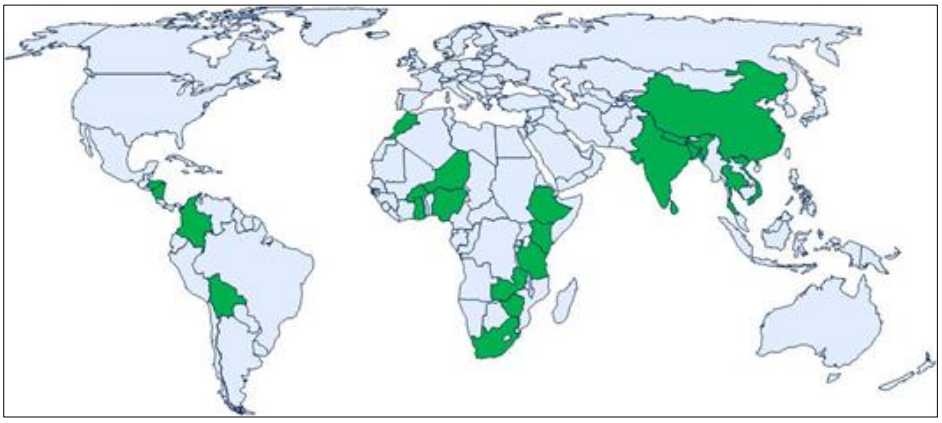

Figure 1: Countries where MUS has been applied

1.1 Livelihood returns

In terms of livelihood improvements, MUS concurrently improves health, food security, and income, and reduces women's and girls' drudgery, especially among the poor in rural and peri-urban areas where their multi-faceted, agriculture-based livelihoods depend in multiple ways on access to water. Livelihood benefits mutually reinforce each other. Thus, MUS gives 'the most MDG per drop' (Renault 2008). Livelihood benefits tend to be more durable because participatory planning empowers communities to articulate their own priorities, thus enhancing ownership and willingness to pay for services. From the domestic sector perspective, adding income opportunities improves the ability to pay, hence, MUS unlocks new financing streams.

Livelihood returns from MUS investments are also more durable because they are holistic. People in many rural communities have practiced their own forms of 'integrated water resource development and management' for self-supply for many generations. Similarly, every water manager of a system designed for a single use has come to realize that people use a system for more than one purpose, planned or not. Prohibiting these other-than-planned *de facto* uses, for example by declaring such uses illegal, has typically been in vain. MUS turns the problem of unplanned uses into an opportunity to leverage investments, avoid infrastructure damage from unplanned use, and generate broader livelihood returns.

1.2 Environmental sustainability and justice

In terms of environmental sustainability and water efficiency, MUS recognizes that people use and re-use conjunctive water sources in ways that optimize, for them, the efficient development and management of rain, surface water, soil moisture, wetlands, and groundwater, and other related natural resources within their local environment. Even within the homestead, households can use up to nine different water sources, as found in Thailand (Penning de Vries and Ruaysoongnern 2010) Local knowledge and coping strategies for mitigating seasonal and annual climatic variability by combining multiple sources is at the heart of community resilience. Such efficiency and resilience will become ever more important as the impacts of climate change become more visible.

The MUS focus on the poor puts people and multiple uses at centre stage instead of casting allocation issues in terms of monolithic 'use sectors' that fail to differentiate between vested interests and multiple small-scale uses for basic livelihoods. Instead, MUS considers the distribution of water use by individuals, each with multiple water needs. Quantification of the distribution of water use is revealing. In rural South Africa, for example, 0.5 percent of users use 95 percent of the water resources. More than doubling current estimated water access by every rural user from 116 to 277 liters per capita per day would require the 0.5 percent large-scale users to share only six percent of their current water uses (Cullis and Van Koppen 2007). Focusing on the poor, MUS especially safeguards poor people's rights to water, food and livelihoods and their fair share of the resource in quantitative terms, and exposes poor people's greater vulnerability to unsafe water in qualitative terms.

1.3 A focus on community integrated water management

Last but not least, in opening up new livelihood and environmental opportunities, MUS recognizes that the natural intersection of multiple uses and multiple sources starts locally, at household and community level. MUS is bottom-up IWRM, starting with local users as clients and active participants instead of 'aid recipients'. MUS complements past IWRM efforts in two new ways. First, while IWRM tended to be a 'push' from the top-down (e.g. by establishing basin organizations), MUS is a 'pull' for integration from below, where human well being and water resources are integrated.

Second, past IWRM efforts tended to prioritize governance over infrastructure development. The 's' in MUS stands for 'services' in the sense of reliably ensuring the availability of water in certain quantities and qualities, at certain times, and at a certain sites, during the full project cycle and after the construction phase. Services result from the appropriate balance between sustainable infrastructure investments and water governance. Infrastructure investments to harvest and store water in the rainy season for use in the dry season increase the pie of available water resources for all. This win-win solution reduces

competition for water in open basins where there are still uncommitted water resources available for development. Yet, in many IWRM debates that focused on sharing an inevitably limited pie, this solution tended to be ignored. Obviously, infrastructure development is a precondition to improve access to and control over water for the 'have-nots', even if that implies that the 'haves' need to save water when basins are closing.

1.4 Key questions

In the light of these untapped livelihood, resource and integration opportunities, the key question is: How can scaling up be accelerated? The question has two sides: first, what are the barriers and constraints that currently limit the scaling up of MUS and what is their comparative importance? (e.g., financing, governance, policy, awareness, implementation capacity); and, second, what are the opportunities for scaling up MUS modalities in terms of scaling pathways, overcoming challenges, and potential key partner institutions? These are the questions the Rockefeller Foundation posed to the International Water Management Institute (IWMI), in collaboration with the International Water and Sanitation Centre (IRC).

1.5 Geographic focus

The geographic focus of the scoping studies is five countries where IWMI and IRC see strong potential for scaling up MUS modalities: India and Nepal in Asia, and Ethiopia, Ghana, and Tanzania in Africa (linked to the Alliance for a Green Revolution in Africa). The answers to these questions are presented in five stand-alone country reports and one synthesis report. The present country report discusses the findings in Nepal.

The research objective and questions are elaborated next. This is followed by an analysis of empirical MUS related research in Africa and South Asia with the aim to further conceptualize scaling up of MUS for investigation in the five countries and to enable a structured synthesis of the results. The section on theory of change discusses four MUS modalities and related scaling pathways, i.e. 'what' can be scaled up. The chapter concludes with a section on the practice of change, i.e. 'how' MUS has been scaled in the past, and can continue to be scaled up through networking.

1.6 Study objective and questions

1.6.1 Objective

The objective of this study is to conduct country-specific research on the barriers that limit the scaling up of a multiple use services modalities to water management, the comparative importance of these barriers, and possibilities for overcoming these challenges for poor and vulnerable people in South Asia and Africa.

1.6.2 Research questions

- What are the different MUS modalities that have emerged, and how are they related to specific scaling pathways?
- What are the most important barriers limiting greater adoption of these modalities?
- What specifically could be done to overcome these barriers?
- What specific organizations are well placed to overcome these barriers?
- What geographic conditions would be most suitable for scaling up each kind of MUS model?
- What kinds of policy incentives are needed in each case?

- What kind of capacities and skills need to be built?
- What kind of information dissemination and engagement/partnership building needs to occur?
- What is the optimal sequencing of interventions needed to enable broader scaling up?

1.7 Theory of change: MUS modalities and scaling pathways

We define scaling up MUS as: better institutionalization of more robust MUS modalities and achieving a wider geographic spread. For people in rural and peri-urban communities, multiple uses from multiple sources is already a wide spread practice. The holistic development and management of multiple sources for multiple uses continues, both as multiple uses of systems designed for a single-use, and also as self-supply, whereby users themselves invest in the development and management of water sources for multiple purposes. These practices are often informal, sometimes without formal institutions even knowing about them. For people in many communities, the notion of 'MUS' is an articulation of what they do every day.

Scaling up MUS is primarily a matter of institutional transformation of water services delivery by government agencies, NGOs, financing agencies and donors, who conventionally structure their respective policies and water development programs into isolated and vertical sub-sectors (Van Koppen *et al.* 2009). Each sub-sector focuses on and budgets for the development of services for a single use, which is the sector mandate. This is often accompanied by pre-determined technologies and related management structures. Sub-sectors structure their accountability to tax payers and other financers by justifying their budget allocations according to their performance on a single livelihood dimension such as improved health through safe water for domestic uses, or improved health through nutrition, or food security, or income. Formal professional training in colleges and universities is structured along similar lines. This compartmentalization, with vested professional interests, is the main reason for single-use services, and, hence, the main barrier that MUS proponents have sought to overcome.

The 'theory of change' adopted by most MUS proponents was to gradually channel existing institutions and financing streams towards MUS as a win-win strategy to better meet sector mandates while generating additional benefits. Accordingly, MUS proponents started addressing sectoral divides in essentially four ways or four 'MUS modalities' as shown in Table 1. This gradual channelling allows for leveraging of existing human, technical, institutional and financial resources.

The following description of the four MUS modalities is the 'ideal-typical' case. The precise content, relevance, current robustness and scaling potential greatly differ by country. Differences among and between modalities are a function of the entry point. They are not mutually exclusive but overlap and mutually support each other. Each modality contributes knowledge and resources to the common pool, which renders the whole more than the sum of the components. Ultimately, for example, the community-based MUS modality, in which community members articulate and negotiate the public water services they prioritize, would encompass all other three.

Table 1: MUS modalities

MUS modality	Priority setting	Implicit priority use and site	Primary investors in infrastructure and funding earmarks	Primary scaling partners
Domestic-plus	WASH –sector, including local government, line agencies and NGOs	Domestic, near homesteads	Sub-sector, funding earmarked for domestic and some other uses, specific service levels, and often to a limited set of technologies; co-investments by users	WASH sector, with support for productive uses; sector working groups, and research centres, in learning networks
Productive-plus	Agricultural line agencies (irrigation, fish, livestock, trees), NGOs	The single productive use of the line agency, siting where appropriate	Sub-sector, funding earmarked for specific productive and some other uses; often a limited set of technologies; co-investments by users	Agricultural line agencies and NGOs, with support for drinking water quality and other domestic needs; sector working groups, and research centres, in learning networks
Self-supply MUS	Users	Multiple uses, siting where appropriate	Users, limited by available technology choice	NGOs and private sector for technology supply, with support for drinking water quality, other domestic uses, productive uses and government support for market support, regulation; sector working groups, and research centres, in learning networks
Community-based MUS	Users	Multiple uses, siting where appropriate	Government or NGOs, with less earmarking of funds or with convergence; co-investments by users	Local government, with support of NGOs and line agencies; multiple sector working groups, and research centres, in learning networks

1.7.1 Domestic- and productive-plus modalities

The first two modalities are known as domestic-plus and productive-plus. Those who pursue these modalities work to scale up from within their own water sub-sector by widening the scope of public investments for their mandated single use to encompass other uses. Sub-sectors often subsidize capital investments in infrastructure, while communities are usually responsible for operation and maintenance. In +plus modalities, the implicit priority for either water for domestic uses near homesteads or crops in fields (or fisheries, or livestock watering) continues to be set by sub-sector professionals, not local users. Planning and budgeting from the top-down and a narrow range of options continues to be the norm. Planning remains 'formal' in the sense of strong involvement of government and public donors and NGOs closely collaborating with government.

However, in the +plus modalities, the sub-sectors open up their mandate. This tends to happen in a step-wise fashion. The subsequent steps from single-use to multiple-use progress from: ignoring or denying non-planned uses or declaring illegal to: turning a blind eye on these uses ('not my job') to: implementing marginal practices on the ground to accommodate multiple uses to: accommodating *de facto* multiple uses at management level to: fully integrating multiple uses from multiple sources in planning, design and use (Renault 2010). Especially in the WASH and irrigation sub-sectors, these +plus modalities have developed into fairly robust scaling models.

These steps were supported by valuation studies that identified the range of *de facto* uses and calculated the returns (Meinzen-Dick, 1997; Bakker *et al.*, 1999; Renwick 2001). In +plus approaches, the water sub-sectors are investors interested in all returns on their investments, instead of investors who may go so far as to criminalize livelihood returns only because they were not planned.

A strong argument in favour of +plus modalities is that relatively small incremental investment costs generate major livelihood benefits and avoid damage caused by unplanned uses. The benefit-cost ratio of these incremental investments is high, as confirmed by the in-depth financial evaluation of both domestic-plus and irrigation-plus scenarios conducted by Renwick (2007).

The domestic-plus modality builds on the water services ladder. While the WASH sector assumes that water quantities at higher service levels are still primarily, if not exclusively used for domestic uses, empirical research confirms that poor rural and peri-urban users in agrarian societies use and re-use water for livestock and other productive uses well below even basic service levels (see Figure 2). Similarly, studies have shown how higher service levels in terms of quantities, nearby availability and reliability lead to more productive uses. Hence, domestic-plus consists of providing higher levels of service, roughly doubling or tripling current supplies.

As domestic-plus modalities maintain a priority for meeting people's domestic and sanitation needs near to or at homesteads or residential areas, productive uses also tend to concentrate there. This site is especially relevant for women, who tend to have a stronger say over income from productive activities around their homes than from distant household production. Further, for the land-poor, sick and elderly, the homestead may be the only place where they are able to use water productively. Thus, the relatively small incremental improvements to domestic water supply systems result in relatively high benefits from small-scale productive uses, principally backyard gardening, livestock and home-based industries. Renwick (2007) calculated that intermediate MUS service levels of MUS at 50 to 100 litres per capita per day generate income which allows repayment of the infrastructure investment and operational costs within 6 months to 3 years.

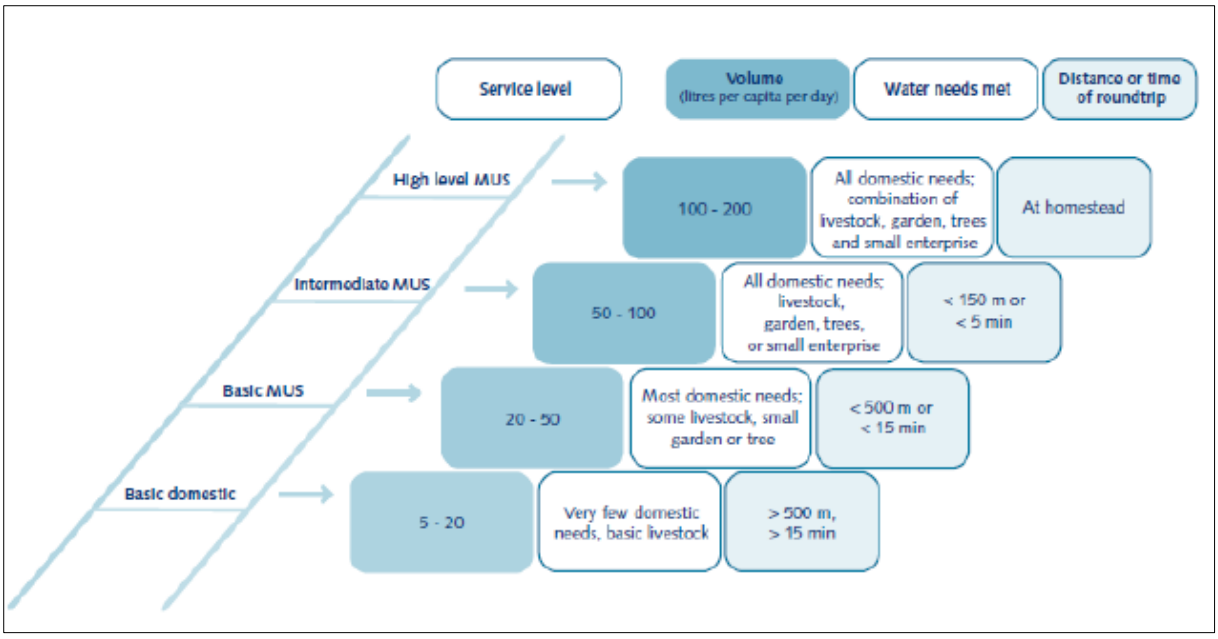

Figure 2: The domestic-plus water ladder (Renwick, 2007; Van Koppen *et al.*, 2009)

At any step on this service ladder, at least 3-5 liters per capita per day should be safe for drinking and cooking. This quantity of safe water is important for domestic water supplies, and for the many situations in which people drink water from other sources. Higher quantities of water of lesser quality for personal hygiene and sanitation are equally important for health (Van der Hoek *et al.* 2002). Scaling up domestic-plus happens mostly via the WASH sector, increasingly in collaboration with local governments.

The **irrigation-plus modality** most frequently applied in India, Vietnam, and China, is the FAO Mapping Systems and Services for Multiple Uses (MASSMUS) methodology for the modernization of large-scale irrigation systems. Relatively small incremental improvements are added on to existing irrigation infrastructure, which mostly improve access to surface water (cattle entry points, washing steps, small diversions for laundry, bridges, roads, etc.). Conjunctive use of seepage for groundwater recharge for irrigation and domestic uses are considered in planning for lining canals or not. In areas where canal water is the main source of water, water is supplied year-round and reservoirs are filled for residential areas. MASSMUS has specific domestic water and gender modules. MASSMUS makes many recommendations that can be applied to small-scale schemes as well, but they have not been systematized into a robust MUS modality as yet.

Other productive-plus modalities

The fisheries sector also conducted research on the better integration of fish and other products into water bodies, e.g. dams or irrigated fields as a 'productive-productive' approach (Nguyen-Khoa *et al.*, 2005). Ancient and modern small village reservoirs have been operated and studied from various productive and domestic entry points, including irrigation, fisheries, forestry, livestock and domestic uses (Palanisami and Meinzen-Dick, 2001; Venot *et al.*, 2011). Documentation and implementation of these productive-productive and productive-domestic approaches is still fragmentary. With more consolidated effort and coordination they could well crystallize into robust MUS modalities.

Scaling up irrigation-plus and other productive-plus modalities is largely through technical line agencies and NGOs. Line agency collaboration with local government tends to be underdeveloped.

1.7.2 User-driven MUS

In the user-driven and community-based modality, water users define the water systems they need for their multiple uses. Government agencies and NGOs avoid setting a priority for any water use, or a specific technology. These approaches are more recent and most are still being piloted.

'Self-supply for multiple uses' is the one user-driven MUS modality. Here, users themselves invest in most infrastructure capital costs, often on an individual or household basis, although some communal arrangements may be included. Examples are self-financed wells, pumps, water harvesting techniques, gravity flows, drilling options, and water quality point-of-use treatment devices. Users decide about the purchase, installation and uses, which are often multiple. Scaling up self-supply is largely through market-led supply chains which are often highly effective and sustainable. Public sector support can focus on things like technological innovation, market development for supply chains, credit for purchase, and awareness raising.

The second user-driven MUS modality is **'community-based MUS'.** In this modality, government or NGOs fund the bulk of mainly communal infrastructure construction or rehabilitation costs, but the choice of the technology, siting, and lay-out is in the hands of the community. Community members, including women and marginalized groups, are empowered to articulate their needs and demands, access information, and make choices regarding their assets and resources. This MUS modality applies the general principles of community-based natural resource management (CBNRM) to water resources. (Water sub-sectors divides probably contributed to the delay in adopting community-based management compared to land or forestry resources for example). Community-based MUS can be implemented on a project basis or align with the global trend toward decentralization of decision-making of public support through local government, or as a combination of both. An example of the latter is the SADC/Danida supported IWRM Demonstration Projects in five SADC countries (SADC/Danida 2009a and 2009b).

Integration in local government is important because local government agencies are permanent institutions, which not only provide a potential solution for financial and institutional sustainability of communal water systems, but also offer considerable scope for nation-wide scaling. Decentralized decision-making through local government about the allocation of public resources can lead to community-based MUS without any explicit intention, but as a result of a community's own prioritization for improving the use of multiple sources for multiple uses. This is the case, for example, in India's Mahatma Ghandi National Rural Employment Guarantee Scheme (MG-NREGA), as elaborated in the India country study.

In scaling through local government or through programs interacting more directly with communities, the major challenge is to match bottom-up needs with top-down state and other funds. Institutional support should facilitate participatory planning, ensure inclusion of women and marginalized peoples, and build capacity for making informed choices to

articulate long lists of community needs into priority-ranked, time- and budget-bound undertakings, or small 'bankable projects'. These projects are meant to be matched with available top-down financing streams. This can be achieved either by loosening some of the strings on financing and removing or modifying single-use and single-livelihood constraints, or by converging parallel financing streams and pooling them into one project.

In community-based MUS, communities plan and solicit external support based on their overview of all multiple uses and multiple sources for their livelihoods. At this level they can tap efficiencies of developing infrastructure for multiple uses and combining and managing multiple conjunctive sources, which saves funds. Also, communities can negotiate their water needs *vis-à-vis* the needs of other users in the same watershed and at higher levels. Inter-basin transfers may also warrant negotiation. They can formally voice their concerns through local government agencies, up to watershed, district and higher levels as the issue at stake requires, without depending on the top-down establishment of new governance layers like watershed and basin organizations where the more vocal social groups tend to dominate. In this way, community-based MUS is the lowest appropriate level for pro-poor IWRM.

1.8 The practice of change: MUS networking

The 'theory of change' of scaling via one of the four modalities or a combination thereof is one side of the coin. The other side is the 'practice of change'. In the past, MUS innovation and scaling was primarily the result of the effective crafting of networks of MUS proponents from local to global level into communities of practice or learning alliances, primarily through the global MUS Group (see www.musgroup.net). A 'right mix' provides for well-informed and rigorous evidence-based innovation, in which next generic lessons and local specificities are continuously identified. The same network also ensured continuous dissemination and advocacy of this evolving body of knowledge. Such a network also brought the 'right mix of people' together, encompassing water users organizations and professionals from the different sub-sectors; academics, policy makers, and implementers; experts at the lowest local level up to national and global levels; donors and financing agencies and government officials. This scoping study also analyses such past innovation and networking and recommends partners for future networking to implement the high-potential MUS scaling pathways.

1.8.1 Geographic focus: Nepal

Nepal was selected as one of the five countries where IWMI and IRC see a strong potential to scale up MUS because it was home to the world's earliest experiences with MUS. That first pilot was the USAID funded Smallholder Irrigation and Market Initiative (SIMI), implemented by Winrock International in partnership with International Development Enterprise (IDE). From 2004 to 2008 the documentation and scaling up of these MUS experiences was supported by the global MUS project, a partnership of IWMI, IDE, and International Water and Sanitation Centre, and national partners in eight countries. Since then, Winrock, IDE, and partners have continued implementing MUS projects. The focus of IDE and Winrock through USAID support, as well as the focus of this report, is on the middle hills. For a MUS approach in the large-scale irrigation systems in the Tarai, we refer to the methodology developed by FAO on Mapping Services and Systems for Multiple Use Services (FAO 2010).

1.9 Methodology

The study was conducted from August to October 2011. The primary method was collecting information from organizations and individuals involved in the water management sector in Nepal. On 18 August 2011, IDE convened a workshop with 20 participants on obstacles and potential for scaling up MUS in Nepal.

Interviews were held with officials from the government implementing agencies, donor agencies, non-governmental implementing agencies, and independent experts. Altogether, over 40 individuals from 18 institutions were interviewed (Annex 1).

Policy documents and implementation program reports were also reviewed. The major policy documents included National Water Plan, Irrigation Policy 2003, Three Year Interim Plan 2007, Three Year Plan 2011, Agriculture Perspective Plan: Implementation Action Plan 2006, and Millennium Development Goals: Needs Assessment Report 2010. The Preliminary Report of the Census 2011, recently published by the Central Bureau of Statistics, was reviewed to analyze the demography. In addition to these documents, progress reports, case studies, brochures of these organizations, samples of water use master plans, and Nationwide Coverage and Functionality Status of Water Supply and Sanitation in Nepal 2011 were reviewed.

1.10 Organization of the report

The next chapter provides general background information on water resources and the socio-economic context in the country. The third chapter discusses the institutional setup and policies on water management in Nepal by government and NGOs. The fourth chapter discusses the different modalities of MUS that have emerged and future potential for scaling up. In the conclusions, we summarize the potential for scaling up gravity flow systems for multiple uses and the Water Use Management Plan methodology in Nepal.

2 Nepal: An overview

Nepal is among the poorest countries with a Human Development Index of 0.428 and ranks 138 out of 169 countries (CBS, 2011; UNDP, 2010). A new democratic government was elected in 2006, ending the Maoist uprisings. Since then, Nepal has been in a transition stage. Governance structures are being renewed, with strong decentralization and devolvement of decision-making and resources to local Village Development Committees (VDC) and District Development Committees (DDC). The upcoming state restructuring is expected to further decentralize and stabilize the country. These changes provide room for innovation.

Geographically and ecologically, Nepal has three zones: mountain, hill, and Tarai, each running parallel in an east-west direction. According to the 2001 census data and classification criteria, the Tarai constitutes 17 percent of the total land area and 49 percent of the cultivable land. The hills constitute 68 percent of total area and 20 percent of cultivable land, and mountain constitutes 15 percent of total area and 11 percent of the cultivable land.

Figure 3: Nepal (Source: Wikipedia)

Agriculture is the mainstay of the majority of the Nepalese population and land is the principal productive asset. Out of the total area of the country, about 2,641,000 ha is arable land (NPC/GON 2011). The average landholding size as per the 2001 census is 0.73 ha in the mountains, 0.66 ha in the hills, and 0.94 ha in the Tarai. The cropping pattern also differs in these three ecological zones. The size of landholdings determines the status of a family and often the participation in the development process.

Of the total arable land, only 1,766,000 ha are irrigable. At the end of the fiscal year 2009/2010, total irrigated area reached 1,252,476 ha (GON/NPC 2010). Of this, surface irrigation accounts for 675,991 ha and ground water irrigation 299,696 ha. The Non-conventional Irrigation Technology Project (NITP), implemented by the Department of Irrigation (DOI) applies other than conventional irrigation methods like micro-irrigation

technologies and services 2,586 ha. About two thirds of the agriculture land designated 'not possible to irrigate' (875,000 ha), lies in the hills and mountains.

The 2011 Census numbers the population of Nepal at 26.62 million, with an annual growth rate of 1.4 over the last 10 years. Some 379,000 households are in the mountains; 2.644 million in hills, and 2.637 million in the Tarai. The demography differs only slightly in each of the three zones and is characterized by population growth and male outmigration. The percentage of the population living in the Tarai has increased about 2 percent (from 48 to 50 percent) and decreased about 1 percent in the hills and mountains (from 44 to 43 percent in hills and from 7 to 6.5 percent respectively).

Nepal has 25.4 percent of its population living below the national poverty line (NPC 2010). Poverty alleviation has been the prime agenda item of development efforts in Nepal ever since 1956 when the country started planned development. The Tenth Five Year Plan (2002-2007) was termed the Poverty Reduction Strategy Paper which strongly committed the national government to reducing poverty. As a result of concentrated efforts, the percentage of people living under the poverty line has been reduced from 30.8 percent in 2003 to 25.4 percent in 2009 (CBS 2009). However, there is a disparity in rural and urban areas in terms of poverty distribution.

The preliminary report of the census showed trends that need to be taken into account when planning technological interventions. One of the most important findings is the reduction in the net population in 23 districts in the hills and mountains in the eastern, central, and western development region. The average household size has decreased from 5.44 in 2001 to 4.7 in 2011. In the mountain the average household size is 4.74, in the hills it is 4.34 and in Tarai it is 5.06.

There has also been a rapid increase in the absentee population. Of the total absentee population of 1.66 million, 52 percent are from hills, 42.3 percent from Tarai and the remainder from the mountains. Nearly 90 percent (86.7) percent of the absentee population is male. In terms of regional origin of out-migration, 85.4 percent of the absentee population is from rural areas. Ten years ago, the absentee population was only 0.76 million. The rapid increase in the absentee population implies an increase in the pace of 'feminization' of agriculture. Moreover, since the absentee population is almost completely among the youth, it reflects an aging society. Jointly, these processes create additional burdens on women for managing agriculture. This implication is also reflected in the change in sex ratio (number of males for every 100 females). The national average sex ratio has decreased from 99.8 in 2001 to 94.41 in 2011. Among the ecological regions, the sex ratio in 2011 in the hills and mountains is 92 and 94 respectively.

The processes of feminization of agriculture and ageing are more acute in the hills. This fact underlines the need for urgency in taking social processes into consideration while designing development interventions. In the current study context, any local level water management intervention should address the concerns of women farmers, and should be manageable by women and aimed at reducing the burdens on women.

3 Water resources and self-supply

3.1 Water resources

Nepal has more than 6,000 rivers of varying size forming a dense network of rivers with steep topographic features. All the river systems drain from north to south towards the Ganges. Total annual water availability is estimated at 225 billion cubic meters (BCM) out of which only 15 BCM has been estimated to be used for economic and social purposes (WECS 2005). Water for irrigation from big rivers is largely inaccessible both in the hills and mountains as rivers cut deeply into the valleys and only very long canal works or pumping can make the water usable. People access water from springs originating on the slopes and smaller streams for drinking and irrigation purposes. Discharge from these sources varies in different seasons. Lately, people have been reporting a drying up of these smaller water sources in many hill areas. The cause might range from land use change, mostly the degradation of forests, to the broader effects of climate change. In the hill and mountain regions, large tracts of forests, especially those which have not been handed over as community forests, are converted to agricultural land by slash and burn agriculture or felling of trees. The degradation of forest also alters the hydrological cycle.

3.2 Informal water development for self-supply

In the middle hills of Nepal there is a long history of community-managed water development and management for self-supply. Local people continue to respond dynamically to new technologies and opportunities, outside the ambit of the state and NGOs. For people in rural communities, it is age-old practice to meet their multiple needs by developing water for multiple uses, taking water from multiple conjunctive sources. Water from sources used for drinking is also used for watering plants in the kitchen garden and for watering livestock. Similarly, water from irrigation canals is used for domestic uses like cleaning grain and utensils, and washing clothes. Wherever access to a separate drinking water source is limited, people drink water from irrigation canals. Sometimes, as in the case of high altitude settlements like in Lomonthang in the Upper Mustang, where the water freezes in tap stands in the winter months, the only source for drinking water is irrigation canals. People chisel out the top layer of ice and collect water flowing underneath (box 1).

Water from irrigation canals is used to run the traditional water mills for grinding grain and, in some places, for making wooden crafts. People in rural areas have been using these simple mills since long (box 2). People in some places also collect water in earthen ponds for irrigating crops and for buffalo wallows. These earthen ponds help store water and contribute to the hydrological recharge of the system.

Multiple use practices range from an individual household using the same source of water for drinking, cleaning, livestock, and irrigating crops, to the whole community undertaking initiatives to collectively meet domestic needs and irrigation and the energy requirements of the community. People use locally available technologies but also technologies not available in the community. Examples of locally available technologies are the traditional water mills, which are installed along canals and rainwater harvesting ponds for buffalo wallows, and for irrigating the crops. However, in many rural areas, people have also bought modern equipment and use canal water for running mills for rice hulling or grinding grain, and even to generate electricity. Electricity for mills for dehusking rice and grinding grain greatly mitigates the work loads of women.

When installing expensive equipment, communities often seek external financial support and will mortgage their land as collateral. Communities develop elaborate rules to govern competing multiple uses of water, when to use water for irrigation and when to use it for power generation. The following boxes briefly describe two cases of these informal initiatives for self-supply.

Box 1. Water collection pond in Ghyakar of upper Mustang

Water is a scarce resource in the Upper Mustang where the annual rainfall is less than 300 mm. Crop production is not possible without reliable irrigation facilities in all the settlements of the region. In many settlements, the level of water flow at the source is not enough to irrigate fields. People construct a water harvesting pond called a *ching*. In Ghyakar, a small village with 13 households in Chhuksang VDC, people have built an earthen pond of about 1250 m^2 with an average depth of about 2.5 m. The water from the Ghyakar *khola* is brought to this pond through a 2.85 km long canal. In the spring season when the water flow in the stream is not enough, water is released from the pond on every other day to irrigate the fields. When the water level increases in the stream in the monsoon season, water is stored at night and released during the day for irrigating fields. A water mill has been installed along the canal between the pond and the fields so that grain can be ground while irrigating the field. A leader or *ghempa,* is selected annually for managing water allocation, and only the *ghempa* can sanction release of water from the pond. They have developed elaborate rules for water turns for irrigation and grinding grain. The pond, besides providing adequate flow of water for irrigation and running the mill, insures against drought in the critical crop growth period.

Box 2. Water mill in Chherlung

In 1928, farmers of Chherlung Village in Boughagumha VDC of Palpa District built an eight km long canal. The canal took three years to build and costed Rs 5,500. The villagers have developed an elaborate mechanism to distribute water in proportion to the amount of the initial investment made for the construction of the canal. Individual farmers can sell and buy water irrespective of land transactions. Water from this canal is used for washing clothes, bathing, and livestock. Until a separate drinking water supply system was installed in the village, this canal used to be the main source for drinking water too. The community installed a modern water mill in 1981 by borrowing money from the Agricultural Development Bank. The water mill is used to dehusk rice and grind grain. This has greatly reduced the work load of women. Water from the canal is passed through the mill so that it does not compete with water for irrigation. The villagers have hired a mill operator and the mill is functioning on its own. Although the technology used was external, its installation was driven by the community.

These practices of using multiple sources for multiple uses contrast with interventions by external agencies, which tend to focus on one single use. Interventions are either for irrigation (productive) or drinking (domestic) uses, as elaborated in the following section. However, this is gradually changing as a result of the recent introduction of Multiple Use Water Services (MUS) by the Smallholder Irrigation and Marketing Initiative implemented by Winrock International and IDE, as discussed in a later section.

4 Single-use and resource-oriented water policies and institutions

4.1.1 Policy background

The major regulation guiding water use and management in the country is the Water Resources Act 1992. Through this Act, the government vested all the ownership rights of water in the state. The Act laid down the priority of water use in the order of drinking and domestic use, irrigation, livestock and fisheries, hydro electricity, and other industrial uses. This Act formed the basis for issuing other policies and regulations.

The Water Resources Strategy (WRS) 2002 identifies major objectives to help reduce the incidence of poverty, unemployment and under-employment, provide access to safe and adequate drinking water and sanitation, increase agricultural production, and generate hydropower to satisfy national energy needs, among others.

To operationalize the Water Resources Strategy, the government formulated the National Water Plan (NWP) 2005, which has stipulated short-, medium-, and long-term plans for the water resources sector. The Plan developed for the period of 2002 to 2027 sets 2007, 2017, and 2027 as target years for meeting short-, medium- and long-term objectives. The NWP has adopted Integrated Water Resources Management as guiding principles for water management. Yet, the identified five major subdivisions are largely sectoral: water-induced disaster, watershed management, drinking water and sanitation, irrigation, and hydropower. The Plan aims to achieve following targets among others by 2017:

- Provide drinking water facilities to 100 percent of the population,
- Provide basic sanitation facilities to 100 percent of the population,
- Provide irrigation to 97% of irrigable land and year-round irrigation to 64% of the total irrigable area,
- Serve 80 percent of the potential area by irrigation systems; and
- Develop 2035 MW hydropower to meet the projected domestic need.

Although the Integrated Water Resource Management approach has been stated as the guiding approach for the government, at the policy and implementation levels, programs are approached on a sectoral basis. Thus, the government has developed specific policies, which are all sectoral: the Hydropower Development Policy 2001, Irrigation Policy 2003, National Water Supply Policy 1997, Rural Water Supply and Sanitation Policy 2003, Urban Water Supply and Sanitation Policy 2005, Policy on the NGOs' Participation in Water Supply and Sanitation Program 1996, and Water Induced Disaster Management Policy 2005. A new Agricultural Perspective Plan is currently being formulated. For further regulations, see Annex 3.

The irrigation policies focus on one single use. However, an important recent shift was the stronger emphasis on expansion of technology choice to smaller-scale technologies and introduction of irrigation to marginal lands (see Box 3). Below, we will show how this shift was also important for the introduction of MUS.

Box 3: Policy statements with potential implications for MUS

The **Millennium Development Goals** for Nepal have identified expansion of irrigation facilities with appropriate technologies as a strategic intervention to meet MDG Goal 1, the reduction of hunger. The resources needed for non-conventional small irrigation for the period from 2011 to 2015 has been estimated at 2,133.4 million Rupees (USD 29.6 million) and for conventional small irrigation, 773 million Rupees (USD 10.5 million).

The **Agricultural Perspective Plan Implementation Action Plan** admits that in the former APP: 'APP only emphasized surface and groundwater systems of medium and large-scale and ignored micro-irrigation technologies such as rainwater harvesting, sprinkler and drip systems, and manual pumps which are 'poor friendly'.'

The **Three Year Perspective Plan** of 2010 in its strategy on irrigation states: 'Increase agricultural production, alleviate poverty and generate employment with the help of irrigation programs which are being conducted under multi-purpose water resources projects.' The Plan also states that rainwater harvesting and subsurface irrigation will be promoted to ensure year-round irrigation. It also plans activities for watershed and source conservation and recharging deep tubewells and preparation of a water use master plan at the local level.

The Irrigation Policy 2003 states that 'projects shall be formulated and guided by the principles of integrated water resources management to ensure water availability to all stakeholders, return of investment, investment sharing and self-insurance against natural calamities.'

Further, the Irrigation Policy 2003, while considering APP's thrust on year-round farmer-controlled irrigation systems, underlines the need for expanding irrigation facilities to marginal land and emphasizes non-conventional irrigation systems such as rainwater harvesting, ponds, sprinklers, drip, and treadle pumps for small command areas.

4.1.2 Formal institutional set up

In Nepal, the various government and non-governmental agencies involved in water management are organized according to sectors. Accordingly, allocation of funding is also almost exclusively along single uses for line agencies. However, for smaller projects, both for drinking water and irrigation, the funds are distributed under the umbrella of the Ministry of Local Development through the Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR) at the district level. Furthermore, each VDC receives Rs.2.4 million (about USD 33,000) per year for social, economic and infrastructure development in the VDC.

The main water uses and their line agencies for water are the following.

- Drinking water supply and sanitation (Ministry of Physical Planning and Works and the Department of Local Infrastructure and Agricultural Roads of the Ministry of Local Development);
- Hydropower generation (Ministry of Energy);
- Irrigation (Ministry of Irrigation, mainly for large-scale irrigation; Ministry of Agriculture and Cooperatives for small-scale irrigation; Ministry of Women, Children, and Social Welfare for small-scale irrigation; Department of Local Infrastructure Development and Agricultural Roads for small-scale irrigation);
- Soil conservation and watershed management (Department of Soil Conservation and Watershed Management (DSCWM) of the Ministry of Forest and Soil Conservation); and
- Local planning and rural infrastructure (Ministry of Local Development, with its Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR), and District Development Committees and Village Development Committees)

Figure 4 illustrates the government sectoral set up for two sectors, drinking water supply and sanitation and irrigation, and their collaboration with local government, as well as the structure for NGOs and donor projects.

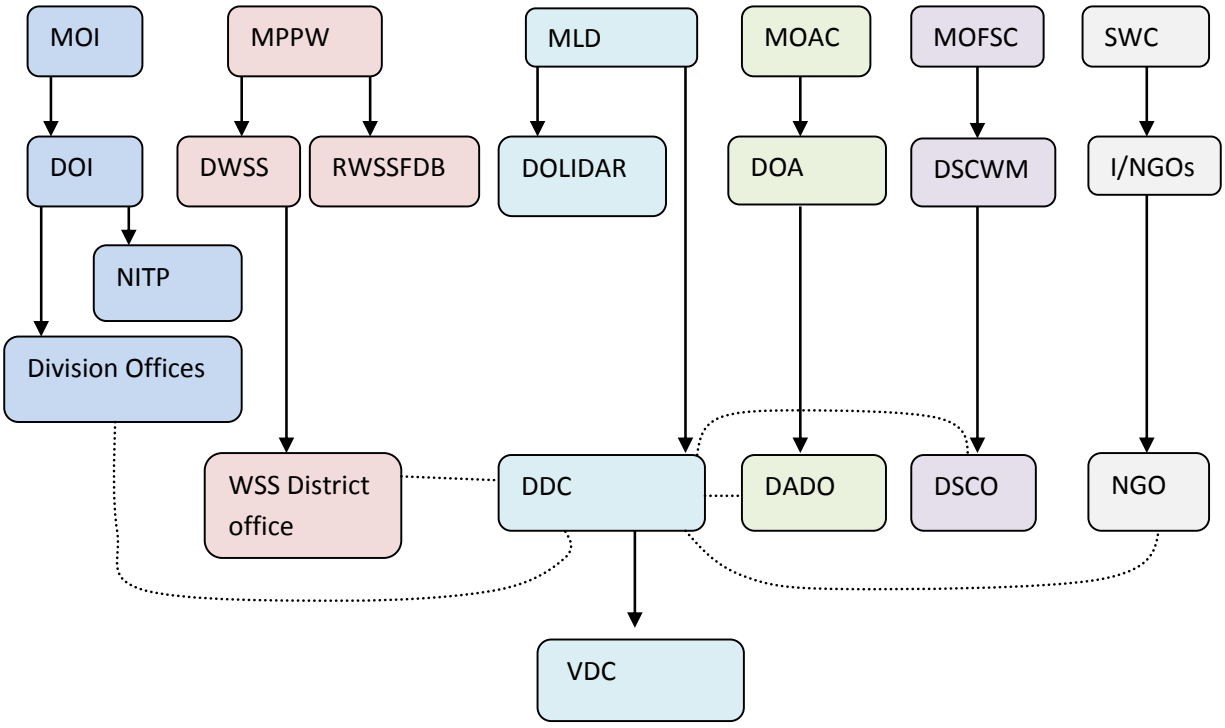

Figure 4: Government sectoral setup

For NGOs and INGOs, which tend to also adopt a sectoral approach, the Social Welfare Council is the umbrella body for all NGOs and INGOs working in the country and is under the Ministry of Women, Children, and Social Welfare. INGOs working in the country are not supposed to directly implement projects in the field but are required to implement projects through local or national NGOs. Local NGOs are required to have their programs approved by the District Council as part of the annual program planning and review meeting of the District Development Committee (DDC). The DDC provides the platform for coordination for

all the development initiatives in the district. All NGOs have to coordinate with the DDC for program implementation, although some NGOs fail to meet this requirement.

The line ministries have under them departments working at the central level. These departments have district level offices or one office in a few districts. For example, the Department of Irrigation (DOI) has one Division Irrigation Office covering more than one district, whereas the Department of Water Supply and Sewage and the Department of Agriculture and Cooperatives have district level offices in each district. The district-level line agency offices also have to pass their activities through the District Council.

Some national projects, like the Renewable Energy for Rural Livelihood, Western Upland Poverty Alleviation Project, are directly implemented through the DDC platform. Others, like the Poverty Alleviation Fund Project (elaborated below), have their own funding, but also pass through the District Council.

At the Village Development Committee level, village councils of similar nature are held annually. The Secretary, appointed by the government, supports the VDC. Currently, there are no elected representatives. As a contribution to the peace process, efforts are underway to prepare decentralized decision-making and good local governance. These efforts to improve the performance of the DDC and VDC will greatly influence the scope for bottom-up integrated planning for multiple water uses.

For example, decentralization, local governance, and community development is strengthened by programs of the Ministry of Local Development such as the Local Governance for Community Development Programme. This program is supported by a Joint Program of six UN organizations and an increasing number of other donors (e.g. DFID, Danida, GTZ, Finland, SDC, World Bank). The program develops procedures, guidelines and manuals and trains people on inclusive and accountable governance for service delivery. Training encompasses social mobilization techniques, funding mechanisms (e.g. minimum conditions and performance based funding, conditional and unconditional block grants and 'top-up grants'), fiscal revenue generation, procurement, accountancy, and auditing. Particular attention is being paid to child rights and women's inclusion and environmental concerns for infrastructure development and road construction. This array of activities is likely to expand over-time, and could include MUS (LGCDP 2011).

4.1.3 Domestic water supply

Within government, the Ministry of Physical Planning and Works and the Ministry of Local Development are the major units working in the drinking water and sanitation sector. The Government of Nepal instituted the Rural Drinking Water Supply and Sanitation Fund Development Board in 1996 to promote the program, bringing NGOs and private sector on board.

Several international and national agencies have been working jointly with the government in providing drinking water services. Although international agencies are actively involved in the WASH program, their direct contribution in terms of monetary investment is only about 10 percent, as reported in our interviews with officials. The remaining 90 percent is borne by the government, to which support of international agencies is channeled. Of the 90 percent share of the government, the Ministry of Physical Planning and Works, through the

Department of Water Supply and Sewerage, covers 65 percent, and the Ministry of Local Development bears the remaining 35 percent. At the district level, the District Water Supply and Sanitation Office implements the water supply system serving more than 1,000 people. Any drinking water supply system serving less than 1,000 is now undertaken by the DOLIDAR under the Ministry of Local Development.

Government agencies and many international agencies are active in the domestic water sector such as UNICEF, World Bank, the Asian Development Bank, and donor countries including the EU, Finland, UK, Switzerland, Germany, and many NGOs such as WaterAid, NEWAH or SAPPROS. They are organized in networks such as the Nepal Wash Coalition and the national chapter of the Water Supply and Sanitation Collaborative Council. With few exceptions, their focus is exclusively on domestic water and sanitation.

Achievements in meeting water supply goals have been remarkable in terms of the percentage of people having, in theory, access to protected drinking water sources. This has increased from 6 percent in 1970 to 34 percent in 1990 and 80 percent in 2010. Sanitation coverage in 2010 was only 43 percent. However, the status of drinking water systems presents a contrasting image. A survey, the Nationwide Coverage and Functionality Status of Water Supply and Sanitation, conducted by the National Management Information Project/DWSS states that many of the drinking water supply systems are in dire need of rehabilitation, reconstruction or major repair. The survey revealed that 42 percent of schemes are not functioning and need major repairs, rehabilitation, or reconstruction. If we take into account these dysfunctional systems, then the coverage comes down to about 56 percent. Table 2 shows the functional status of the drinking water schemes in the country.

Table 2: Functional status of drinking water projects

Status	No of schemes	Covered households	Percentage
Normally functioning	24,399	1,183,291	56.8
Well managed projects	7,464	373,295	17.9
Minor repairs required	16,935	809,996	38.9
Poorly functioning	12,780	874,037	41.9
Major repairs required	4,375	246,481	11.8
To be rehabilitated	4,967	437,800	21
To be reconstructed	3,438	189,756	9.1
Not functioning	467	27,008	1.3
Not possible for reoperation	467	27008	1.3
Not identified	15	530	0
Total	37,657	2,084,866	100

Source: NMIP/DWSS 2010

Making all water supply schemes functional for ensuring regular and adequate supply of drinking water has been identified as a major challenge to meet MDG 7. The government has recently brought forth the Sanitation and Hygiene Master Plan 2011. In most interviews with domestic sector professionals, their primary interest in a domestic-plus approach lies in the possibility that income generation from small-scale productive uses increases the ability to pay for operation and maintenance. This could contribute to sustainability.

Equitable allocation of public resources is a concern in Nepal, in particular by NGOs like WaterAid. Domestic sector professionals have also raised this in some interviews as an obstacle to MUS. Would the slightly more expensive higher service levels not deprive others who did not even have access to low service levels? However, WaterAid Nepal found that the current inequity in public resource allocation is at least partly the result of weak targeting to VDCs with the least water points. In Baglung, out of 26 VDCs studied, 7 VDCs had only one WASH project in each VDC during the last five years, whereas five VDCs had over five WASH schemes in each VDC during the same period. In Damek VDC, there have been 11 schemes constructed during the last five years (WaterAid Nepal 2010). This implies that better targeting of MUS would allow the unserved to catch up even quicker through a better service.

4.1.4 Irrigation

For irrigation, the Department of Irrigation is the major intervening agency. However, for the last two years, the Department of Irrigation has transferred the responsibility of managing small scale irrigation, with the exception of non-conventional technologies, to the Department of Local Infrastructure Development and Agricultural Roads (DOLIDAR). Any system irrigating less than 200 ha in the Tarai and 25 ha in the hills and mountains is categorized as a small irrigation system. These small systems are mostly surface canal and water harvesting ponds. The average unit cost of a rain water harvesting pond has been estimated at Rs. 10,800 (US$ 150). The DOLIDAR has a presence in all 75 districts of the country and also coordinates with other donor agencies involved in small scale irrigation projects.

In the Three Year Perspective Plan phase, the DOLIDAR's small irrigation projects, financed and implemented by DDCs in all the 75 districts, aim to cover an area of 9,000 ha. DOLIDAR provides support to rehabilitate the existing systems or to initiate new small-scale ones. Individual projects are identified at the DDC level with the involvement of the District Agricultural Development Office. Funding is partly in the form of grants. Recently, the condition was set that 15 percent of that fund should be spent on agriculture. Before this condition, much of the money was spent on rural roads.

An irrigation project by DOLIDAR since 2011 is the Community Irrigation Project (CIP) with financial support of USD26 million from Asian Development Bank in 12 western districts to address the needs of farmers having less than 2.5 ha of land. The project aims to cover an area of 5,000 ha in the six year project duration. It also aims to include women in the participatory needs assessment. Yet, in our interviews about the possibility to include multiple uses in the design, the fear was expressed that addressing multiple needs 'would become too complex'. As the first irrigation project of ADB with DOLIDAR, the project was felt to be already complex enough.

While small-scale irrigation systems have been transferred to DOLIDAR, the DOI has retained the Non-conventional Irrigation Technology Project (NITP) Unit that promotes irrigation through non-conventional means such as sprinkler, drip, treadle, rainwater harvesting, and piped systems. The NITP was initiated in 2003 and the IDE has collaborated in the field of small-scale affordable technologies (e.g. treadle pumps and drip irrigation). These non-conventional technologies were important entry points for MUS innovation and scaling up, as elaborated below. One particular technology used by NITP is the piped gravity

flow system. Apart from five MUS projects in collaboration with IDE (see below), the incorporation of a drinking water component in the design is not mainstreamed. Yet, water from the source to the reservoir is delivered through the pipe, thus with little exposure for contamination. The piped systems of NITP are often larger, but for the rest they are similar to the piped gravity flow systems that have been developed for domestic and for multiple uses.

Currently, the NITP has an annual budget of about 120 million Rupees (USD 16.7 million) and is undertaking about 250 schemes. Staff of the Irrigation Division, the decentralized unit of the Department of Irrigation covering a few districts, generally prefers undertaking larger schemes under the DOI. The implementation of smaller NITP schemes requires much interaction between staff and community relative to the budget of the scheme. Nevertheless, during the last three-year plan period 1,247 ha of land has been brought under irrigation under the NITP. The total area under NITP so far is 2,586 ha. Selection of these schemes is done directly at the DOI level and not at the division offices located near the districts. The demand for such schemes often comes through political leaders at the central level who want to initiate the project to please their constituencies. Thus, political influences at the central level play a role in the selection of schemes. If this bias is addressed, the policy goal of expansion of irrigated land can be met by MUS.

The Department of Agriculture, under the Ministry of Agriculture and Cooperatives, coordinates with national agencies working on irrigation. The Department works through District Agriculture Development Offices (DADO) in all 75 districts. The Department also helps to implement small farmer-managed irrigation systems. The agricultural technicians working at the district level, popularly called JTs (Junior Technician) and JTAs (Junior Technical Assistant), are authorized to design and estimate irrigation scheme costing less than Rs. 100,000 (USD 1500). The DADO coordinates with the DDC to implement irrigation schemes.

Various sectoral NGOs and donors also focus on irrigation in support of the government. For example, the Local Infrastructure for Livelihood Improvement Project, implemented by Helvetas Nepal in eight districts with the support of SDC, undertakes mostly canal irrigation and construction of ponds for irrigation to help poor farmers. It aims to cover an area of 5,000 ha in the next three years. The project engineers said they were aware of the multiple uses of such schemes. Informally, they encourage people to cover springs that are also used for drinking, so they are better protected.

Neither in government nor in NGOs and donors did we find any concern that irrigation, or irrigation-plus with domestic water uses and livestock watering, would be unfeasible because of water scarcity. On the contrary, both land and water are considered to be underused as a result of Nepal's limited capital and other resources needed for development. For irrigation-plus, water volumes for domestic uses are generally only a fraction of volumes for irrigation.

4.1.5 Storage, watershed management and soil conservation

Storage is key to saving water in the wet season for use in the dry season. Various departments and NGOs support storage, including the Departments of Agriculture, Irrigation, DOLIDAR, Soil Conservation and Watershed Management, and the DWWS. Ponds are popular. They are dug for harvesting rain water or water conveyed from other sources. Ponds constructed by NITP are largely cement lined, or agencies help to build Silpaulin (plastic) lined ponds. Local communities prefer cement or plastic lined ponds, as the seepage loss is minimal. However, earthen ponds are constructed by the Department of Soil Conservation and Watershed Management; this aims at recharging groundwater. Seepage water has important ecological functions. Some agencies construct standard sizes of ponds. In other cases the capacity of the pond is variable depending on the field situation and the number of users. Water from a pond is either distributed through a piped system and irrigation off-takes or through earthen channels if the water is not too limited. At the household level, Thai jars have been installed to collect water. Water collected in such jars is used for domestic purpose and irrigating small plots. Water from storage is typically used for multiple uses: domestic needs such as cleaning, bathing, laundry, and watering animals in addition to irrigating crops.

The Department of Soil Conservation and Watershed Management (DSCWM) of the Ministry of Forest and Soil Conservation focuses mainly on soil and water conservation at sub-watershed level. Although their interventions may well overlap with irrigation interventions, their approach is from the ecological perspective rather than from a utilitarian perspective. The Department through their offices in 65 districts helps communities to dig water conservation ponds, which also help to irrigate the farmland. In the fiscal year 2010/2011, the Department helped digging 119 ponds and conserving 161 km of irrigation canals (DSCWM 2011). In addition to constructing ponds for water conservation, they have recently begun building underground barriers in streams, which dry up in the dry season, to harvest leaked water in the Churia hills. Collected water is then diverted to main irrigation canals for irrigating crops. This newly developed method collects seepage water and makes it available during the dry season as well. Many community forestry groups have been created that engage in water storage and recharge. Against the backdrop of the growing demands for water sources and drying of water sources in the hill slopes, the work of the Department of Soil Conservation and Watershed Management will become more important in sustaining the water and land resources locally and downstream.

Although people's use of storage and water saved from other works for multiple uses generates livelihood benefits locally and downstream, the Department of Watershed Management and Soil Conservation focuses primarily on environmental sustainability. Hence, there is potential to add a more holistic people-centered approach, with stronger decision-making by communities, as elaborated in the next section.

5 MUS innovation and potentials for scaling up

5.1 Domestic-plus

5.1.1 Winrock/IDE's hybrid gravity flow systems

The Smallholder Irrigation Marketing Initiative (SIMI) project of Winrock International and IDE introduced piped gravity flow systems for multiple uses and, with it, the concept of MUS into Nepal. In late 1990s, when Winrock and IDE promoted micro irrigation, they realized that the domestic piped gravity flow systems were an excellent water source (Polak *et al.* 2004). Gravity flows do not require expensive energy for lifting, so just by increasing the size of the pipe much more water can be delivered at hardly additional costs. Pipes can also overcome undulations, which canals cannot. Moreover, there is no need for usually arduous land leveling work. So unlike conventional irrigation systems, which can only irrigate leveled *khet* plots, piped gravity flows can irrigate unleveled *bari* land. Moreover, for more efficient water use drip irrigation were introduced.

IDE and Winrock along with other NGOs like SAPPROS Nepal, Agricultural Enterprise Centre, and Centre for Environmental and Development (CEAPRED) innovated and field-tested these 'hybrid' systems from 2003 onwards. IWMI and others documented and contributed to a national learning alliance for scaling up, especially as part of the eight-country MUS project, supported by the Challenge Program on Water and Food, from 2004 to 2008 (Pant et. al. 2006; Mikhail and Yoder 2008).

Since then, these agencies have helped build 200 hybrid systems serving 5,000 households (30,000 people), all in the middle-hills. IDE's specialized contribution to the MUS systems is the promotion of micro-irrigation technologies and value-chain development. For example, IDE and Winrock organize collection centers for marketing in bulk, capitalizing on the fact that one MUS system serves more households. Winrock International, in partnership with IDE and CEAPRED through the Education for Income Generation project, helped to establish 30 MUS systems in the Midwestern region of Nepal

The net income generated is significant. In a study conducted in 64 hybrid gravity flow types systems to assess cost-benefit analysis, the average cost per household was found to be USD 81, including both cash and no-cash components (De Boer, 2007). The average cost per beneficiary was USD 14. The average increase in income per household per year was found to be USD 163 when farmers grew high value crops like vegetables.

In another cost-benefit analysis conducted in five gravity flow piped MUS systems in 2010, the cost of installation of MUS per household was found to range from USD 137 to USD 512, with an average per household cost of USD 228. The average income per household year from vegetable production made possible was USD 75 ranging from USD 40 to USD 156. The payback period ranged from 9 to 21 months (Shrestha 2010). IDE reported in general that for an average household investment of USD 100, the annual average return per household was USD 200. This shows that the infrastructure pays in less than year.

The hybrid system delivers a higher service level. Technically, as per the standard government norm for designing a drinking water supply system, the per capita daily requirement is 45 l. According to the multiple-use water services ladder in Figure 2, the per

capita requirement increases as the water is used for multiple purposes and reaches up to 200 lpcd in high-level MUS. In systems where basic domestic needs and irrigation of vegetable gardens are to be met, IDE-Winrock designs for 400 l/day/hh. This addition of water to the system generally requires an additional investment of about 30 percent (personal communication, Adhikari Deepak). Although livestock production is an integral part of farming systems in rural Nepal, meeting the water demands for livestock has not featured in IDE's MUS designs, or other NGOs' designs. The current MUS system designs take drinking, domestic, and irrigation needs into account.

The detailed technical design depends on the water availability and need for storage. Moreover, IDE engineers paid much attention to the concern that introducing multiple-use systems risks 'stealing water' and, thus, risks jeopardizing everybody's priority domestic uses. The conventional design is one storage tank with one distribution network. The other design comprises two-storage tanks, each with its own distribution network. The tank for irrigation can be plastic lined (Silpaulin) or an earthen pond. There can be special irrigation off-takes (which are low to the ground and allow connecting a hose) and drinking water tap stands (which are high so a water container can be put underneath), or single stands for both drinking and irrigation. Although the one-tank, one-distribution network design is cheaper than the two-tank and two-distribution network design, the two-tank, two-distribution network design is seen as a way to 'hardwire' a priority for domestic uses into the technology. One tank with distribution network is for domestic uses, and only the overflow of the first tank goes into the second tank and distribution network and is meant for irrigation.

However, in practice, communities may have other rules and aspirations. This became clear during a field visit during this study (see Box 4). This underlines the limitations of technical hardwiring of people's priorities of a specific water use. A participatory approach to technology choice and layout may better allow communities setting their own social rules on prioritizing domestic uses.

When water is scarcer, household storage is included in the design as a buffer for intermittent supplies. IDE important the 'Thai jars' from Thailand for that purpose. Drip irrigation is, in principle, always included in the design for efficient water use.

Further refining of the designs can make the designs more robust. For example, many people have found drip systems complicated. The frequent clogging of drip holes and the lower versatility of drip systems were reported to be problems in the existing drip technology. Similarly, it was also reported that the modified Thai jars have to be made more robust as cracking was reported after some time.

Box 4: Hardwiring priority water uses in Magargaun, Banepa

Before IDE intervened in Magargaun, Banepa, there was a domestic water supply system. This took water from a spring and delivered it into one tank with an outlet that had a valve which could be closed water during scarcity. From that outlet, a piped network brought it to a few standpipes. This was not enough during the dry season, so women added water from dug wells for drinking and other domestic uses during that period.

IDE upgraded this system, by:

- Constructing a big new Thai jar and redirecting the iron pipe from the spring that used to go into the old water supply tank directly into the jar, so that only the overflow would go into the old tank, which then became designated as an irrigation tank. The Thai jar was meant for priority domestic uses.

- Changing the earlier outlet and network into an irrigation distribution network with various irrigation off-takes at the highest points of homesteads.

- Linked to the new Thai jar, constructing a box with 5 new outlets with valves. These were connected to new distribution networks meant for domestic supplies with domestic standpipes.

After this intervention, the villagers continued with their own initiatives. With support from the municipality, they constructed two more boxes linked to the old tank, each with five outlets/valves, so the system can now provide water to 15 clusters of 4-5 households each, plus water to the irrigation distribution network.

They bifurcated the iron pipe from the spring: one part directly goes into the old tank, as before, and one part into the jar. They removed the overflow construction. They said that, overall, this allowed the most storage capacity of night time trickles from the spring.
Out of the total of 50 to 70 households in the 15 clusters plus those connected to the 'irrigation distribution network' cluster, some 15 households use the water for irrigation. They belong to any of the clusters or former ‘irrigation network’. This allows those households to irrigate until January/February, but not throughout the dry months. Few famers irrigate year-round. The different designs for domestic stand pipes and irrigation off-takes appeared to be ignored in factual water use. Women used the irrigation off-takes for domestic water by also using a hose pipe to fill their pots. So the designed lack of height was no problem.

Water users have adopted a rotational distribution schedule. This is implemented by a guard who is compensated for this job. The guard opens and closes the valves during a few hours in the morning and a few hours in the afternoon. The priority for domestic uses was safeguarded by this guard, who judged how much water would be available over the year. When it became insufficient, the social norm became to only use this water for drinking purposes. The sanction was to be cut off entirely. Women said this norm was well respected. In the dry season, women use the dug wells for purposes that do not require potable water.

As a next incremental step to improve their water supply for multiple uses, our respondents expressed their preference for electric lifting of water.

This case shows that hardwiring flows for pre-determined single uses may not always work. People tend to use water for all their needs wherever water is available on a certain site. The priority for domestic uses remains a social concern. Negotiating this priority requires, above all, women's decision-making power in community water management.

Photos: The redesigned two-tank system in Bagargaun. Source: Barbara van Koppen

Winrock and IDE through the EIG project have also taken up motorized and solar pump lift irrigation. In Surkhet, for example, the Winrock/IDE/CEAPRED partnership has supported the installation of a motorized lift system. Their success encouraged people in nearby places to install two more units. The water lifted was stored in a double tank. Solar-operated lift systems have been successfully demonstrated by IDE in Jagat Bhanjyang of Syangja district and also in Dhading district. However, the initial cost of the system was USD 35,000, which requires a six year payback period and good markets. In addition to being expensive, the system is complicated to manage.

Besides innovating technologies for multiple uses, Winrock and IDE continue developing the value chain approach, especially by setting up collection centers. The profitability of high value crops is the critical 'pull' factor for MUS. Linking MUS with markets encourages farmers to invest privately, which would greatly boost scaling up.

5.1.2 Scaling up through NGOs

Other NGOs have also adopted these multiple use systems. NEWAH, the partner organization of WaterAid, expanded their piped gravity flow schemes to allow for productive uses at homesteads, wherever local context allows. They recently increased their

design norms to 20 percent over the water required for domestic purposes. This was primarily to enable productive uses rather than for anticipated population growth. Although they have not conducted any systematic study, their field observations gave them the impression that such integration of productive uses in domestic schemes contributes to enhanced scheme performance and sustainability. In some places, for example, Udayapur and Gorkha, NEWAH also successfully tried fish farming integrated with their drinking water schemes.

NGOs like SAPPROS, CARE Nepal, and Plan Nepal undertake both irrigation and drinking water schemes. In some cases, they combined the drinking water and irrigation components into one single scheme. CARE Nepal, for example, integrated their separate irrigation and drinking water component programs into one scheme in Dadeldhura District. They reported that the total cost of the scheme was much less than if they had to build the two separate schemes for drinking water and irrigation. However, examples of such cases are not that common. In this particular case, both the schemes were approved for the same community and the source had enough water which made it possible to integrate two schemes. The successful implementation of a MUS system in a village in Makawanpur by Plan Nepal has encouraged people from neighboring villages to ask for similar schemes.

Even though examples of success with MUS have been observed, CARE and Plan have not systemically incorporated the MUS concept into their designs for new systems. Our interviews suggest that the most convincing argument in favor of MUS for the domestic sector is income generation. This could at least partially address the sector's greatest problem and vicious circle: lack of payment, lack of maintenance of schemes, unreliable services, underuse, and lack of payment. As mentioned, 42 percent of drinking water schemes in Nepal need major rehabilitation work. Rehabilitation of domestic schemes with added productive uses could enhance scheme functioning, as experienced by agencies like NEWAH and Plan Nepal. Dysfunctional domestic schemes can be rehabilitated into multiple-use systems wherever the local conditions allow that in terms of gravity flow availability, affordable lifting potential, marketing outlets, and social systems.

5.1.3 Scaling up through NITP

Although the innovation and promotion of MUS came almost exclusively from NGOs, Winrock-IDE was also able to scale up MUS within government agencies, overcoming the common institutional rigidity to cross disciplinary boundaries. In close collaboration with Winrock-IDE around the promotion of micro-technologies, the Department of Irrigation launched a 'Non-conventional Irrigation Technology Project (NITP)' in 2003. Focusing on productive water uses, the project applies methods like drip, sprinkler, low cost water storage, treadle pump, rain water harvesting, and piped gravity flow systems. Its goal is to provide irrigation facilities to areas formally designated as 'non irrigable' for various reasons. Reasons range from high development costs to lack of sufficient quantities of water for conventional irrigation schemes. With their growing experience of MUS, IDE undertook effective advocacy, for example through its National Project Advisory Committee, where the Departments of Agriculture and Irrigation are represented. As a result, NITP also supported IDE in implementing five piped gravity flow systems for multiple uses.

5.1.4 Potentials for scaling gravity flow systems as domestic-plus

Our study confirms that there is good potential for further scaling up piped gravity flow systems for multiple uses. This is fully supported by the current policy to expand irrigated land. These systems can irrigate the 875,000 ha of arable land that has been designated as unirrigable by conventional means. Gravity schemes bring water in a cost-effective manner. Both the domestic sector and NITP apply this technology. As piped water is less exposed to contamination than canal water, irrigation engineers can safely promote 'irrigation' water for drinking purposes under the same conditions as the WASH sector.

The potential is also strong because market opportunities keep expanding in the middle hills of Nepal. Roads have been considerably improved and political stability is gradually being restored. The slope gradients and climate variation also support commercial production of vegetables, thus increasing the potential successes of MUS. Agencies like IDE and Winrock are able to better open up market opportunities and experiment with crop diversification.

In order to tap these scaling potentials, consortiums should be forged in which each party contributes their expertise. In the workshop in August 2011, hosted by IDE as part of this scoping study, partners emphasized the need to look beyond water and water efficiency through drip irrigation alone. Consortiums are needed that bring the different types of expertise together. For example, collection centers open up markets, especially if schemes are better clustered. NITP suggested further support for the development and application of micro-irrigation in marginally irrigable land, including lifting technologies. Private public partnership could be developed to open up new commercial pockets where MUS technologies are applied.

The early innovators recommend as first step for such scaling to consolidate lessons learnt from past gravity flow systems for multiple uses over one to two years. Both the piloting of success cases and the scaling up through learning alliances as adopted by IDE, Winrock and other partners from 2005 onwards have contributed to a certain awareness of the notion of 'MUS' in Nepal. Yet, the MUS success cases have remained rather scattered and diffused. Past documentation and advocacy appeared insufficient. A consolidation phase allows for a rigorous evaluation of the current MUS systems. Gender dimensions of homestead-based multiple water uses and prioritization of water for domestic uses should receive specific attention. Such consolidation would also identify conditions for success. Lessons learned should be synthesized into evidence-based guidelines for further improvements and going to scale.

With those clearer messages, awareness is to be raised more widely, and advocacy can be undertaken for more significant policy buy-in and impact. A network of relevant stakeholders should be created from the outset. The lessons learnt can already inform the current formulation of the next Agricultural Development Strategy. This process is supported by the Asian Development Bank and other donors. Inclusion in the policy is a good opportunity to further integrate homestead-scale multiple use systems into policy. For advocacy among the WASH sector, the consolidation phase should fully address the potential of income generation and its potential impact on scheme sustainability. This is seen as the most important potential of MUS. WASH sector professionals, at their turn, should advise on water quality issues wherever gravity flows are unsafe. Measures to avoid

contamination, such as spring protection, or point-of-use treatment can be introduced more pro-actively.

In this further networking and collaboration between the domestic and irrigation sectors, it will also be needed to clarify the concept of MUS and unravel the precise technologies that the different people implicitly refer to. According to the definitions of this scoping study, this modality is domestic-plus because the communal schemes are partly subsidized and the priority remains for domestic uses around homesteads. However, the simultaneous priority for profitable irrigation makes it productive-plus for these formerly 'unirrigable areas'. The focus on private investments also links to self-supply (see below). It could be called 'gravity flow MUS' or '*bari* MUS for health and food security'. Whatever the definitions, the consolidation phase needs to forge a common understanding for these gravity flow systems for multiple uses that meet both the domestic and irrigation sectors' mandates, and more.

5.2 Irrigation-plus

As described in section four, conventional irrigation by government and NGOs is sector-based. Although there is general agreement on *de facto* non-irrigation uses, the next step of designing for such uses has not yet been taken. This forfeits the option of generating additional livelihood benefits. It also increases the risk of damage. Yet, in the current sectoral set-up incentives are lacking to add what is seen as an extra complication for a non-planned. At the higher national and international managerial levels single water uses are enshrined in mandates and the performance criteria that assess fund allocation.

An entry point for exploring the untapped benefits of irrigation-plus and the potential for their scaling could be innovative engineers of engineering schools such as the Nepal engineering college, DOLIDAR and NGOs. With in-depth knowledge of the local people and their hydro-physical conditions, such engineers might already have found solutions. However, strict single-use instructions from above for standard designs, based on hectares and crops, stifle innovation for most engineers. This renders them even more important as change agents. The solutions proposed for innovative engineering designs can be pilot-tested. For further scaling livelihood-oriented projects are warranted with a more open, participatory approach that count all livelihood benefits generated.

5.3 Self-supply

Water self-supply is initiated and financed by water users themselves and is typically for multiple uses. The MUS modality of self-supply seeks to support such individual investments. The age-old dynamism of self-supply in Nepal was described above. People's own investments in drip-irrigation, treadle pumps, plastic household water tanks, Thai jars, and other new technologies are other forms of self-supply. Motorized pump irrigation are still relatively rare in the middle hills. They are very common in the Tarai.

A strong demand for support for self-supply for multiple uses in the middle hills is for hydropower from streams and canals. Electricity generates a virtuous circle. An example is the cheap hydropower supplied by the Andhikhola community multipurpose scheme. This makes it possible to operate a three-staged 340 m high lift system for domestic use and irrigation in neighbouring Phoksingkot. The community has installed meters to levy charges. The NITP of Department of Irrigation has helped to install this three-stage lift system.

Elsewhere, the integration of micro hydropower in streams and irrigation canals is also widely practiced and in high demand. People usually use the water for irrigating crops during the day and use it for generating electricity at night. As micro-hydro plants are expensive, funds are solicited from various sources including the annual grants of VDCs and DDCs and a Renewable Energy for Rural Livelihood fund. The Rural Village Water Resource Management Project (RVWRMP) discussed below, for example, has installed a micro-hydro plant in Pouwagadhi Village of Bajhang District in this way. People from smaller settlements often install electricity generating sets that only generate a few kilowatts. Activities like installing traditional or improved water mills are also integrated into irrigation systems or water courses. At household scale, biogas is promoted by NGOs like BSG to meet energy needs.

A last important self-supply technology is point-of-use treatment, such as the ceramic candle filter. Point-of-use treatment is a vital component of MUS in rural areas where surface water is contaminated. In Kathmandu Valley, point-of-use treatment is also recommended (Wolfe et al. 2000; Luca Morganti *et al.* 2002).

The weakness of self-supply is that the technologies may be unaffordable for the poor and that women fail to get easy access to a male-dominated supply chain. The upfront capital requirements also often exclude the poor. The possibility of more affordable technologies and financing facilities needs further study.

In conclusion, there is an important potential for a MUS self-supply in the middle hills in Nepal. The first step to explore this potential is to further assess people's ongoing investments and needs for micro-irrigation, individual water storage, hydropower, biogas and other components, so that they meet people's complete water needs together with state investments in communal systems. The wealth and gender composition of adopters needs to be monitored and incentives explored to better reach the poor and women. Barriers and potentials in technology development, supply chain, financing facilities and an enabling policy environment should be identified in further detail. Focus should be on untapped opportunities for multiple uses and re-uses of water. The findings will inform strategies for further scaling MUS for self supply.

5.4 Community-based MUS

5.4.1 Water Use Master Plans

Innovation in community-based MUS is more advanced in Nepal than anywhere else. Already since 1998, the Water Resources Management Program (WARM-P) of Helvetas has developed a methodology called Water User Master Plans (WUMP). The concept is precisely what we have defined as community-based MUS; we were not aware of Helvetas' earlier, similar approach. From 2006 onwards, the Rural Village Water Resource Management Project, supported by Finnada, also started working with this approach in the mid- and far-western region. This is a dry area with frequent landslides. Together, these projects developed WUMP guidelines (RVWRMP 2008). The guidelines spell out how WUMP is a participatory planning tool and process with the aim to develop water for multiple uses with an IWRM approach. WUMP steps are: making an inventory of water resources and other relevant local resources and the existing water related infrastructure and facilities; identifying and prioritizing potential activities in the water sector; promoting sustainable investment in water sectors; and promoting conservation of water resources and environmental sanitation. WUMP is not 'just a new and attractive theoretical concept', but a water management tool for local actors. WUMP goes beyond a specific water sector and looks at water resources, water demands and potential uses in a broad and integrative way. The output is a medium-term master plan, which is owned by local stakeholders. They plan and are responsible for implementation in a participatory and transparent manner, with the help of private and public support organizations. WUMP empowers marginalized groups to access water, pursuing equitable sharing of water within and between communities with a gender and social inclusion strategy.

WUMP is fully embedded in the local and district government structures, also for the negotiation of required funding. Before starting a planning process in a selected VDC, a workshop is held at district level with the village committee and potential resource organizations. By explaining the mutual working modalities, the resource organizations know, and preferably commit to, the approach to be taken and the villagers know whether and how they can solicit support for the activities identified in the WUMP. After identifying priority activities, a feasibility study with cost estimates is done for the infrastructure required. The community contracts a consultant/engineer or NGO. The feasibility study is discussed in the community with special emphasis on locally available resources and funding options. Funds need to be secured before a decision is taken. The guidelines include proposal forms, which distinguish single-use domestic supplies, irrigation, and 'multiple use system application' (musa) (RVWRMP 2008).

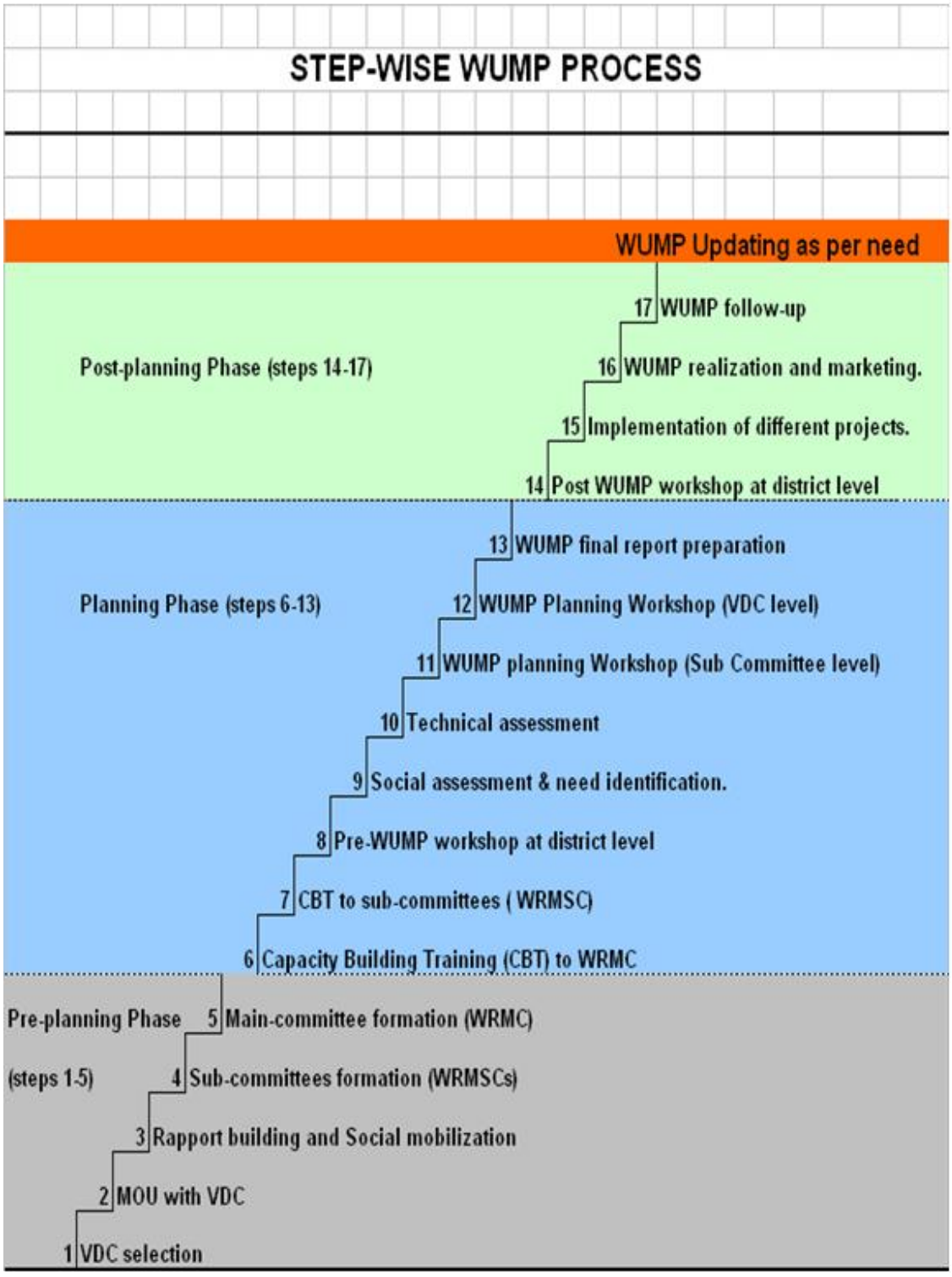

Figure 5: Step wise WUMP process. Source: Guidelines 2008 RVWRMP

Important lessons can be learnt from RVWRMP's experiences. In the first phase, from 2006 to 2010, the project built 470 schemes benefiting 270,300 people. The five-year VDC WUMPS include comprehensive data on all water resources, uses, and potential and socio-economic data. Ranking villagers' priorities over a five-year period appeared effective in reducing the *ad hoc* nature of heavily lobbied and politically motivated project selection.

Water Use Management Plan process in Chhatara VDC of Bajura District
Source: RVWRMP Main Report: WUMP Report Chhatara VDC of Bajura District

In the project data base, most schemes are indicated as single-use. For the last fiscal year, the proportions were: 44 percent water supply; 36 percent sanitation; 10 percent irrigation and 10 percent 'musa' (with domestic, irrigation, micro hydro-power, fish ponds, water mills, aquaduct, etc.) (RVWRMP 2011 progress report). Sanna-Leena Rautanen, Theme Leader, suggested the following possible explanations. One of the reasons could be the project's initial emphasis on water supply and sanitation. This emphasis might have missed opportunities where there would have been sufficient water from streams or springs for larger tanks and pipes. In some cases the irrigation potential truly captured attention only afterwards. In such cases they built more ponds to capture the flow during the night.

Another reason was the role of technical consultants, often from Kathmandu. Trained in single-use designs and with limited time in the communities, standard designs were the quickest. Communities did not challenge this either, as this was what they are used to.

Further, the dominance of single-use works in this otherwise full-fledged community-based MUS approach can be explained by some underreporting of homestead cultivation from 'domestic' systems. The project promoted homestead cultivation with drainage water, and some households grew crops at their homesteads. In fact, this incidentally led to upstream users leaving taps open for over-watering their vegetables, depriving downstream users. This seemed especially the case in larger schemes without an effective users committee to close down branches as needed. Similar problems of upstream over-use were observed when people had household connections, which also increases use. Power relations and caste inequities, aggravated by a decade of social unrest and conflict also contributed to conflicts over water. The project sometimes adapted the technical design to limit flows upstream to avoid over-use there.

In the upcoming second phase, RVWRMP intends to explore the potentials of multiple use systems more proactively. The potential for MUS, including sanitation will be identified by sensitizing villagers to such opportunities that earlier projects never offered. In collaboration with the District Agricultural Development Office, homestead cultivation will be promoted among up to 70% of the households. Water efficiency, (e.g., with drip and sprinklers), will be important. Visits will be organized to expose district engineers and consultants to successful MUS cases. Earlier experiences with the multi-purpose hydropower schemes will be scaled.

Another innovation during the second phase is scaling up the VDC-level WUMPS to district-level, with the district water resource management committees. Further, the WUMPS will

become modular. A basic WUMP includes the minimum process, which can be handled by VDCs themselves without much external support. Depending on external resources, the more resource-intensive elements such as water volume measurements and GPS data mapping can be added (Rautanen personal communication).

The WUMP methodology has found wider applications, although also limited to single uses. In the domestic sector in 2008/2009, WaterAid Nepal worked with Nepal Water for Health (NEWAH) to initiate a WASH intervention in the Ghyachok VDC of Gorkha District to develop a Water Use Master Plan (WUMP). Based on the WUMP's recommendations, eight schemes were identified to address water, sanitation and hygiene (WASH) requirements in the Ghyachok VDC. A three year implementation plan for 100% coverage for domestic supplies was developed. In the productive sector, the SDC supported Local Infrastructure for Livelihood Improvement (LILI) project applies WUMP.

In sum, there is quite some awareness and implementation experience on WUMP in Nepal. However, the potential advantages of the integration of multiple sources for multiple uses are still not fully tapped. Single use foci keep dominating service delivery. A further investigation on the causes and potential solutions would inform future implementation by RVWRMP and other organizations. The scaling up of WUMP to district level provides generic models of community-based MUS that can be scaled across Nepal.

5.4.2 Poverty Alleviation Fund

Since 2004, a second relevant initiative has been implemented in Nepal: the Poverty Alleviation Fund. This is a general participatory program, in which water projects emerged. Building on the extensive cross-country experience of the World Bank in Community-driven Development (CDD), this approach was piloted and then scaled out to 40 districts with low Human Development Indices. This scaling out was also to support the new government in 2006 to establish credibility on the ground. The World Bank, International Development Association and IFAD contribute annually to fund some Rs. 2481.5 million (about USD 35 million; 2009/2010). In this community-driven development approach, the poor are well targeted and organized in community organizations. They are 'in the driver's seat' when it comes to deciding which activity and how to implement. 'Partner Organizations' (POs) facilitate the process of identification, planning, fund disbursement, and implementation of sub-projects according to guidelines. The community action plan is incorporated into the VDC and DDC planning. The prime minister chairs the board of governors and the project collaborates with VDCs; however, funding streams are directly to Partner Organizations and communities. By 2011, the PAF had implemented 16,576 income generation sub-projects, benefiting 550,000 people.

The project has four component programs, including social mobilization, capacity building, income generation and a community infrastructure component. The latter includes water infrastructure for water supply and sanitation, small irrigation, river bed land reclamation, water management, plastic tanks, sprinkler-drip systems, farmer-managed irrigation systems, and micro-hydro. About a quarter of the funds are for community infrastructure (PAF 2010).

One of the project reports cited evidence from several studies in Nepal that showed that public investments and service delivery, in which line ministries and central government planned, financed and executed, performed less well than did demand-driven participatory investments. Unit costs of selected infrastructure projects executed by central government and community organizations showed that community organizations' works are between 13 percent and 47.5 percent lower than central government. The reasons may relate to factors such as the greater sense of ownership and more careful stewardship of resources which beneficiaries view as their own, and better knowledge of local prices and quality of local service providers than central agencies could reasonably possess.

We could not find further information on the precise nature of the water works and the extent to which community decision-making power has shifted interventions towards the more integrated and sustainable approach of multiple uses from multiple sources. Further study would reveal these practices, barriers and potentials.

5.4.3 Water conservation

Communities' efficient and sustainable combination of multiple conjunctive sources is an intrinsic component of community-based MUS. Communities' interest in improved access to water and sustainability of the resource cannot be separated. Considerable investments are being made in soil and water conservation in the middle hills of Nepal, supported by community-based forestry and watershed management groups, for example by Winrock. However, the resource is typically taken as an entry point. Different departments and villagers seem to have contradictory visions on topics like lined or earthen ponds. Community decision-making and the link with people's livelihoods and their own priorities tend to be ignored. Hence, there is potential to bring 'a human face' to conservation measures in which people are the pull for integration. People would lead in the harmonization of different interventions according to their own knowledge of their ecosystems and their own priorities for resource uses for livelihoods. Again, engineers and other technicians in DOLIDAR and the DDCs will play a pivotal role in harmonizing these fragmented approaches to the sustainable use of environmental resources. They need to be supported by their superiors.

There has been very limited research as yet on links between water resource conservation measures, water services, and communities' management of multiple sources for multiple uses. A scoping study of these links and potentials for community-led integration would be the first step.

5.4.4 Potential for scaling up community-based MUS

There is a strong potential for scaling community-based MUS in Nepal. This fully aligns with the ongoing efforts of government, NGOs, and international partners to decentralize service delivery to VDCs and DDCs and to prepare the ground for the election of community representatives. The well-tested WUMP and PAF guidelines are sufficiently robust for scaling at village level. The envisaged modules of the WUMP will allow further adjustment according to needs and available resources at community-level. The WUMPs prepared for the VDCs in several districts are already a precious data base for other agencies to invest in the water sector.

RVWRMP's initiatives to scale up WUMP to district levels will bring further lessons on participatory planning in which people's integrated water needs and priorities are transparently and equitably matched with top-down funding sources. DDCs and District Councils are the forum for coordination. All donor agencies and NGOs working in the district are required to work under the umbrella of the DDC. All the intervention agencies, including district level offices of line agencies, have to present their plans annually in the District Council. They are usually passed without alteration. All VDCs in Nepal get an annual budget from the government, with only guidelines for proportions that are to be allocated to the different sectors. Untied funding streams to the VDCs and DDCs enable the meaningful matching of needs with resources.

The major barrier to tap this potential of untied funding streams and accountability vested in well-coordinated governance processes instead of top-down priorities, remains the disciplinary, specialized focus of engineers, technicians and extension workers at all levels. Sectoral thinking is still strong. As we noticed in our interviews, it is not automatic that district officials consider combining water supply funds and agricultural funds into one multiple-use system. Resource conservation and water services initiatives keep working in parallel. Local engineers may remain accountable upward to superiors in the line agencies who only reward construction aims for single uses (length of canals, number of water works and people reached, crops, single livelihood dimensions etc.). These obstacles compound the simply extraordinary workload of the few trained cadres at district and village levels and the high consultancy and transport costs for more senior inputs.

As people-oriented design for multiple uses from multiple sources is not covered in the agriculture or engineering curricula, there is a need for training. Younger engineers may be more open to crossing boundaries and use their 'neutral' technical skills as architects for what their clients want. The Council for Technical and Vocational Education Training, which accredits training institutes, could be assigned to conduct training and develop human resources for MUS. Field level technicians like sub-overseers could be trained on design and implementation of MUS.

Therefore, further scaling of community-based MUS (or WUMP) would entail:

- advocacy and scaling of the by now robust modules of WUMP at community-level, also in other socio-economic, institutional and water resource settings;
- action-research to implement WUMP at district level in various regions, in order to derive scalable models for district-level integration of water services for multiple uses
- an analysis of water projects within the Poverty Alleviation Fund program to assess potentials and barriers for tapping the advantages of multiple uses from multiple sources;
- conducting a scoping study on the potentials for better linking people-driven water services and technicians- and resource-driven water conservation programs;
- training engineers and technicians, starting at their training institutes, in participatory planning for multiple uses from multiple sources.

6 Conclusions and networking

This last section focuses on the question: How can the barriers of the four MUS modalities together be overcome so that their potentials can be realized in a mutually reinforcing way? The first steps proposed in the foregoing are to **consolidate the two major MUS initiatives**, which render Nepal a global leader on MUS innovation. The first is the gravity flow systems for multiple uses as part of the value chain, as implemented by IDE, Winrock, SAPPROS, NEWAH, CARE, Plan, other NGOs, the Department of Agriculture, and NITP/Department of Irrigation. The second is WUMP (community-based MUS), conceived and implemented by RVWRMP, Helvetas, LILI, WaterAid and NEWAH, with the ministry of Local Development with DOLIDAR. Research centers should support this consolidation of credible documentation and impact evaluation.

This consolidation phase would probe how the already developed MUS modalities were replicated, and why or why not. It would also address how projects managed to move beyond well-defined single use project boundaries. This concerns engineering designs in particular. The limited interactions till to date between MUS innovators and government's domestic water sector should also be better understood. Fears and realities that productive water uses would 'steal' water for domestic uses can be further examined. Such prioritization issues should be placed in the context of deep-rooted allocation asymmetries along caste, gender, and power lines that determine communities' own rules and practices, biased targeting and elite capture of public funds, upstream/downstream location, etc. The consolidation phase should lead to clear unambiguous names, advocacy messages and guidelines on MUS and/or WUMP. Such robust MUS domestic-plus and community-based MUS modalities would constitute a powerful basis for further scaling across Nepal – and elsewhere.

Further, this scoping study identified **two new initiatives with high potentials, for further exploration**. There may be strong potentials for MUS in the large-scale Poverty Alleviation Fund. So it is recommended to explore how the advantages of integrated water infrastructure and governance were tapped in this program, or not, and why. Such analysis should indicate how MUS can become more robust. The Fund is already being implemented at large scales, so scalability of robust MUS modalities through this program is significant. A scoping study is also recommended on the links, or the lack thereof, between water services provision and water resource conservation projects, as implemented by the Department of Soil Conservation and Watershed Management. This would be the start of bridging those divides towards people-led sustainable and integrated water development and management.

This scoping study already identified the importance of engineers' and technicians single use foci in perpetuating single use services, even if funding has less stringent earmarks. So the third recommendation is to start at short term with **a training program for engineers** on participatory design of multi-purpose infrastructure.

Last but not least, it is proposed to conduct these consolidation and exploration phases and trainings from the outset in a **learning alliance mode**. At short term, a network should be created that includes all organizations mentioned above, and also current champions on self

supply for multiple uses and potential champions on irrigation-plus. One task of this network is to guide the consolidation of past experiences with gravity flows for multiple uses and the WUMPs. It would also advise on exploring MUS in the Poverty Alleviation Fund and water conservation programs; and on the engineers' training program. The network would be well placed to identify new opportunities for scaling MUS. For example, the network could identify strategic pilot projects and action-research in collaboration with VDCs, DDCs, DOLIDAR and other partners. In this way, the network becomes a resource center on MUS, with the authority to take up advocacy in ongoing policy initiatives, such as the Agricultural Development Strategy, or new donor initiatives. If this network links with the global MUS Group, it would have a global dissemination channel for Nepal's pioneering MUS experiences, and benefit from experiences elsewhere.

We recommend the names listed below in Table 3 as key partners in Nepal to engage in a network on MUS.

Table 3: Contact persons and addresses for MUS network

Name	Position	Institution	Phone Number (+977) (1)	Email
Luna Bharati	Head	IWMI	5542306	l.bharati@cgiar.org
Luke Calavito	Country Director	IDE Nepal	5520943	lcolavito@idenepal.org
Darrell Deppert	Chief of Party	WINROCK/IGE	5526659	ddeppert@winrockeigcm.org
Raj Babu Shrestha	Executive Director	PAF	4410041	rbshrestha@pafnepal.org.np
Bharat Prasad Pudasaini	Director General	DSCWM	4220552	b.pudasaini@yahoo.com
Sanna- Leena Rautanen	Team Leader	RVWRMP	5550628, (91)526262	Sannaleenar.2@gmail.com
Juerg Merz	International Program Advisor	Helvetas Nepal	5524925	Juerg.merz@helvetas.org.np
Umesh Pandey	Director	NEWAH	4015707	umeshpandey@newah.org.np
Kishor Bhattarai	Project Coordinator	NITP	5545345	Kishor_bh@hotmail.com
Bhupendra Bahadur Basnet	Director General	DOLIDAR	5000107	bbbasnet@dolidar.gov.np
Prakash Thapa	Project Coordinator	CIP	5547264	phapa920@yahoo.com
Dhruba Pant	Lecturer	Nepal Engineering College	9851126479	drpant.pant@gmail.com
Sri Krishna Upadhaya	Executive Director	SAPPROS	4244913	sapprosnepal@ntc.net.np
Deepak Adhikari	Consultant/ former engineer IDE	freelance	6851007916	deepaklocah@yahoo.com
Ashutosh Tiwari	Country Representative	Water Aid Nepal	5011625	wateraidnepal@wateraid.org
Indira Shakya	Technical Advisor	BSP Nepal rainwater	5524665	ishakya_bspnepal@yahoo.co.in
Dandi Ram Bishwakarma	Senior Program Officer	SDC	5524927	Dandiram.bishwakarma@sdc.net

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8 Annex 1 List of the respondents

SN	Person	Position	Institution
1	Luke Colavito	Country Director	IDE
2	Mohan Pariyar	Program Development Director	IDE
3	Kailash Sharma	Engineering Program Director	IDE
4	Raj K.C.	Program Coordinator	IDE
5	Bimala Rai Colavito	Communication	IDE
6	S. Bajracharya	Consultant	IDE
7	Komal Pradhan	N.P.O.	IDE
8	Binod Sharma	Gov. Pr. Dev. Sp.	IDE
9	Binod Dhakal	TS	IDE
10	Amitendra Chaudhary	Program Officer	Winrock International
11	Darrel Deppert	Chief of Party	Winrock International
12	Shira Sundar Shrestha	consultant	Former DG of Min of Agriculture
13	Kanchan Raj Pandey	Chief Planning	Department of Agriculture
14	Govind Prasad Pandey	Free lance agronomist	Former secretary of Min. of Agriculture
15	Indra Shakya	Technical advisor	BSP-Nepal
16	Charushree Nakarmi	Manager	BSP-Nepal
17	Indra Prasad Basyal	Senior officer	MLD
18	Vinod K. Barai	Senior Social Development Officer	LILI - HELVETAS
19	Kabir Das Rajbhandari	Program Manager	Water Aid
20	Nabin Pradhan	Water and Environmental Sanitation Coordinator	Plan Nepal
21	Madhav Pahari	WASH Specialist	UNICEF
22	Prachanda Pradhan		Independent
23	Prakash Thapa	Project Coordinator	CIP/DOLIDAR
24	Niraj Acharya	Senior Program Officer	Helvetas Nepal
25	Juerg Merz	International Program Advisor	Helvetas Nepal
26	Bharat Pudasaini	Director General	Department of Soil Conservation and Watershed Management
27	Kishor Bhattarai		Department of Irrigation/NITP
28	B.K. Gyawali	Team leader	IPMCRSP/IDE
29	Dandi Ram Bishwokarma	Senior Program Officer	SDC
30	Raj Babu Shrestha	Executive Director	PAF Nepal
31	Sanna-Leena Rautanen	Team Leader	RVWRMP II
32	Narayan Prasad Wagle	Planning and Monitoring Specialist	RVWRMP II
33	Narendra KC	Director	SAPPROS Nepal
34	Raj Man Shrestha	Technical Officer	SAPPROS Nepal
35	Kamal Raj Gautam	Director ABP&MDD	Department of Agriculture
36	Jay Shankar Lal	Program Coordinator	CARE Nepal
37	Chiranjibi Rijal		ADS
38	Deepak Adhikari		ADS
39	Dhruba Pant		
40	Santosh Basnet	Technical Development Manager	NEWAH
41	Umesh Pandey	Director	NEWAH
42	Antoinette Kome	Regional advisor	SNV
43	Cindy Malvicini	Senior water resources specialist	ADB
44	Jon Cooke	consultant	ADB

9 Annex 2. Synthesis of the Outcomes of the MUS workshop

18 August 2011 Convened by IDE Nepal

Barriers to scaling MUS are:

- Lack of linkages between the different governmental and non-governmental institutions supporting rural communities.
- Each institution brings important components of support (a range of technologies: micro-irrigation, sprinklers, biogas, (lining for) ponds, canals, rainwater harvesting, piped systems for domestic supplies and/or irrigation, (solar) lifting, sanitation/latrines, hydropower; engineering skills and technical training, agricultural produce collection centers, hygiene education, etceteras. However, communities cannot always choose among technologies, as each institution comes directly to the community with its own specialization and mandate.
- For technologies primarily designed for productive water uses, institutions hesitate to encourage its use for drinking as the water quality often does not meet the ideal health standards. However, people use for drinking anyhow, as any alternative is worse. Sometimes communities themselves take the initiative, e.g. by covering and protecting the source.
- Available water resources are increasingly used and competition intensifies in many areas. The land-rich elite often grab the water resources.
- Communal management of collective systems is difficult: they often break down or function sub-optimally.

Potentials for scaling MUS are high, and include:

- Recognizing that communities use single-use designed systems for unplanned uses anyhow. These uses give important livelihood benefits but they are often not accounted for as returns on investments.
- Purposively designing to provide more water, as the IDE MUS systems, renders other uses possible (agricultural production, cattle drinking, but also e.g., biogas).
- Domestic service providers can undertake additional activities, as for fish ponds or vegetable seeds.
- If communal systems are designed for multiple uses to better meet people's priority needs, users' buy-in and sustainability could increase. Anyhow, projects should provide a few years of further support after construction of communal systems.
- The DDCs and VDCs have significant funds now for own, community-driven and integrated planning. There can be communities' demand pressure now.
- Exchange programs can be initiated. Governmental and non-governmental service providers can mobilize and successes can be replicated. Partnerships and consortiums can be forged.
- 15% of DDC funds are now for agriculture. MLD/DDC has also a budget line for domestic supplies. Can these two sect oral budget allocations be converged for multiple-use systems?
- Better training of engineers will support better designs and construction for multiple uses. Extension worker also need to be trained in MUS.
- Comprehensive district water plans support good planning and mitigation of conflicts for greater equity.

Notes: Barbara van Koppen

10 Annex 3: Overview of water resource management legislation

(source: RVWRMP Main Report WUMP Chhatara VDC of Bajura District)

Act and Regulation	Major Management Issues
Essential Commodity Conservation Act 1955	• Drinking water regarded as essential commodity to be managed for strict conservation • Illegal use, misuse, theft and loss to be strictly prohibited
Muluki Ain 2020 B.S. (National Code of Conduct, 1963)	• For irrigation purpose priority should be established • Arrangement is made for managed irrigation system for traditional farming system
Solid Waste Management and Modification Act, 1987	• Solid waste management center has been established for the management of solid waste management. • Arrangements for solid waste to control water pollution
Solid Waste Management, Resource Mobilization Center Regulation, 1989	• Establishment of Nepal Drinking Water Supply Corporation with authority to supply drinking water under government authority. • Arrangements for prohibiting activities that impacts supply of drinking water and penalty.
Nepal Drinking Water Corporation Act, 1989.	• Law on the overall management of water resources • Identification of priorities for water utilization • Arrangement for ownership of water resources • Prohibition of water pollution • Guarantee of life and property. • Arrangements for property acquisition and compensation • Management of water utilization for hydropower.
Water Resources Act, 1992.	• Arrangement for authorization letter • Identification of work, duty and authority of individual with authority letter. • Some economic concession to authorized individual • Role of government specified.
Electricity Act, 1992	• Authorization letter required for the establishment, expansion and diversification of environmentally sensitive industries. • Arrangement of economic exemption for environment friendly industries.
Industrial Profession Act, 1992	• Regulation for overall water resource management • Arrangement of licensing process for the registration of users organization • Establishment of district water resources committee • Authority and responsibilities of water users'

Act and Regulation	Major Management Issues
	committee and authorized individual • Arrangements for house and land acquisition and compensation on related matters.
Water Resources Regulation, 1993	• Arrangements for receiving authorization letter process arrangements. • House / Land acquisition and compensation • Delineation of work, duties and authority of receiving authorization letter.
Electricity Regulation, 1993	• Inventory of Hydropower projects requiring environmental impact assessment, environmental external impact. • Arrangements for water resources pollution control and provision of pollution control certificate
Environmental Protection Act, 1996	• Inventory use of hydropower projects requiring environment impact assessment and external environment impact assessment. • Arrangements for water resources pollution control and provision of pollution control certificate
Environment Protection regulation, 1997	• Establishment of drinking water service utilization • Registration process for water users' formation arrangements. • Arrangement for authorization letter of drinking water utilization • Arrangements for water resources pollution control for maintaining drinking water quality. • Conditions for drinking water service utilization • House / Land acquisition and compensation.
Drinking Water Regulation, 1998	• Arrangement for decentralized administrative structures • Arrangements and delineation for authority, work and duties of Village Development Committee (VDC), Municipality and District Development Committee (DDC) in relation to Drinking water and sanitation. • Local Institutions Rights on Natural Resources and Empowerment of Local Institutions for leveling Tax on Natural Resources.
Local Self Governance Act, 1998	• Arrangement and delineation of Authority, Work and Duties of Village Development Committee (VDC), Municipality and District Development Committee (DDC) in relation to Drinking Water Supply and Sanitation • Arrangement of process for planning and implementation of water resources.
Local Self Governance Regulations, 1999	• Arrangements for working with Water Users' Association for irrigation and project handover to water users' association. • Arrangements for joint management by Government of Nepal and Water Users' Association.

Act and Regulation	Major Management Issues
	• Arrangements for working with Irrigation and River Control Committee. • Arrangement of Service delivery conditions • Arrangements for responsibilities of water users' association including service fee generation. • Arrangements for conservation repair and maintenance of irrigation system
Irrigation Regulation, 1999	• Drinking Water Act Bill, 2005 • Drinking Water Supply Board Act, 2005 • Drinking Water Fees Fixing Commission Act, 2005
Drinking Water and Sanitation Bill, 2005	• Drinking Water Act Bill, 2005 • Drinking Water Supply Board Act, 2005 • Drinking Water Fees Fixing Commission Act, 2005