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Working Paper

Process and Benefits of Community-led Multiple Use Water Services: Comparing Two Communities in South Africa

Barbara van Koppen, Manuel S. Magombeyi, Inga Jacobs-Mata, Virginia Molose, Kenny Phasha, Thando Bophela, Itumeleng Modiba and Malcolm White

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Project

This study was implemented as part of the project *Operationalizing community-led multiple use water services (MUS) in South Africa* – Project K1/2609//1 of the Water Research Commission (WRC), South Africa, supported by the African Water Facility (AWF) of the African Development Bank (AfDB).

Collaborators

Water Research Commission (WRC), South Africa

International Water Management Institute (IWMI)

Tsogang Water and Sanitation, South Africa

Department of Water and Sanitation, South Africa

Office of the Premier, Limpopo Provincial Government, South Africa

Limpopo Department of Agriculture and Rural Development, South Africa

Donors

African Water Facility (AWF) of the African Development Bank (AfDB), Côte d'Ivoire

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Contents

Summary

In the global search for system change in water services provision in low-income rural areas, the emphasis has been on changes that need to be made in government and other support agencies. Our study seeks to complement such efforts by exploring changes in the roles and responsibilities of communities in new forms of co-management with the government. Such changes are aimed at mobilizing community innovation in self-governed water supply and integrated water management to meet multiple needs through cost-effective multipurpose infrastructure and use and reuse of multiple sources. In this form of co-management, communities participate from the earliest planning phase of new external support onward in a stepwise, community-led multiple use water services (MUS) approach.

Our study assesses these processes and outcomes in two villages, Ga Mokgotho and Ga Moela, in Sekhukhune district of South Africa under the project *'Operationalizing community-led multiple use water services (MUS) in South Africa'* (in short, MUS project) executed by the nongovernmental organization (NGO) Tsogang Water and Sanitation from 2016 to 2019 with support from the African Water Facility of the African Development Bank and the Water Research Commission (WRC) of South Africa. Using quantitative and qualitative methods throughout the process, the study analyzed water users' views and satisfaction about the participatory process, the resulting access to water, the multiple water uses and the livelihood benefits derived from those uses, as well as each community's views on future co-management with the government.

The study found unanimous buy-in into all steps of the participatory process, and appreciation for the NGO's sociotechnical facilitation, technical and institutional capacity development, advice, supervision and quality control, besides financial support for materials and construction labor. In both villages, the quantity of water use increased by about 56%. Water also became available more reliably, and in Ga Moela nearer to the residents' houses, which more than halved the time needed to fetch water. Almost all households used water for multiple purposes, even when the average quantities used were below South Africa's basic volume of 25 liters per capita per day. The monetary value of irrigated fruit trees in Ga Mokgotho and Ga Moela was estimated to have increased by 60% and 64%, respectively.

While the process applied and the relative improvements achieved were similar in the two villages, the mutual roles and responsibilities of the government and the community diverged in line with differences in local hydrology, infrastructure characteristics and user organization. In Ga Mokgotho, the gravity system for 800 households that an NGO had constructed a decade earlier was in a dilapidated condition due to the lack of a user organization with a governance structure to enforce rules among the members and hold the sole operator accountable. Facilitated by the MUS project, the community managed. Active local leadership and local technicians catalyzed community action to fill this gap in governance. The MUS project's technical advice and demand-driven provision of materials improved water intake from streams and enabled the repairs needed and scheme extension. In future co-management arrangements, external support can focus on providing materials as requested and then monitoring the implementation.

In contrast, Ga Moela's hydrology leaves mechanized boreholes as the only solution for the 108 households to end their dependence on scattered unimproved hand-dug wells. The MUS project upgraded two existing but hardly used municipal boreholes with new storage and reticulation to give first-time access to four different neighborhoods or 'sections'. However, the municipality took long to address the breakdown of one borehole and to provide fuel. Water users expressed willingness to organize and take up responsibilities for fuel provision, pump operation or small repairs in their section. However, such community action materialized in only one section. By end 2019, two other sections were still waiting for the national electricity company to arrange a power connection for the booster pump. Clear and realistic co-management arrangements with a time frame of support could have mobilized water users' initiatives here too. Local divergence in these two villages and elsewhere underlines the need for bottom-up participatory processes to achieve co-management arrangements that mobilize community innovation.

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Goal and Methodology

Goal

In the global effort to progressively realize every person's basic right to water and to satisfy ever higher water needs, it is increasingly being acknowledged that the project approach, adopted and practiced since the 1980s, only partially achieves those goals, especially in low-income rural areas (Moriarty et al. 2013). This approach of rapid design, financing and construction of new infrastructure by external agencies to provide first-time access to rural communities appears to have been too optimistic in expecting that the communities are able and willing to take up responsibility for the operation and maintenance of the new water schemes. However, the widespread subfunctionality, if not total failure, of such schemes, attests to a maintenance backlog. Frequently, after construction, forms of external support remain needed for operation, maintenance and replacement of assets (Hutchings et al. 2017). Moreover, once communities have received sustainable first-time basic access, they aspire to steady upgrades in access to water beyond basic volumes. Given such a scenario, a range of alternative rural water services modalities are being explored, including professionalization of community management, support to community-based service providers and to water users, who initiate, largely or fully, finance and construct their own infrastructure for self supply (Moriarty et al. 2013).

The recent emphasis on 'system thinking' has further spurred this search by governments and other support agencies for the building blocks or principles that are essential for sustainable delivery of rural water services. As Moriarty et al. (2013) noted, "What these more recent frameworks have in common is a gradual move away from identifying factors at community level, and within the project cycle, to drawing out factors at other institutional levels or (those) that are not linked to a specific project implementation framework" (p. 338). Our study seeks to complement this search for changes in higher-level institutions with the other side of the coin: innovative community participation as part of a new system thinking of 'co-management'. Such co-management would consist of agreed and sustainable complementarity in the roles and responsibilities performed by communities on the one hand and by governments as duty bearer and other public agencies on the other.

The potentials of innovative community participation are clearest in the case of self supply. Both the Water, Sanitation and Hygiene (WASH) sector (Butterworth et al. 2013) and the irrigation sector (Giordano et al. 2012; Woodhouse et al. 2017) are increasingly seeing individuals or small self-organized groups install, operate and sustainably maintain smaller-scale rainwater harvesting, gravity systems or shallow groundwater wells and lifting technologies. These systems provide for self supply, and often also enable sharing of water or informal sale. Self supply not only provides a backup to interrupted or collapsed public services, but also meets rural people's aspirations for higher service levels than just basic volumes, supposedly for domestic uses only. Hence, one form of co-management is public support to self supply.

The research presented here not only echoes this call for support to self supply, but also identifies local innovation as a contribution communities can make to co-management. This is holistic, integrated and people-driven management of multiple water sources to meet a community's multiple water needs through multipurpose infrastructure where possible. Multipurpose infrastructure is widespread. When people invest in self supply they seek to meet the entire range of their water needs for their multi-faceted livelihoods (Butterworth et al. 2013). In fact, public schemes designed for a single use are in reality used for non-planned purposes as well (Renwick 2007; FAO 2010a, 2010b, 2010c, 2010d; van Koppen et al. 2014). A people-centered consideration of multiple water needs ensures that improvements in one dimension of well-being positively affect other dimensions. Better health as a result of clean drinking water and nutritious food produced by year-round irrigation ensures productive lives. Income gain as an outcome of irrigation enables spending on health care or can then be reinvested in infrastructure. Especially around homesteads, water concurrently contributes to many dimensions of health, nutrition and food security: domestic needs, livestock, homestead cultivation of trees and crops, adjacent fields, home-based small-scale enterprise, brickmaking and other uses (van Koppen et al. 2014). Thus, multipurpose infrastructure is a cost-effective and water-efficient engineering innovation that can have a mutually reinforcing impact on livelihood benefits.

Rural people have from time immemorial harnessed their communities' water resources in an integrated manner. They use and reuse multiple sources of water such as groundwater, wetlands and surface water through multiple sets of infrastructure. This includes the increasingly frequent coexistence of public infrastructure and self supply. Depending on seasonal and annual water availability, customary arrangements, anchored in local institutions, govern the sharing of water resources (van Koppen et al. 2020).

Mobilizing a community's innovative contribution of labor, money, knowledge and skills in new forms of co-management requires its involvement from the first planning phase itself. Unlike earlier, when participation was confined to the use phase, mobilization of innovation requires sociotechnical facilitation from the first contact onward. Appropriate support depends on a proper diagnosis of the local situation. Such a diagnosis can do justice to local diversity, the coexistence of public infrastructure and self supply, and the knowledge residing in communities which manage such local complexities as a matter of daily life. During the planning and design phases, accommodating the people's priorities and their desire for incremental improvements is not only key for sustainability but it also avoids the kind of alterations—in particular the notorious 'illegal' household connections—that may happen later in an anarchic and damaging way. The present study conceptualizes such a process as 'community-led multiple use water services' (MUS).

The process may be similar from location to location, but geohydrological and socioeconomic conditions and the type of technologies and service levels differ. Hence, the resulting co-management arrangements will differ as well. The goal of the present study was to analyze the implementation of community-led MUS in diverse settings to both articulate the common process and highlight the differences.

Methodology

Our study compared two cases in South Africa. In spite of the considerable resources spent under the new dispensation since 1994 to ensure nationwide realization of the constitutional rights to sufficient water and food, gains initially made in providing first-time access to water have recently declined (Balzer 2019). In the poorest districts of Vhembe and Sekhukhune, up to 83% and 93% of municipal boreholes, respectively, are defunct (DWS 2017a, 2017b). A need for systematic change in local government has been flagged (Gibson 2010; Lagardien et al. 2010). Further, national policies do call for approaches that meet the multiple water needs of rural people (DWA 2013).

In view of this situation, the African Water Facility (AWF) of the African Development Bank initiated a demonstration project 'Operationalizing community-led multiple use water services (MUS) in South Africa' (or the 'MUS project'). Implementation started in late 2016. The implementing agent was the Water Research Commission (WRC) of South Africa. The nongovernmental organization (NGO) Tsogang Water and Sanitation (or 'Tsogang') was the sociotechnical facilitator for the project in six villages in Limpopo, one of the poorest provinces in South Africa. The International Water Management Institute (IWMI) was the research partner in the project, and led the study presented here.

The project defines multiple use water services (MUS) as:

> A holistic, participatory approach to planning and providing water services that support people's self supply and their multiple water needs, as identified by the community, and coordinates across government departments as needed.

Figure 1 presents a conceptualization of this approach as a six-step planning process, which, in the case of MUS, is community-led: (1) initiating collaboration (agreeing on goals and creating a community structure); (2) diagnosing; (3) envisioning solutions; (4) fitting the financial framework; (5) implementing (procuring materials, recruiting workers, constructing, and testing and starting operations); and (6) operating and maintaining in the use phase. The steps are not rigid. They merely indicate the earlier actions that are needed for a next step, but one can, and often does, come back to an earlier step and adjust.

The two villages selected for this study are both in Sekhukhune district. Ga Mokgotho has about 800 households and lies in a mountainous area with several streams. The community shares one large communal piped gravity system that an NGO constructed in 2007. In contrast, Ga Moela is a small village with just over 100 scattered households. Before the project, most people and livestock in Ga Moela depended on shallow groundwater drawn from hand-dug wells, wetlands and some small seasonal streams. Three government boreholes provided water to the school and a few households. At the time of this study, late 2019, these two villages were the first of the six MUS project villages in which the implementation phase (step 5) had been finalized.

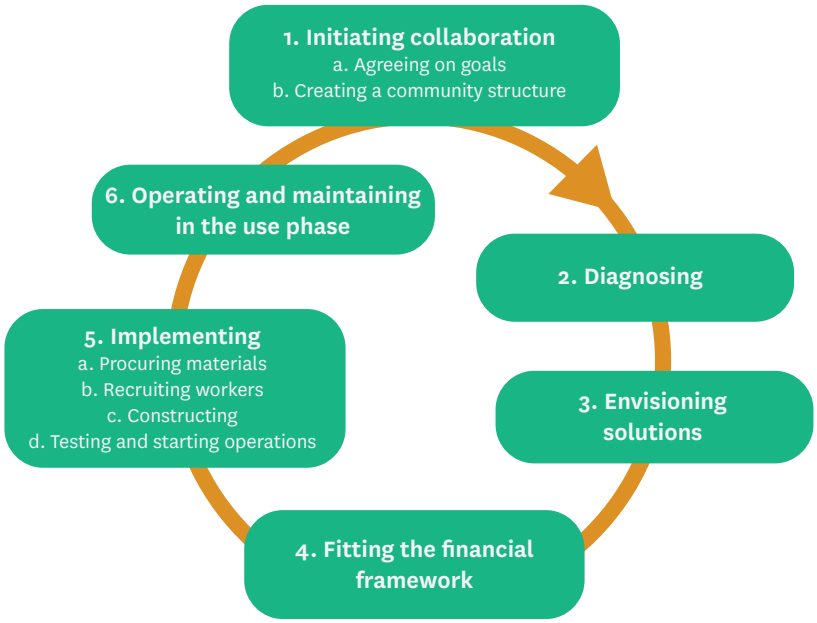

Figure 1. The six steps of the community-led multiple use water services (MUS) approach.
Source: Adapted from Adank et al. 2012.

Method

In both villages, the same mixed method was adopted. This included detailed reporting of the intervention process from 2017 to 2019 by Tsogang. IWMI compiled a diagnostic study in 2017 and continued participatory observation and qualitative interviews with key stakeholders throughout the implementation stage to compile detailed process documentation reports. A postconstruction user satisfaction survey consisting of both qualitative and quantitative parts was conducted at the end of 2019. Qualitative focus group discussions were held with the MUS Forum, comprising community representatives that villagers had nominated to lead the process. The quantitative survey was conducted among randomly sampled households, and interviews were held with the primary adult found at home.

In Ga Mokgotho, 59 households (out of 800) were randomly selected (Figure 2). The respondents were 14 men and 45 women. In Ga Moela, the sample consisted of 42 (out of 108) households (Figure 3). The primary adults found at home were 12 men and 30 women. Further, in April 2019, MUS Forum members and others made a 10-minute video telling their water story.[1]

The closed and open-ended survey questions elicited the respondents' opinions on the participatory process and the project impacts in terms of changes in the water infrastructure and its operation, water uses and livelihood benefits. For impact assessment, the preproject (2018) and postproject (2019) periods were compared through oral recall. The survey took place at the end of the dry season; so for better comparison, questions on the preproject period also focused on the dry season of the previous year. However, in one of the four neighborhoods in Ga Moela (the Letlabela section), households only received water from mid-December 2018 to March 2019, so respondents were asked to recall their water use during that period as 'postconstruction' uses and benefits.

Structure

This paper presents the findings of the study in chronological order: the preproject situation; local implementation of the six-step process; the resulting changes in the water supply systems, followed by changes in water use and livelihood benefits; and respondents' evaluation of the process and their views on future co-management with the government. In both villages, a few (2-4) respondents also used private pipes from streams to irrigate their distant fields. However, they are not considered further here; the focus is on water supplies to individuals' homesteads for multiple uses. Illustrative literal expressions are indicated in quotation marks. Detailed survey findings and other aspects of this project, including village selection, have been documented and are available with the authors or have been published elsewhere.

[1] Available at http://stories.iwmi.org/voicing-water-visions/mus-south-africa/

Preproject Situation

Ga Mokgotho: A Large Subfunctional Community-operated Gravity System

Ga Mokgotho is a village of 800 households situated in a mountainous area with an average rainfall of about 800 mm per year (see Figure 2). It lies about 40 km north of Burgersfort in Limpopo province. Administratively, it falls in Ward 16 of the Fetakgomo/Greater Tubatse Local Municipality in Sekhukhune district. Four sections of the village were included in the study: Segabeng, Lekgwareng, Nkoteng and Sethogeng, the last named being the most downhill. In 2007, a bridge built over the adjacent river opened up access to the community, which has grown fast since then. In 2013, all households in Ga Mokgotho were connected to electricity lines.

The main source of water in the village is a communal system—the construction of which was started in 2007 by Tsogang Water and Sanitation. Water from a spring stream was led into a large brick reservoir of 200 m^3 that initially supplied 94 taps serving some 400 households. In 2013, the municipality refurbished the system by adding a separation box and 43 taps. In 2015, a second intake was constructed to better fill the reservoir. Sometime after that, a fire destroyed part of the 1,350 m polyethylene pipeline from the spring to the main reservoir, and it was only partially repaired. From the main reservoir, there were, and still are, three main reticulation pipelines to the street taps. The two outer lines went to two smaller steel reservoirs and, from there, each to one line supplying the taps. The third line in the middle from the main reservoir directly provides water to street taps. A total of 135 taps are shared by the surrounding households.

Immediately after the construction of the water supply system in 2007, a managing committee was established with the support of the tribal authorities. One of the builders during the construction phase took up the responsibility of scheme operator. According to the written rules, water users were supposed to pay ZAR 10[2] per household for operation and maintenance. However, over time, very few users paid, and the committee stopped functioning. In the absence of a communal structure that represented the common interests of the village and was mandated to set and enforce rules for all members and to hold the operator accountable, the system started breaking down.

The operator simply left the valves to all three lines open 24 hours. The valves of the two smaller reservoirs got damaged. Pressure fluctuated unpredictably. The pipes from the reservoir to the taps became leaky as nobody attended to them. Where pressure in the system was too low, water in the buried pipes could not be pushed up to the tap. Taps were even stolen, allegedly by people from a neighboring village.

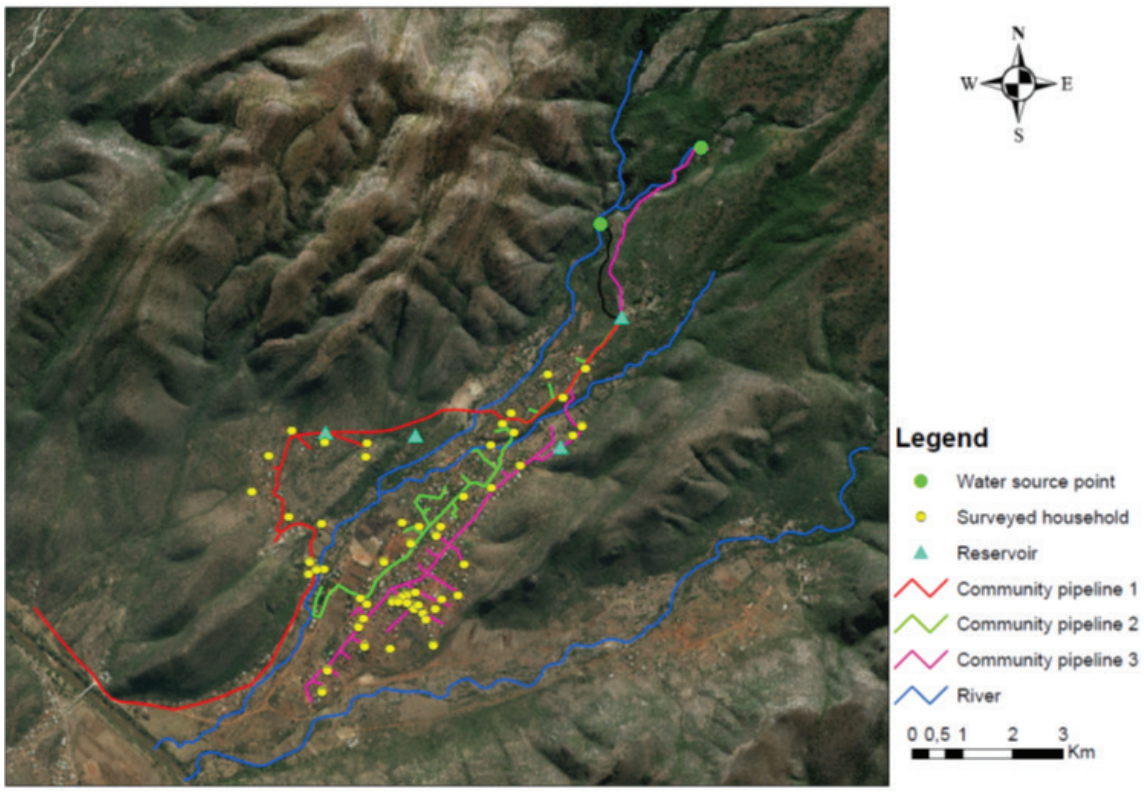

Figure 2. A map of Ga Mokgotho village showing the communal water supply system and the surveyed households.

[2] USD 1 = ZAR 15 (approximate rate taking into consideration exchange rate fluctuations between 2007 and 2019).

Complaints by the water users were not followed up. As the operator was not paid and was not held accountable to report to a communal authority, the system became his private business. When demand for water increased, he gave in—allegedly for a remuneration of ZAR 500-600—to individual villagers' demands to install new household connections. For example, multiple underground connections were laid, working even at night, merely a few meters away from a tap point. He was one of the elders advising the tribal authority. Although other elders considered his behavior to be illegal, they too failed to act.

Owing to this unreliable service, and also in response to water needs in new settlements, and aspirations for higher service levels and more productive uses, some households in Ga Mokgotho installed their own private pipes to bring water from streams higher up in the mountains to their homesteads. Other households requested water from neighbors that had better access to the communal system, or from those who had installed private gravity pipes. Most neighbors provided water for free, but some asked for payment. For example, in the tailend of the Sethogeng section, a private pipe owner charged ZAR 50 per month. Two schools and two households had their own borehole.

In the postconstruction survey, respondents recalled the problems they experienced before the MUS project: there had been poor system operation and a lack of proper water provision; there was only one person controlling the system; no one was responsible for managing the system; the reservoir was not cleaned; there were no rules for water distribution; pipes leaked; water pressure in the taps was low; taps dripped; taps did not work properly, or were broken, or stolen, or placed at a distant location; there was insufficient water to fill household storage; there were periods of three days or two weeks or even months without water; and people were forced to ask neighbors for water.

Ga Moela: Dispersed Groundwater Wells and Municipal Boreholes

Ga Moela is a small community of 118 households situated amidst the Leolo mountains 20 km east of Jane Furse in Limpopo province (see Figure 3). It is part of Ward 14 of Makhuduthamaga Local Municipality in Sekhukhune District Municipality. The 118 households are dispersed over five sections: Tawaneng (36 households), Letlabela (22), Moela (27)—not to be confused with Ga Moela, which indicates the entire village—Mabusa (23) and Ga Pudi (10). Almost all the households got electricity connections in 2010.

Rainfall between 500 mm and 750 mm supports rainfed agriculture, mainly maize, on the fertile soil in addition to livestock keeping. Poverty has led to out-migration, mainly by young men. Sixty percent of the adult family members in the sampled households were women; half of the households were female-headed. Three quarters of the households were headed by persons older than 50 years. With too few students, Ga Moela's Lerato Secondary School had to be closed and merged with a distant school.

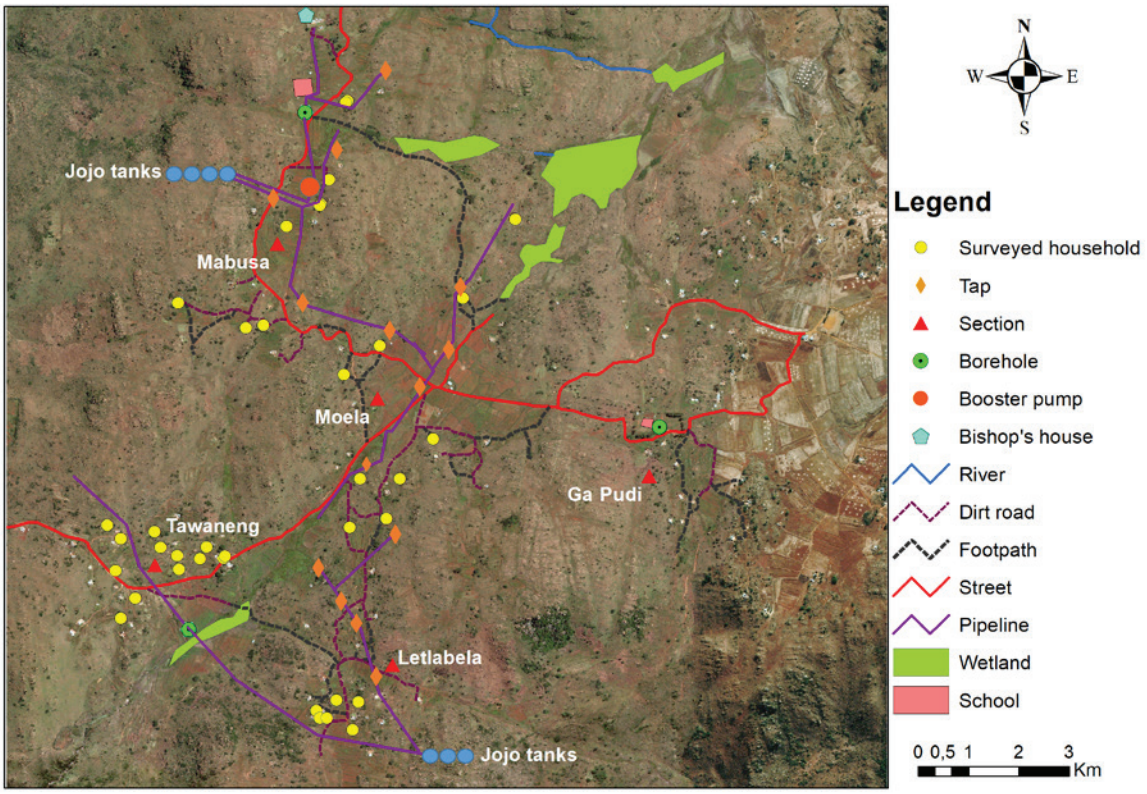

Figure 3. A map of Ga Moela including the communal water supply system and the location of surveyed households.

The main water sources were some 20 scattered shallow hand-dug wells of 0.5–1 m depth, and small streams, some of which turn into wetlands in the rainy season and some dry up at the end of the dry season in August-September. Almost all the respondents in our survey said they used to depend on these wells as the primary source of water, mostly carrying it in buckets or, wherever the rocky terrain allowed, using a wheelbarrow. The water in the shallow wells is dirty. "We shared water with animals" was the respondents' most common description of the preproject situation.

There were three functioning boreholes in Ga Moela, each installed for a different purpose: a former prospector's borehole near the Tawaneng section, the borehole of the former Lerato Secondary School in the Mabusa section, and the borehole of the Ntshitshimale Primary School in the Ga Pudi section.

The diesel-powered borehole near the Tawaneng section was installed by mineral prospectors. Finding no minerals, they left, and ownership of the borehole passed to the Sekhukhune District Municipality. In 2016, a contractor employed by the municipality constructed a main line, four 10,000-liter plastic tanks (called 'jojos'[3]) and reticulation to five taps in the Tawaneng section, which is the largest section and closest to the borehole. Two other taps were constructed. However, these had not been connected after the contractor left. Moreover, some steel standpipes for the jojos that had been procured were left unused. The municipality provided diesel incidentally, at best. So, in order to access water more reliably, people in the Tawaneng section started contributing money to buy diesel. An elected woman volunteer operated the borehole twice a week to fill the communal jojos for distribution the next day until 5 pm. In the MUS project, this former prospector's borehole became the Tawaneng/Letlabela borehole: the project finalized the reticulation in the Tawaneng section, and installed a new main line to new storage and reticulation in the Letlabela section on the opposite side of the borehole.

After the Lerato Secondary School had been closed, the municipality took over the borehole from the Department of Education along with its reservoir of four 5,000-liter jojos and three nearby public taps. The municipality continued providing diesel and paying the operator as before. A small religious congregation of three households nearby made an agreement with the municipality that the congregation would buy a private pipe and connect this from the pump system to its premises uphill. The congregation called the operator when water in the reservoirs was depleted. Households very near the public taps continued using them. When there were small breakdowns or when it took long for the municipality to respond, the congregation carried out the repairs itself. In the MUS project, this former Lerato Secondary School borehole became the Mabusa/Moela borehole. The project constructed a new main line from the pump house to new storage tanks uphill to serve most of the Mabusa section and the Moela section over the hills. It also extended the existing reservoir near the school to the few houses on the other side of the Mabusa section.

The borehole of the Ntshitshimale Primary School in Ga Pudi was owned by the Department of Education and used only by the school. There was a hand pump to serve the surrounding households but it was broken. Two households in the village had their own private boreholes and shared or sold the water.

Three earlier municipal projects to drill new boreholes had failed in Ga Moela. Two boreholes never worked (the engine of one was soon stolen, and the jojo was stored at the chief's place). A large multivillage project that had started in the adjacent village of Ma Chupi also stopped without finalization. The idle equipment disappeared thereafter.

Lastly, there were various water vendors who served the Ga Moela community during functions and droughts. One respondent in the Tawaneng section was such a water vendor; he explained how clients in need of water call him, and he delivers water in his car fitted with a 1,000-liter tank. He used to take water from the former prospector's borehole, but he was not allowed to do that anymore. Then he drew from a hand-dug well, but he stopped that too when more people started using that well. After that, he began to buy water from a borehole owner in Ga Pudi at ZAR 50 per fill of his 1,000-liter tank, which he sells at ZAR 170.

This was the context in which the MUS project started.

[3] These plastic storage tanks, with a capacity ranging from 2,500 to 10,000 liters, are named after the brand name 'Jojo'. This paper uses the popular name 'jojo'

Community-led Processes

Step 1. Initiating Collaboration (Agreeing on Goals and Creating a Community Structure)

As part of the MUS project team's selection of the villages for this study, the NGO Tsogang informally visited Ga Mokgotho and Ga Moela to secure the tribal authorities' endorsement, which it received. Tsogang then called a mass meeting (in March 2017 in Ga Mokgotho, attended by 130 villagers; and in June 2017 in Ga Moela, attended by 31 men and 24 women). These mass meetings were inclusive. Most respondents in the postconstruction survey (83% in Ga Mokgotho; 92% in Ga Moela) remembered being invited to this introductory meeting and to subsequent meetings. Elderly villagers and community members with disabilities, however, were not always invited. About two-thirds of the respondents in both villages attended these meetings. The most common reasons given by those who did not attend included: not being around that day, old age, taking care of children, pregnancy, other commitments, or another family member already attending.

At the first mass meeting, Tsogang introduced the MUS project team and explained the project's participatory approach and its goal of meeting multiple water needs. A committee was established in the first or second mass meeting. This became known as the 'water committee' in the local language, or as the 'MUS Forum' in English. Tsogang explained the committee's tasks: (i) to oversee the implementation of the project; (ii) to serve as the link between the community and Tsogang; and (iii) to report back to the community. The criteria for selection to the committee included gender, youth, representation of all governance structures and geographic sections. Participants in the meeting were then invited to propose and second potential candidates to serve on the committee. Tsogang then asked the new MUS Forum members to elect the committee's executive (chair, secretary, treasurer and, as needed, vices) among themselves, without further intervention by the NGO. After that, Tsogang instructed the MUS Forum about their roles and responsibilities, and assessed their existing skills and skill development needs.

In Ga Mokgotho, 19 members were thus nominated: eight women and 11 men—four of them young people. The chair was a dynamic person who had previously participated in local government elections. He was well-connected with the tribal authorities and with local government structures. A new operator came forward to manage the reservoir and its outlet. Over time, some 10 members became more active in the MUS Forum. Our survey found that most of the respondents knew the members of the MUS Forum to a certain extent: 77% of them knew the chair by name; 50% knew the new operator of the main reservoir by name. In addition, depending on those representing the geographical reticulation line and its segments, between 11% and 44% knew the names of one or more or all of the 10 active MUS Forum members as well.

The survey also asked the respondents what they understood, in hindsight, about the tasks of the MUS Forum and how they evaluated its performance. They felt that the main task of the forum, that of ensuring the village gets access to water, had been an ambitious one. This involved water provision (operation, rotation across the three water supply lines, fixing broken and blocked pipes and taps), oversight (checking the reservoir, taps and flows), and problem solving by following 'fair and satisfactory processes'. The respondents appreciated the MUS Forum's execution of these tasks. Their appreciation was evident in some of their comments: "They listen to people before doing work and are committed to their work"; "the forum calls for a meeting and identifies a solution and swiftly implements it as per the community discussions"; "they report back on queries asked in meetings and they show the quotations before buying and the invoices after purchasing materials". Most of the respondents—with the exception of one—were satisfied with this transparency on financial matters. As will be shown below, the MUS Forum filled the main gap in Ga Mokgotho by becoming an organization of water users with a governance structure that could enforce rules and obligations and to which the (new) operator reported.

In Ga Moela, 12 members (six women and six men) were nominated to the MUS Forum, seven of them young persons. However, the composition changed immediately afterward when three of the new members left. A year later, the young chair, who was also chair of the tribal council, got a job in Pretoria and left Ga Moela altogether. Further, two of the three other young committee leaders also got employment outside Ga Moela. When our survey probed respondents to mention the names of MUS Forum members, these three most active persons were known to 55% of them; three other members were mentioned by 26% of the respondents. The other members were mentioned by very few respondents.

None of the MUS Forum members in Ga Moela had any previous experience of working in committees, chairing meetings or keeping records. Unlike in Ga Mokgotho, awareness of a communal scheme's infrastructure and its management was scattered in Ga Moela. Yet, respondents acknowledged the important role of the MUS Forum, saying "they ensure supply of water" or "without them, water would not be available". Some respondents specified the role played by the forum that they found useful: calling meetings, giving information, monitoring the project, conveying members' messages to Tsogang, serving as a new committee for water management so that people can report water challenges, solving conflicts and so on. They also referred to the forum's leadership in community-led construction. Respondents were overwhelmingly satisfied with the MUS Forum's performance. Several of them said they hoped it would operate new systems in the future.

Step 2. Diagnosing

The diagnosis phase of the project took three to four months. Tsogang, the MUS Forum and the community members analyzed the water situation in the community through participatory resource mapping on the ground (Figure 4) which was then copied on paper; focus group discussions including pairwise ranking of needs; transect walks; and interviews. The information thus collected was presented in the next mass meeting. This generated a shared understanding of the current situation and provided the basis for the next steps. Tsogang also started technical measurements of flows, the state and discharges of pumps and other infrastructure, and geographic information system (GIS) measurements of sites and elevation. Half of the respondents (Ga Moela) or more (69% in Ga Mokgotho) participated in the resource mapping and focus group discussions.

With regard to the resource mapping, respondents in Ga Mokgotho mentioned how the mapping helped them to learn about 'each household in the village', 'water to other sections', 'water flowing in three supply lines, buried pipes, or more reservoirs in the village'. Only a few participants, mainly elder men, appeared well aware of the detailed water sources and infrastructure across the village. They shared their insights, teaching some others.

In Ga Moela, respondents learned from this map how the houses, boreholes, wells, the water system in Tawaneng, and the streams in their village are arranged in the landscape, or as one respondent put it, "how they look from the sky". One respondent said, "I now know all the areas in the village." Another respondent realized "how challenging it is to provision taps as households are far away from each other."

In both villages, the Tsogang facilitator noted how the men enthusiastically started the mapping, and how the women gently corrected them. One respondent in each village felt that the explanation of the mapping exercise had been unclear but they were too shy to ask questions. The map helped to plan for the location of new taps and valves in the next step.

In Ga Moela, Tsogang also liaised with officials of the nearby satellite office of the municipality (in Schoonoord), which is also a depot for diesel for the municipal boreholes. Tsogang briefed them about the project, which the local officials fully supported, and asked for further technical information about these boreholes.

Step 3. Envisioning Solutions

In step three, the range of technical and institutional solutions were identified, analyzed and prioritized. The villagers already had some solutions in mind before the project started, and other solutions came up during the introductory and diagnostic phases as well. In step 3, Tsogang, in collaboration with the respective MUS Forum, further identified, detailed, costed, compared and ranked these solutions according to their priorities. Conditions were set as well. After two to three months of measurements and deliberations, a list of solutions was made and presented for discussion in the mass meeting. In addition, in both villages, the project envisaged handing out 2,500-liter jojos to vulnerable households: 15 in Ga Mokgotho and 10 in Ga Moela. Tsogang left the selection of these beneficiary households to the MUS Forum and the village authorities.

Figure 4. Participatory resource mapping in Ga Mokgotho (*photo:* Barbara van Koppen).

Ga Mokgotho

In Ga Mokgotho, Tsogang insisted that the community swiftly take action to address the management failures of the system before any renovations to the existing infrastructure were taken up. Realizing the damage done to the scheme for about 10 years, the MUS Forum publicly dug out some of the illegal connections installed by the former pump operator and took this illegal behavior by the pump operator and households involved to the notice of the tribal authority. The MUS Forum also gradually started supporting another pump operator who had taken part in the construction of the communal system in 2007. The erring former operator, who had become a pensioner in the meantime, continued to participate in the meetings, but was no longer involved in decision-making or implementation.

The long-standing wish of the community was to develop a new dam to access water from a more distant source, the Diphalafaleng River. Tsogang assessed and costed this option, but found that it would be too expensive for the available budget. Moreover, with the envisaged upgrading of water intakes from the streams to provide water to the existing reservoir, water supplies to the communal scheme would already enlarge.

By October 2017, after further listing, costing and prioritization, the following solutions were proposed: refurbish both intakes at the source, and fence and protect them against leaves and other debris falling in; install a new pipe from one intake to the reservoir (1.4 km) and repair the other line (1.1 km); replace four dysfunctional valves; add a valve box and a control valve to increase pressure; repair or replace leaking pipes and broken or stolen taps; extend the reticulation line at the tail end of the Sethogeng section by 600 m and set up three more taps to serve 50 households; and build two animal troughs connected to the system (which was an entirely new idea proposed by Tsogang). Moreover, the community aspired to have yard connections rather than share street taps. This would meet people's needs but also avoid the intrinsic risks of vandalism of public taps. However, households were supposed to self-organize and finance such yard connections. Tsogang would help to avoid leakages when people were connecting into the reticulation lines.

The survey found that respondents who attended these meetings supported and trusted the process, generally feeling that "they proposed what I want", even "without fully understanding the technical details", as one respondent commented.

Ga Moela

A similar process was followed in Ga Moela, and the respondents there expressed similar appreciation: "Tsogang really listens to our ideas"; "I was thinking about the same things that were discussed"; "It gave us a chance to speak up and discuss problems and the changes we wanted"; and "I proposed that we should have a water committee to maintain taps and pipelines once the project is finished". Some respondents felt that their own listening skills and communication skills improved in the process.

As the MUS project's budget was not sufficient for a new borehole, the villagers and Tsogang alike proposed improvement of the three existing boreholes by adding more storage and installing or extending reticulation to more street taps in order to reach more households. Women and men groups separately suggested sites for the new storage and street taps (Figure 5).

In the following months of 2017, technical measurements were made, and Tsogang hired an engineering company to provide advice on the pumping capacity of the boreholes, water availability, head loss in the undulating terrain, and the diameter and class of pipes required.

For the former prospector's borehole near the Tawaneng section of Ga Moela, neither the Makhuduthamaga Local Municipality nor the existing users in that section objected

Figure 5. Participatory design for new street taps in Ga Moela (*photo:* Barbara van Koppen).

to sharing the borehole with the Letlabela section; so a new main line from the pump house was proposed with a storage reservoir of three 5,000-liter jojos, and reticulation to serve the 22 households in Letlabela. In Tawaneng, the two already constructed taps were to be connected to the existing storage, requiring just 20 m of extra line and couplings.

The satellite office of the Local Municipality and the congregation that was using the former Lerato Secondary School borehole also supported the idea of sharing it with others in the neighborhood. The municipality provided some information on the capacity of the borehole, but that was not tested further. One small extension was planned to serve a few scattered households. A much larger extension from the pump house was planned to feed a new storage (of initially three, but ultimately four jojos of 5,000 liters each) on top of the hill. This was to provide water to some 20 households in the Mabusa section and most of the 27 households in the distant Moela section over the hills. However, the site chosen for the reservoir appeared too rocky, and the household on whose land the next best site was located refused to allow it. So, a third site was selected for the reservoir. The household owning this site got a tap near their house as compensation for keeping an eye on the storage. In the whole of Ga Moela, 14 new taps were proposed.

The MUS Forum also approached the Governing Board of the Ntshitshimale Primary School in Ga Pudi section to allow it to extend their borehole to serve the surrounding households. However, the board refused. So, plans for this section were limited to repairing the hand pump. The repairs were finalized after the postconstruction survey; so, Ga Pudi was not included in the survey sample.

Lastly, as in Ga Mokgotho, Tsogang also suggested two cattle troughs in Ga Moela, one in the Mabusa section and one in the Moela section in the list of proposed solutions.

Step 4. Fitting the Financial Framework

In Step 4, from December 2017 to April 2018, proposals identified in Step 3 (together with proposals from four other villages participating in the MUS project which followed a similar participatory planning and design process) were screened and adjusted to fit the project's overall financial framework. This was then translated into contractual arrangements between all parties stipulating the implementation modalities for procurement of materials and labor. With some support from a professional engineer, Tsogang finalized the draft designs, bills of quantities and costs in a draft Work Design Book for each village, and proposed them from the bottom up to WRC and AWF as the national project managers and financiers. In several iterations, Tsogang communicated the results of these deliberations, including the Work Design Books and the final budget allocation, to Ga Mokgotho and Ga Moela (and also to the other four villages). For the procurement of materials, WRC was obliged to follow national procurement procedures, so the total cost estimates for materials were tentative. Materials for construction in Ga Mokgotho were budgeted at ZAR 241,530. In Ga Moela, it was ZAR 363,097.

For the procurement of labor, all six villages and Tsogang were adamant that the communities themselves execute the work. Especially in Ga Moela, villagers recalled the adverse experiences they had faced with outside contractors in earlier projects. WRC and AWF supported this argument. The next question was whether semiskilled workers should be remunerated, and if so, how much. All parties preferred payment of a modest 'stipend', rather than 'wages', of ZAR 90 per day, as is done in South Africa's employment generation programs. Once WRC had approved this, Tsogang divided the work into one-day 'tasks'. Digging a trench of 6 m length, 70 cm depth and 50 cm width was the standard for one task of ZAR 90. Backfilling of that stretch was estimated to cost ZAR 30. For skilled jobs, the costs were estimated as lump sums. In this way, Tsogang calculated the total semiskilled and skilled labor costs for Ga Mokgotho at ZAR 65,250 and for Ga Moela at ZAR 158,020. Payment for the work would only be done after completion and quality checks by Tsogang and the MUS Forum.

For handling money, the MUS Forum had to formalize into a legally recognized institution and open a bank account, co-signed by Tsogang and two MUS Forum members. It was decided that the MUS Forums would be organized as 'Primary Cooperatives' as defined in Section 7 of the Cooperatives Act 2005 (Act 14 of 2005) under the Companies and Intellectual Property Commission (CIPC) of the Department of Trade and Industries Group. Tax clearance certificates and Broad-Based Black Economic Empowerment (B-BBEE) certificates were also required. The advantage of this structure was that it enabled community structures to also bid for government tenders. Such successful tendering was expected to render the MUS Forum more sustainable, and also for operation and maintenance of the water infrastructure. Thus, the Kgomotso Multipurpose Primary Cooperative Ltd (Ga Mokgotho) and the Phelake Phele Multipurpose Primary Cooperative Ltd (Ga Moela) were registered by the end of 2017. This formalization, however, was difficult in Ga Moela. All MUS Forum members were supposed to become directors of the Primary Cooperative but the MUS Forum's precise composition was unclear. The lack of experience and the resignation of the chairperson and the search for a replacement caused further delays in opening a bank account. Guidance by Tsogang and learnings from the example of Ga Mokgotho proved invaluable in Ga Moela.

In both villages, Tsogang used the new structure for the catering of meals after project meetings. In Ga Mokgotho, the dynamic leadership used the Primary Cooperative to successfully tender for government assignments. This did not happen in Ga Moela. In December 2018, Tsogang

facilitated two MUS Forum members from Ga Mokgotho and one from Ga Moela to attend a three-day training program in tendering skills, facilitated by the Limpopo Economic Development Agency in the Fetakgomo-Tubatse Municipality and the CIPC in Burgersfort.

A formal Memorandum of Understanding between Tsogang and each of the two MUS Forums (now officially constituted as Primary Cooperatives) was drafted and signed in April 2018. This agreement specified all works, mutual roles and responsibilities and the amounts to be paid as stipend for skilled and semiskilled tasks. In meetings with the MUS Forum and village leaders, Tsogang also explained the budgets. Such transparency was meant to mitigate the common suspicion that villagers involved in development projects misuse public money (described locally as 'eating money').

Tsogang also tried to formalize relations with Sekhukhune district for Ga Mokgotho and Ga Moela (and the third village in this district out of the six villages in the MUS project) combined by drafting a Memorandum of Understanding for approval of works and handover of finalized works to the Sekhukhune District Municipality. In Ga Moela, this included the expectation of continued operation and maintenance, more fuel and longer operation hours of the municipal boreholes to give many more people access to more water. The district officials saw the memorandum and did not object, but never signed it.

Step 5. Implementing

Procuring Materials

Step 5 of implementation started with the procurement of materials. Based on the bills of quantities and the estimated total price for the three demonstration villages in Sekhukhune District Municipality, WRC proceeded to procure materials, following the national government procedures. In March 2018, it issued a Request for Quotations to suppliers in Sekhukhune district. However, the winning supplier needed a loan. This took time, so he only delivered materials in Ga Mokgotho in June that year. For Ga Moela, the supplier was unfamiliar with the area, and he underestimated the steep and rocky access road to the village. So, other transporters had to be mobilized, which took till July.

At delivery, Tsogang checked the quality and signed off. The materials were safely stored at the chief's place. Tsogang and local transporters assisted in transporting construction materials such as cement, cement blocks, pipes and tools to the construction sites, either voluntarily or as a task for a stipend. In Ga Mokgotho, the two intakes in the streams were inaccessible by car, so workers had to carry the materials on foot.

At a meeting in August 2018 that Tsogang organized for the three villages in the Sekhukhune District Municipality, communities looked back at their experience with procurement. Feeling sidelined by the national procurement policy followed by WRC, they proposed opening up of procurement to communities or local enterprises and agencies as well. Locally available materials can be cheaper and would reduce transport costs. In Ga Mokgotho, the supplier delivered river sand and building sand from 200 km away while sand was locally available at a much lower price. Also, communities know the local road conditions and can immediately provide appropriate transport. Local procurement would also strengthen contacts and allow villagers to learn where to get spares during operation and maintenance of systems. Moreover, this would save money. A comparison of the prices paid by WRC to suppliers and the prices Tsogang quoted for local off-the-shelf purchase of the same materials showed that the supplier's markup was 12% in Ga Mokgotho and 4% in Ga Moela.

Recruiting Workers

In April 2018, in preparation for the construction work, Tsogang conducted a five-day technical training program for MUS Forum members in Ga Mokgotho and Ga Moela. The themes included reading and interpreting drawings, identifying different types of pipes, pipe laying, excavation and backfilling, checking the scope of work against materials requested, and occupational health and safety and first aid. Tsogang exposed cultural beliefs and practices that put women at a disadvantage. Women found it interesting to learn new things about water resources that they had previously thought only men needed to know.

Tsogang left the recruitment procedures to the MUS Forums and local leaders, providing they would include women. After intensive discussions in Ga Mokgotho, it was decided to call a mass meeting and put yes-no cards in a hat for the participants to pick. Ga Moela followed the same procedure. Almost all respondents who were available attended that mass meeting. Even though the majority of the participating respondents drew a 'no' card, the process was unanimously seen as fair. One respondent in Ga Mokgotho even suggested that "this method must be adopted worldwide". Some who drew a 'no' card voluntarily helped. Family members also helped, in some cases for remuneration. MUS Forum members did not follow this procedure and took up tasks as each of them saw fit.

At the recruitment meeting, Tsogang and the MUS Forum kept managing expectations about remuneration by emphasizing that they needed volunteers. The main reward from the works would be the community's improved access to water. One respondent in Ga Mokgotho who did not attend the mass meeting was unhappy about that, and said, "I did not know that recruited people would be paid and I thought they were just volunteers; hence I was confused."

The recruitment was different for skilled masons, fence installers, welders and plumbers who were to fence

springs or build intakes with filter boxes, valve boxes, concrete slabs and animal troughs; in Ga Moela, they also had to build foundations, erect steel stands and install big jojo storage tanks. For these tasks, Tsogang and MUS Forum members invited local builders and explained to them the technical designs. Then, the builders submitted quotations as a total lump sum. Tsogang and MUS Forum members inspected their previous works for quality. Skilled workers were paid upon satisfactory completion of works. However, in Ga Moela, only a few artisans who had worked on the initial Tawaneng system were available. So, builders from Ga Mokgotho were invited to build and train the workers of Ga Moela on site.

These quotations were often lower than the budget estimates, so money was saved. This allowed some flexibility to adjust the designs and the expenditure on materials or other costs. Accordingly, in both villages, Tsogang held budget discussions with MUS Forum members on how much money was saved and, hence, available for other local expenditure.

Parallel to the recruitment of workers, the MUS Forums selected the beneficiaries of household jojo tanks in collaboration with the ward committee and the tribal authorities. Tsogang instructed them on how to operate, clean and maintain their new jojos.

Constructing

The construction was done swiftly. All the main works were finalized and ready for testing by November 2018. Members of the MUS Forum guided the works by marking sites, organizing workers, and recording the progress. Tsogang regularly supervised, trained, participated in ("to show that we are not commanding", as the NGO's facilitator explained) and inspected the work at key moments, such as during connection of pipes or during more complex works. The designs were flexibly adjusted when opportunities came up (for example, in Ga Mokgotho, a 100-m shorter route was found for the 1,450 m long pipeline from the source to the reservoir) or when obstacles were encountered (in Ga Moela, for example, the soil was rocky and warranted galvanized pipes instead of polyethylene pipes). Also, in both villages negotiations about the location of taps continued.

In Ga Mokgotho, survey respondents who had been lucky to pick a 'yes' card said they learned to excavate trenches, lay pipes, backfill and connect pipes of gradually reducing diameter. All workers said they liked learning new things: team work; the purpose of water provision; but also that "when you dig deep, pipes will be cold as compared to surface pipes which give hot water". The number of days and stipends received varied from 1 to 30 days and ZAR 30 to ZAR 1,000, respectively. Explicitly asked to point out any disadvantages they noticed, the respondents mentioned, in order of frequency: payment rates "below the national employment act"; lack of sufficient personal protective equipment; late payment; and preference for payment into the workers' bank accounts rather than cash payment "to avoid theft". One MUS Forum member thought the payment rates were generally accepted by the workers, cheekily commenting "we had no strikes".

Semiskilled workers in Ga Moela expressed similar views in the survey. They appreciated both the stipend and the learning from the process: excavating trenches, laying and connecting pipes, backfilling, joining taps, etc. Asked what they liked the least, some workers said they liked everything. Others made the point that the stipend should have been ZAR 120 per task or that there was no protective clothing. One complained "my back would hurt". Another remark heard during the survey was that machines were more effective than manual labor for digging trenches. Payment into bank accounts was seen as safe and easy, but there was a delay because the MUS Forum member who was the authorized signatory inadvertently used a different signature on the bank cheque. After this, Tsogang organized the payments in cash.

In Ga Mokgotho, the construction generated employment for 58 skilled and semiskilled workers and dispensed stipends amounting to ZAR 61,500. In terms of person days of employment for semiskilled workers, the project provided 485 days of work. In Ga Moela, 38 semiskilled and skilled workers had employment for a total stipend of ZAR 124,890. The number of semiskilled person days generated was 1,025 days. One MUS Forum member said in the survey that he had earned ZAR 8,000 in total. In both villages, women and men unanimously emphasized that there was no difference whatsoever between women and men doing semiskilled jobs.

Testing and Starting Operations

Works were completed by November 2018, and Tsogang held a five-day training program on operations for MUS Forum members from all three villages in Sekhukhune district in Ga Mokgotho during the period January 20–25, 2019. The topics of this training program included: environmental health and community hygiene practices, water quality, climate change, operations and maintenance, and basic bookkeeping. Moreover, MUS Forum members and others received training in homestead cultivation and seeds.

In Ga Mokgotho, the refurbished system started functioning from November 2018 onward. However, a crack developed in the brick wall of the reservoir due to the higher volume of inflows into the reservoir and the longer storage. Tsogang quickly repaired the crack. However, the plan to organize yard connections instead of street taps and to ensure that connections would be leak-proof never materialized. There were no local champions to initiate such a process.

In Ga Moela, some technical problems arose. Construction of the new reservoir and reticulation in the Mabusa/Moela sections went well and the new system was

ready for testing. However, the diesel pump broke down. The municipality found that it needed servicing and replacement of a fan belt. Instead of waiting for the municipality to do something, the already existing users of the pump collected money (ZAR 20 per household) to buy a fan belt themselves. The municipality sent people to repair the fan belt, and then the new Mabusa/Moela storage and reticulation system was ready for testing.

However, two problems came up during the testing. One was that the steel stands of the big jojo tanks started bending when the jojos were filled. The materials appeared to have been of low quality. Tsogang organized the welding of additional steel bars to reinforce the structure. The second problem was that the diesel pump did not have the capacity to fill up the new storage. So, Tsogang installed a booster pump halfway along to push the water up to the storage. The electricity line was temporarily linked to a volunteer household. This required the users to mobilize money (ZAR 10 per household) to buy prepaid electricity. The MUS Forum submitted a request to the national electricity company for a new communal line, but there had been no response as yet when we did the survey. By then, the system had been operated three or four times, mainly for testing purposes. Hence, the survey in most parts of the Mabusa and Moela sections assessed the impacts of the few times that water was supplied.

In Letlabela, construction of the new storage and reticulation system went well, followed by the final connections in the Tawaneng section (Figure 6).

From December 2018 onward, the Letlabela extension was ready to function. Without diesel supply from the municipality, both the Letlabela and Tawaneng sections collected money to buy diesel so that the volunteer pump operator from the Tawaneng section could operate the pump. She did from December onward. However, the pump stopped working in mid-March 2019. The satellite office found that the generator had broken down. However, after repairs were made to the generator, the pump itself appeared to be broken. In September 2019, after five months, the municipality replaced the pump with a petrol-powered engine, and promised to consider replacing it with an electric engine later on. The satellite office said the municipality had ordered petrol for the shared pump, but that it had not been delivered as yet (it explained to Tsogang, but not to the community, that the approval of the shift from diesel for diesel pumps to petrol for petrol pumps took time). The Tawaneng section decided to take up collecting funds again to buy petrol, as it had done before. Urgent water needs for a funeral triggered this initiative. However, such collective action remained absent in the Letlabela section, for whom the system and the required organization was still new. One argument was that the municipality would stop providing fuel when it saw that communities could organize it themselves. So, the survey in October 2019 in Letlabela assessed the impacts of the MUS project by asking respondents to compare postconstruction water uses during the period that the system was working in early 2019 with the preproject situation.

The following chapters present the findings of this comparison between preproject and postproject access to water, livelihood benefits and views on the overall process. The presentation of findings for both villages has been separated as appropriate.

Figure 6. New storage in the Letlabela section of Ga Moela (*photo:* Barbara van Koppen).

More Water, More Reliable Supplies

Ga Mokgotho

More Water

In Ga Mokgotho, the average volume of water used per household per week increased from 733 liters in 2018 to 1,138 liters if you did not consider the project's jojo beneficiaries (so an increase of 55%), and to 1,305 liters (78%) if the jojo beneficiaries were included (Annex 1).

Among the 88% of respondents (52 out of 59) for whom the communal water supply system was their primary source, almost everyone noted at least one, but often a range of tangible improvements in their water supply in 2019 compared to 2018. Almost everyone observed that there was more water supplied with higher pressure in 2019 than the year before. One respondent commented: "We never thought such tremendous water pressure would be possible in Ga Mokgotho." Improvements in water quality were noticed as well, as further elaborated below. Even the six households that were receiving the same quantity of water as earlier pointed out three advantages: 'higher pressure', 'more reliable', and 'there is somewhere to go for complaints'. Only one respondent mentioned one disadvantage while acknowledging the advantages: The tap had been relocated to a more distant place. One household located in a valley reported no change because it always had enough water.

For seven of the 52 households that primarily depended on the communal water supply system, it was their only source. All others had a secondary source. The MUS project improved the water supply even for those who had a secondary source, which in most cases was a neighbor who had a private pipe or, in one case, owned a borehole. However, only a few villagers owned a private gravity pipe as a secondary source of water. Thanks to the improved communal system, households were relieved that they no longer needed to ask their neighbors for water, or, as one respondent admitted, steal water from the neighbor. It was also a relief for households with private self supplies that neighbors stopped asking for their water. The water vendor at the tail-end of Sethogeng, where three new taps were placed, lost most of his customers. He got more time for any remaining requests.

Of the 12% of sample households (7 out of 59) that had a primary source other than the communal system, two still benefited from the project: they kept their private pipe as the primary source, and started using the communal tap as their secondary source. Moreover, one of these households shifted its private gravity pipe to tap into the stream where the big reservoir overflowed. Two other households in uphill locations, where the communal system could not reach, owned boreholes with sufficient water. The other three respondents did not see any benefit from the MUS project. They were still dependent on private pipe owners or neighbors. In one respondent's case, the flow in the communal system's distribution line under her tap was too fast as a result of the steep slope, so she continued to depend on her neighbor's private pipe as her primary source and used the communal system as a secondary source at best. Another respondent complained that the MUS project "like all earlier water projects" had not resolved her problem: her neighbors refused to share water from the communal system with her. Both of these respondents reported their problems to the MUS Forum, but without any results. The third respondent who saw no benefit from the project was a new arrival in the village and was living too far away from the communal water system.

More Reliable and Equal Operation

Asked about the causes of these improved supplies brought in by the project, survey respondents cited technical, operational and institutional reasons. The technical improvements included bigger and better quality pipes, proximity to homesteads, and repairs to blocked and leaking taps.

They also noticed the new operational arrangements. A new operator, who had been involved in the construction of the water supply system in 2007, had come forward to manage the operations from the intakes at the streams to the main reservoir and from the reservoir to the three lines. He closed the three reticulation lines at night so that the pressure would build up, and turned on the water into the three lines during day. Each day, two lines got full supply, and one line got half by rotation.

There are two or three segments within each of the reticulation lines. The MUS Forum involved the community members of each segment in the operation of valves in that segment. However, when there was a social event or ceremony in a particular location in the village, water had to be supplied to that location. Seventy-one percent of the respondents knew which of the three supply lines served their household. Ninety percent of the respondents for whom the communal system was their primary source of water said they were familiar with the water supply rotation schedule, which was once every five days in the middle reticulation line, or every two or three alternate days in the other two lines. Some noted also that all segments of the line were open on Sundays. Ten percent of the respondents said they were not familiar with the water schedule: water came as a surprise. They checked the tap to see if water was being supplied, or heard of it from others. A few households mentioned continuous access to at least some water in their lines. Only two did not notice any difference in reliability compared to 2018.

Respondents appreciated this predictability and reliability of water supply compared to the situation in 2018, when there were occasions when water would not be available

for up to two weeks or even a month. The comments of several respondents in our survey illustrate this: "Rotational supply of water is more reliable in 2019; I get water as promised"; "The distribution of water across the three lines and across the segments is fair and equal now, unlike earlier when some sections of the village were privileged"; "There is no more favoritism in water supply now; everyone has equal water rights".

The MUS Forum was seen as the main institutional improvement. Respondents clarified how: "In 2018, there was no one to report the problem to, but now we report to the MUS Forum"; "There are no illegal connections anymore; everything is transparent"; "There was no water and no water committee; now there is more water and reliable water"; "Now random people cannot open valves and hence we get more water more reliably"; and "We now share water properly without conflict."

One negative change was observed by a respondent with self supply. To him, the former pump operator had been better in all respects. One other respondent also felt that the community could have benefited more from the old operator's technical knowledge.

Asked explicitly whether they saw any disadvantages in the technical, operational and institutional changes brought about by the MUS project, over three quarters of the respondents could not find one. The disadvantages mentioned by a few other respondents were insufficient improvement in water pressure in the taps, inconvenient rotation, tardy tap repair, or distant tap location. However, most of the respondents who noted disadvantages regretted that household connections had not yet been installed. One respondent called this "an empty promise". Another emphasized: "The project should help install household connections and then we can all be responsible for maintenance and fixing it ourselves."

Maintenance, Repairs and Upgrades

When the postconstruction survey was done, there had been no breakdowns of taps or reticulation lines. Nevertheless, respondents were aware of their responsibilities regarding maintenance and repairs. When a tap broke down, the households sharing the tap were expected to inform the MUS Forum to organize somebody to fix it. The households were to contribute money for that person to go and buy the required equipment or components. That person was expected to show a bill as proof of expenditure. In the case of breakdown of a reticulation line, a similar procedure was envisaged. All water users served by that line were expected to contribute toward the repair. The MUS Forum members who operated the reticulation line, the operator, and in all cases the chair of the MUS Forum were vital in these arrangements. The MUS Forum chair was the one who was expected to know what had to be done, and was the last resort if households and MUS Forum members could not solve a problem.

The chair also facilitated further improvements and expansions of the system in order to accommodate new sections in this growing village. Encouraged by Tsogang, the chair of the MUS Forum, on behalf of the Primary Cooperative and in collaboration with the ward councillor, continued writing letters requesting materials to the Area Manager of the water division of the Fetakgomo/ Greater Tubatse Local Municipality in Burgersfort. In 2018, his request for two 10,000-liter jojos, pipes and other materials to extend the small steel reservoir, all valued at ZAR 110,658, was accepted. A second request was submitted a year later, in September 2019, for four 10,000-liter jojos, pipes and other material that would use the current overflow of the main storage reservoir. Villagers volunteered to help in the digging and connecting work for these extensions.

Ga Moela

More Water, and Closer and Cleaner Water

In Ga Moela, too, respondents reported positive changes in their water supply. As many new taps had been installed, the survey included questions about the time spent in fetching water. On average, a household used 613 liters of water per week in 2018, which took 9.5 hours per week to fetch. After construction of the community water systems, the average household use of water, excluding jojo beneficiaries, rose to 965 liters per household per week (an increase of 57%) but it took only 4.1 hours per week to fetch. If we included the jojo beneficiaries, household use of water increased to 1,167 liters per household per week (90% increase) but the time requirement was similar, 4.3 hours per week (Annex 2).

The system was a new source of water for 79% of the respondents. Their responses to survey questions indicated that they were happy and satisfied with the new infrastructure of closer taps, good quality pipes and communal storage: "We are pleased as access to water is near and we do not have to carry buckets over long distances anymore for fresh and clean water," one of them said. "We store more water now, and do not travel far for water and do not have to depend on wells and buy water anymore," said another. For the households in Ga Moela, the time spent in fetching water decreased, even for two of the three respondents that already had connections to taps and boreholes (two in Tawaneng and the congregation in Mabusa). The third household had access to a public tap in 2018, but at 40 minutes walking distance. Since the construction of a communal water supply system, this household spent as much time on fetching water as before but stored more than three times the quantity of water.

To questions on any disadvantages from the new water supplies, almost half of the respondents in Ga Moela saw none. The others just wanted further improvements: regular or continuous supply; more communal storage; steel pipes; more taps and closer taps; not having to share a tap with more than one other household so that there

would be no need to queue up; or, the most preferred option, a household connection. Some households were dissatisfied with the location of taps. One of them pointed out that, at the participatory design stage of the project, her tap was to be located between her house and that of the chief, but during the actual construction it was shifted nearer to the chief's premises, where a new storage tank to serve the Moela section of the village had been installed.

All households with access to the communal system as their primary source had hand-dug wells or rivers as a secondary source. Water purchase too remained a secondary source, especially for special events. The water vendor in the Tawaneng section benefited from the extension of the pipe to a tap near his house. He acknowledged that he had lost business but, overall, he was pleased, emphasizing that "it is good that other people do not have to suffer".

Twenty-one percent of the randomly sampled respondents said they did not use the new system. These were people who lived far from the taps, at the bottom or top of slopes and had access, with or without a gravity pipe, to nearer hand-dug wells or a perennial stream. One-third of these households were satisfied with the situation. The others said they would like to be connected to the new communal system through a nearer tap or by using a hose pipe from a tap. They were worried that their current source of hand-dug wells and streams might dry up due to overuse, leaving the groundwater-fed communal systems as their only water source.

Pump Operation and Maintenance, and Water Distribution

Pumps posed some problems in Ga Moela. For the borehole in Tawaneng and Letlabela, water users had to arrange for fuel and an operator. This worked in Tawaneng, where water users managed to appoint a volunteer operator and raised money for fuel. The pump was operated twice a week (mostly Saturdays and Tuesdays) to fill two big jojo storage tanks. The next day, the valve operators, who were well-known in the locality, opened the valves but only till 5 pm to save water. From the sound of the pump working, people knew that there would be water the next day or were told by neighbors that there was water in the tap.

A similar arrangement of fundraising and fuel provision by water users worked in Letlabela for a few months, but it was discontinued when the municipality had repaired the pump but did not provide petrol as yet. People then reverted to their alternative of hand-dug wells and streams. Various factors played a role in the failure of this initiative. Unlike Tawaneng, their experience in collecting money for fuel had been short, a few months only. Collecting money was felt to be embarrassing (as testified by the household in Mabusa that temporarily provided electricity for the booster pump and was designated to collect the money). When users refused to pay, it created conflicts. Moreover, non-paying neighbors could hardly be excluded from using a communal tap as sanction for non-payment.

The initial rule in Letlabela was that each household, or two or more related small households living together in one compound, had to pay ZAR 20 per month irrespective of family size. Also, the poorest households could not afford to pay this amount. Last but not least, the municipality's promise to bring fuel, as they saw happening in the case of the Mabusa/Moela borehole, discouraged efforts to solve the problem through collective action. Some water users preferred waiting for the municipality rather than start contributing their own money. Others were tired of waiting and ready to contribute.

For the Mabusa/Moela pump, however, after the above-mentioned closure of the Lerato School and hand-over of the pump to the municipality, the provision of fuel, payment of the pump operator and maintenance of the pump continued —although repairs were so slow that a few users decided to solve the problem themselves. As mentioned above, for long this had only served the congregation that connected a pipe to the pump and a few households that travelled the long distance. However, once the big storage and reticulation to many more households in the Mabusa section and virtually all households in the Moela section had been constructed, problems arose over fund mobilization for the booster pump, and the new Mabusa/Moela segment could be operated only a few times. When we did the postconstruction survey, water still came as a surprise here. Survey respondents said they referred the problem to a few MUS Forum members but realized that a local committee needs to be formed to decide when water can be supplied and to help the operator of the valves in monitoring storage and tap maintenance. The chief was hesitant to get involved because the system was still new and Tsogang and MUS Forum members were still taking charge. However, he confirmed, "If the management of water supply is not resolved in the short term, I will get involved as custodian of the community." Survey respondents, including the chief, said they were waiting for Tsogang to catalyze the formation of a collective authority that will set rules and implement them for collective operation of the infrastructure and its future maintenance.

In our survey, no respondent complained about having to pay ZAR 10 or ZAR 20 for fuel (Tawaneng/Letlabela borehole) or electricity (Mabusa/Moela booster pump). On the other hand, respondents said payment would instill a strong need to use water efficiently, and make it easier to elicit cooperation for some decisions, for example, the move to reduce hours of water supply in Tawaneng.

Respondents preferred the municipality to act on solutions such as providing fuel for the pumps. While the

two pump operators served as a communication channel between the villagers and the municipality, they did not have much power to make the municipality act faster. Lack of clarity from the municipality on when promises would be implemented led to a state of limbo in Ga Moela, where some people preferred to wait. This discouraged those who were willing to organize and collectively raise funds. The municipality could have avoided such hurdles to local cooperation by being clear on when it would be able to provide fuel and avoiding unmet promises.

Sharing Taps in Both Villages

An average of 4.1 households in Ga Mokgotho and 4.3 households in Ga Moela shared each street tap. Qualitative interviews in our survey brought out many similarities in both villages in the way water distribution and maintenance and repair were organized at the ground level. Water sharing is not only time consuming but can often lead to conflict. For example, some respondents felt that 'if someone used the tap for a longer period, it leaves less water for the others'. Ga Moela's costs of pumping were a further incentive for diligent water sharing.

Several physical factors and social arrangements influenced water sharing. The overall aim was to be 'fair and equal' in the wording of the local language of SePedi. However, as water supply rotated over two, if not more, days, household storage capacity had a strong influence on the volume of water taken. Further, the physical location of a tap favored the household closest to the tap, which tended to get more water. Some respondents said that this created jealousies, even if such households tried to ensure that other users got their fair share, or took up responsibility of monitoring the taps. Water distribution also depended on how water was transported: carried by foot in 20-liter containers (the most common arrangement in Ga Moela) or in wheelbarrows (hardly possible in the rocky terrain in Ga Moela) or by connecting pipes to taps at a higher elevation so that water would flow by gravity (as most respondents in Ga Mokgotho did).

The most common social arrangement to distribute water was by agreeing on turns, which could be based on a range of considerations. The simplest of these rules was first-come-first-served wherein that person could draw water for as long as she or he needed. In Ga Moela, the more common rule was 'first some for all'. A water fetcher could only take a certain quantity, and then had to give the turn to the next person so that everyone got a minimum quantity first. After everyone had their turn, households could come for a second or third fill. As one respondent explained, this rule ensures that "no one fills a lot of containers while others are still waiting for their first fill", and "priority is given to those who have smaller containers".

In Ga Mokgotho, where there was reliable rotational water availability, turns could also be fixed for households by time of day or day of the week. Turns could range from one to five hours. If there was no queue, it was a good practice for someone who had finished taking water to inform the next household that the tap was now available. Similarly, it was forbidden to just remove a hosepipe connected to a tap without informing the owner of the pipe.

Sharing arrangements were based more on volumes and less on a person's water needs. Larger families, for example, had to abide by the 'first some for all' rule in Ga Moela. As one respondent clarified, "I live alone, so I don't have to queue up for several rounds. I am better off compared to those who have to go for more rounds." Similarly, it was seen as everybody's right to decide what to use the water for—domestic use, livestock, irrigation or otherwise. For example, one respondent filled all her storage and continued to irrigate, and only then handed the tap over to the next household. Very few respondents in both villages said water use for irrigation, livestock and brickmaking had a lower priority than domestic use. Households decided how the water was used. However, limited availability stifled more uses, as one respondent in Ga Moela said: "I need to have water from the tap regularly so that I can start irrigating." Only one respondent in the survey said that water from the communal system, which was of a better quality, should be reserved for domestic uses while river water could be used for irrigation.

Even when households agreed about rules for sharing, they were not always implemented. Respondents complained that "some households take water for more than two hours". One respondent in Ga Mokgotho narrated: "My neighbor just attaches her hosepipe to the tap. I have tried to confront her, but the same problem occurred again. Now I do not talk to her anymore. Two of the other four households that share our tap also confronted her but without any result." A similar story was noted in the Tawaneng section in Ga Moela. One respondent said, "When the hosepipe is in their house, it does not come out." As water supply ceases at 5 pm, this respondent had to fall back on a hand-dug well for his domestic water.

Another set of rules prohibited wasting water. Taps had to be turned off after filling water. Children had to be taught to turn off the tap and not to play with taps. Hosepipes had to be tightly connected to the tap to avoid leaks and not left on the ground lest water be wasted when supply is resumed. Respondents in Ga Moela added how animals in search of water could damage taps, and should therefore be kept at a distance. However, these rules were difficult to enforce.

As advised by Tsogang, about 50% of the respondents in Ga Mokgotho and about 80% in Ga Moela fixed locks to their taps to enforce water-sharing rules and to avoid leakage. This prevented theft of the tap and damage by children. It also enabled total closure when pipes had to be repaired. If it was not possible for every household to have a key to the tap locks, some households were given custody of the keys, to be shared with others as needed.

In Ga Mokgotho, respondents reported several issues relating to locks such as broken locks, lost keys, cost of locks, and mismatch between locks and taps. Two respondents said taps should remain open so that people passing by can get water.

Some respondents tried to address the breach of rules at a higher organizational level than the group of households sharing the tap. One respondent in Ga Mokgotho said he supported taking these issues to the MUS Forum: "Some people are afraid to raise water issues during community meetings at the tribal office. However, people should speak up confidently about their problems to the water committee." In Tawaneng, another respondent tried in vain to elicit the help of the volunteer pump operator in enforcing rules: "We told the pump operator about a problem but she could not resolve the issue either; so we kept quiet to avoid a quarrel." The importance of a higher-level community structure to assist in agreeing on and enforcing rules was felt in Letlabela. Immediately after finalizing new storage and reticulation, a woman in one household illegally connected a pipe to her yard. Tsogang invoked the rule against illegal connections in the Sekhukhune District Municipality and the MUS Forum reprimanded her. After this, Tsogang changed the tap location and added a tap.

According to all respondents, the only solution to these tensions of water sharing and damage to street taps is to have yard connections, fed by sufficient supplies, and possibly equipped with meters to measure water use.

Jojo Beneficiaries in Both Villages

As indicated earlier, community water supply systems in both Ga Mokgotho and Ga Moela led to a steep increase in water use by beneficiaries of household jojos, even more than for other respondents.

In Ga Mokgotho, there were 15 jojo beneficiaries, selected by the MUS Forum from a list of needy households maintained by the ward committee. Seven of the respondents of our postconstruction survey were jojo beneficiaries. Some of them had applied for a jojo; to others, the award of a jojo was a surprise. One of them had left Ga Mokgotho in the meantime, and the jojo given to him was kept at the tribal office. With year-round reliable water supply being available from the communal system, all the jojo beneficiaries in our sample used the jojo as storage, and not for rainwater harvesting. Asked about possible disadvantages, one respondent explained how her jojo was constructed near a road, so people were able to see it. Some people seemed somewhat jealous that she had got a jojo instead of them.

In Ga Moela, the chief led the selection of jojo beneficiaries. He included households that could not be reached by the new reticulation. Half of the jojos were used mainly for rooftop rainwater harvesting, and half for storage. One satisfied beneficiary filled the jojo with water from a nearby stream that provided abundant water (the largest user, see Annex 2). On the other hand, a respondent who lived at an elevated site did not accept the offer as there was no nearby water source from which to fill the jojo. An elder woman beneficiary did not use it at all, and stored it, unused, at her son's homestead. Lastly, the three most active MUS Forum members also got a jojo. Their jojos had been initially allocated to others, but those beneficiaries had moved out of the village or otherwise did not need one. Other MUS Forum members were somewhat unhappy about this. Two of the MUS Forum members who were given jojos were active farmers and justified having a jojo because it enabled irrigation and was in line with the project's aim to promote agricultural water use. One of them who used her jojo for irrigation at her homestead said: "The jojo has changed our lives as we can store water now." The other set up the jojo in his distant field, filling it with water from the nearby stream. The third MUS Forum member filled his jojo at his homestead with water from the reticulation system. The only disadvantage of jojos mentioned in our survey was that without water they can crack or be blown about by the wind.

Improved water supplies led to the use of water for multiple purposes, as discussed in the following chapter. These uses, in turn, brought more livelihood benefits to Ga Mokgotho and Ga Moela, as will be discussed after that.

More Multiple Uses

Multiple Uses

When we looked at the water-use patterns in the two villages, we found that only 10% of the households in Ga Mokgotho (Figure 7) and 5% in Ga Moela (Figure 8) used water from their infrastructure exclusively for domestic purposes.

In Ga Mokgotho, most households surveyed (64%) used or reused water for three purposes: domestic use, irrigation and livestock needs. Irrigation was practiced by 86% of the households. This includes the 64% of households using water for three purposes plus 22% of households that used water for both domestic as well as irrigation

purposes. In 68% of the households, livestock received water, so the same 64% plus 4% of the households reported using their water for domestic as well as livestock purposes (Figure 7).

In Ga Moela, a village with more livestock, a higher proportion of households used the communal system for livestock than in Ga Mokgotho. The total proportion of 82% is the sum of the households using water for domestic purposes and livestock (41%) and the proportion of households that use water for the three purposes (also 41%). The proportion of households that irrigate is less than in Ga Mokgotho. This is just over half (54%), which is the sum of households using water for three purposes and households using water for domestic needs and irrigation (13%) (Figure 8).

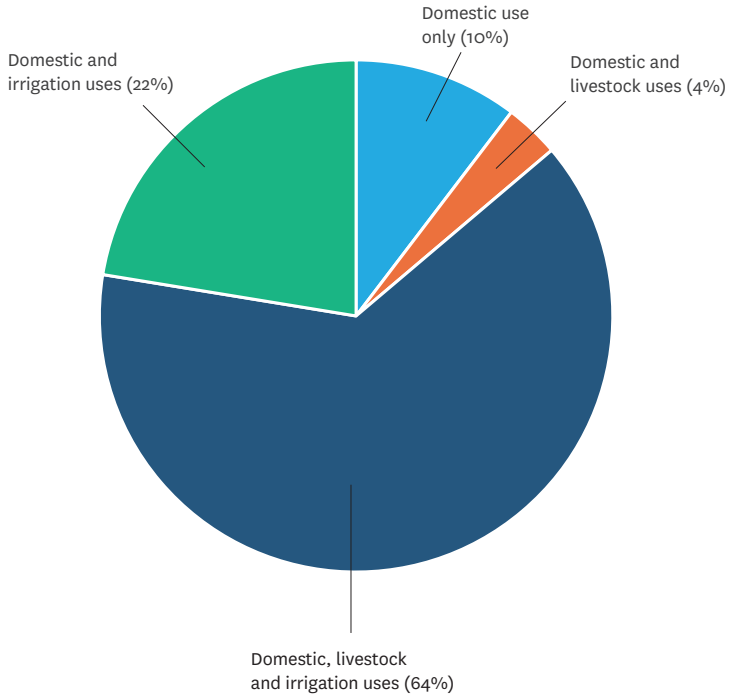

Figure 7. Household water-use pattern (n=59) in Ga Mokgotho.

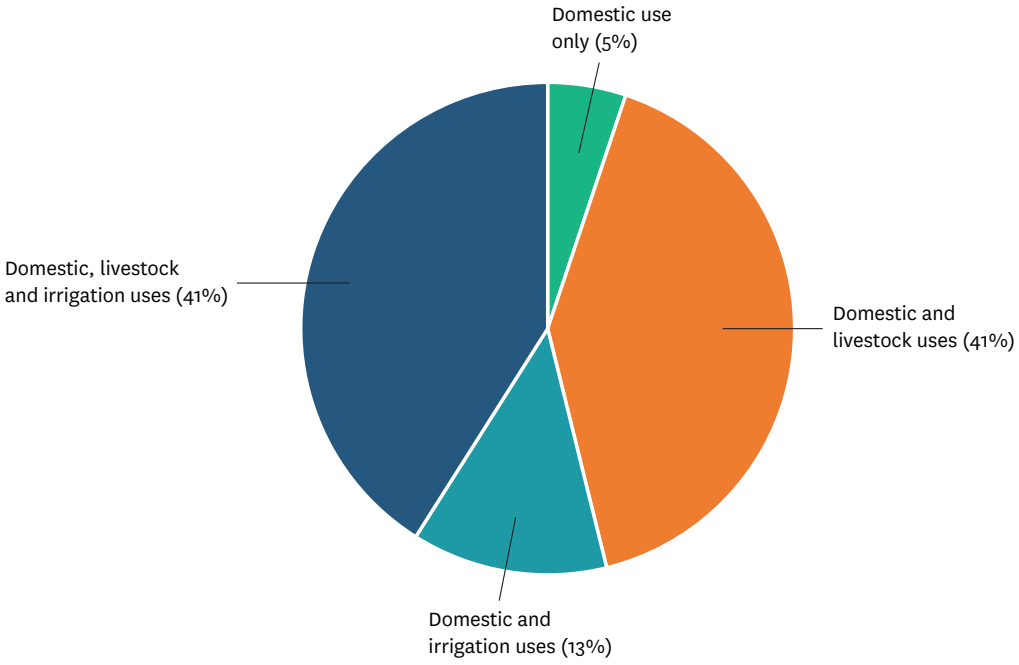

Figure 8. Household water-use pattern (n=39) in Ga Moela.

Irregular water uses, such as brickmaking, are discussed further below.

These findings underline how water infrastructure to homesteads, whether a communal water system, private pipes or boreholes, usually serve multiple needs. The multipurpose character of infrastructure to homesteads held for primary and secondary sources alike. In Ga Mokgotho, only four households (7% of the respondents) used one source for one purpose and a different source for a separate purpose. Two of these four exceptional households used the communal system as the primary source for their domestic uses and a private pipe (owned or borrowed from a neighbor) for irrigation. They explained that they avoided using the communal system for irrigation because water was scarce and other households needed the water as well. Another of these four households did quite the opposite: They used a pipe to draw water from the communal water system to irrigate their yard, and a private pipe to fill a jojo for domestic use. For similar practical reasons, the fourth of these four households used a private pipe belonging to a neighbor to irrigate the vegetable plot adjacent to their yard, and her own storage from the communal system to irrigate another vegetable plot on the other side of their homestead.

Increased Water Use by Household Categories

In Figures 9 and 10, households are grouped into the same four categories according to their use of water: one category of households that used water for domestic purposes only; and three multiple use categories—domestic and livestock; domestic and irrigation; and domestic, livestock and irrigation. For each category, the average quantity of water used per person per day was calculated for 2018 and 2019, as derived from the quantity of water used per household per week and the number of household members. For 2019, two averages were calculated, one including the jojo beneficiaries and the other excluding them. The findings were analyzed with reference to South Africa's constitutional right to water and the Free Basic Water Policy, which mandates a minimum of 25 liters per capita per day (lpcd) (this analysis excluded a few households for which there were no appropriate data for all uses).

As Figure 9 shows, multiple uses already prevailed in Ga Mokgotho in 2018, but with average quantities less than the norm set by the Free Basic Water Policy. Also, the six households that used water only for domestic purposes in 2018 used *more* water per person per day than households in the three multiple use categories that year. This pattern of higher average water use by domestic-use-only households continued in 2019: these single-use households continued to use more water than households in two of the three multiple use categories with only the domestic-livestock-irrigation category using comparable quantities.

Figure 9 also shows that the relative increase in quantities per capita was highest for irrigating households. Overall, quantities of water used by jojo beneficiaries were considerably higher in 2019 than in 2018.

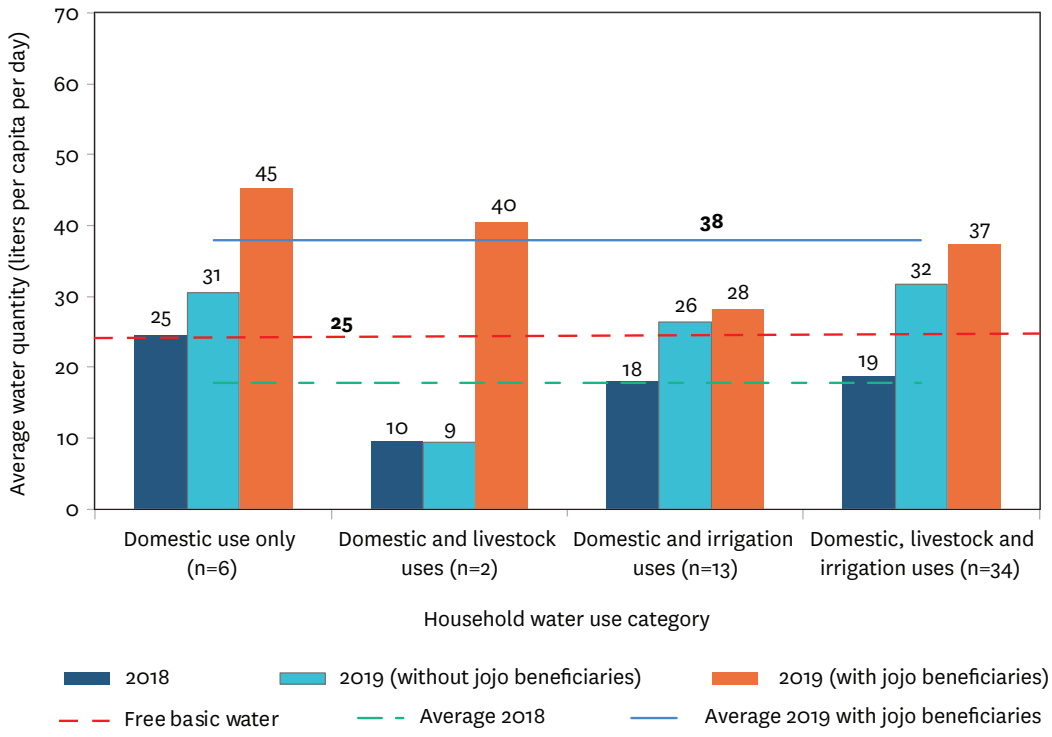

Figure 9. Pattern of water use (liters per capita per day) by homesteads (n=55) for various purposes in Ga Mokgotho in 2018 and 2019.

Figure 10 for Ga Moela shows that multiple uses of water took place well below the 25 lpcd norm for 30 of the 35 households analyzed. Unlike in Ga Mokgotho, average service levels (for multiple uses) of these 30 households remained below the 25 lpcd norm even after construction of the community water system, except in the case of jojo beneficiaries using water for domestic, livestock and irrigation purposes. The quantities used by the four households that irrigated (without livestock) increased the most – but their number was small. The impacts of the jojos on water quantities per person per day were mixed.

Overall, these findings challenge, first, the assumption that water uses up to the threshold of 25 lpcd only meet domestic uses and that multiple uses only start at higher service levels. Instead, in rural areas where people depend in many ways on water, they seek to meet all water needs from small volumes onward. Second, multipurpose infrastructure is the most common. This challenges the widespread assumption among water professionals that water systems are single use, so a 'domestic system' or an 'irrigation system'. The MUS project's recognition of these rural realities was welcomed. One respondent in Ga Mokgotho commented: "I already had awareness of multiple uses of water and I discussed it with my neighbor. I was happy and amazed that the idea was implemented in my village."

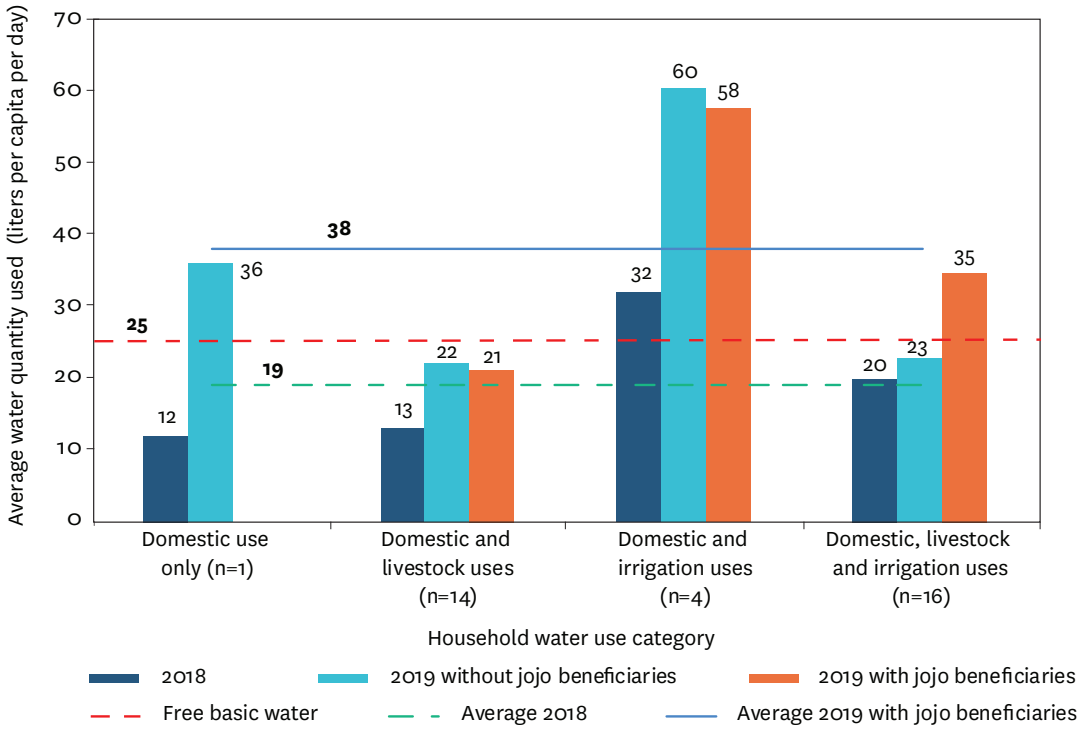

Figure 10. Pattern of water use (liters per capita per day) by homesteads (n=35) for various purposes in Ga Moela in 2018 and 2019.

Better Health, Nutrition and Income

By improving water supplies and supporting multiple uses, the MUS project generated more benefits from these water uses.

Domestic Uses: Less Effort, Better Health

Water use to meet domestic needs increased in both villages. All respondents in Ga Mokgotho, except one, reported using more water for domestic purposes, in particular for washing blankets ("before only once a year, but now every two months") and clothes ("once a week now"), but also for bathing and cleaning floors and windows.

In Ga Moela, the new communal water system became the primary source for drinking and other domestic uses for almost all respondents connected to the system. Water availability with relatively less effort led to an increase in the quantities used, even for laundry. Whereas villagers used to walk far to the river or to the Lerato Secondary School borehole or carried buckets of water home to wash their clothes, they could now do it at home at any time.

Only two households still used the well or the river as their primary source for laundry and bathing. By doing this, one of them sought "to save water from the tap". The other did not want to confront the neighboring household that refused to share water with them. Eight households exercised both options: they sometimes did their laundry at home and sometimes took it to the well or river. Two respondents explicitly mentioned the cost saving thanks to the MUS project; they no longer had to buy water—at ZAR 170 for four 210-liter drums—even for bathing.

The quality of water for drinking also improved in both villages. However, in Ga Mokgotho, only a fifth of the respondents noted this improvement as a result of the project's spring protection to avoid debris, cleaning of the reservoir and the high pressure. The latter made the water look whitish. Water was also cooler, so it was seen as better for health. In spite of noting the better quality, one household continued treating the water before consumption while another stopped aloe treatment and yet another household stopped boiling the water. The other four-fifths of respondents thought that the water quality was the same as before. One of these respondents explained that water was sometimes still brownish with sediments, especially in the rainy season. Only one of these other households always boiled water.

In contrast, respondents in Ga Moela were unanimous in reporting a major improvement in water quality and, as one of them reported, "not having to share dirty well water with animals anymore". Two respondents reported that "the pipe has some smell of oil but it has reduced over time". Nevertheless, despite the perception of better quality, only one household stopped treating water for drinking whereas three continued treating it with bleach or vinegar.

The NGO Tsogang aimed to enhance these health benefits by training villagers on handwashing and water treatment options, including bleach (with a chlorine tester to assess chlorine concentration) and boiling water for drinking. The training also discussed how indigenous filters like sand, rocks and cloth removed physical dirt from the water.

Water for Livestock

Water use for livestock also improved in both villages. In Ga Mokgotho, two-thirds of the households had one or more types of livestock. Poultry was the most common (kept by 61% of the livestock-keeping households), followed by goats (55%) and cattle (34%). Very few kept cats or dogs. Almost half of these households noted a positive change in water availability for livestock. One respondent said, "This year I could give more water to livestock without thinking twice. Last year the priority was for domestic use, and livestock got less water." One respondent said her poultry had more water now and this was attracting wild pigeons, which are food to her. Water quality had improved as well. Instead of reusing bath water, villagers were now filling cleaner and cooler water in the containers once every one or two days. Poultry, which had to fend for itself in 2018, had sufficient water in 2019. New cattle troughs were the sign of a positive change for 11% of the livestock-owning households. Cattle did not have to be taken to distant places to graze and drink, sometimes returning home after two weeks. The troughs also alleviated the burden of providing water for livestock at homesteads.

In Ga Moela, most respondents (82%) had one or more types of livestock, mostly poultry and goats but also cattle, donkeys, and cats and dogs. In 2018, livestock uses were served by shallow wells, rivers, reuse of water at homesteads or purchased water.

Postconstruction, out of the 17 households that had cattle, 11 continued to use a distant well or river as their primary source. The cattle belonging to other respondents drank at the homestead as a primary source (three households); both at the homestead and a distant source (two); and the new animal trough (one). In seven households, goats continued to drink water from distant sources. Six households gave tap water to their goats at the homesteads; two households reused water. Five households with goats used the new trough as a primary source. Poultry directly benefitted from tap water in the 17 poultry-keeping households. For one respondent, more and cleaner water contributed to an increase in the number of chicken. Poultry from five households drank from the new trough. Similar sources held for the 13 households with cats and dogs: most households gave them tap water. The trough was the primary source for four such households.

Irrigation for Nutrition and Income

Ga Mokgotho

More irrigation

Our study showed that irrigation yields in both villages expanded as an outcome of the community water system. In Ga Mokgotho, improved water supplies boosted irrigation of both fruit trees and vegetables and planting of new seedlings. Out of the 51 irrigating households in 2019 (86% of the sample), 41 households indicated an increase in the water quantities they were using. In ten of these cases, irrigation was newly taken up in 2019. Eight of the remaining 10 irrigating households used the same quantities as before but still noted improvements in water pressure, taps closer, and fixed, reliability and frequency of water supply. Also, in 2018, trees used to be mainly irrigated with bathing or laundry water. Some households removed the soapsuds by adding ash. After the improvements, water from the communal system was also directly used to irrigate.

Benefits in homestead irrigation largely accrued to women as 68% of the households with homestead cultivation were managed by women; 17% mainly by women; and

9% by both women and men equally. In only 6% of the households with homestead cultivation was cultivation exclusively managed by men (See Figure 11).

The 14% of sample households that still did not irrigate in 2019 had diverse reasons for not doing so. In order of frequency with which they were mentioned, these reasons were: "using the communal tap for irrigation may lead to deficiency of water in other communal taps"; "we irrigate at a distant field instead of the homestead"; "we are not staying at the homestead all the time because of employment elsewhere"; and "I am disabled".

Fruit trees

Most households irrigated fruit trees. In order of frequency, these were: mango (by 84% of fruit tree growing households), banana, avocado, papaya, orange, guava and peach. Other fruit trees irrigated were pomegranate, grapes, apples and apricot. Mangoes were the most common cash fruit and sold to the manufacturing facility of achar (pickle) in Ga Mokgotho or to other markets. A proportion of the mangoes and larger proportions of fruits from other trees were consumed, especially when trees were few and the yields low.

Figure 11. New homestead cultivation in Ga Mokgotho (*photo:* Barbara van Koppen).

At the time of the interviews, which was the initial stage of fruit production, respondents reported good growth of fruits as a result of better watering. In the case of 38 of the 51 respondents in Ga Mokgotho, the data collected were sufficiently detailed to compare production in 2018 with estimates of future production. Assuming normal weather, the total yields harvested in 2018 and the estimates for 2019 were calculated (Figure 12). For mango, the most important fruit, yields were expected to increase by 36% from 1,267 crates in 2018 to 1,722 crates in 2019. The total yield of all fruit trees was expected to move from 1,447 crates to 2,112 crates, an increase of 46%. The unit price of produce was projected to increase by an average of 2.8% in 2019 compared to 2018.

As respondents expected prices to slightly increase as well, the aggregate gross market value of all fruit tree yields (irrespective of their factual use for the household's own consumption) is shown in Figure 13.

Figure 13 shows that the value of mangoes is expected to increase by 53% from ZAR 101,320 in 2018 to ZAR 154,980 in 2019. The total value of all fruits was expected to increase by 60% from ZAR 110,300 to ZAR 176,281.

For extrapolation of these findings to all 800 households in Ga Mokgotho, it was assumed that the 38 households with valid data were representative of all 51 irrigating households in the village and that the randomly selected sample of 59 households was representative of the 800 households of Ga Mokgotho. It was thus inferred that 692 households irrigate fruit trees. This equals a total value of ZAR 2,324,123 in 2018 and, with an increase of 60% (ZAR 1,389,075), a total value of ZAR 3,713,198 in 2019.

Vegetables

Vegetables are the other important irrigated crop in Ga Mokgotho, in particular spinach, cabbage and onions. Beetroot, butternut, chillies and lentils are grown less

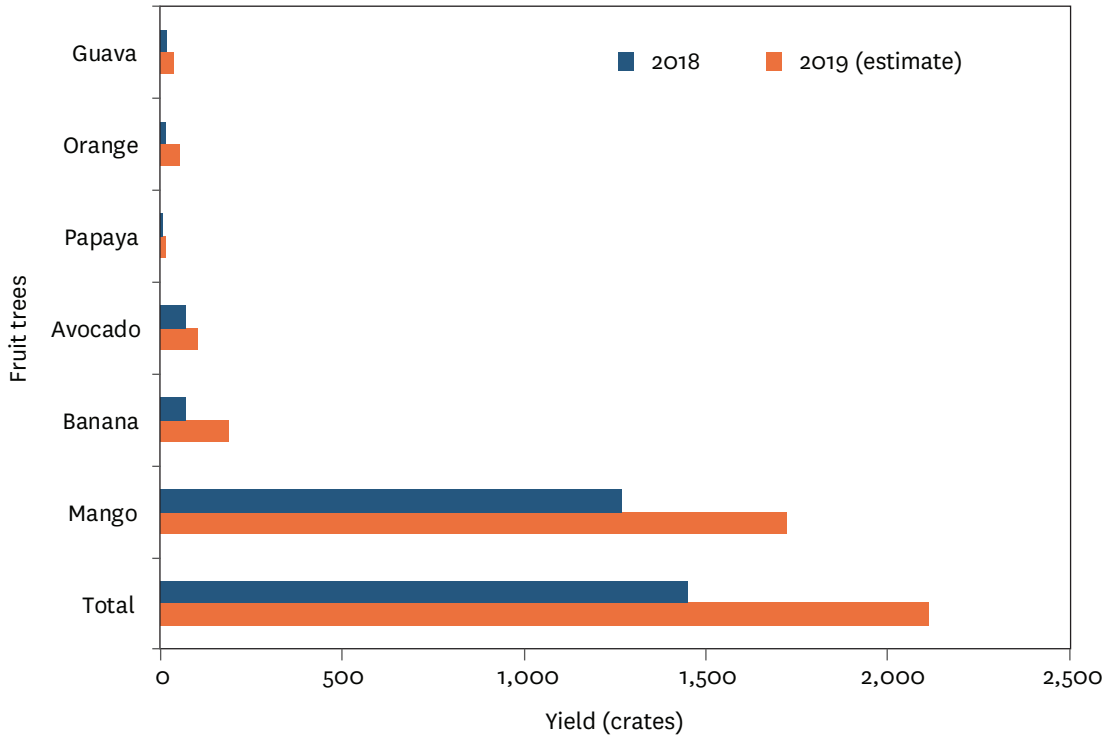

Figure 12. A comparison of yields from fruit trees in Ga Mokgotho in 2018 and (estimated) in 2019 (n=38 households).

frequently, and flowers and sugarcane on rare occasions. Vegetables are mostly used for own consumption. However, some households sell their vegetables, and one respondent started a nursery enterprise.

Improved irrigation also led to higher yields of vegetables. For example, based on past yields and on already-harvested or estimated future production, groundnut yields were projected to increase by 105%, from 959 kg in 2018 to 1,963 kg in 2019. For tomatoes, the calculated increase in yields was 28%, from 48 crates in 2018 to 62 crates in 2019.

Tsogang's proactive encouragement of irrigation throughout the MUS project and their training of villagers on 'how to sell and earn money' were appreciated in Ga Mokgotho. In sum, in addition to meeting domestic and livestock water needs, availability of water for irrigation contributed to higher productivity, better nutrition, food security and income, and to self-esteem among the villagers, as was evident in the comment by one respondent: "We are now a developing village as we have more water for production."

Ga Moela

More irrigation

As mentioned above, 54% of sample households in Ga Moela irrigated in 2019. Fifty percent (21 respondents) irrigated at their homesteads. They directly used water from the new system or they reused bath or laundry water for irrigation. For the majority (81%) of these homestead irrigators, the new water supply systems had enabled taking up irrigation for the first time, or the system had improved yields compared to 2018. Some households combined water from the tap with water from streams. The remaining 4% of the sample households irrigated distant fields, using other water sources. This included the above-mentioned MUS Forum member who used his jojo in his distant field.

Irrigation was mainly or exclusively for own consumption. Only five respondents, including two MUS Forum members with jojos, sold irrigated produce. Women managed irrigated cultivation in 60% of the cases; men managed in 25%; and both women and men were managers in 15% of the irrigating households.

For all the respondents who did not irrigate, the single most important reason was the lack of sufficient water. The taps were still far away. One respondent said she did not want to reuse water for irrigation. Moreover, respondents referred to a rule that the communal system should not be used for irrigation in order to save on fuel for pumping and to ensure that everybody gets water. Yet, many expressed a desire to get more fuel from the municipality so that there would be more water available for irrigation. They were interested in further training. A less often cited reason for not irrigating was the absence of fencing: livestock would destroy the unprotected plants.

Fruit trees

Most irrigating households irrigated fruit trees such as (in order of frequency) peach, granadilla, grapes, guava, mango, apple, avocado and apricot. In the interviews conducted for this study, which took place in the initial stage of fruit production, respondents reported good growth of fruits. Based on detailed data from 16 of the

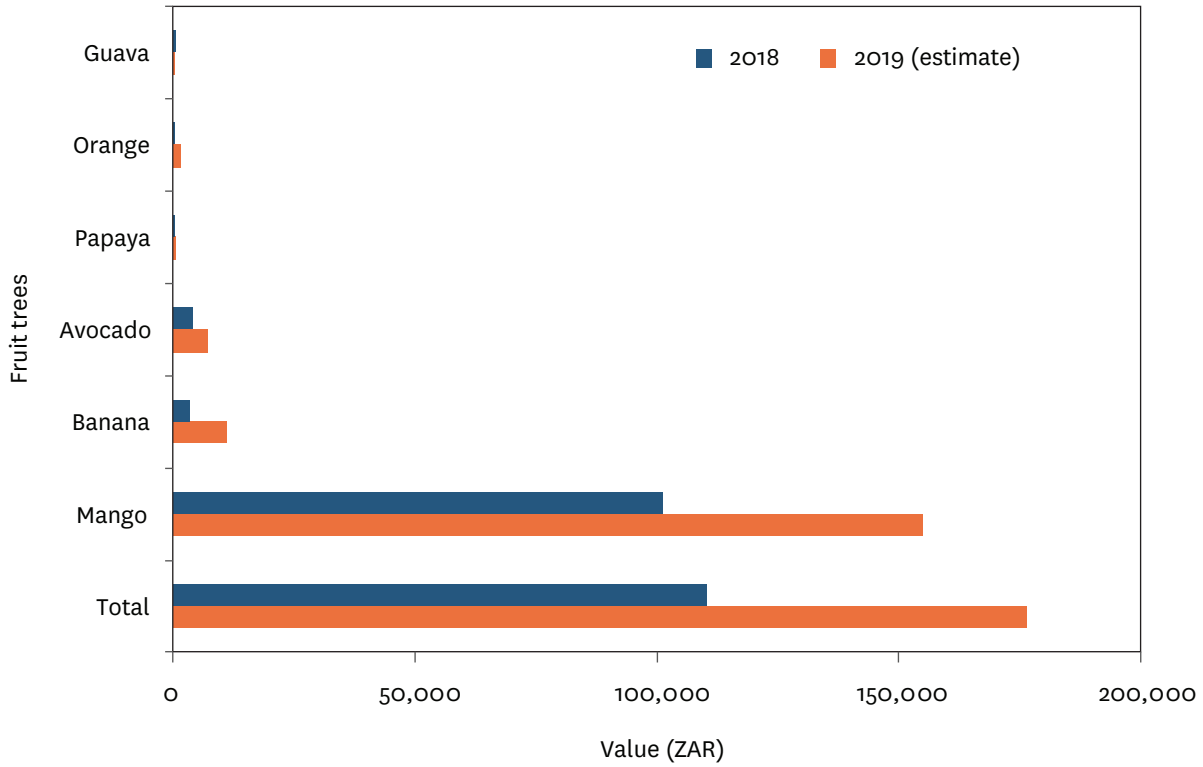

Figure 13. Market value (ZAR) of yield from the main fruit trees in Ga Mokgotho in 2018 and (estimated) in 2019 (n=38 households).

21 irrigating households and on estimates of future production assuming normal weather conditions, the total yields harvested in 2018 and the estimates for 2019 were calculated (Figure 14). The total yields increased by 46% from 280 crates in 2018 to 439 crates in 2019.

Figure 15 shows the growth of the monetary value of fruits, irrespective of use, based on the respondents' given market prices. The estimated total value of irrigated fruits increased by 64% from ZAR 29,860 in 2018 to ZAR 48,850 in 2019 as a result of improved water availability and price rise. The unit price of produce increased by an average of 3% in 2019 compared to 2018.

Vegetables
The second most important irrigated crop in Ga Moela was vegetables: potato, beans, onion, tomatoes, beetroot, spinach, carrot and minimal sweet potato. Figures 16 and 17 are based on data from the 16 irrigating households. Total yields increased by 34% from 273 crates in 2018 to 366 crates in 2019.

The monetary value of vegetable produce is shown in Figure 17. The total value increased by 95% from ZAR 18,930 in 2018 to ZAR 36,820 in 2019, especially because of a major increase in the value of profitable potatoes. The average increase in the price of vegetable produce was 7.8%, mainly contributed by beetroot and sweet potatoes.

As for Ga Mokgotho, to extrapolate these findings on the value created by irrigation to the entire village of Ga Moela, it was assumed that the 16 households with valid data were representative of all 21 irrigating households and that the randomly selected sample of 42 households was representative of the 108 households in Ga Moela. So, 54 households were assumed to irrigate.

So, for the whole of Ga Moela village, irrigation of fruit trees would increase the value produced by 64%, from ZAR 100,778 in 2018 to ZAR 164,869 in 2019.

Similarly, for the whole of Ga Moela, irrigation for vegetable production would increase the value produced by 95%, from ZAR 63,889 in 2018 to ZAR 124,268 in 2019.

Taking the value of irrigated fruit trees and vegetables together, irrigation in 2018 was calculated to have created a value of ZAR 164,666. Due to the MUS project, the estimated value of irrigated produce was ZAR 289,136 in 2019. This represents an increase of ZAR 124,470, so 76%.

In sum, in addition to better meeting domestic and livestock water needs, more irrigation contributed to higher productivity, better nutrition, food security, and added value of ZAR 124,470. However, water scarcity remains the main impediment to broader irrigation uptake.

Improved Other Uses

In both Ga Mokgotho and Ga Moela, the new water supply systems improved uses other than domestic, livestock or irrigation purposes. The most common of these other purposes that was facilitated by the new

water system was brickmaking for house construction. Some respondents also said that they mixed water with cow dung for floor protection. Others used water to settle dust, and for wall decoration. Water continued to be provided to neighbors who asked for it. Income generation was enabled for several respondents by using water in their tuck shops, or for making artwork for sale, or by selling water. These benefits further contributed to the health, nutrition and income generated by the improved water supplies.

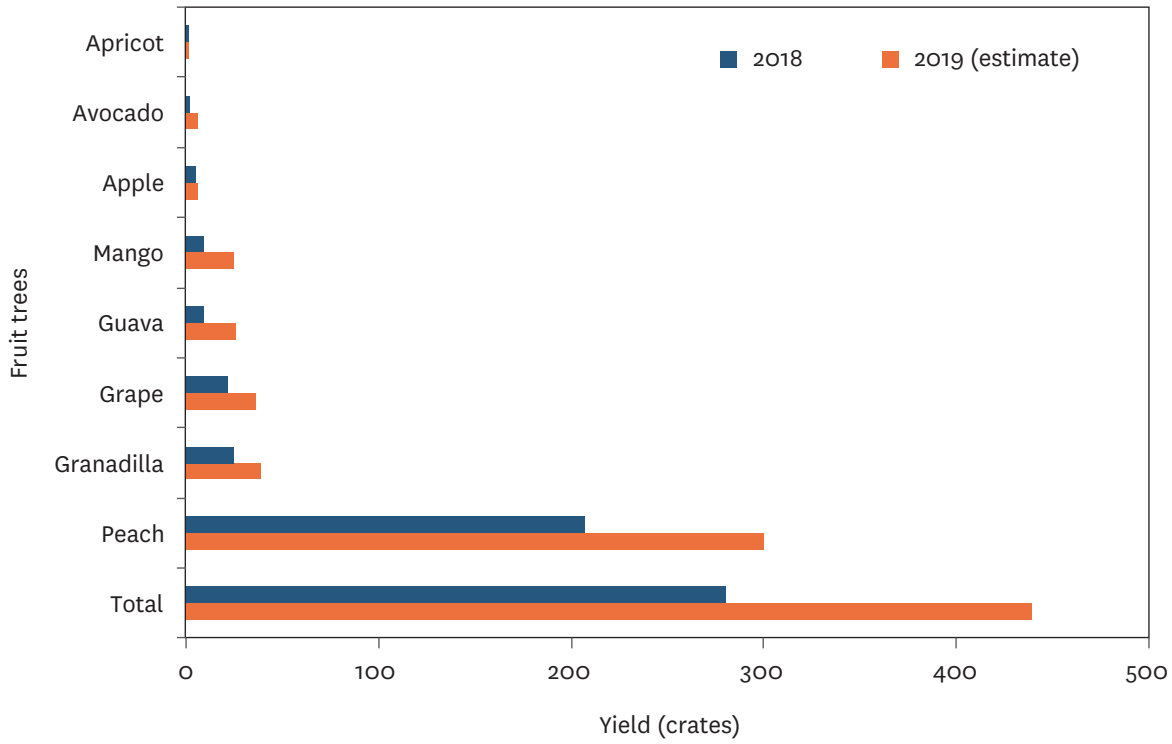

Figure 14. A comparison of total yields of main fruit trees in Ga Moela in 2018 and (estimated) in 2019 (n=16 households).

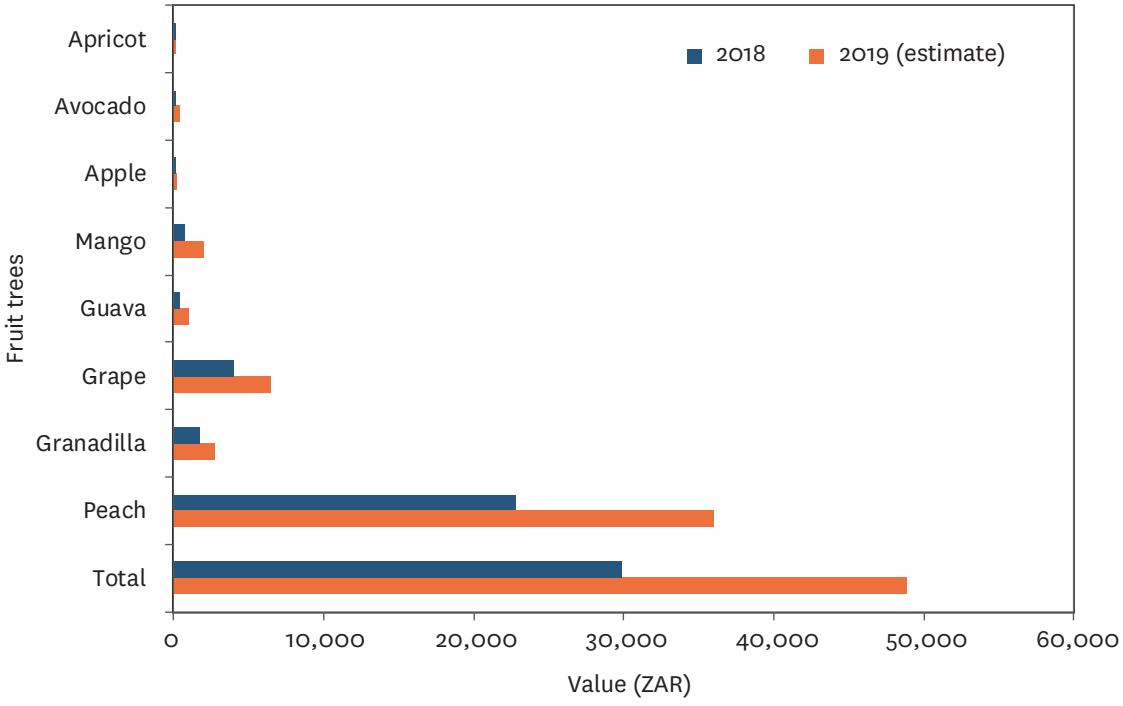

Figure 15. A comparison of the total market value (in ZAR) of yields from the main fruit trees in Ga Moela in 2018 and (estimated) in 2019 (n=16 households).

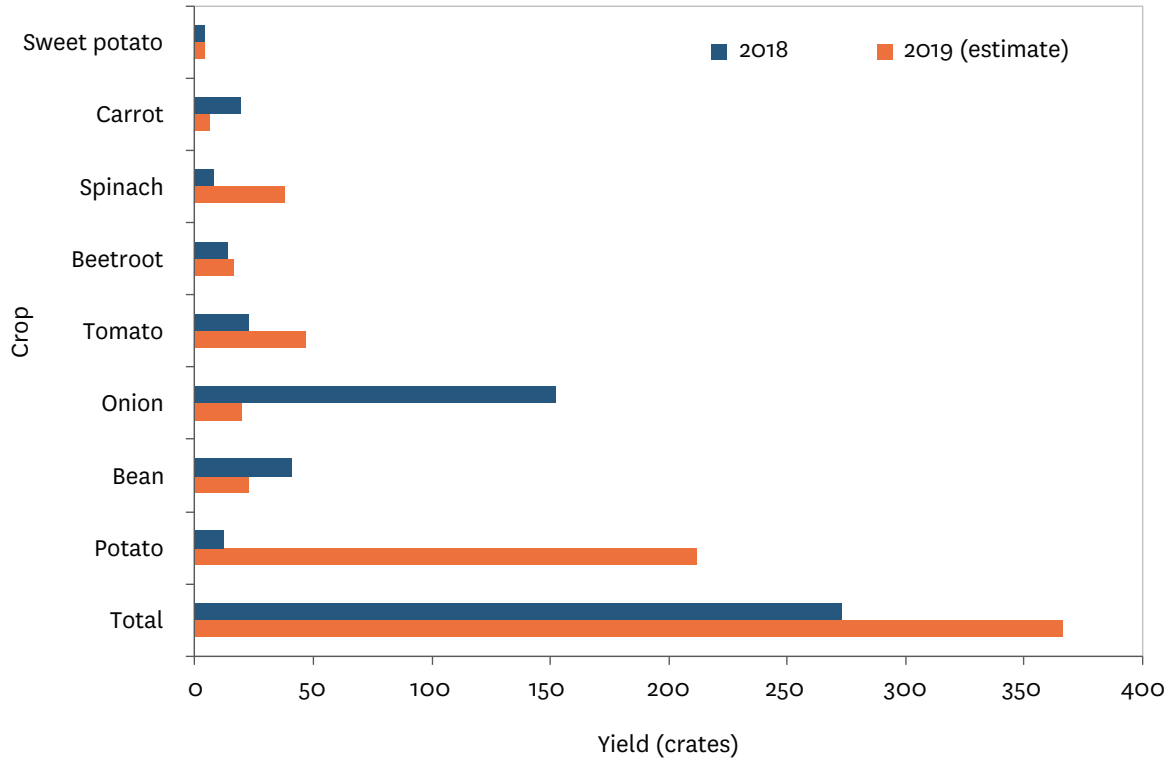

Figure 16. A comparison of the total vegetable yields (in crates) in Ga Moela in 2018 and (estimated) in 2019 (n=16 households).

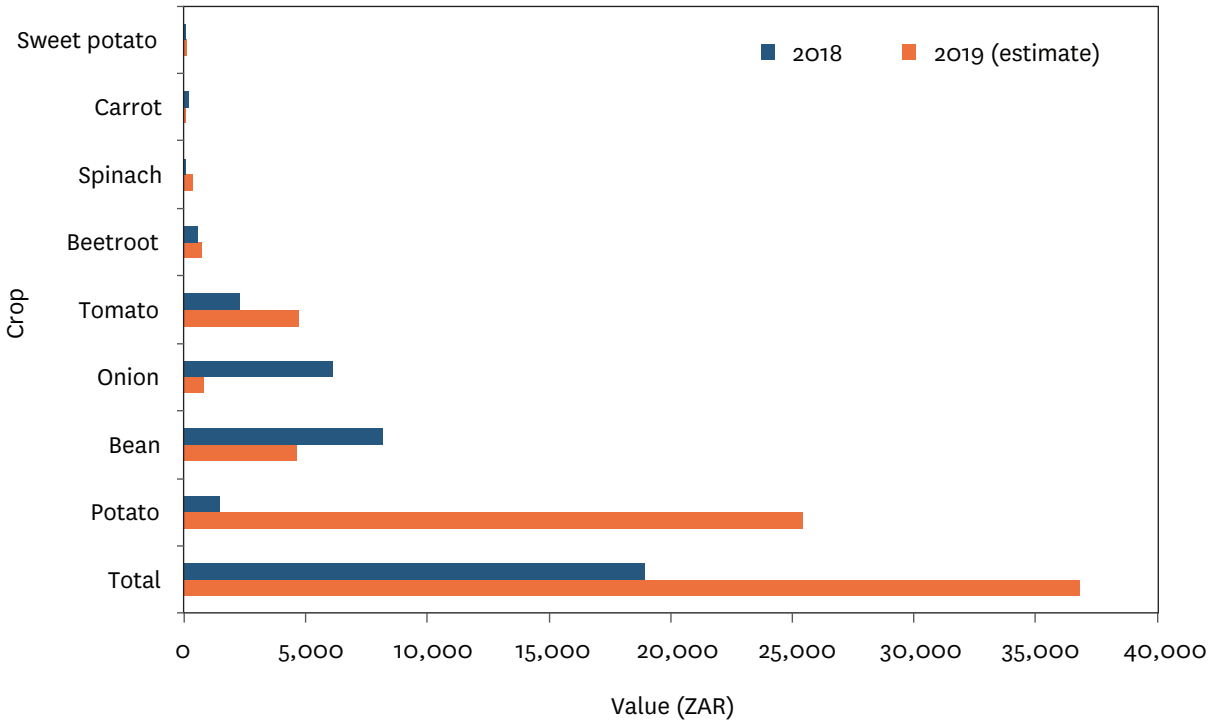

Figure 17. A comparison of the total gross income (in ZAR) from vegetable yields in Ga Moela in 2018 and (estimated) in 2019 (n=16 households).

External Support and Co-management

This section moves from the local processes to external support agencies. It presents the perceptions of the survey respondents and MUS Forum members in both villages on the external support as provided by Tsogang during the MUS project's process, also comparing it with earlier experiences of interventions managed by contractors; and their views on longer-term co-management with the government.

Ga Mokgotho

Process and Outcomes

In Ga Mokgotho, respondents and MUS Forum members unambiguously appreciated the overall process and capacity development, as implemented by Tsogang, as indicated by some of the responses: "They fulfilled their promises"; "a great job done"; "Tsogang listened to our thoughts and perceptions"; and "they allowed the community to learn by doing it themselves". The aspects of learning that were positively received included: "working as a team in the community"; "doing things on our own"; and "learning to organize and raise community problems and making the community share ideas". In particular, respondents mentioned participatory mapping, which they said created awareness and provided insights into the importance of water, water reticulation, storage, irrigation, and the need to save water and prevent children from tampering with taps. "The meetings were empowering and educative to us," said one respondent. In the words of another, the major advantage of this approach was that once the contractor had left, "the community can sustain and take responsibility for the infrastructure and the project." Other appreciative observations included: "A community-driven process makes the community stronger" and "we would not vandalize resources because we worked extremely hard for them".

The respondents compared the community-driven approach of the MUS project with their earlier experiences with contractors. Their complaints were: "A contractor comes and goes"; "he does not listen"; "he works on his own terms"; and "he may even run away before finishing the project". There was emphasis on sustainability in these observations of respondents: "If the community is not involved in fixing taps, the community cannot do anything itself about a new system when he (the contractor) has gone." A few other respondents were milder in their recall of the previous contractor experience: "They can work according to their rules as long as the community gets water and the promised results are met." Nevertheless, "contractors should at least inform the tribal authority and explain the work plan, and be transparent about the process." The community should also "talk to contractors to get involved in the construction process so that they can learn and maintain the system and the infrastructure".

In sum, the respondents felt that in all collaboration projects with external support agencies the community should *lead* the project because "the project is for us". As one respondent said, "We know our problems, needs and struggles best."

Future Co-management

Our survey in Ga Mokgotho also explored the respondents' expectations of the long-term roles that should be played by communities and the government in relation to co-management of water services provision. The most frequently mentioned respondent expectation from the government was something that had not been achieved during the MUS project either: that of ensuring a homestead connection for every household. Some residents even expected the government to drill more boreholes to achieve this goal. However, one respondent remarked, "If the government does not help with household connections, the community should help each other."

The second most common expectation was that the government should provide materials to increase water supply by tapping into more distant streams; materials for maintenance of the infrastructure; and materials to fence the communal storage. Bigger, galvanized pipes would better prevent leakage. Residents also stated that all sections and households should be supplied with water. The provision of individual jojos would help households to store water for irrigation.

Other roles of the government, in order of frequency mentioned, were: paying the people who look after the reservoir; treating and purifying water; bringing knowledgeable persons to advise, plan and teach the community how to do it; fining people who use water unnecessarily; giving crop seeds for irrigation; and providing a toilet at the public graveyard.

As co-management is a two-way process, respondents agreed that community members should attend all meetings and discuss the scope of work. Volunteers should help to dig trenches, and households could pay for their own taps, although one respondent expressed the reservation that not every villager would be able to contribute money. Two respondents said "the community has done a lot so far; the municipality should help now". Others said the government was often slow and ineffective in responding to community needs; hence, "it is better to do it ourselves".

Respondents also reflected on the importance of good leadership in future support and co-management. The selection of a committee, in collaboration with the tribal authority, was critical. As one respondent said, "We know about each other's efforts and diligence; so we can select the best persons to lead the project."

Another respondent said, "The committee should plan the various steps of the project, and be involved in it from planning to the final stage." Other respondents emphasized different responsibilities for the committee: It should "ask the community what their problems are and what they want implemented"; and it should "draw up a list of materials needed for the reticulation lines and take the lead on procurement". Another respondent suggested that by hiring local labor instead of bringing subcontractors from elsewhere and by being involved in the construction process "we can learn and maintain the system and infrastructure". When a problem arose, "the committee should inform the tribal authority, who will alert the community to find a solution". Moreover, "the budget and expenditure should be made transparent by showing quotes and receipts"; and the community should "be united to improve themselves as a community, attend meetings and support and not undermine each other".

Ga Moela

Process and Outcomes

In Ga Moela too, the respondents liked the process as implemented by Tsogang. Their observations on the NGO were positive: Tsogang "is reliable"; "it comes back to check whether it works"; and "finishes work and keeps promises". Respondents appreciated how Tsogang introduced itself to the community, listened to the villagers and let the community take the decisions. Other appreciative responses from respondents included: Tsogang "involved the chief"; "handed the project over to the community to lead it"; and "taught us how to work independently". Tsogang staff also came in for praise by the respondents: they "worked very well with us"; they were "energetic", "hardworking" and "passionate about their work". One respondent in particular emphasized, "They do not discriminate; they involve everyone, including the poorer people." Regarding particular aspects of the project that they noticed, the respondents pointed out: "Tsogang designed the map with us"; "guided the village and helped in planning water supply, training and organization"; "finished sections left open by contractors (Tawaneng)"; "provided material, including household jojos"; "monitored people on how to build infrastructure"; and "made sure the community is doing its work to get water". The process developed community capacities—both technical (digging trenches, laying and connecting pipes, knowledge of water management) and institutional (working together as a community).

Most respondents were satisfied with the information provided by Tsogang. However, one of them regretted that Tsogang only met with the MUS Forum members but not the whole community. Regarding the project budget, most respondents found that Tsogang clearly explained it and provided clarity on the accounts. "They showed us purchase records," said one respondent. However, two respondents wanted more clarity on budgets, "which did not make sense" to them; and one of them said he was waiting for Tsogang's explanations on some of his queries. Another said he too had not received sufficient information, but did not mind "as long as the results were delivered".

Asked to point out any disadvantages of the project, most respondents said they did not see any. The few who noticed disadvantages included five respondents who were not serviced by the new system. The main disadvantage pointed out by respondents was the limited funding, which only partially satisfied their water needs. The capacity of the new storage reservoirs was too small. For some respondents, the taps were still too far from their homesteads. They wanted more household jojos and more galvanized steel pipes. Some wanted more information on gardening and irrigation. As in Ga Mokgotho, the villagers of Ga Moela also desired homestead taps which would spare them of the hassle of sharing water.

Given the negative past experiences with contractors in Ga Moela, the comparison between the participatory approach adopted by the MUS project and the contractor-led previous project was straightforward. Two respondents said every contractor should adopt the participatory process. One said, "I wish other projects would learn from MUS." Another compared it with the failed municipal project in the village of Ma-Chupi: "I wish they (the municipality) had given the ZAR 5.5 million project money to Tsogang; then there would have been water everywhere and money would have been saved to do other improvements."

Future Co-management

Unlike in Ga Mokgotho where light-touch support by the government to the existing gravity system would improve water distribution, maintenance and upgrades for better performance, the community in Ga Moela entirely depended on the municipality for first-time access to water from functioning boreholes. Further, the Mabusa/Moela sections still waited for the national electricity company to install an independent line to the electric booster pump. One respondent who had no access to municipal water points at all complained that "the municipality does not help with anything. We wonder if it even exists." Other respondents of Ga Moela noted: "The municipality pays the person who pumps the water and buys fuel for us" (in Mabusa); "the municipality replaced the diesel pump with a petrol pump"; and "in the past they helped sometimes with the diesel" (in Tawaneng/Letlabela).

The frustration that was most often mentioned in Ga Moela was that "the municipality takes time to respond to community needs" or "it keeps us waiting forever". Some other respondents, however, said: "they do their best"; or "that's the way it is". Respondents agreed that it would be quicker if the community took care of small repairs of taps and leakages, or, as one respondent from Letlabela highlighted, provided for petrol. Some villagers "already know how to do those repairs". Otherwise "people could

be trained to fix small repairs". The role of the municipality would then be to help in buying pipes and maintaining and fixing boreholes.

Respondents were generally ready to contribute labor and money, as they had already done to access unimproved sources or to purchase water. The problem as they saw it was organizational: how to avoid "some people benefiting without contributing". Further, "existing conflicts may lead to unfair contributions"; or the other way around: "disagreements in making contributions may result in conflicts". Moreover, "some households may not contribute as they may not earn much". Three respondents further highlighted that "when community contributions are limited, the quality of materials bought from local shops can be poor". Further, cheap material breaks down fast, which also causes conflict.

Lack of clarity on mutual roles and past unmet promises complicated collective fundraising because some users preferred waiting for the municipality to keep its promise even if it took a very long time. The proposed solution was that the municipality gives the money and villagers fix the problem, wherever possible. This lack of clarity on the municipality's role contributed to continued inaction by water users, the MUS Forum, the chief and Tsogang on strengthening organizational structures in the Letlabela and Mabusa/Moela sections to operate and maintain their respective schemes.

Conclusions

This in-depth comparison of the process and outcomes of community-led MUS showed how community participation from the early planning phase onward showed similar advantages in both villages. Community buy-in was strong. Participation mobilized local innovation to make use of multipurpose infrastructure. This cost-effectively led to better health, nutrition and income. Women benefitted in particular. Participation was also cost-effective because improvements were tailored to local conditions and mobilized communities' insights in, and priorities for, repairs, upgrades and next incremental improvements. The mobilization of local semiskilled and skilled workers not only ensured cost-effective and locally appropriate construction but also developed skills that stayed in the village. Local procurement of materials could have further reduced costs and developed skills and contacts with suppliers. All these features are key for the sustainability of the livelihood improvements in any local situation. The same participatory process is likely to generate similar outcomes in low-income rural areas elsewhere.

These benefits were created in a replicable sociotechnical process facilitation with technical and institutional capacity development, advice, supervision and quality control, besides financial support for materials and labor. In principle, governments can provide such support at scale as their share in co-management in any local situation.

Whereas the above-mentioned benefits of community-led MUS and support requirements are generic, this comparison also highlighted important local differences between the two villages in geohydrology, infrastructure and service levels, which further shaped the abilities of the community and the required external support in co-management.

In the large gravity system in the ever-expanding village of Ga Mokgotho, the MUS project reversed the failure of postconstruction community management and scheme dilapidation by establishing a member organization linked to both tribal and political structures and an accountable operator; and by providing materials and advice on repairs and upgrades. For the future, the community already sees small repairs as its own responsibility. As gravity energy is free, future support can probably remain, as the respondents in our survey indicated, a matter of providing materials on request for expansion, some technical and institutional advice, and remuneration of the operator. However, this does not still address the strong desire for household connections and expectations that the government will somehow provide for those. This latter aspiration warrants some further attention by the government or other support agencies to catalyze community organization for this last-mile service, and possibly the implementation of the long-awaited new and bigger system connected to the Diphalafaleng River.

In Ga Moela, the challenge was first-time access that entirely depended on municipal boreholes. The benefits that were experienced during the short use of the new storage and reticulation can only become sustainable when the municipal boreholes work and work harder than before. In co-management of boreholes, municipalities remain in the driver's seat. As part of the systematic change in local government that is called for, communities can participate more strongly. People in Ga Moela expressed willingness to take responsibility for quick responses to repair small breakdowns, and to organize the purchase of fuel and operate the pump. Financial support by the government would be even better. One section already proved its capacity to manage the—often underestimated—complexity of internal organization and steady fund

mobilization. However, municipalities' unmet promises can paralyze such initiatives. A first step toward co-management would be to agree on temporary or longer-term arrangements in which communities take up what they can and want to do to access water, and in which municipalities progressively do their critical part as they are realistically able to.

In sum, involving communities from the earliest phases onward in service provision mobilizes community innovation that sustainably caters for people's multiple water needs. However, the precise contents of co-management depend on local conditions. In this diversity, the government may just have to provide light-touch support or remain the pivot in providing water services.

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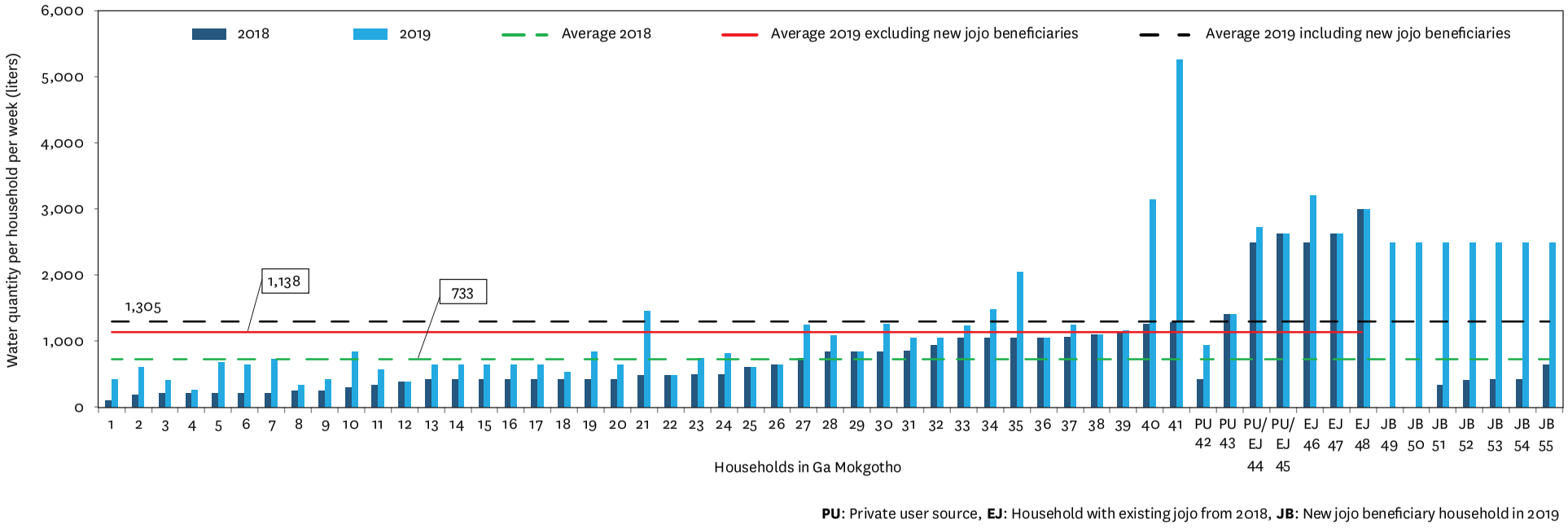
Annex 1. Quantitative Changes in Water Use in Ga Mokgotho.



PU: Private user source, **EJ**: Household with existing jojo from 2018, **JB**: New jojo beneficiary household in 2019

Figure A1. Overview of the quantity of water (liters) used per household per week in Ga Mokgotho during 2018-19, showing average consumption (733 liters) for all 59 households in 2018; for all households excluding jojo beneficiaries in 2019 (1,138 liters); and for all households including jojo beneficiaries in 2019 (1,305 liters).

Note: N = 59; however, for changes in average calculations, N = 55.

Annex 2. Quantitative Changes in Water Use and Time Spent in Ga Moela.

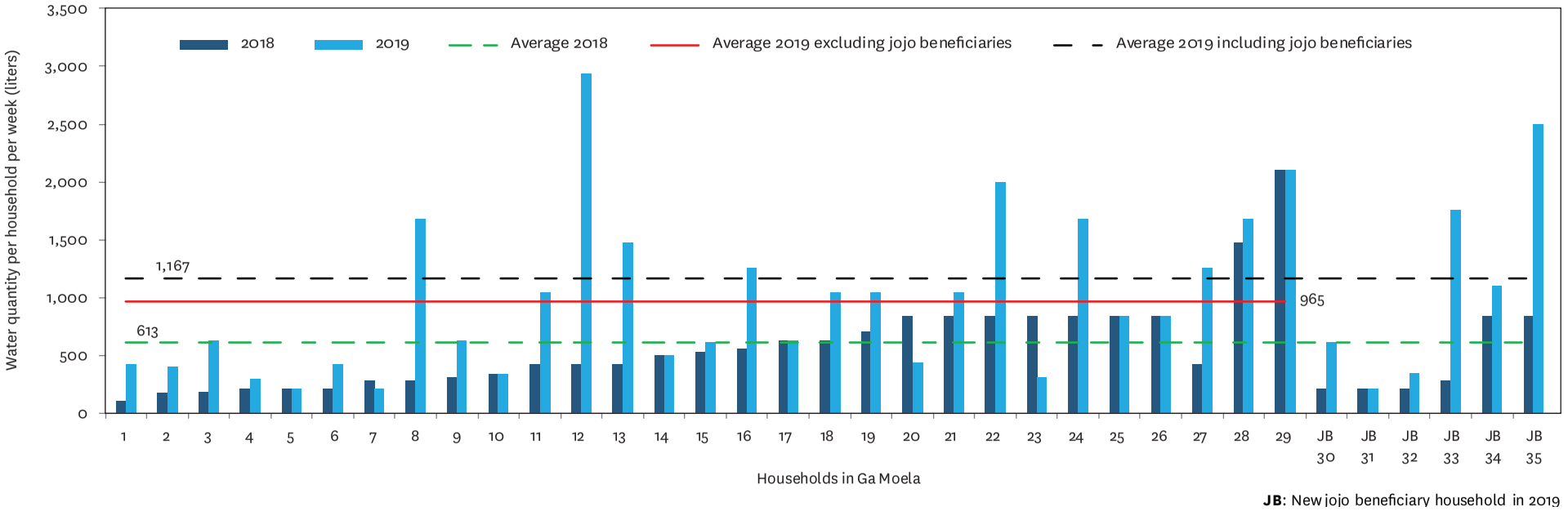
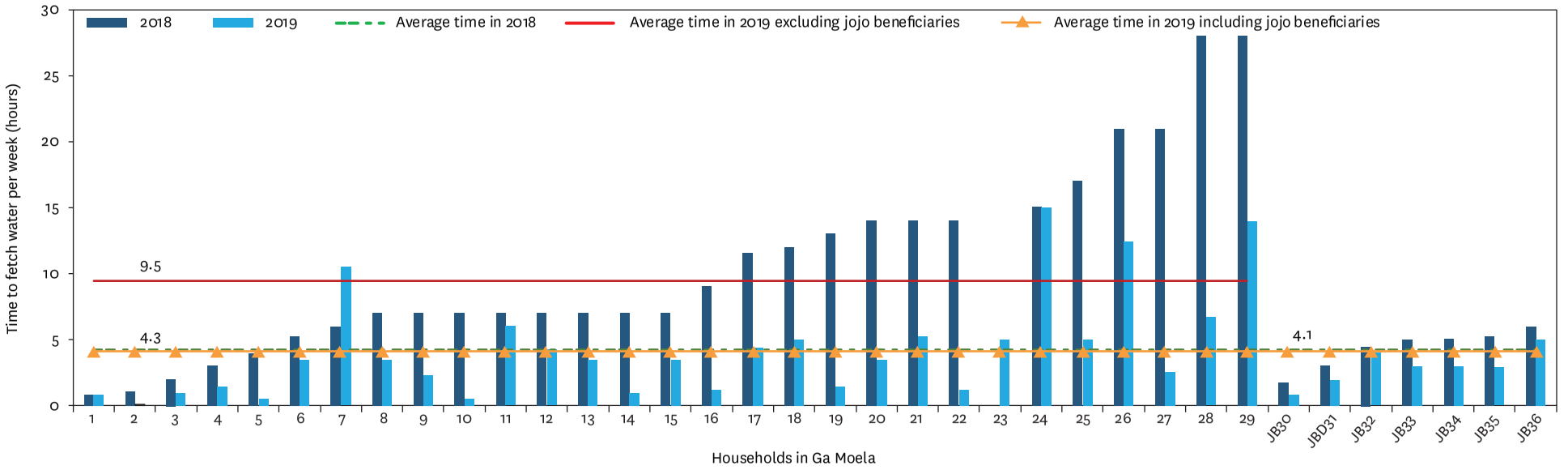


Figure A2.1. Overview of the quantity of water (liters) used per household per week in Ga Moela during 2018-19 (n=35), showing average consumption per household per week in 2018 (613 liters); average consumption per household per week excluding jojo beneficiaries in 2019 (965 liters); and average consumption per household per week including jojo beneficiaries in 2019 (1,167 liters).



JB: New jojo beneficiary household in 2019, **JBD:** New jojo beneficiary household with jojo at distant field in 2019

Figure A2.2. Overview of time spent per week by households (n=36) in Ga Moela in fetching water during 2018-19, showing the average for all households in 2018 (9.5 hours); average for households excluding jojo beneficiaries in 2019 (4.3 hours); and average for households including jojo beneficiaries in 2019 (4.1 hours).

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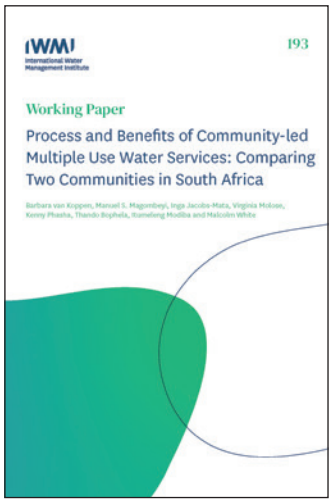

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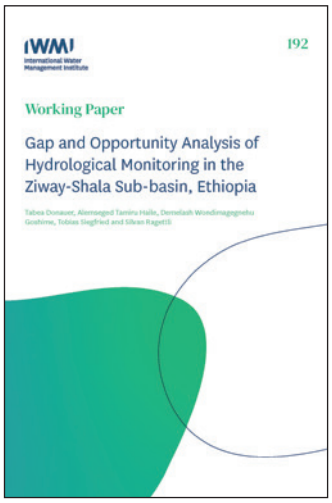

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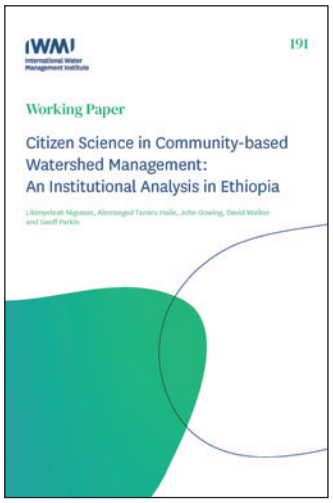

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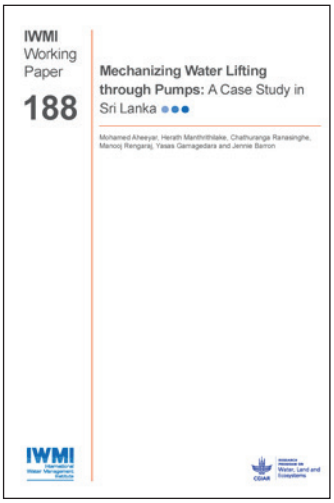

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