Research-inspired Policy and Practice Learning in Ethiopia and the Nile

Towards the Ethiopian goal of universal access to rural water: understanding the potential contribution of self supply

Sally Sutton, Eyasu Mamo, John Butterworth and Desta Dimtse

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Research-inspired Policy and Practice Learning in Ethiopia and the Nile region (RiPPLE) is a 5-year Research Programme Consortium funded by UKaid from the Department for International Development aiming to advance evidence-based learning on water supply and sanitation (WSS). The RiPPLE Consortium is led by the Overseas Development Institute (ODI), working with the College of Development Studies at Addis Ababa University; the Ethiopian Catholic Church Social and Development Coordination Office of Harar (ECC-SDCOH), International Water & Sanitation Centre (IRC) and WaterAid-Ethiopia.

RiPPLE Working Papers contain research questions, methods, analysis and discussion of research results (from case studies or desk research). They are intended to stimulate debate on policy implications of research findings as well as feed into Long-term Action Research.

RiPPLE Office, c/o WaterAid Ethiopia, Kirkos Sub-city, Kebele 04, House no 620, Debrezeit Road, PO Box 4812, Addis Ababa, Ethiopia

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List of acronyms and abbreviations

AW	Aleta Wendo (name of *woreda*)
AWD	Acute watery diarrhoea
BH	Borehole
BoARD	Bureau of Agriculture and Rural Development
BoFED	Bureau of Finance and Economic Development
BoWR	Bureau (regional) of Water Resources
BS	Bolose Sore (name of *woreda*)
CH	Chencha (name of *woreda*)
CLTS	Community-led total sanitation
CSA	Central Statistical Agency
DHS	Demographic Health Survey
DPPC	Disaster Prevention and Preparedness Commission
FC	Faecal coliform
FN	Functional (water source)
HEW	Health Extension Worker
HH	Household
HP	Hand pump
HWTS	Household water treatment and storage
JICA	Japanese Agency for International Cooperation
LPCD	Litres per head per day
MS	Meskan (name of *woreda*)
NF	Non-functional (water source)
NTU	Nephelometric Turbidity Units

POC	Point of Consumption
PSPN	Productive Safety-Net Programme
RWH	Rainwater harvesting
SNNPR	Southern Nations Nationalities and People's Region
SPD	Spring with distribution system
SPS	Spring on spot
SS	Self supply
TTC	Thermo-tolerant coliform
WASH	Water, Sanitation and Hygiene
WRB	Water Resources Bureau

Source definitions

Traditional Hand-dug well (TW or TRHDW) A well usually constructed without lining, and generally dug without help of a de-watering pump. It is generally constructed by the owner, his family or a local artisan.

Hand-dug well (HDW) A large diameter well with concrete ring lining, large (1m wide) apron and drainage. Usually mounted with a hand pump but more rarely a rope pump. Construction funded by government and often with donor or NGO support.

Machine dug shallow well (MSW) PVC or steel-lined drilled borehole to less than 35 m depth.

Hand pump (HP), conventional piston handpump usually an Afridev or India Mk 2

Rope pump (RP) handpump with rotary action and lifting by a continuous rope loop with washers inside a riser pipe. Manufactured locally. (see Sutton and Hailu 2011)

Protected well. Concrete-lined large diameter well with parapet, sealed handpump, apron, drainage and cover.

Semi-protected (SP) well A traditional well which has at a minimum an impermeable parapet and top lining sealed to a concrete apron and a cover. (Conforms to JMP minimum standard).

Un-protected (UP) well. A traditional well which does not have all the features of a semi-protected well.

Executive summary

Traditional (family) well development in SNNPR

- Findings of this study are based on surveys and sampling of 438 drinking water sources in SNNPR including 345 unprotected or semi-protected traditional 'family' wells, 35 rope pumps and 58 protected 'community' wells with handpumps. Household surveys targeted families that owned or shared traditional wells to access drinking water with a total of 128 households sampled. Surveys were carried out by regional, zonal and *woreda* level staff from BoWR and health extension services. Government participation in the study, including release of staff for the surveys by their respective offices and the use of BoWR equipment, is gratefully acknowledged.
- Many hundreds of family wells were found in the four study *woredas* of Aleta Wendo (Sidama zone), Boloso Sore (Welayta zone), Meskan (Gurage zone) and Chencha (Gamu Gofa zone). However relatively few of these traditional wells were used as drinking water supplies on a regular basis. This is because households often use protected supplies where they are available for access to drinking water, or go to specific traditional wells regarded as providing the best water.
- The present level of family well development is almost totally through householders' own initiative. In Boloso Sore there has been some encouragement to improve well head protection through the Productive Safety Net Programme, and a few rope pumps have been installed through *woreda* and JICA-supported initiatives, but overall the present spread and functioning of family wells is a result of personal resourcefulness and generally without advice or outside support. Such resourcefulness is shared by giving neighbours access to the well in almost all cases. On average, 'family' wells are shared by six households.
- Traditional unlined wells were found to be remarkably long-lived, with over half being more than ten years old. A high proportion provided a reliable supply in all the four *woredas* (80% wells on average), and especially in Meskan where 92% were found to have never dried in the previous five years. Traditional wells are dug without de-watering pumps so benefit from deepening in particularly dry years to reach below the normal seasonal water levels. Well owners generally provide regular cleaning out of wells and deepen them when necessary. Reliability was markedly improved by deepening. Half of the wells that had been deepened were found to no longer dry up.
- Traditional wells cost an average of about $50-100 to construct, including the materials, labour and rope and bucket. Most well owners were found to have kept costs low by participating in excavation. Addition of a rope pump cost about $150-300. Judging by previous levels of investment, incremental improvement for around $100-200 appears to be affordable to existing well-owners.
- Traditional well ownership is not confined to the most wealthy or well-educated. Over half of the wells visited were owned by families in the lowest two quintiles in wealth ranking and a third of owners were illiterate.

- Family wells bring major advantages in increased food security, health, school attendance and better childcare according to well owners. More animal watering and crop production seem to be the two major economic changes which follow from more easily accessible water.

Supply performance and benchmarking of family wells

- Comparisons were made between the supply delivery of traditional unprotected wells, rope pumps and protected wells with handpumps with a particular emphasis on water quality risks. There is an improvement in water quality as one moves up the technology ladder from the most basic traditional wells to protected wells fitted with handpumps, but even these do not reach the high levels of consistent good quality which would be expected. Only 47% of handpumps sampled in the study provided bacteriologically uncontaminated water, and 73% had low levels of contamination (<10 TTC/100ml).
- Even with no protection, a significant proportion of traditional wells (19%) were found to be with low contamination levels and this rose to 34% where simple measures had been taken (semi-protected wells) to reduce the return of spilt water or run-off to the well.
- Among wells delivering water of highest risk (>50 TTC/100ml) conventional handpumps were found to be only marginally better (4%) than traditional wells with a parapet and small apron.
- No traditional wells or rope pumps were found to have proper well-protected headworks to avoid the return of dirty water to the well. They were at best semi-protected. Traditional well owners had had little advice on simple measures of protection, and almost all were looking for technical advice and ideas on what to do.
- Most rope pumps (even when known to be used for drinking water supplies) were poorly installed in terms of the wellhead being sufficiently above ground level and top slabs with spilt water taken off to a pit, soak-away or area of plants to absorb waste water. At least half had been installed primarily for irrigation purposes although most were also used for domestic purposes.
- Water quality overall indicated the effects of poor site hygiene and in some cases of poor installation design or practice. Improvements in water quality require good training of masons for wellhead protection and of pump installers for good alignment of wheels, ropes and sealed top slabs. Improved water quality also requires good hygiene education of well owners and users.
- Sanitary surveillance systems used as standard at present give an acceptable indication of risks to water quality for standardised handpump installations. They are less reliable for rope pumps and very unreliable for traditional family wells. For these, new systems of assessment are needed (and are at present being tested in the second round of sampling[1]).
- Half of all households were familiar with household water treatment (HWTS), with almost a third having used chlorine products for disinfection. Few practice HWTS regularly at present

[1] A modified form of the system proposed in the UNICEF (2010) Oromia Self Supply Study

but previous experience could be built on if relevant products were made more easily available in the market place.

- If functionality of water lifting devices is combined with reliability of the source, protected handpump supplies were found to be providing a slightly less year-round delivery of water than traditional wells.
- From the well users' point of view, water quality is only one aspect of their water supply. Long-term reliability, adequacy and convenience, reflected in user satisfaction are all integral parts leading to a sustainable and valued supply. Different types of supply also fulfil different purposes and can, as a whole ensure adequate supplies for all domestic and hygiene purposes through conjunctive use where one supply (particularly communal ones) may not be sufficient on its own.

Recommendations

- A decision should be taken by policy makers on what level of risk is 'acceptable' for family wells (i.e. for calculating coverage with safe sources based on National WASH inventory data) while promoting movement up the water supply ladder. The findings in this report and associated studies provide significant improved information to support this decision-making.
- The rope pump should be promoted as a significant improvement on semi-protected traditional wells and an acceptable level of service, but only with new guidelines on installation and site hygiene. It should first be promoted as a family level solution rather than for large groups.
- Whilst much can be done through upgrading to higher technology levels, attention needs to be given particularly to quality of construction and site hygiene for all types of installation. Measures needed to improve communal source protection and hygiene are also appropriate for family wells and should lead to significant reductions in risk for all, at relatively low cost.
- An impermeable parapet and apron (>0.5m wide) with drainage could be regarded as a minimum level of family well protection. It may be possible to aim at achieving a household level for a water quality of <10 TTC/100ml initially in 50% of cases, aiming for 90% within five years.
- The role of government in accepting and accelerating household investment in water supply should be clarified further, based on the new WASH implementation framework (MoWE, 2011). Government's role in community water supply development and maintenance is well-established. However to promote and support small scale private investment in water to improve service and increase coverage requires different roles and strategies at all levels of public service.
- At least two of the *woredas* identified as having most potential from the surveys in Oromia and SNNPR should be taken as preliminary areas for developing and testing the best ways to plan, accelerate and monitor private investment in household water supply.

Figure 0-1Boloso Sore - well protected under the PSNP initiative.

Figure 0-2 Aleta Wendo - wooden well-head protection - measuring the well diameter

Figure 0-3 Boloso Sore - water sampling

Figure 0-4 Rope pump in family yard in Chencha, used for all domestic purposes

Figure 0-5 Boloso Sore - traditional well with a broken pot as an opening, and a coffee pot as a cover

1. Introduction

1.1 National context

With low current rates of coverage with improved (community level) sources and ambitious targets to provide access to water rapidly to all in rural areas of the country[2], the water policy of the Ethiopian government has, since 2009, been to give more emphasis to lower cost technologies and self-supply approach (MoWR, 2009). In self supply (see Box 1) the initiative and investment to build and improve individual family wells comes from individual households rather than from government. This builds upon existing practice: digging wells has, after all, gone on for centuries. But levels of groundwater exploitation still remain well below the potential in most parts of the country and there is much scope for further development. In self supply, government's role becomes one of establishing the right enabling environments for households to invest: creating the conditions to accelerate the construction of family wells, and promoting practices that make their use safe. In policy, the reformulated strategy for the Accelerated Implementation of the Universal Access Program (MoWR, 2009) made low cost technologies, implemented at household and community levels, the preferred first option for new rural water supplies.

The idea is to make scarce funding resources go further, because as well as being relatively low cost, most of the construction and operating costs of family wells are borne by households and not by the government or its development partners. In reaching for universal coverage, it is unlikely that a single model of (e.g. community) supply will be a cost effective way of serving 100% of people in any given *kebele* or *woreda* with widely varying patterns of settlement. An overlapping patchwork of different systems is likely to be the most appropriate and where households are scattered over large areas, family wells and rainwater harvesting are especially appropriate. Being located closer to the home, the water drawn from family wells also tends to be used for productive activities such as vegetable gardening, food processing, irrigation of seedling and livestock as well as for drinking and other domestic uses. Such water uses, and development of private sector support services tend to support economic development consistent with the new Growth and Transformation Policy (MoFED 2010) which now provides an overall framework to guide national development including water.

Box 1 What is self-supply? (Source: Anon (2008))

At the Wolliso national workshop, the following definition of self supply was agreed:

"*Improvement to water supplies developed largely or wholly through user investment usually at household level*"

The key characteristics are:

- A ladder of incremental improvements in steps which are easily replicable and affordable to users, linked, when necessary, to micro-finance systems and/ or productive use
- Official recognition of lower steps of the ladder as necessary stages towards a level (to be defined) which is recognised as contributing to UAP /MDG.
- Availability of low cost technical options and information on source construction and up-grading, rainwater harvesting and household water treatment
- Management and maintenance based on strong ownership by individual (or community) and local skills
- Demand built through government promotion and private sector marketing

[2] Rural water coverage was reported as 65.8% in 2010, compared to 15.5% in 1991. The target to be achieved by 2015 is 98% (MoWEa, 2011). The UNICEF/WHO Joint Monitoring Programme report much lower coverage based on a different methodology and reporting period.

There are also important disadvantages or concerns associated with self supply. The key concern relating to the approach is that of the safety of water from family wells for drinking. There are less data available for traditional family wells than 'improved' community sources and there are unknowns about water quality risks. Although generally based only on anecdotal evidence, concern is also expressed that promoting self supply might lead to overexploitation of limited groundwater resources that are also vulnerable to climate change and land degradation.

Despite the policy intentions, and perhaps partly due to these concerns, implementation of the self-supply approach has lacked a clear model or strategy. It has generally not been possible to develop models for accelerating family well construction and use despite the UAP 2009 policy. As a result there is less reliance upon self supply in the draft update of this policy, the UAP2 (MoWE, 2011a). An over-riding problem is that since budgets (such as UAP plans) focus on capital investments in new construction, there is little incentive for *woredas* and regions to include self supply as an option in their plans (which are collated and passed upwards to devise the national plan). There does not yet appear to be a mechanism for regional and *woredas* to request funding for self supply supporting activities (such as promotion, training and advisory support) which might be more cost effective in generating coverage than new capital investments in community water supplies. The former could be facilitated by linking self supply support service development more closely to the accepted communal supply options in training, monitoring, and promotion.

A further disincentive has been that, in the past, the contribution of self-supply has not been captured in sector monitoring. Promotion of self-supply at scale has stalled partly due to the fact that such sources were not counted during monitoring of coverage. Huge strides in developing access through family wells in Oromia for example (Mammo 2010) were not built upon or sustained, at least partly for this reason. Since coverage has only been calculated based on the numbers of improved community sources, new family wells were not, according to the statistics, improving access. Since 2011, the new National WASH inventory (NWI) has included a question to collect information on the number of family wells used as the primary household drinking water source (MoWE, 2011b). This will yield important new information on the reality of access to water in the country, although it will still not reflect the true density of family wells. There is, as yet, no agreement on which family wells should be considered as safe sources, and therefore contribute to coverage. The inclusion of some family wells in the NWI however creates potential to do this in the future, should an acceptable benchmark be established. That is one key gap that this study aims to address.

The policy environment is highly dynamic as the country seeks to refine its approaches, and the various policies and plans are not altogether consistent with respect to self supply at the moment. As mentioned above, the UAP2 does not feature self supply strongly despite this being one of the ways to link WASH better to economic development as set out in the GTP. Nevertheless the new draft WASH implementation framework (MoWE, 2011c) does identify *self-supply projects* as a service delivery model alongside *woreda-managed projects* (to be handed over for management by communities) and *community management projects* (community projects that feature community-managed grants for contracts to develop sources). The framework also sets out some key principles for how this should be done.

In general the lack of information on the forms of self supply that already exist and limited piloting of approaches (beyond technology options) to see what works best, has meant that guidelines on how to establish a more enabling environment for self supply are missing. This report aims to address these issues and to set a foundation for scaling up so that stakeholders at all levels can more clearly see how accelerated household investment can be achieved and contribute to coverage.

1.2 This study and research report

RiPPLE research in SNNPR (working in four *woredas*: Aleta Wendo, Boloso Sore, Chencha, and Meskan) has aimed to characterise self-supply in the region through detailed water source and household surveys, water quality analysis, and associated studies examining rope pump introduction, financial constraints and support, and stakeholder attitudes to self supply. Additional studies aim to make a first estimation of self supply potential in the region. (MacDonald 2011 in press) and analyse approaches to the introduction of the rope pump (Sutton and Hailu 2011). These associated studies form separate but linked reports which should be read alongside this report.

1.3 Related research in Oromia

At the same time as this study was being implemented, UNICEF funded a similar study in Oromia (UNICEF, 2010) looking at some of the same aspects and with the aim of providing guidelines on benchmarking family wells. The SNNPR study benefitted considerably from methodologies developed and lessons learned in the Oromia study, and to maximise the synergies, some common staff were involved in each study as well as workshops organised to share and discuss results and their implications. Gap filling research was also planned and undertaken jointly and it is intended that findings will be brought together at a later stage in a single combined synthesis report to ensure conclusions for benchmarking are based on as wide a data set as possible.

2 Study methodology and areas

2.1 Study objectives and key questions

The study focused on three main issues: firstly, assessing the potential for self supply in the SNNP region; secondly, understanding the key issues for accelerating effective household investment in family wells and their upgrading; and thirdly, defining the main barriers to adoption of the approach and examining whether and how these might be overcome. More detailed objectives are set out in Box 2.

Box 2: Detailed objectives of self supply research in SNNPR

Establishing the potential for self supply in the region

The study aimed to identify:

- the degree to which people were currently providing their own supplies, and whether this a growing or dying trend
- whether those supplies are providing a safe and reliable supply (or improved access) or how this could be done
- why people want to invest in their own supplies, and the benefits and problems that arise
- the uses that are made of the water, and whether family wells can pay for their investments themselves over time
- stakeholder perceptions of low cost options

Key issues in accelerating household investment

If family wells are to be scaled-up, a number of issues that will be critical and that the study aimed to shed new light on were:

- the willingness and ability of households to pay
- the availability of low cost technologies through effective supply chains
- the interest and capacity of the private sector in providing services and marketing
- the roles of government and the private sector
- availability of accessible and sustainable credit systems
- whether there should be incentives or subsidies to accelerate uptake.

Possible barriers to adoption of the approach

In relation to implementation of the self supply approach at scale, the study has focused on examining:

- the attitudes of stakeholders including sector professionals, politicians, and end users to low cost options
- concerns over water quality
- strategies of technology introduction focusing on the rope pump
- potential inequity and any lack of sharing access to wells with neighbours
- issues of affordability, financing and subsidy

2.2 Survey design and achievement

Figure 2-1 illustrates the main elements of the study: a water sampling survey, household surveys, key informant interviews, additional studies and case studies.

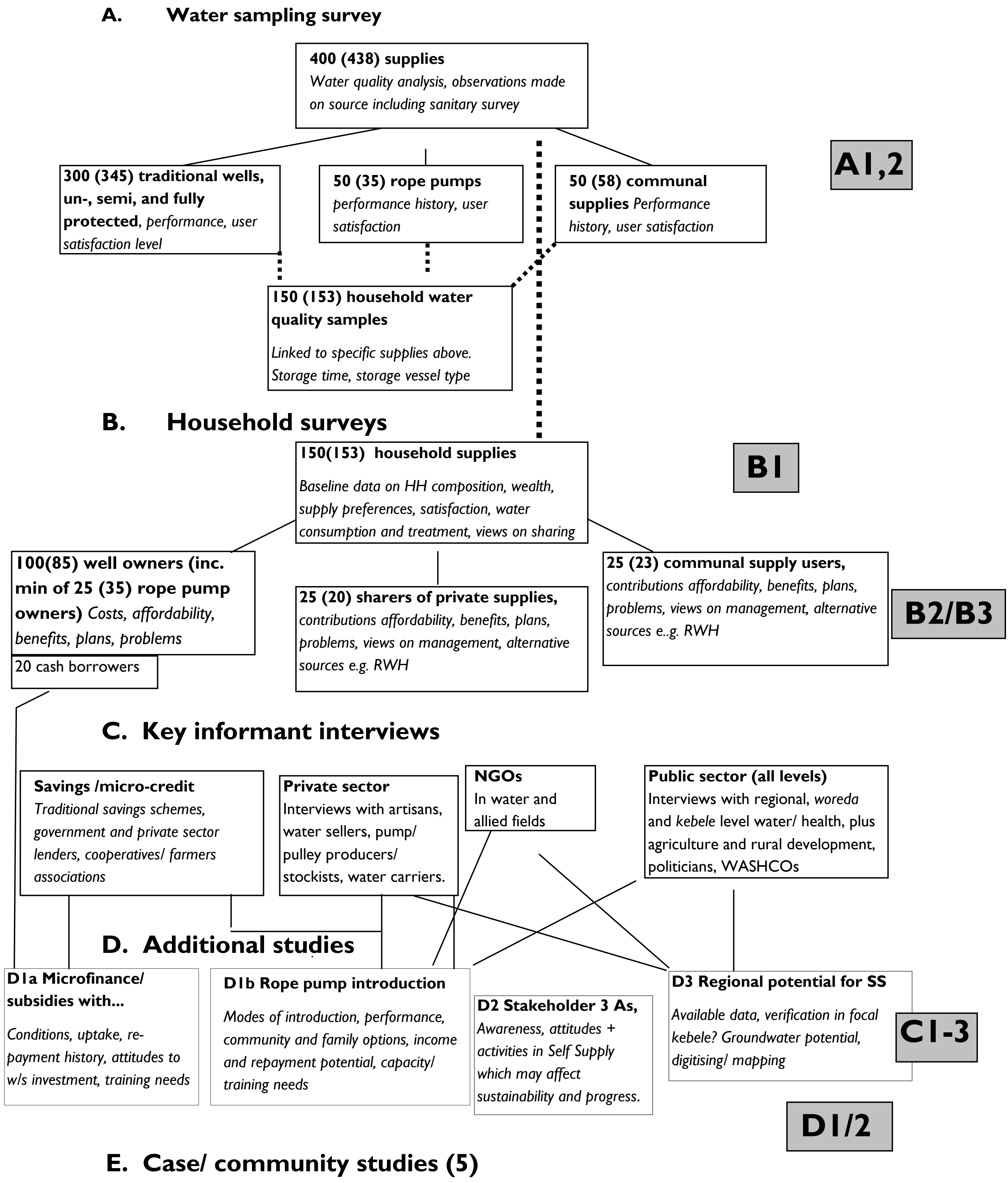
The detailed methodology for these is described in the Research Protocol (RiPPLE 2011). Target (and actual numbers in parentheses) of wells and households sampled are given in Fig 2.1. The first water sampling survey was undertaken during September and October 2010 (at beginning of 2003 according to Ethiopian calendar) around the peak rainfall period which was timed to provide a worst-case water quality scenario during the period when the risk of contamination from surface run-off is greatest. A total of 438 sources were visited during the survey including 345 traditional family wells, 35 wells fitted with rope pumps and 58 nearby communal sources with conventional handpumps. Each source was surveyed and the water quality tested.

Household surveys undertaken at the same time included some water quality analysis of water stored in the household and a detailed survey of household characteristics, investments made in water supply, water use patterns and treatment, benefits, motivation, satisfaction and related issues. This survey included basic information on a total of 153 households and additional information specifically from 85 family well owners, 25 further well owners using rope pumps, 20 neighbouring households that were sharing family well supplies, and 23 households relying upon communal sources. An important constraint in the initial household survey was that household water samples and quality analysis were mostly not taken from the same households as were interviewed. This was addressed in a follow-up survey.

A smaller follow up survey was undertaken in April 2011 representing a dry season and best-case water quality scenario. This aimed for 100 duplicate samples of wells in the dry season, 50 household water samples (especially from those adopting HWTS practices) and 50 previously un-sampled rope pumps. The results were not available in time for this report but will be discussed in an addendum.

The associated studies (rope pump, financial services, stakeholder perspectives and regional potential) are presented as separate reports.

Figure 2-1 Field survey design showing sample size intended and actual sample size (in brackets) and key issues assessed (in italics). Figures relate to September/October 2010 rainy season



2.3 *Woreda* selection

The research *woredas* were selected together with key stakeholders based on brainstorming discussions during a workshop and follow-up interviews at *woreda* level, on the basis of the following criteria:

- Accessibility (within reasonable travelling distance of Hawassa)
- Number of households already with own water supplies (preferring *woredas* with the highest numbers of traditional wells)
- Types of supply (ideally covering a mix of rainwater harvesting, rope pumps, pulleys, and other lifting mechanisms, types of lining etc)
- Private sector capacity
- *Woreda* BoWR capacity
- Hydrogeological context
- Cultural context (to cover a range of religion, ethnic groups, income)

As a result, and most strongly influenced by the first two criteria of accessibility and levels of development, the *woredas* Aleta Wendo, Boloso Sore and Meskan were initially chosen with Chencha being added later to obtain a larger sample of wells with rope pumps (see Table 2-1)

2.4 Selection of *kebeles* and water sources

Within the selected *woredas*, a small number of target *kebeles* were initially chosen where family wells were to be found within areas with reasonable access, and where rope pumps had been installed. Since there were relatively few rope pumps in operation and because family wells are not always used for drinking water in areas with high coverage of functioning conventional water supplies, it proved necessary during the study to increase the number of *kebeles* covered per *woreda*. The plan was to cover 4 *kebeles* per *woreda*, but in order to get the necessary mix of sources more *kebeles* had to be visited to get a sufficiently large sample of operating community supplies, rope pumps or traditional wells used for drinking. In the end the study involved 6 *kebeles* in Aleta Wendo, 5 *kebeles* in Boloso Sore, 12 *kebeles* in Chencha and 4 *kebeles* in Meskan.

Family wells were then selected, aiming to cover the majority of those wells in the *kebele* from which drinking water was commonly taken, although they were often also used for other purposes. The survey included family wells where protected sources were available within 1.5 km if drinking water was also taken from family wells. Rope pump wells were often used primarily for irrigation but they also had to be used for drinking or as a domestic water source to be included in the survey. Approximately half were owned communally and half by families (but almost the same number of users for both). Both appear to be recognised in the BoWR data on supply types (see Tables 2.3-2.6).

Communal wells (50) were selected to prioritise handpumps on protected hand dug wells. In the end 58 were sampled, with equal numbers of boreholes and hand-dug wells (see Table 2.1). Because of the small number of functioning handpumps and rope pumps, all were sampled in the focal *kebeles*.

Table 2-1 Summary of surveyed water points by source type

	Aleta Wendo	Boloso Sore	Meskan	Chencha	Totals
Traditional unprotected HDW	109	90	119	1	319
Traditional semi-protected HDW	2	16	0	8	26
Traditional HDW + rope pump (RP)	4	5	0	24	33
HDW + RP	0	2	0	0	2
MSW + RP	0	0	0	0	0
HDW + hand pump (HP)	7	12	9	1	29
MSW + HP	12	6	5	6	29
Totals	134	131	133	40	438

2.4.1 *Selection of households*

The study targeted 85 households associated with the traditional sources, including 35 households associated with rope pump wells and 25 households using communal protected supplies and 20 sharing neighbours' wells. Well owners were targeted specifically to include some who had used credit facilities. 13 were found, which reflected the low use of credit in most areas. The aim was that at least half of the sample should be ones who have constructed wells in the past five years, in order that the changes to their way of life could be sufficiently recent to be remembered. In the end the long life of wells meant that only 25% recently dug wells, but it seemed the memories of life before the well remained fresh in their minds.

2.5 Field survey methodologies

Field surveys were carried out by six teams, with two teams operating per *woreda* at any one time. Teams were trained together over a two day period, so that ways of asking questions, sampling procedures, and measurements would be taken in the same way by all teams. There was also a testing of the questionnaires in the field to familiarise the teams with the recording of data and to identify problem areas in which misunderstandings might occur.

Each team had two GPS locators, and two Wagtech kits for bacteriological analysis of total and thermo-tolerant coliform colony counts, plus turbidity, conductivity and pH meters. Each *woreda* had one water technician (water quality analysis, regional or zonal) and eight others, for water sampling, site surveys, household surveys (usually two from the health sector). For the household surveys the teams split up into two to cover as much ground as possible. A team carried out, on average, one *woreda* in 19 days. Each team was supervised for most of the time by a local consultant.

2.6 Profiles of the selected *woredas*

The four *woredas* chosen for the survey each lie in different zones (see Table 2-2).

Population density is highest in Aleta Wendo, with Meskan and Chencha having a half or fewer people per square kilometre.

Table 2-2 Basic *woreda* characteristics

Zone ***Woreda***	**Sidama** **Aleta Wendo**	**Welayta** **Boloso Sore**	**Gurage** **Meskan**	**Gamugofa** **Chencha**
Population	174,366	179,905	167,690	117,316
Area	230.5	303.1	446.7	373.5
Population density	756	594	375	314
No of kebeles	33	27	44	50
Water supply coverage (BoWR 2008/09)	30.8%	37.6%	79.7%	50.1%
Livelihood zones	Coffee + enset	Coffee + enset	Mixed, high value	Apples, dairy

Data from BoWR and DPCC 2010

2.6.1 *Aleta Wendo (Sidama Zone, SNNPR)*

Aleta Wendo *woreda* is located 51 km to the south of Hawassa along the main highway, and is a part of Sidama zone. Aleta Wendo or Wendo is the main town. With a population of some 174,366 in 2008 the population density is over 750 persons/km^2. Growth rate is 2.9%.

The *woreda* consists of three livelihoods zones: the Sidama Maize Belt, the coffee zone and the highland enset and barley zone. The *kebeles* chosen for the study were Titira, Woto, Shaicha, Belesto and Gidebo, all located in the coffee zone. Here coffee is the main cash crop, but enset and maize are widely grown for home consumption. Cattle are also a key source of cash income.

Malaria is prevalent, and diarrhoea and intestinal parasites are major health risks, showing seasonal variation.

The *woreda* has high rainfall, numerous springs and shallow wells. The land is highly dissected by streams and so often has steep topographic and piezometric gradients. Slopes are mainly wooded with clearings for crops and grazing (72% reported to cultivated). Many households have their own wells, but relatively few are used for drinking. River waters often have poor quality because of coffee processing, and are highly seasonal because of the steep gradients and relatively rapid run-off.

Community water supply is provided by 143 spot springs, 103 standard hand pumps and 10 rope pumps. Springs are the major source of supply especially in the selected *kebeles*. Overall coverage is low at 30% with plans to reach 36% by the year end 2010 (based on population of 174,366). Water system functionality rates are moderate compared to other study *woredas* with 71% handpumps reported to be working, 50% of rope pumps and 83% of springs.

Table 2-3 Status of communal water sources in Aleta Wendo (source, SNNPR BoWR 2010)

Woreda	Scheme type	Non-functioning supply	Functioning supply	Total	Percentage functioning
Aleta Wendo	Handpump	30	73	103	71%
	Rope pump	5	5	10	50%
	Mechanised borehole	0	0	0	
	Spring with distribution	0	0	0	
	Spot spring	25	118	143	83%
	Total	60	196	256	77%

2.6.2 *Boloso Sore (Welayta Zone, SNNPR)*

Part of Wolayita Zone, Boloso Sore is located 84 km to the west of Hawassa with an administrative center at Areka.

Community water supplies are provided by 75 spot springs, 120 standard hand pumps, 24 rope pumps and 6 mechanised boreholes. Coverage is also relatively low at 37.6%. Water system functionality rates are relatively low too with only 48% handpumps operating, 50% rope pumps, 33% mechanised boreholes and 47% of the spring systems.

The *woreda* is known for its relatively rich cattle owning families (20%) and its production of coffee, *tef* and ginger. Farm holdings are small and so need to be intensively cultivated. The survival of many depends on the sweet potato harvest, which sometimes fails and there is a large non-land-owning element to the rural population which depends on labouring for income. The *kebeles* chosen are half in the coffee and ginger livelihoods zone and half in the maize and root zone, but the difference between them in rural economy seems to be small.

The *woreda* is relatively densely populated with 580 persons/ km^2.

Table 2-4 Status of communal water sources in Boloso Sore (source, SNNPR BoWR 2010)

Woreda	Scheme type	Non-functioning supply	Functioning supply	Total	Percentage functioning
Bolo Sore	Handpump	63	57	120	48%
	Rope pump	12	12	24	50%
	Mechanised borehole	4	2	6	33%

	Spring with distribution	0	0	0	
	Spot spring	40	35	75	47%
Total		119	106	225	47%

2.6.3 *Meskan (Gurage Zone, SNNPR)*

Meskan is located 117 km to the north of Hawassa in Gurage Zone in the northernmost part of the region and relatively close to Addis Ababa. The administrative centre is at Butajira.

The *woreda* is known for its productive farming with high value cash crops such as enset, chat and peppers providing good incomes to land owning families. It is also a *woreda* in which there has been considerable re-settlement and so farms tend to be spread out and farmers keener on innovations. High value cash crops enable farmers to invest in wells and even sometimes in diesel pumps (or to rent them from neighbours) so that family wells are a common sight in the *woreda*. In some areas almost every house has its own well.

Wells fitted with hand pumps are the most common community water supplies (268) with some mechanised boreholes (6), springs with distribution systems (4) and spot springs developed (25). Meskan has the highest coverage (80% according to BoWR figures for 2008/9) and the highest rate of functioning of all the *woredas* chosen for the study. A very high 98% of handpumps were reported operational, all the mechanised boreholes and most of the spring systems (one systems with distribution not functioning and two of the spot springs).

Table 2-5 Status of communal water sources in Meskan (source, SNNPR BoWR 2010)

Woreda	**Scheme type**	**Non-functioning supply**	**Functioning supply**	**Total**	**Percentage functioning**
Meskan	Handpump	6	262	268	98%
	Mechanised borehole	0	6	6	100%
	Spring with distribution	1	3	4	75%
	Spot spring	2	23	25	92%
Total		9	294	303	97%

2.6.4 *Chencha (Gamo Gofa Zone, SNNPR)*

Chencha is found about 130 km to the south west of Hawassa, bordering Mirab Abaya and lying in the highlands above Lake Abaya. It is an area of highly productive farming, and noted for its apple orchards and dairy cattle.

Community water supplies are provided by 27 wells with hand pumps, 1 mechanised borehole, 45 rope pumps (of which some 50% are family-owned) and 35 spot springs. Functionality is about average with 67% handpumps reported operational, 67% rope pumps and 69% of the spring systems.

Coverage from BoWR figures for 2008/9 is 50.1%.

Table 2-6 Status of communal water sources in Chencha (source, SNNPR BoWR 2010)

Woreda	**Scheme type**	**Non-functioning supply**	**Functioning supply**	**Total**	**Percentage functioning**
Chencha	Handpump	9	18	27	67%
	Mechanised borehole	0	1	1	100%
	Rope pump	15	30	45	67%
	Spot spring	11	24	35	69%
Total		35	73	108	68%

Figure 2-2 Members of the field survey team in Meskan

Figure 2-3 Members of the field survey team in Boloso Sore

Figure 2-4 Members of the field survey team in Aleta Wendo

Figure 2-5 Water sample analysis in Boloso Sore

Figure 2-6 Checking survey forms, Meskan

3 The growth and status of family wells

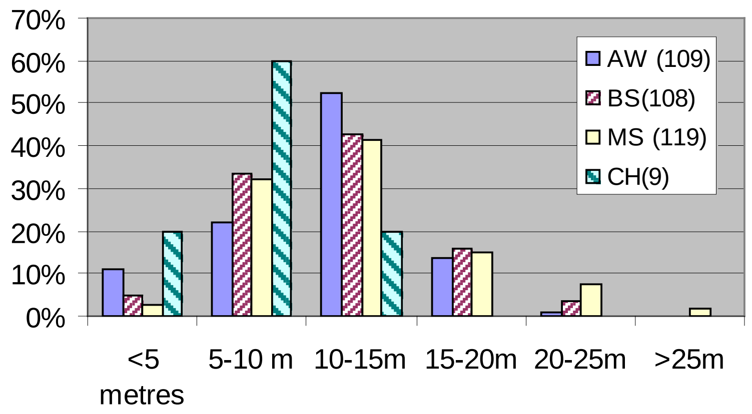
3.1 Technology options and their uptake

Overall the level of traditional well improvement and protection is very low in the *woredas* visited by the survey. Unlike some other areas in the country, pulleys are hardly used at all to reduce effort and contamination, but wells are mostly less than 15m deep (See Fig 3.1) so effort for water lifting is relatively small. There appears to be little interest or knowledge of ways to improve water quality, although there is a perception that quality is poor from traditional wells, and rather better from those with rope pumps or handpumps. Certain traditional wells are regarded as safer than others and so preferred for drinking. Many wells are not primarily regarded as drinking water sources and in very few cases is care taken to keep surroundings clean and minimise contamination. This observation concurs with the complaints of Health Extension Workers (HEWs) that people do not really listen to them. There was some interest voiced in the household surveys to make improvements, but that is still a long way from strong enough demand to make the changes.

3.2 Basic family well characteristics

Almost half of the surveyed wells were between 10-15m deep (44% sample) and 30% 5-10m (see Fig 3-1). Greater depths are only possible in very firm ground since traditional well lining techniques are poorly developed, with the exception of some timber lining in Aleto Wendo and masonry in Meskan. The wells that were visited in Chencha tended to be particularly shallow.

Figure 3-1 Depth of traditional wells



3.2.1 *Aleta Wendo*

Many households in Aleta Wendo have their own wells, but relatively few are used for drinking. Wells are typically lined with wood at ground level and may also have a wooden super-structure with a lid to allow closure and to avoid children or animals falling into the well. Plastic or sacking may be added to fill gaps. A common alternative is an oil drum set into the well mouth and perched on a wooden framework. The ground is seldom built up using spoil from the well to divert surface water away from the well. Most wells here are generally less than 15 metres deep.

Table 3-1 Aleta Wendo well superstructure characteristics

Earth mound	3%
Oil drum	30%
Wooden box	46%
Tyre/hub/logs	9%
Concrete ring	2%
Brick/stone wall	2%
Wooden slab	1%
Broken pot	0%
Pump casing	0%
PVC/pump stand	0%
Covered?	86%

Figure 3-2 Timber well headworks A. Wendo

Figure 3-3 Timber well parapet in Aleta Wendo

Figure 3-4 Oil drum well parapet Aleta Wendo

3.2.2 *Boloso Sore*

In Ardimancho *kebele*, the practice is for the area around the well mouth to be mounded up, but elsewhere level ground is more normal. The well mouth is commonly protected by an oil drum or in some areas (Chama Hembecho and Gara Godo) using broken earthenware pottery. This is a *woreda* in which NGOs and BoARD have promoted well head protection as part of the Productive Safety Net Program (PSNP). Under this initiative well owners were encouraged to install oil drums and small concrete aprons, and were assisted with the required materials. 20% of wells are more than 15m deep.

Figure 3-5 Oil drum and apron, Boloso Sore

Figure 3-6 Clay pot parapet and lid, Boloso Sore

3.2.3 *Meskan*

In Meskan, almost all wells have a mound around the well mouth, often with tree trunks or planks at the top. These are used to stop the rope and bucket from hitting the side of the well, and providing, as they wear, a guide within which the rope runs. The mound and wooden lip are normally combined with dry stone walling to varying depths depending on the stability of the soil. In order to install the lining, wells tend to be of larger diameter which makes them more difficult to cover. Covers are therefore rare (only 10% wells), whereas they are very common in the other *woredas*. Meskan also has a few rope pumps, but those seen were installed under the auspices of the International Rescue Committee (IRC, see Table 3-2) and used for drinking despite poor well protection. (Elsewhere IRC-funded pumps were installed to higher standards). A quarter of wells visited in the *woreda* were more than 15 metres deep, with two at over 25m depth.

Table 3-2 Meskan well superstructure

Earth mound	93%
Oil drum	1%
Wooden box	3%
Tyre/hub/logs	0%
Concrete ring	0%
Brick/stone wall	0%
Wooden slab	0%
Broken pot	0%
Pump casing	0%
PVC/pump stand	0%
Covered?	10%

Figure 3-7 Wooden support with lid, Meskan

Figure 3-8 Timber parapet and dry-stone topping, Meskan

Figure 3-9 Poorly installed rope pump, Meskan

3.2.4 *Chencha*

Not so many wells were visited in Chencha, where the focus was on increasing the sample size of rope pumps, but it was observed that wells tend to be much shallower than in the other *woredas*. Oil drums are the commonest form of protection, with all wells being covered, but little elevation of the well mouth above ground level. Rope pumps that were installed through JICA and World Vision were in half of all cases intended for irrigation rather than primarily for domestic use, but they tend to serve both purposes in practice. Nevertheless, the slab is seldom much above ground level.

Table 3-3 Chencha well superstructure

Earth mound	0%
Oil drum	89%
Wooden box	0%
Tyre/hub/logs	11%
Concrete ring	11%
Brick/stone wall	0%
Wooden slab	0%
Broken pot	0%
Pump casing	0%
PVC/pump stand	0%
Covered?	100%

Figure 3-10 Rope pump for domestic use Chencha

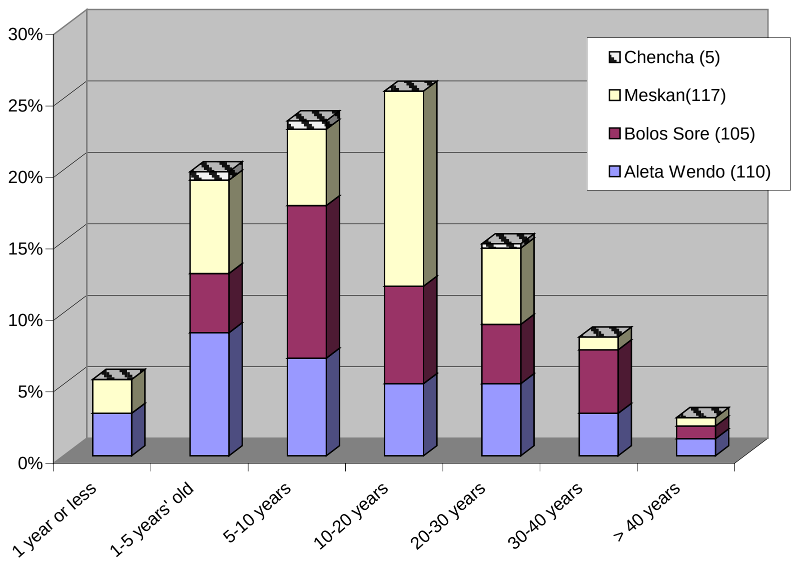
Figure 3-11 Spare tyre parapet installed where a broken rope pump has been removed, Chencha

3.3 Trends in well construction and reliability

3.3.1 *Well construction and longevity*

Well construction appears to have a long tradition in the areas surveyed, and most wells seem to be long-lived. Half of family wells are more than ten years' old, and more than one in ten are over thirty years' old (see Fig 3-12). This is a considerable achievement for wells which generally have no lining much below ground level.

Figure 3-12 Age of traditional wells



Only in Aleta Wendo is there some indication of a small recent increase in well digging i.e since 2005. However, it is not known if those are new wells, or, because life expectancy of wells in that area is lower, some wells are being replaced. Boloso Sore seems to have had a peak in wells constructed in the period 2000-2005, and Meskan in the 1990s. In all cases there does not seem to be any significant trend of increasing well construction in the last few years. Bearing in mind the different time intervals on the graph, Meskan seems to have had the most constant rate of well construction since 1990.

3.3.2 *Traditional well reliability*

Traditional wells may be expected to be more prone to going dry than protected community wells because of their lack of lining limiting their depth and stability. However this depends also on the area and the local ground conditions. Where excavation is relatively easy below water level, and the ground does not cave in afterwards, then year-round supplies are possible. Such conditions exist especially in Meskan, where 94% of traditional wells have provided water consistently for the last 12 months, and 92% for the past five years. Overall 81% of traditional wells did not dry up in the previous 12 months.

Boloso Sore has less reliable wells and Aleta Wendo the most problem for perennial supplies, with a third going dry for some time over the past five years.

Figure 3-13 Traditional well vulnerability to water fluctuations in last year

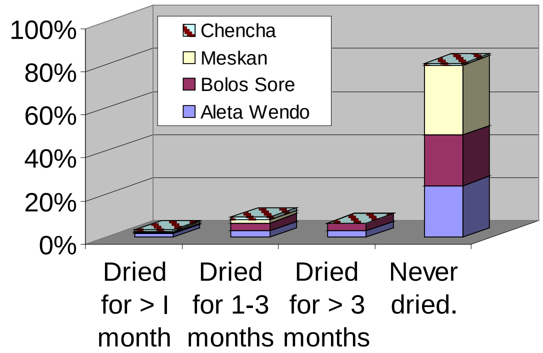


Table 3-4 Vulnerability of traditional wells to drought

	AW	BS	MS
Dried in past 5 years	33%	25%	8%
Never dried	67%	75%	92%

Accordingly, Aleta Wendo also has the highest number of wells being deepened (See Section 3.3). Almost half of all them have been deepened since construction, compared with 20% or less in the other *woredas*.

3.3.3 *Traditional well deepening*

According to owners in the four *woredas*, a quarter of all wells have needed deepening since they were dug. Construction is undertaken without de-watering pumps and so needs to be done at the times of lowest water level. Some well owners may need to follow water levels down in progressive droughts or areas of falling water table, but over half (57%) of those deepened across the four *woredas* have not dried since the work was carried out. Thus the number of reliable supplies is increasing as many owners are able to deepen them in times of drought. They are then more reliable in the average years.

In Aleta Wendo however over half the wells which have been deepened (57%) are still going dry, which suggests that either there is greater instability of the well shafts, causing accumulation of debris at the bottom or a progressive falling of water levels. These well owners are also almost all ones who undertake regular maintenance of their wells. Well owners in Aleta Wendo reported that the well shaft is more unstable below the water level but whilst lining can be installed at the top, there is no tradition of lining wells all the way down. Cheap concrete rings and techniques of dry stone lining below water levels are needed to help improve reliability in all areas.

In Meskan, few wells (less than one in five) go dry after deepening, suggesting that water levels are more stable. A need to deepen may simply reflect initial excavation not having been at the time of lowest water levels. Boloso Sore is intermediate between Meskan and Aleta Wendo but with around 40% of wells still drying after deepening. Since instability of the shaft is not regarded as a major problem in this area (see table 3-5), permanent or seasonal water level fluctuations may be more to blame.

Table 3-5 Traditional well stability

Well stability	Percentage of wells not vulnerable to collapse		
	Aleta Wendo	Boloso Sore	Meskan
Top of shaft stable without support	73%+	81%	44%
Shaft stable below water level	67%	84%	47%

3.4 Maintenance and sustainability

3.4.1 *Traditional wells*

Traditional well maintenance is relatively simple compared to higher levels of technology. It mainly involves periodic cleaning out of accumulated debris (broken buckets and ropes, and debris sloughing off the walls of the shaft), cleaning around the well, and replacement of rope or bucket. Cleaning out was reported to be done on a fairly regular (i.e. annual) basis by many well owners, and almost 90% of owners have cleaned out the well since construction. This finding implies that either households still have good contact with a well-digger, or more commonly, that a member of the family is prepared to go down the well and clean it out at a time when water levels are low. Almost half of well owners have deepened their well at some stage (see section 3.3.3) and a quarter have improved the apron to reduce seepage or surface flow back into the well. Maintenance of traditional wells is a normal routine unlike maintenance for communal wells. For the latter, deepening, cleaning out and major pump repairs are far more costly undertakings which require *woreda* offices to plan and to include them in their budgets. This contributes to the higher levels of reliability of many traditional wells (see Section 5.6.2) compared with communal supplies.

The low number of surveyed households that mentioned replacing ropes and buckets may reflect the long use of these items, or it might also suggest that this is not regarded as maintenance or as a major issue, since rope may be locally manufactured (using tyres, cloth, and fibres) and buckets tend to be broken plastic cooking oil containers.

Table 3-6 Types of maintenance activities carried out since well construction

	AW (29)	**BS (28)**	**MS (32)**	**All**
Cleaning out	93%	96%	75%	88%
Lining	0%	11%	34%	16%
Well head protection	10%	36%	25%	24%
Apron	0%	11%	0%	3%
Replacing rope	38%	29%	47%	38%
Replacing bucket	10%	21%	9%	13%

In Meskan over a third of wells have had some post-construction lining installed, which is usually dry stone walling. This may sometimes become unstable or need extending, but reduces the amount of soil which falls into the well from the top, and so lessens the need for cleaning out.

In Boloso Sore, just over a third of well owners have improved the level of well head protection since construction. The wells in this area are often poorly protected and improvements were promoted by the PSNP. In particular, this initiative introduced the idea of parapets and aprons to reduce the inflow and infiltration of surface water to the well and they provided cement for such improvements to be made.

3.5 Costs

How much householders have paid towards their water supplies varies quite widely (see table 3-7) depending on ground conditions, the depth to water and the willingness of owners and their neighbours to undertake some of the work.

Table 3-7 Inputs to well construction

Average cost per *woreda (in ETB)*	**AW**	**BS**	**MS**	**Average**
Traditional wells				
Lifting device cost	28	49	50	42
Materials	80	264	166	165
Labour	125	183	453	253
Total	233	496	669	460
Other labour inputs				
Owner worked on construction	2	7	20	
Neighbour worked on construction	0	3	3	
Total households surveyed	27	27	32	

However the total figures show the average cost of a traditional well to be just under 500 ETB. Material costs are highest in Boloso Sore where well owners have often sourced stones from a considerable distance and oil drums. Here, cement was mostly provided by the PSNP. Labour costs are highest in Meskan, even though most well owners (over 60%) assist with well digging. This is because well diameters tend to be larger, depths greater, and the ground harder. Water is also sometimes harder to find, with investors digging more than one well before water is found. Lifting device costs in Meskan and Boloso Sore are almost the same, but less in Aleta Wendo where tin cans are more often used for lifting water.

Overall it is apparent that a step to developing a family well costing around 500 ETB has, in the past, been acceptable to many household. These households have then also been prepared to continue to deepen and invest further in maintenance of the asset that they have created (see also Section 4.7.3). Bearing in mind the devaluation of the Birr over time, on average these wells, constructed over more than twenty years will probably have actually taken at least three or four times as much (1500-2000

ETB) to construct at present ETB value. With the recent growth seen in cash crops, entry level costs of 1500-3000 ETB ($100-200) appear affordable for a significant number of families, and in some areas much higher investments would be possible if promotion and advice were easily available.

3.6 Alternative sources of water and user choice

Productive uses and personal hygiene are important benefits facilitated by family wells. Levels of water use for bathing, and for watering animals are high at over three quarters of all wells surveyed in the four *woredas* (see Table 3-8). Small scale irrigation is also important but for a smaller proportion of households, especially in Boloso Sore). The economic value of traditional wells is likely to be highest in Meskan, where almost half the owners use the water for irrigation and all of them for watering animals. The patterns of water use are related to the alternatives sources of supply that are available.

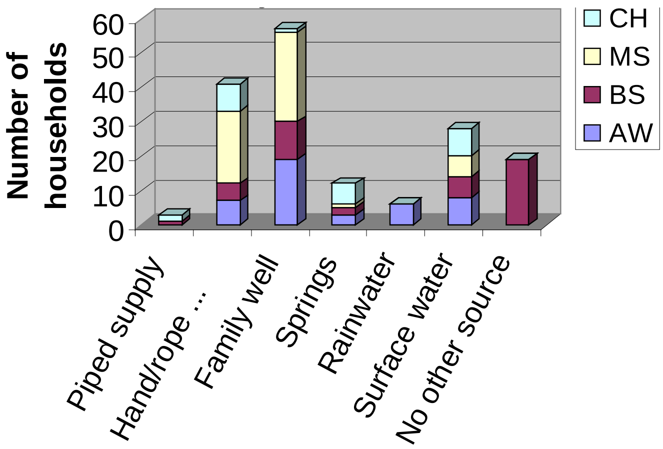
Aleta Wendo and Boloso Sore have more alternative sources of water which can be used for animals and bathing as well as family wells. In Aleta Wendo more than four out of five households have access to surface water as the nearest alternative to their own well, which affects their water usage especially if their family well begins to dry up. This compensates, in part, for the very low water coverage with protected supplies in this *woreda*.

A different pattern is observed in Meskan. Here, traditional well owners mostly have alternative access to communal supplies which, while of perceived good quality, cannot easily be used to satisfy bulk water demands (and they have to be paid for). Thus most households use their own or neighbouring traditional wells for most purposes, but in Meskan the high coverage with handpumps make these an accessible option too, especially for drinking and cooking water.

Table 3-8 Use of family wells for bathing and productive uses (i.e. none drinking water uses)

	AW	BS	MS
Bathing	77%	82%	99%
Watering animals	76%	78%	100%
Irrigation	27%	13%	47%

Figure 3-14 Nearest alternative water supply for any use



Source: Supply type2 (2) analyses

The high availability of hand-pumps in Meskan reflects the higher coverage with improved supplies in this *woreda* and proximity to the administrative centre at Butajira. The remaining un-served households (20%) are likely to be in scattered communities where communal supplies may be the most difficult to establish or serve enough people to be sustainable. An important observation however is that the nearest alternative water point for 75% of Meskan households is more than a kilometre away. Even where coverage is high therefore, there can be good incentives to keep the family supply working or even constructing more family wells. The high economic value of family wells in Meskan suggests that it would therefore be a prime *woreda* for starting off any acceleration of Self Supply to reach universal coverage, and to improve the supply of those nominally covered.

More than half of all households surveyed in Boloso Sore and Chencha have alternative sources which are more than a kilometre away. Only in Aleta Wendo is surface water so plentiful that two-thirds of households have an alternative source within a kilometre.

Alternative sources are chiefly used if the traditional well dries out or in the wet season when family wells may be highly turbid and very unpalatable for drinking. Since alternatives are generally much further away from the household and transporting water is hard, their use is confined to drinking and cooking.

3.7 Summary of main findings on family well development

- The present level of development of family wells is almost totally down to householders own initiatives. Only the Productive Safety Net Programme (PSNP) has significantly promoted improved well-head protection and JICA and other NGOs have piloted rope pump introduction but with very limited spread.

- Family wells in different *woredas* tend to have different characteristics. These are partly because of varying geomorphology and availability of materials, but also because of the habit of copying one's neighbours good ideas which means that locally adapted methods are quite recognisable.
- Meskan's family wells tend to have little protection apart from a slight rise in ground level around the well mouth, and are seldom covered, being of larger diameter. Aleta Wendo's wells tend to have a parapet of wood or an old oil drum, whilst Boloso Sore's wells have an oil drum or, as in Meskan, a slight mounding. A significant number of wells in Boloso Sore have been improved with a small apron and an oil drum through the PSNP.
- Most efforts at well protection are small, for the safety of children more than with reduction of contamination or ease of water lifting in mind. Much marketing will be necessary in most areas if demand for improved protection to family supplies is to develop.
- Wells are generally shallow (<20m) and long-lived. Despite some problems of unstable ground both above and below water level, local efforts at stabilisation (with dry stone and timber) and cleaning out, seem to avoid the need for well replacement.
- Owners value their wells enough to keep them working and invest in considerable regular, or sporadic maintenance (on an 'as needed' basis) to keep them operating.
- Costs of developing a family well in the range of 1500-3000 ETB ($US100-200) per step seem relatively affordable with higher ranges acceptable to some cash crop growers.
- Productive uses and improved personal hygiene are important benefits facilitated by family wells in addition to drinking and other domestic uses. Levels of well water use for bathing, and for watering animals, are high at over three quarters of all wells surveyed *woredas*. Small scale irrigation is less widespread but is practiced by almost half of families surveyed in Meskan.
- Well owners in Aleta Wendo and to a lesser extent in Boloso Sore have higher access to alternative sources of bulk water for animal watering. Meskan does not, as the nearest alternative source for most people is a communal supply which generally cannot be used for productive purposes.
- Meskan's experience illustrates how people are developing their own supplies to fill the gaps where communal supplies cannot reach or are inadequate, and where money can be made from water. It is therefore an area of particularly high potential for developing sustainable self supply support.

4 Socio-economic factors in self supply

4.1 Well ownership

Most traditional wells are owned by one family. Initiatives to construct a traditional well are usually the idea of one person, who takes the lead and ownership of the well. Only 4% of traditional wells are regarded as communally owned, where a group has got together to organise excavation (see Table 4-1). Of the rest, the vast majority (86%) are owned by an individual or family but shared with a number of neighbours. Only 10% of well owners do not share their well with any other household and that is generally in areas where wells are so numerous that each house has its own well.

In contrast, 97% of conventionally protected wells are communally owned and managed. Rope pumps, because of the nature of their introduction (mainly to communities but to one well-owner by JICA and to individual farmers by World Vision) fall between the two. Some 40% of rope pumps are owned and used by one family, and almost 50% are privately owned but communally used. These differences are important in their effect on management effectiveness, because many people have experience of managing their own well and organising those who share it, but community management is something new and often more challenging where it does not build on previous experience.

Table 4-1 Types of well ownership

	Traditional wells (345)	**Rope pumps (35)**	**Conventional protected**
One family	10%	40%	0%
One family but shared	86%	49%	3%
Communally owned	4%	9%	97%
Institution	0%	3%	0%

In terms of education (see table 4-2) well owners appear to be more likely to have secondary education or above both in terms of comparison with sharers and with regional averages, but still a third of owners are illiterate, and almost half have limited education.

Table 4-2 Educational status of well owners, sharers and regional averages

			DHS 2005
Education	**Owners**	**Sharers**	**SNNP males**
Illiterate	33%	37%	47.3%
Read and write	12%	6%	38%
Primary	21%	37%	7.2%
Secondary	27%	14%	17.5%
Above	7%	6%	1%

The majority of the rural population depends on agriculture and this is reflected in the occupation of well owners. But it is also apparent that salaried people seem to invest in water, but surprisingly less of those involved in trading (see Table 4-3).

Table 4-3 Occupational status of well owners

Occupation	Owners	Sharers	Average
Merchant	3%	8%	4%
Farmer	88%	83%	87%
Daily labourer	1%	3%	2%
Govt worker	7%	3%	6%
Housewife	1%	3%	1%

In each *woreda* a locally appropriate wealth ranking was developed (see Table 4-4). In all, corrugated iron or zinc roofs were used as one indicator of wealth, and generally land and cattle ownership were also included. A point was given for each indicator of wealth that a household had. The minimum score was therefore 0 (the poorest quintile) and the maximum score was 4, (representing the richest) except in Meskan where only three indicators were identified. Here totals were adjusted for ease of comparison with the other *woredas*. The method however provides more meaningful comparisons within *woredas* than between them.

Table 4-4 Household wealth ranking criteria by *woreda*

Woreda	Wealth Criteria 1	Wealth Criteria 2	Wealth Criteria 3	Wealth Criteria 4
Aleta Wendo	Zinc roof	>1 milk cow	1 ha of coffee or more	0.5 ha or more of enset
Boloso Sore	Zinc roof	>35 cattle	>13,000 Birr from crops	35,000 Birr from natural resources
Meskan	Zinc roof	>5 livestock	> 2 hectares	-
Chencha	Zinc roof	>/=2 cattle	>= 0.5 hectare	Send children to school

Using these indicators and assuming that they reliably reflect wealth, the profile of well owners does not suggest that that only the richest invest in water as might be assumed given the need for personal investment. Indeed, in Boloso Sore and Meskan the study found that households from the poorer quintiles are more likely to be well-owners (see Figure 4-1).

Figure 4-1 Wealth profiles of well owners, proportion falling in each quintile

	Aleta Wendo	Boloso Sore	Meskan	Chencha
Poorest	3%	72%	24%	9%
	32%	23%	42%	0%
	35%	3%	0%	13%
	12%	3%	16%	39%
Richest	18%	0%	18%	39%

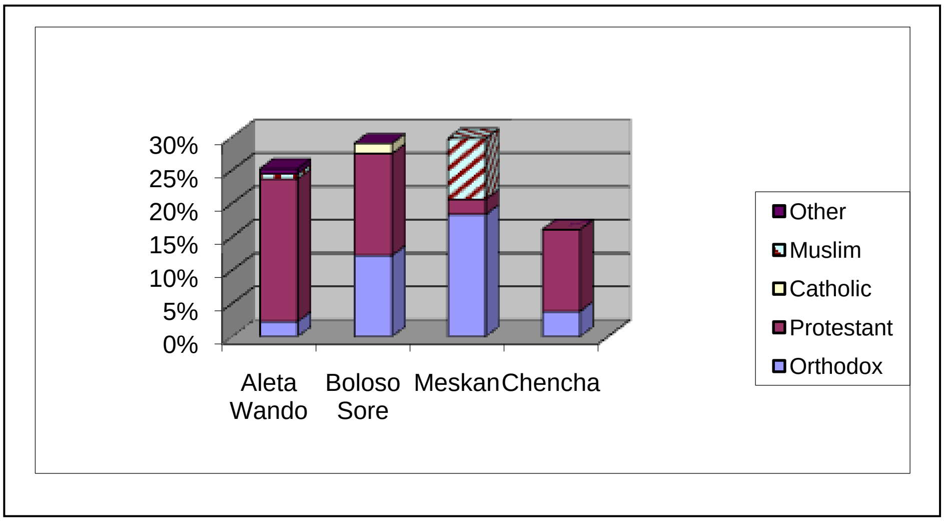
In the case of Boloso Sore this may be because most wells appear to be relatively shallow and easily dug by the family, and little further investment in terms of cash or effort is made. In Meskan, a significant number of wells are owned by people growing cash crops and a third of well owners fall in the richer two quintiles. An even higher percentage in Chencha were in the upper two quintiles but this may be because the wells selected were mostly those with rope pumps. These pumps were mainly given by projects to richer more influential members of communities and families that were farming cash crops such as apples. Overall it is apparent that family wells are not just the property of the rich, but may be attainable even by those regarded as being the less affluent in the community. This is partly because, in the areas chosen, groundwater is relatively easily accessed and well-digging can be done by families themselves or, as is more common in Aleta Wendo, by small groups. Comparing owners and sharers it appears that sharers are slightly more likely to be in the lowest quintiles (See Table 4-5). Given the large numbers of sharers (see next section), sharing family wells appears to extend the access of the poor to water supplies significantly

Table 4-5 Comparison of wealth ranking of owners and sharers

Wealth quintiles			
Poorest	**Owners**	**Sharers**	**Total**
0	37%	59%	41%
1	21%	7%	18%
2	15%	10%	14%
3	13%	14%	14%
4	13%	10%	13%
Richest			

In terms of respondents' religion the survey targeted about average numbers of Protestant and Catholics owning wells, slightly below average numbers of Muslim well owners and rather above average numbers with an Orthodox background (see Table 4-6) in terms of regional averages.

Figure 4-2 Religion of well owning families



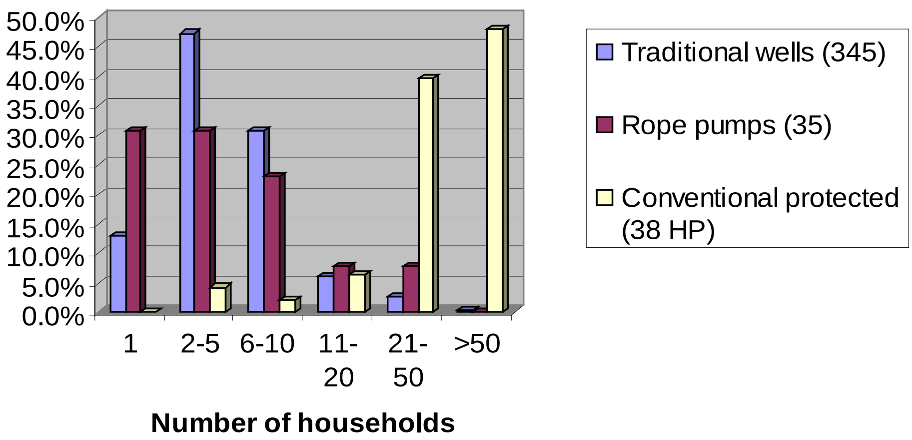
Muslims and Orthodox well owners were mostly found in Meskan, whilst Aleta Wendo and Chencha were mainly Protestant with some Orthodox.

Table 4-6 Well owner religious profiles compared to regional averages

	SNNPR	**2007 Census**
Religion	Well owners	SNNPR
Orthodox	37%	20%
Protestant	51%	55.5%
Catholic	2%	2.4%
Muslim	10%	14.1%
Other	1%	7%

4.2 Well sharing

Figure 4-3 Numbers of households sharing a supply

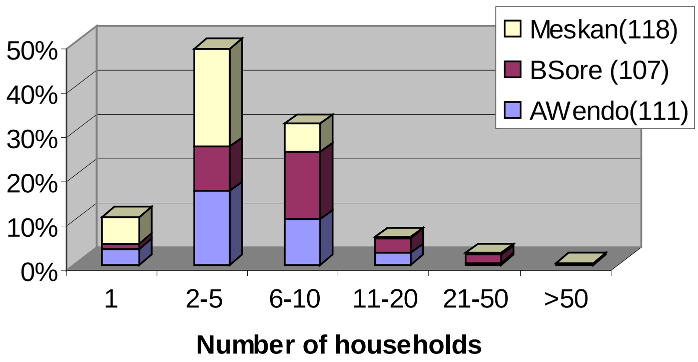


It is normal for neighbours to be invited to use the closest supply, and many will be related to the owner. Others are invited by the owner or ask permission. The result is that sharing is the norm, but often among relatively small groups (see Fig 4-3)

Traditional wells are most commonly shared between a group of 2-10 households (see Fig 4-4) with an average of 6.7 people per household. Groups of more than about 65 people (10 households) are relatively rare, but one well owner has 150 households using the well (Meskan), as it is the only one in the area. It has taken him 5 attempts to find water and others have not been so persistent. Since water in his well is plentiful he allows all to use it, and even to irrigate their vegetables.

Rope pumps are more often individually owned as half of them (mostly in Chencha) have been given to individual farmers, principally for irrigation, and one by a producer to act as a demonstration overseen by the owner. The rest have come from JICA through the *woreda* as demonstration units, which serve small groups.

Figure 4-4 Proportion of traditional wells serving a number of households



Source: Supply type 2(2) Analyses

Aleta Wendo and Meskan tend to have smaller groups using each traditional well than is the case in Boloso Sore. This may reflect both more easily available alternative water sources of all types, but also, in the case of Meskan, higher coverage with community water supplies.

The average number of users for communal wells is 56 households, ranging from 4 to 180 with a median of 44 households or approximately 260 people (see Table 4-7). For all well types the median is also less than the average as the latter are skewed by a few wells with very high numbers of users.

Table 4-7 Average number of households sharing different supply types

	Traditional wells (345)	**Rope pumps (35)**	**Conventional protected**
Average	6.2	6.3	56.6
Median	4.5	3.6	44.3

Among the 85 well owners interviewed in the more detailed household survey, two-thirds shared the well almost exclusively with relatives and a third also with others not regarded as family members. In Aleta Wendo and Boloso Sore, the proportion sharing with and beyond the family were approximately equal, but in Meskan it was commoner just to share with family. However the *kebeles* concerned in Meskan mostly have more plentiful groundwater and so it is common for many households to have constructed their own supply.

It appears that restrictions placed on sharing with more than just family are only a decision of the owner where the well is sometimes in danger of going dry, or where neighbours did not cooperate in construction when asked. Otherwise use is not restricted by the owner.

The number of well users is not a constant (see Table 4-8). In many places (especially in Boloso Sore) the number of users depends on the season. Where some sources go dry in the dry season, user numbers increase for more reliable sources, but also where some well water becomes very turbid in the wet season, people turn to those wells where water stays clearer. Thus some wells have fewer wet season users because the supply is of poor quality, whilst others have fewer because neighbours' own wells have water at that time. Those wells which have more users in the wet season tend to be those which are less turbid or where owners only restrict use by neighbours in the dry season.

Table 4-8 Proportion of wells with seasonal user patterns

	AW	**BS**	**Meskan**
Same all year	50%	27%	67%
More in wet than dry season	21%	27%	18%
More in dry than wet season	29%	46%	15%

People appreciate good water quality, and so are often prepared to walk further for drinking water. Thus a great many traditional wells are not used for drinking if there is a hand pump within a reasonable distance, but they may be used if the hand pump breaks down and an alternative one is too far away. Among traditional wells, there are distinct preferences for some as drinking water sources, because of perceptions of cleanliness and taste. Some 75% of rope pump owners have found that the number of users increased when they installed a pump, as more neighbours elected to come to what they perceive as a cleaner source. On average 50 more people took their drinking water from each well with a rope pump installation.

For traditional wells, sharing is not a fixed relationship but depends on the wishes of the owner. Some wish to keep autonomous control of their well, or regard it as a service to the community around them and so take responsibility for all costs and maintenance issues themselves. This would appear to be true for about half of all owners, with the remainder mainly calling on neighbours and extended family to provide labour or materials when needed. Only one owner asked for regular contributions from neighbours in the same way as conventional supplies but he has a rope pump and a very high number of wet season users (150 households) which may mean that he is trying to control numbers by asking for payment. Another two owners ask those taking water to help them in their fields in return for providing them with water. A small number, about 12% of sharers, provided food or materials at the time of well construction or maintenance.

Overall there is no acknowledged system by which sharers recompense owners, so it is on an informal basis which does not involve establishing a tradition of payment or even often of obligation.

For communally owned conventional hand pump supplies 75% of users pay a monthly contribution (of 1-2 Birr per month per household or very rarely by jerrycan), while the rest do not pay and do not feel that payment is necessary. All those who do pay seem to accept the need for funds to keep the pump working.

4.3 Multiple uses and benefits of family wells

The wells chosen for the survey were selected to be those used for drinking, among other uses. However in order to include as many rope pumps as possible, two were included that are not used for drinking. Some wells are used for drinking seasonally if preferred sources dry up or go cloudy.

Table 4-9 Water uses for different supply types

	Traditional well	Rope pump	Community HP
Drinking	99%	92%	100%
Cooking	99%	97%	89%
Washing clothes	90%	70%	15%
Bathing	86%	49%	17%
Watering animals	85%	54%	15%
Irrigation	30%	43%	0%

It is apparent from Table 4-9, that traditional wells are widely used for all purposes, especially those within the home. Most bathing and animal watering is also done from these sources but if surface water is nearby, its use saves lifting water for these larger volume purposes. Only a third of traditional wells are used for irrigation, probably because of the difficulties of lifting enough water by hand. With the rope pumps, the main uses in the home are mostly satisfied by the pump, but activities requiring privacy such as clothes washing and bathing tend to be carried out elsewhere, as the rope pump is usually outside the family compound and often located in open fields. Many of the rope pumps form part of NGO initiatives to increase irrigation capacity and so a higher proportion are used for this purpose.

The uses to which water is put may vary over time. Those whose wells go cloudy in the wet season may only use them for drinking in the dry season, but use them for washing or bathing all the year round. Of those who have installed rope pumps and use them to provide drinking water (94%), 52% only started drinking the water from the well when the pump was installed, with the other 48% having always used the source for drinking.

In contrast, community hand pumps are hardly ever used for watering crops, as water has to be carried too far to the farmer's land and communal wells are often under heavy pressure of demand. Areas around communal wells may also have unclear land ownership or be able only to provide benefit to one landowner, rather than the whole community. Similarly communal sources are seldom used for watering animals for fear of increasing contamination of the water and because of the pressure of demand which constrains the amount of water anyone may draw at one time. This and the public nature of the communal well mean they are usually not suitable for clothes washing or bathing except for those people in the nearest houses who may carry water home. The uses of improved community sources are thus more limited, which can translate into less economic pressure to keep them working. On the other hand these types of source are preferred for drinking water by most people, but some of these users have nearer alternative sources of water they are prepared to use for cooking. They can also revert to these alternative sources for all domestic purposes if the hand pump breaks down, also reducing the pressure to organise a repair.

Apart from giving more flexibility in water usage, households seem to find that owning a well has tangible benefits which can positively impact on the whole life of the family. Thus of those who have dug their own wells over a quarter (26%) already had a source within 10 minutes walk, but felt it worthwhile to have their own well rather than sharing a community well or one belonging to someone else. A fifth saved themselves two to three hours a day in water collection, and the rest one to two hours. Time saving and additional water have brought many benefits, the most remarkable of which is the apparent shift in food security. Before having such easy access to water, 82% of families (see Table 4-10) said that they did not produce enough food to cover needs for the whole year. After they dug their own well, 76% produced enough for all the year and noted in particular the growing of a wider variety of crops and the increased number of animals which the improved access made possible (see Table 4-11). Part of the increase in productivity is probably due to the reduced time to collect water, moving from sources over a kilometre away to a supply 'on the doorstep'. This benefit would also apply to those nearby households sharing the supply. However, usually it is only the well owner who is in a position to expand irrigation although sometimes sharers may take water for seedlings or if they have adjacent plots to the source.

Table 4-10 Perceived changes in family food security after well construction

Food production before and after family well construction		
Food insufficient all year	**Before**	**After**
Food produced is enough for all year	82%	1%
Food produced is enough to sell as well	4%	76%
Save expenditure with own produce	3%	5%
Invest earned money in other activities	0%	3%
Aspects not possible before	1%	1%

Table 4-11 Main aspects of change in relating to productive uses after well construction

Expanding production	
More crops	43%
Different crops	63%
More animals	67%
Other productive use	12%
No change	17%

The possible availability of time gained from having a closer source may not be noticeable as all it does is allow other activities which fill the time available. Few surveyed respondents mentioned greater availability of time as a change after getting a well, perhaps because the time gained immediately became filled with other activities. However, in Boloso Sore and Aleta Wendo well owning families did mentioned that children are more able to go to school, small children didn't need to be left so often on their own while water was being collected, and that health has improved, sometimes leading to lower outlay on medication. Aleta Wendo owners mostly recognised that having a well changed their relationship with their neighbours giving them more status and a feeling of being able to provide a service to them.

Table 4-12 Changes to household quality of life after constructing a family well

Other changes brought for 84 households			
Respondent	**Aleta Wendo**	**Boloso Sore**	**Meskan**
1. More time	4%	15%	10%
2. More income	18%	19%	13%
3. Social	79%	4%	10%

4. Health	79%	77%	53%
5. Economic benefit	93%	42%	27%
6. Education	64%	23%	57%
Family			
1. More time	7%	27%	30%
2. Small children not left	71%	54%	60%
3. Less medication	21%	31%	30%

Almost all rope pump owners felt that having the pump had reduced the time taken to draw water, made more water available and provided cleaner water. Of the two wells where this was not the case, one had a rope pump which had broken down too frequently (ten times) and one well tended to go dry. All except one respondent, felt that the effort of drawing water was now less, and the exception was a rope pump on the deepest well in Chencha (30m) which is at the very limit for the standard rope pump to perform.

A quarter of rope pump owners reported no change in what they could now do with their well water, but a third felt that there was more water available for domestic purposes and for watering vegetables, and a fifth now used the water more for animal watering. Half of them said that their productivity had improved with introduction of the pump.

Table 4-13 Perceived benefits reported by rope pump users (sample 35 interviews)

	Households mentioning specific benefit in interviews				
Water drawing	**Number of HH**	**Percentage**	**Water usage**	**Number of HH**	**Percentage**
Reduced time	33	94%	**No new uses**	9	26%
More water	33	94%	**More for vegetables**	25	71%
Reduced effort	32	91%	**More for domestic use**	26	74%
Cleaner water	33	94%	**More for animals**	16	46%
Other	3	9%			
Total	35				

Just under half of rope pump owners felt that having extra water easily available gave them enough additional income to pay back for the pump. They generally had a good idea of the cost of the pump, and those obtaining it through the *woreda*/ JICA scheme had mostly begun to pay something back towards the cost.

4.4 Problems and conflicts

Few people report problems with the supply from their family well as the high satisfaction levels suggest. Most problems are related to the sharing of wells. From the owner's point of view, the main problem is how to limit the number of users so that the well does not go dry, and how to reduce number of users at times of limited water availability. From the sharers' viewpoint the main problem lies in getting permission to use the nearest well if it is not owned by immediate family, and the awkwardness of using (and wear and tear on) the owner's rope and bucket as the sharer seldom contributes to replacement.

Total exclusion is rare and usually arises if either there is family conflict or if the one who wants to share a well did not contribute towards construction with labour or materials when other neighbours joined in. Partial exclusion usually refers either to limitations on the uses to which water may be put (e.g. no irrigation, especially from communal wells), or activities (e.g. no clothes washing near the well). Some 82% of sharers had never been denied access, but of those that had, half were because the source was drying up. For the rest it was because of family conflict or non-payment for a communal supply.

Conflicts are therefore most likely to be avoided if users:

- Are related to the owner (traditional wells)
- Have permission to use the well
- Keep to the rules the owner/ community sets,
- Volunteer to help with works if required

And if there are:

- Many wells so that almost every house has one, and there is no pressure on the facility
- And water is plentiful all the year round

Five users (20%) of communal supplies complained of management issues. One user of a communal supply voiced concern that they are allowed to collect water on only certain days in the week, although this is not one of the wells with highest number of users.

Two other households voiced concern over the time taken to organise repairs and the lack of water treatment, and two others felt there were management issues but did not give details, Apart from these concerns, communal sharers do not seem to think that there are any management issues causing problems. Among those sharing private wells one family (5% of sample population) complained that they were not allowed to wash their clothes by the well, but otherwise management was thought to be without problem, even if it did require careful usage of the rope pumps where they were installed.

A problem which arises mainly for communal wells with many users is that of having to queue for water. One in five householders said they had to queue, but of these a third collected water within five minutes and three quarters within 15 minutes. Those who waited the longest were mainly waiting at pumps with over 300 users. Two rope pumps with many users (one about 200 and one over 400 users) also suffered from regular waiting to collect water. Whilst theoretically pumps can provide water for as many as 500 people this assumes a constant stream of people all day. As most people want to collect water in the morning before going to the fields and in the evening when they come back, the number who can conveniently collect water without delay is usually much fewer (around 200).

4.5 Satisfaction, preferences and aspirations

The survey explored user and sharer satisfaction with supplies, and the underlying reasons, looking both at variations between *woredas* and differences between owners and sharers of wells.

Some 82% of traditional well users were satisfied with their supply, while 16% were not (2% gave no answer). Analysing the responses more carefully it is apparent that among families with sole use some 90% are happy with their supply. All of those who are not satisfied are sharing their wells with others in Meskan, mainly in Yemerwacho 1 and 3 *kebeles*. Their prime worry is over contamination of the wells and also the difficulty of drawing water. None of the wells are ones that go dry. They are mainly ones in which depth to water is in the range of 15-20 metres, and which do not have pulleys to help in water lifting. In most other wells in the area water is less than 10 metres from the surface.

Both owners and sharers were found to be generally satisfied with their supplies, particularly those with rope and handpump supplies. Over 90% of communal wells sharers said they were happy with the supply, and all of the rope pump users. However the latter group consists only of those whose pumps were working and so does not reflect rope pump users as a whole. Many with rope pumps that are not working are much less happy with the technology because of the difficulty of obtaining spare parts and trained mechanics (see Rope pump report) to undertake repairs.

Table 4-14 Levels of satisfaction with the supply from difference sources

	Respondents satisfied	**Total respondents**	**Percentage satisfied**
Conventional	42	46	91%
Rope pumps	35	35	100%
Traditional wells	263	322	82%

It is only when it comes to the ability to use the supply for many different purposes that traditional wells are really appreciated, and here too rope pumps have a distinct advantage, compared with communally owned wells (See table 4.14).

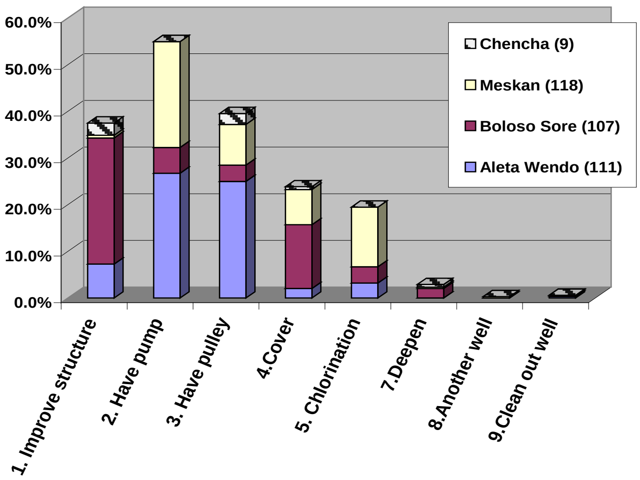
Among sharers, satisfaction with supply seems to be highest among those accessing traditional wells, 100% being satisfied or very satisfied. For rope pump and hand pump sharers the proportion is a bit lower, at 88% and 83% respectively.

Table 4-15 Reasons for satisfaction and dissatisfaction

	Traditional well	Rope pump	Conventional communal
Satisfaction with			
1. Distance	45%	63%	54%
2. Convenience	49%	91%	80%
3. Privacy	1%	0%	2%
4. Can use for many purposes	51%	66%	30%
Dissatisfaction			
11. Easily contaminated	15%	0%	0%
12 Difficulty to use at night	1%	0%	0%
13.Difficulty of use	11%	0%	4%

	Traditional well	Rope pump	Conventional communal
Satisfaction with			
1. Distance	45%	63%	54%
2. Convenience	49%	91%	80%
3. Privacy	1%	0%	2%
4. Can use for many purposes	51%	66%	30%
Dissatisfaction			
11. Easily contaminated	15%	0%	0%
12 Difficulty to use at night	1%	0%	0%
13.Difficulty of use	11%	0%	4%

Figure 4-5 Changes to supply wanted by traditional well users (344)



Well users were also asked what changes to their supply they would most like to see, for all types of well. Those using traditional wells expressed concerns over well head protection and lifting devices, but also one in five mentioned the chlorination of wells. Families in Meskan were found not to be particularly interested in improving protection, but more in pulleys or pumps, and chlorination. Boloso Sore well users are most keen on well head protection, probably since so few of their wells have parapets and because they have seen others with well-constructed aprons. Aleta Wendo and Meskan well users are more interested in lifting devices than Boloso Sore probably because of the greater depths to water in these *woredas*. For other types of well there seems to be some possible confusion, or a real wish to return to a lower level of service which is easier to maintain. This would need more investigation considering rope pump owners were all satisfied with their supply, yet some 26% say they would like to change to a pulley.

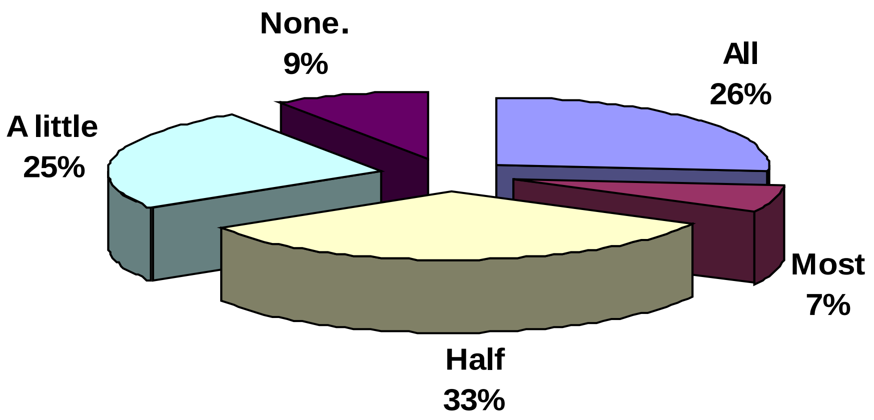
Well owners almost all do want to make some improvements to their wells. Some 80% want to have an improved lifting device, often specified to be a rope pump in the case of Aleta Wendo. In the areas surveyed there is almost no tradition of using pulleys. Nearly as many would like to improve protection, whilst 60% would like to increase lining. A few also mentioned water storage and deepening.

Table 4-16 Traditional well owners preferred changes to supply

Changes like to make		
Well head improvement	56	74%
Lining	50	66%
Lifting device	60	79%
Water storage	5	7%
Deepening	1	1%

Owners were then asked whether they could make these changes themselves. Surprisingly few felt that they needed to depend totally on others. The respondents were after all, people who have already shown some initiative and put their own efforts into improving water supply.

Figure 4-6 Proportion of cost well owners are prepared to cover



It seems that they are aware of basic costs (e.g. rope pump and cement) and are willing to invest further in their supply. The willingness to invest varies according to the economy of the area and also the way of thinking of the owners. Desire for change and willingness to invest seems highest in Meskan.

Figure 4-7 *Woreda* differences in well owner willingness to pay

Proportion of cost owner can cover	AW	BS	MS
All	21%	12%	50%
Most	3%	0%	18%
Half	41%	44%	9%
A little	17%	36%	23%
None.	17%	8%	0%

The greatest constraint that potential family well investors face is a lack of technical advice on how to make improvements, the materials and equipment they will need, and where to go to for support services on pumps, lining and well-head protection. Few (less than 10%) required full external funding, and more than 50% were prepared to cover at least half the cost directly and more if loans were available.

Table 4-17 Perceived support required by well owners

What assistance they would need		
Technical advice	59	78%
Links to a producer/artisan	39	51%
A loan	19	25%
A grant	20	26%

Those families that were interviewed but were without their own supply were asked what supply type they preferred and what type of ownership (private or public). They also gave reasons for their preferences. There is little difference in regard to whether these households want a public (communal) or private (family well) source (53% to 47%). Those who would prefer a communal supply mostly cite hygiene as the main reason (57%), but it also seemed that respondents were not aware that a communal supply would imply payment for water. A quarter of respondents think that not having to pay would be a major advantage of a communal source, when in fact payment is now required.

Table 4-18 Well sharers service type preferences

Reasons	Public	Private
Don't have to pay	26%	10%
Have own rules	17%	20%
Long lasting	17%	40%
Hygienic	57%	40%
Maintenance	9%	0%
Financial	9%	5%

Preferred technologies (without any discussion of the cost implications to users or *woreda* budgets) were:

Table 4-19 Well sharers technology type preferences

Rope and bucket	5%
Handpump	30%
Standpost	42%
Rope pump private	14%

Rope pump communal	9%

Those without their own supply were asked what type of supply they would prefer. Most would ideally like access to supplies that would need to be communal (see Table 4-20). However 53% of those without their own source have contemplated constructing a well themselves, the rest being content to keep sharing. Of the 53%, half of them would like to install a rope pump (reflecting the 23% wanting private or communal rope pumps above). Of the rest (small sample, only 9 households), two want to just have a well with good wellhead protection, three want a handpump and four perhaps even more unrealistically wanted a tap. For most the main constraint to constructing their own well is said to be financial but some give the local rock formations as a reason, suggesting efforts have already been made unsuccessfully to develop private supplies in their area.

Table 4-20 Well sharers requirements from government

	First priority		Secondary priorities	
More community water points	21	50%	0	0%
Technical advice for own supply	11	26%	16	47%
Loans	1	2%	5	15%
Full funding for private supply	9	21%	13	38%

Government support desired is primarily for more community water points, except in Meskan where emphasis is more on support for private initiative, reflecting the high existing coverage and demand for water for productive purposes. After that most sharers of water supplies wanted technical advice for establishing their own supply, and to a lesser extent full funding.

4.6 Summary of main findings on socio-economic factors

4.8.1 Almost all traditional family wells are shared, except where they are so numerous that almost every house has one. Wells are on average shared by a group of around 6 houses or 20 people (median 4.5 or 15), ranging from 1-150 households for traditional wells.

4.8.2. Owners of family wells are better educated than average, but even so a third are illiterate. Well over a half of owners are in the lowest 2 quintiles for wealth indicators, so family wells are not just the province of the rich and best educated.

4.8.4 Well usage varies from season to season depending on the nearest available sources acceptable for different uses.

4.8.5 People appreciate water quality from rope pumps and communal handpumps, and when a rope pump is installed the owners can expect an average of fifty more people wanting to use the supply.

4.8.6 There is little culture of payment for water in rural areas, so it is not a common practice to charge users to share a family well supply unless it is near to a paid -for system (communal piped supply/ handpump).

4.8.7 Family wells tend to be used for all purposes, and this, along with convenience, is their main advantage. Generally people are only taking water for drinking and cooking from communal protected sources, looking elsewhere for more convenient (nearer to the household and with less queuing) supplies for bulk water uses. Thus even where not used for drinking, family wells play an important role in reducing pressure on communal supplies, so that adequate water is available for all domestic and hygienic purposes.

4.8.8 Owning a well seems to have a major impact on food security, allowing more animal watering and more crop types and production. Some of this benefit may be from reduced time taken to draw drinking water, and some a direct benefit from more easily accessible water.

4.8.9 Other family well benefits cited include better health, family economy, less keeping children out of school and better childcare.

4.8.10 Owning a rope pump has additional benefits in reducing the time taken to draw water and further improving productivity. About half of the rope pump owners felt that the economic benefits would be sufficient to enable them to repay any loan for the pump.

4.8.11 Exclusion from private well use is very rare unless the supply is going dry. Some cases of family conflict may also lead to exclusion.

4.8.12 Family well owners most want to improve water lifting and protection, and around two-thirds (but three quarters in Meskan) were ready to prepared to pay half the cost or more, even without any campaign to promote demand or self reliance. The greatest demand is not for financial assistance but for technical advice and knowledge on providers of good artisanal services.

5 Water supply delivery and benchmarking

The aim of this section is to look at the performance of different water supply systems in terms of water quality, reliability and adequacy along with user satisfaction in order to help recommend norms and protection standards.

5.1 Observed water quality

5.1.1 *Impact of source type on bacteriological quality*

Before making any comparisons between the water quality distribution in different source types some words of caution are required. It should be borne in mind that only conventional hand pumps and lined wells have been constructed specifically with drinking water standards in mind. This relates not only to the technical specification of the installation but also to the associated education given to users on how to avoid contamination. Family wells have had no such precautionary measures taken, and observed water quality may not therefore reflect the potential for such supplies to deliver better quality water.

Figure 5-1 Water quality in different source types (400)

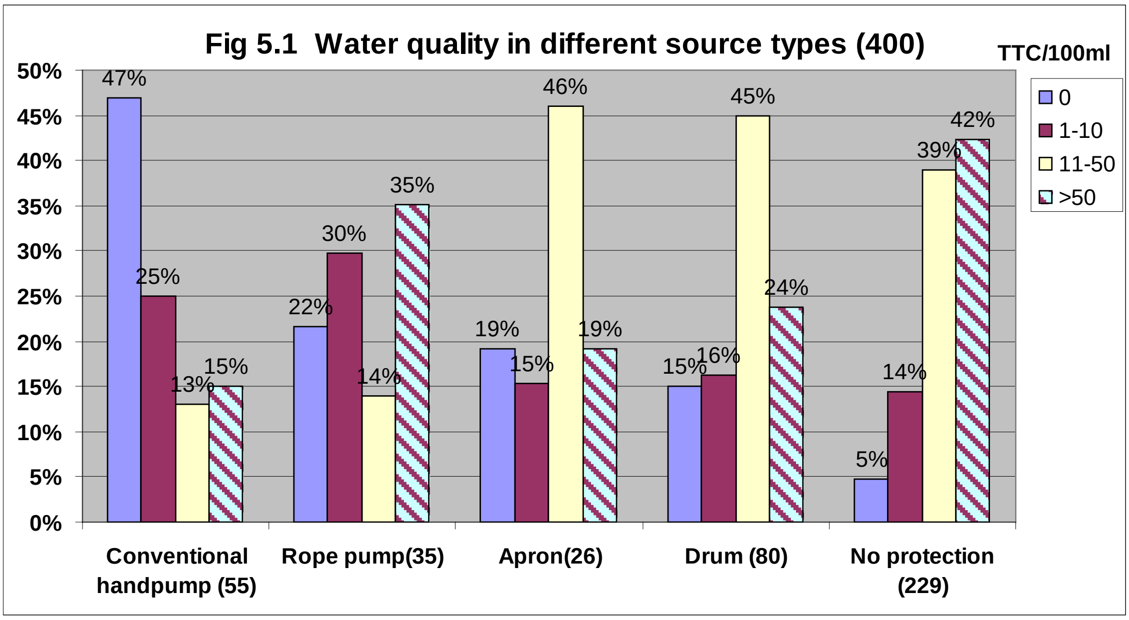


Figure 5-1 shows clearly that the **handpumps** on lined wells do give the best quality water. Nevertheless, only 47% conformed with the national standard for drinking water supplies (zero faecal-coliform, FC, or thermo-tolerant coliform, TTC). A total of 73% however had less than 10 TTC/100ml which may be taken as low risk for rural water supplies. With levels over 50 TTC/100ml, 15% of handpumps may be regarded as high risk. Examining the different types of communally managed and protected sources, it becomes apparent that handpumps on hand-dug wells are more prone to contamination through site hygiene and or construction than shallow boreholes. Only 38% of handpumps on hand-dug wells delivered water with zero faecal coliform (some 65.5% had levels less than 10 TTC/100ml) whilst of those on drilled shallow boreholes, 59% had zero TT coliform, and 81% less than 10 TTC/100ml. There are more opportunities for leakage back into the concrete ring lining under top slabs on larger diameter wells than into cased boreholes, and so more care needs to be taken around hand-dug wells even if they are thought to be sealed by the handpump and top slab.

Figure 5-2 Good rope pump, but installed below ground level, with no drainage or spout, so high opportunity for spilled water to seep back into the well

The **rope pump** results indicate that if absence of thermo-tolerant coliform is the test, then the supplies performed half as well as conventional handpumps. Over half (52%) had less than 10 TTC/100ml, some 10% less than handpumps on better protected shallow wells. This poorer performance is not surprising. Many of the rope pumps were not installed primarily as drinking supplies. The five sampled in Aleta Wendo were installed for domestic use more than two years ago, and of these three were completely free of thermo-tolerant coliform and two had a low count of 2 or less, both in the wet and the dry season, illustrating that safe levels are achievable with this technology. The pump also cut by almost half the proportion of wells with moderate contamination (between 20-50TTC/100ml) compared to traditional wells without rope pumps (14% and 26% respectively).

The majority of rope pumps sampled were in Chencha where NGOs have mainly promoted the pump for irrigation purposes. The sources are generally used for drinking as well, but have mostly been installed with top slabs at or almost at, ground level, and with no apron or drainage (see Fig 5-2). Additionally the spout on several was seen to have broken off so that excess water spilled onto the top slab and drained off directly onto the ground surrounding the slab. From here it is easy to imagine that the water will return to the well. This may well explain the high proportion of wells with gross contamination (a third with more than 50 TTC/100ml). 87% of the rope pumps with high contamination levels were found to have water ponding close to the well and no drainage channel. Of the 10 with highest thermo-tolerant coliform counts, all had been repaired in the past six months, without being chlorinated afterwards, or were set below ground level without drainage and with easy leakage of water back into the well, or both. The low numbers of operating rope pumps used primarily for drinking water, and the generally poor installation practices severely affected the possibility of sampling a wide selection of pumps with adequate protection.

Later dry season sampling in Zuway (May 2011), or rope pumps on shallow hand-dug (unlined) wells installed primarily for irrigation, found fewer wells with very low contamination but also significantly fewer (15% as opposed to 33%) which were badly contaminated (over 50 TTC/100ml).

Of the traditional wells, separating those wells with an impermeable parapet (such as an old oil drum) and those also with an apron from those wells with lesser protection (See Fig 5-1) suggests that these two features do provide a significant level of protection. However the aprons were mostly of very small width (20-40 cm) and generally had no lip and drainage to take spilt water away from the top of the well shaft. Thus they provided a small level of protection and potentially could provide much more if better designed and constructed. The installation of an oil drum and an apron at the well mouth halved the number of wells with high risk thermo-tolerant coliform levels (over 50 TTC/100ml), and nearly tripled the proportion with no contamination compared to unprotected wells. Since this kind of protection was commonest in Boloso Sore, the results in this *woreda* were significantly better than in the others.

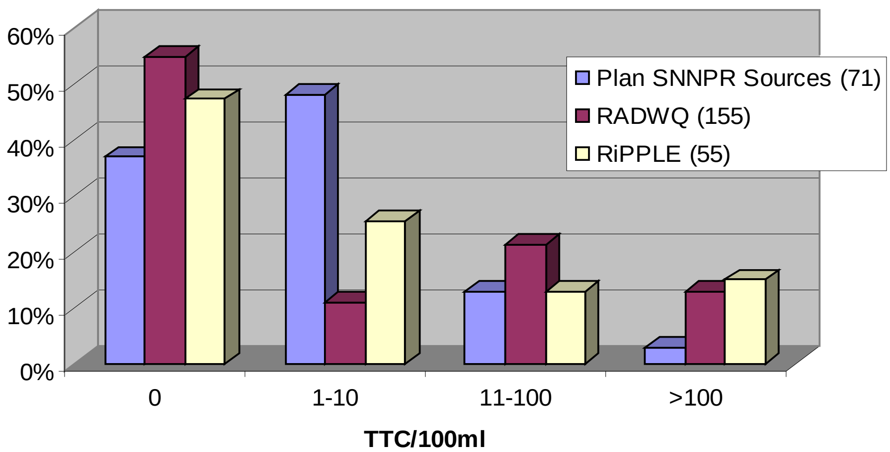
For all types of supply it seems that there is good awareness of the need to avoid putting a well and latrine close to each other. Despite quite high latrine coverage in Aleta Wendo and Boloso Sore (91% and 92% of households respectively) and rather lower levels in Meskan (54%), less than 1% of wells had a latrine within 10 metres. However a third did have a latrine within 30 metres.

Although water quality was generally not 'safe' in traditional wells, and the survey was undertaken in the rainy season when diarrhoeal incidence would be expected to be at its height, interviews recorded very low rates of such illness. The rate of those with diarrhoea in the previous two weeks, was 1.4% overall and 4.7% in under 5's with a survey covering some 1,135 people.

5.1.2 *Comparison with other studies on water quality of protected sources*

Water quality studies have been undertaken in the last five years by BoWR for Plan International and by UNICEF, Ministry of Health and WHO for the Rapid Assessment of Drinking Water Quality (RADWQ). These help to put the results of this survey in a national context. It appears that for handpumps, the RiPPLE results for SNNPR fall between those for RADWQ (WHO 2010) and the Plan Study (2006), but reflecting a rather similar pattern to RADWQ findings for those with zero and >100 TTC/100ml (see Fig 5-3). Unfortunately neither of these other studies looked at unprotected water sources so no comparisons can be made about these sources.

Figure 5-3 Water quality results for protected wells with handpumps



There is also a lack of other data with which water quality from rope pumps can be compared. The only data available is that for a comparative study of rope pumps and Afridev handpumps installed on communal drinking water supplies in Mozambique (WaterAid 2008, See Table 5-1). This study also found that rope pump water quality does tend to be slightly worse than conventional handpumps, probably because of poor sealing of the headworks, especially on hand-dug wells. Table 5-1 shows that for low risk water quality, the studies in SNNPR and Mozambique reflect a similar pattern with three quarters of conventional handpumps providing low risk water and just over half of rope pumps. The biggest difference between the studies is in the numbers of sources providing high risk supplies. The SNNPR rope pumps having over fifteen times as much chance of being badly contaminated, reflecting the more stringent installation standards in Mozambique, where the rope pumps are for community drinking water supplies.

Table 5-1 Water quality in conventional handpumps and rope pumps

TTC count	Mozambique Afridev	SNNPR handpump	Mozambique rope pump	SNNPR rope
<10 TTC/100ml	76%	73%	54%	51%
>50 TTC/100ml	1%	15%	2%	34%
Sample number	91	55	92	35

5.1.3 *Differences between woredas in bacteriological water quality*

The distribution of water quality per *woreda* for traditional wells (Fig 5-4) shows that there are major differences. Meskan wells exhibit significantly worse water quality than those of Aleta Wendo and Boloso Sore, especially in relation to the highest levels of contamination, with over 55% of sources in Meskan having more than 50TTC/100ml (more than twice as many as Aleta Wendo). This ties up with the observation that few Meskan wells have a parapet, apron or are covered (see Section 3.2) leaving them more open to contamination by inflowing water and wind-blown dirt. Wells in the other two Woredas are much more often closed and with an oil drum or significant mounding of earth to keep out some of the return seepage and spilt water. Boloso Sore in particular has many examples of wells improved under the PSNP with a small apron and oil drum.

Preliminary results from the sampling undertaken in May 2011 suggest that the performance, in water quality terms, or traditional wells is better in the dry season. Monitoring 90 wells in both seasons showed that the proportion with less than 10 TTC/100ml rose from 20% in the wet season to 53% in the dry season. Similarly the proportion which were badly contaminated fell from 39% to 20%. This would suggest that with better protection against inflowing water from the surface, traditional wells with water drawn by hand with rope and bucket, do have the capacity to provide improved water quality.

Figure 5-4 Water quality in traditional wells

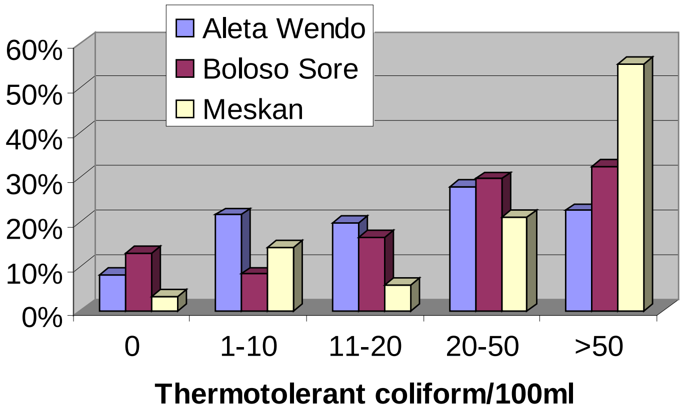


Figure 5-5 Comparison of conventional and rope pumps Mozambique and SNNPR

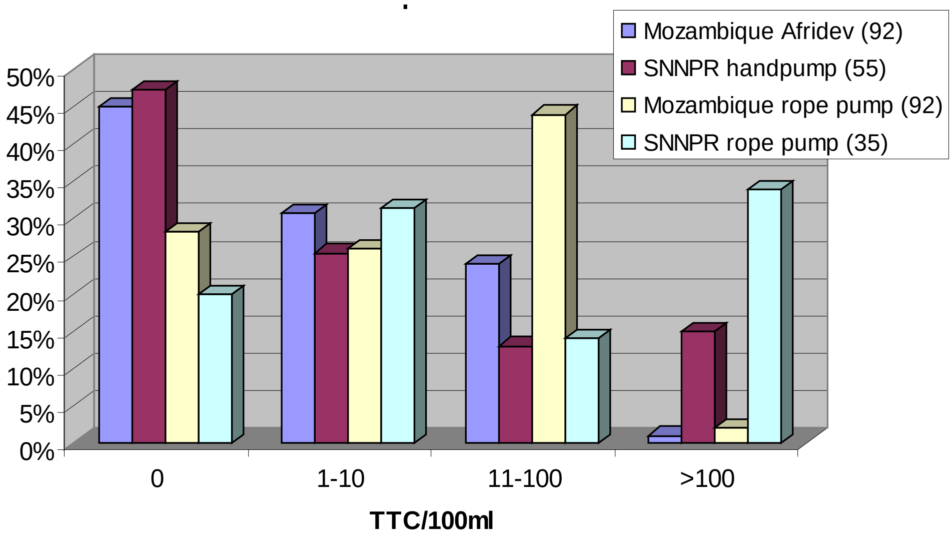


Table 5-2 Wet and dry season water quality in traditional wells

TTC/100ml	Wet season	Dry season
0	9%	14%
1-10	11%	39%
11-20	16%	11%
20-50	26%	16%
>50	39%	20%

5.1.4 *Turbidity and conductivity*

Measurements of electrical conductivity all suggested relatively low levels of dissolved solids, with the lowest conductivity levels in Chencha and Boloso Sore (below 200 μ-Siemens/cm^{-1}), and mostly under 600 μ-Siemens/cm^{-1} in Aleta Wendo and Meskan. Yemerwacho 3 Kebele (in Meskan) had the highest levels of any *woreda* but even there the highest individual reading was under 900 µ-Siemens/cm-1

Aleta Wendo and Meskan have relatively clear shallow groundwater, but Boloso Sore has problems of high turbidity (see Fig 5-6). The problem is worst in the rainy season, and also in the shallower groundwater, but even borehole water suffers to some degree from increased turbidity at times. The Ethiopian National Guideline maximum value is 7 NTU, and 83% of samples in Aleta Wendo conformed to this guideline at the worst time of year (and 97% were less than 15 NTU). In Meskan 92% were less than 15 NTU and two thirds less than 7 NTU. In Boloso Sore, however, 89% wells had waters recording more than 15 NTU and 97% more than 7 NTU. As a result, many people preferred the less turbid waters of distant hand pumps when these were functioning.

5.2 Sanitary surveillance

5.2.1 *Sanitary surveillance and source types*

Sanitary surveillance scoring uses observation of ten elements of the well construction and hygiene to indicate relative risks of contamination. Such scoring system can be used to highlight aspects of a source which need improvement. However the scoring is designed for conventional wells with standardised forms of protection. The study therefore also looked at the degree to which this scoring system reflects actual measured water quality for different sources types to see how well it performs for family wells.

Figure 5-6 Turbidity in traditional wells

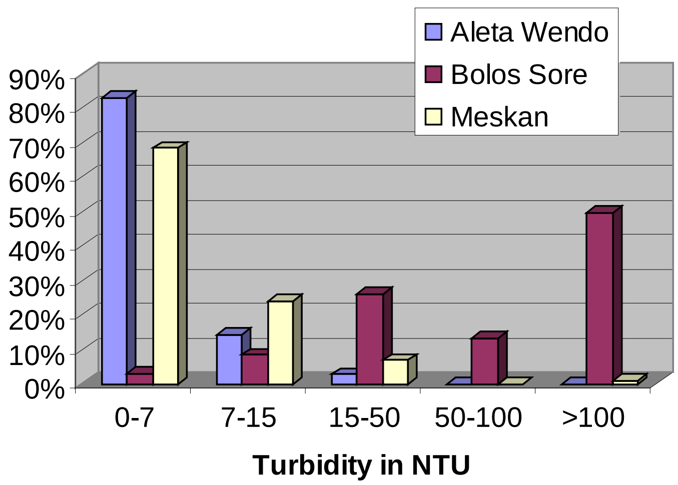
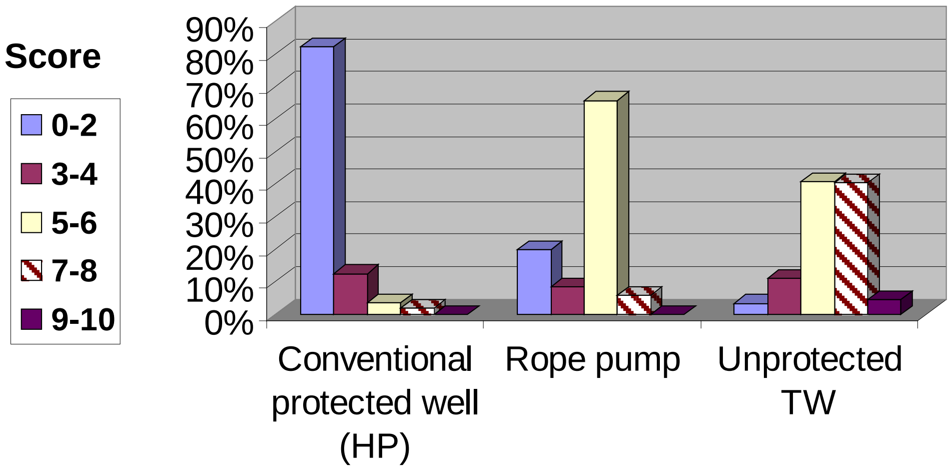


Figure 5-7 shows that, as is to be expected, handpumps on conventionally protected hand-dug wells present the lowest estimated risk with a high proportion (82%) having a score of 2 or less. Some 20% of rope pumps offer a similar lower risk, but none or almost no traditional sources fall in this lower risk band. Very few wells of any type reach total scores reflecting the maximum levels of risk (9-10).

This pattern of risk distribution is similar in all *woredas*, and seems to reasonably reflect the relative levels of contamination presented by each source type. However the question then arises whether this is by chance or whether it is because there is a direct relationship between scored risk and observed water quality. If the latter is true, then the scoring system can substitute for water quality analyses in a cost effective fashion.

Figure 5-7 Sanitary inspection scores for different well types



5.2.2 *Sanitary surveillance and water quality*

If the results for sanitary surveillance scoring are compared with water quality in a matrix, it is possible to see how good scoring is at predicting water quality. Figure 5-8 shows that for handpumps on fully protected wells the predictions are quite reliable. Some 85% of the handpumps with zero TTC have a score of less than 2, and 80% of those with low levels of contamination (<10TTC/100ml). The scoring provides a reasonable system for indicating risks for conventional handpumps as standard installations, (for which the system was designed). The sanitary surveillance system can be used with a fair degree of confidence (80%) to predict risks. However it should be noted that 20% of those wells which are identified as presenting low contamination risk actually have water with more than 20 TTC/100ml. Sanitary scoring for handpumps indicates a high level of probability for water quality, but not a foolproof indicator which can replace actual measurement.

Figure 5-8 Handpump sanitary inspection scores vs. water quality

SI score Coliform count	0-2	3-4	5-6	7-8	9-10
A 0 TTC/100ml	HP,HP,HP,HP,HP HP,HP,HP,HP,HP HP,HP,HP,HP,HP HP,HP,HP,HP,HP HP,HP.	HP,HP,HP,HP			
B 1-10 TTC/100ml	HP,HP,HP,HP,HP HP,HP,HP,HP,HP HP,HP	HP,HP			
C 11-20 TTC/100ml		HP			
D 20-50 TTC/100ml	HP,HP,HP,HP,HP HP				
E 50-500 TTC/100ml	HP		HP	HP	
F TNC	HP,HP		HP		

A similar matrix mapping exercise was carried out for the other two types of supply, rope pumps and traditional sources. For the rope pumps, as Figure 5-9 shows, the majority (two-thirds) of installations fall in the middle of the range (5-6) of risks.

Figure 5-9 shows the range of 5-6 scores to be related to 52% of sources with less than 10 TTC/100ml and 39% with more than 50TTC/100ml, so the sanitary inspection does not give a good indication of water quality in these cases. Of those with zero TTC, 57% were correctly attributed with a low risk factor, but only 31% of those with a TTC count of less than 10 TTC/100ml had a sanitary surveillance score of less than 4. This suggests that the system would need some adjustment for rope pumps, in particular to describe the seal between the slab and the well lining and its relationship to the surrounding ground level. The leakage of water back from the rope and wheel, and absence of a spout to take water beyond the slab are features that are not captured by the present scoring.

Figure 5-9 Rope pump sanitary inspection scores vs bacteriological water quality

SI score Coliform count	0-2	3-4	5-6	7-8	9-10
A 0 TTC/100ml	RP,RP,RP,RP	RP	RP,RP		
B 1-10 TTC/100ml	RP		RP,RP,RP,RP,RP RP,RP,RP,RP,RP		
C 11-20 TTC/100ml					
D 20-50 TTC/100ml	RP,RP	RP	RP,RP		
E 50-500 TTC/100ml		RP	RP,RP,RP,RP,RP RP,RP,RP,	RP	
F TNC			RP	RP	

For traditional wells the range of variables is even greater, because wells are protected in many different ways rather than using standard designs and more depends on the hygiene of individual drawers of water who are more closely in contact with the water in the well. It is not surprising, therefore, that the ten point scoring system performs even less well in reflecting actual levels of risk.

Figure 5-10 Traditional well sanitary inspection score vs. bacteriological water quality

SI score Coliform count	0-2	3-4	5-6	7-8	9-10
A 0 TTC/ 100ml	TWTW	TWTWTWTWTW	TWTWTWTWTW TWTWTWTWTW TWTWTW	TWTWTWTWTW TWTW	TW
B 1-10 TTC/ 100ml	TW	TWTWTWTWTW TW	TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTW	TWTWTWTWTW TWTWTWTWTW TWTWTW	TW
C 11-20 TTC/100ml	TWTWTWTW	TWTWTW	TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTW	TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW	TWTW
D 20-50 TTC/100ml	TWTWTWTWTW	TWTWTWTWTW TWTWTWTWTW TWTW	TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTW	TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTWTW TWTWTWTW	TWTW
E 50-500 TTC/100ml	TW	TWTWTWTW	TWTWTWTWTWTW TWTWTWTW	TWTWTWTWTW TWTWTWTWTW TWTWTWTWT	
F TNC		TWTWTWTW	TWTWTWTWTWTW TWTWTW	TWTWTWTWTW TWTWTWTWTW TW	

The high concentration of sanitary inspection scores in the range 5-8 (see Fig 5-10) is very marked. It is certainly true that the risks for this technology type are higher than for handpumps, as is reflected in the scores,, but the scoring system does not identify reliably those wells which have low contamination. Some 25% (85) of traditional wells have less than 10 TTC/100ml, but of these only 16% (14 wells) also have a low risk sanitary inspection score of less than 4. Of those found with no contamination (27 wells), the scoring system only predicted two. The pattern of scoring is almost random around the axis of best fit (as correlation coefficients also show) suggesting that an alternative system of scoring is needed.

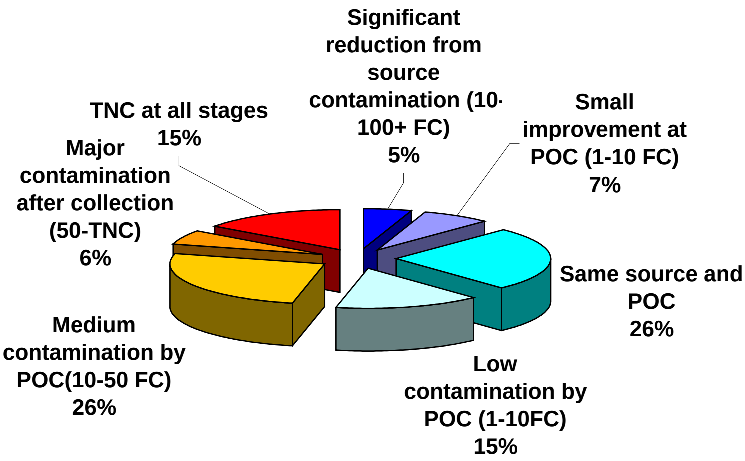
For the traditional wells there is a sufficient sample size in this study to explore further which elements of the scoring system may have the most effect on observed water quality. Preliminary analysis shows that the proximity of a latrine, and the addition of a parapet and an apron had the most effect on water quality. Further improvements to water quality can be achieved with better site hygiene and water collection practices.

5.3 Water quality at the point of consumption

Significant changes in water quality may occur between the source and time of consumption. Collection practices, transport of water and storing it all provide plenty of opportunities for contamination, which can negate good source water quality or, on occasions, improve on it.

Changes between the source and point of consumption were measured in 155 households and show that for 53% of households, contamination during collection and storage was minimal or non-existent (see Figure 5-11). For a further 15% coliform counts were 'too numerous to count' both at the source and in the so the degree to which contamination '*en route*' contributes could not be ascertained. Thus for just over half of all households, any improvement to water quality at the source would be carried through to the point of consumption, and may be for more. Only 6% of households were shown to grossly contaminated their water during or after collection.

Figure 5-11 Changes in water quality between source and POC (155 households)



5.4 Water treatment at source

The previous sections show that a significant proportion of drawn water needs treatment whether it is taken from 'safe' sources or not. Contaminated sources may be disinfected or water treated during storage in the house. The survey has looked at both '*in situ*' water treatment (i.e well disinfection) and household water treatment as part of water supply improvement. '*In situ*' treatment consists mainly of periodic disinfection of wells, usually by health authorities, using calcium hypochlorite powder or more rarely sodium hypochlorite solution. Household water treatment may also use chlorine solutions, but also boiling, filtering by cloth, ceramic filters or settlement of suspended solids after water is brought to the house. Some households use a combination of these methods. Household water treatment can remove contamination accumulated during collection and transport, whilst in situ water treatment cannot do this unless very frequently administered, since the protective chlorine residual will not be maintained.

In situ disinfection with chlorine is regarded as a form of 'shock' treatment, carried out on a very sporadic basis, usually in response to specific outbreaks of disease. As such it has been most often carried out on communal wells, with some 72% of the wells surveyed recording treatment at some time. In contrast only 32% of traditional wells have ever been chlorinated, and less than half (44%) of rope pumps. The latter figure is particularly of concern as it shows that organisations promoting the introduction of the rope pump are not systematically chlorinating wells when the pump is installed, or repaired, even when it is known that the water is likely to be used for drinking as well as other purposes.

In total, 62% of all surveyed sources had never been chlorinated, and only 11% in the last six months. However more than half of all conventional wells had been treated in the last year, and 21% or traditional wells. This suggests that systems are in place which may improve safety of supply, if source water treatment is felt to be a good way to do this. The procedure used and its efficacy would need further investigation. Chlorination is not done on a regular basis at short intervals and so may not be very effective. More emphasis now tends to be put on treatment of stored water rather than the source.

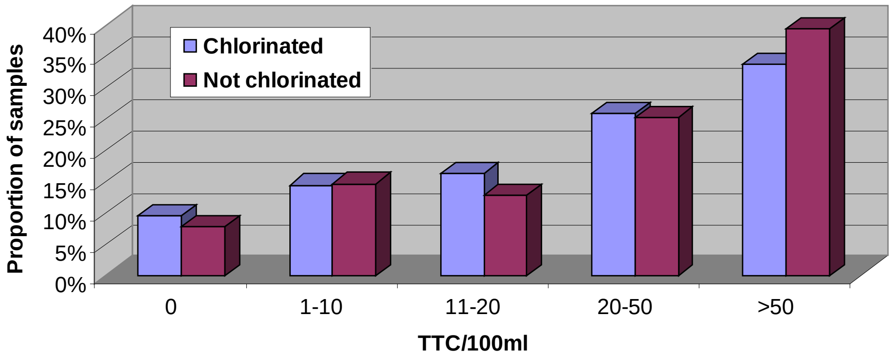
Most in situ water treatment is carried out by health or water bureaux (see Table 5-3). In the case of community supplies (both rope pump and conventional handpumps), it is the Water Bureau which has undertaken chlorination. For traditional wells, health officers also carry out such work, especially when there are outbreaks of acute watery diarrhoea, (AWD) but in Meskan and Boloso Sore a significant number of owners undertook some chlorination themselves when they had access to some form of chlorine. It seems that NGOs do not carry out disinfection themselves. This may be because they engage the health or water bureaux to carry out any disinfection for them, but interviews rather suggest that it is simply that at present they do not include this aspect in their work programmes.

Table 5-3 Agents for well disinfection

	Who does well disinfection		
	TRHDW	**RP**	**HP**
Health officer	36	0	0
Water office	41	13	32
NGO	0	0	0
Owner	24	2	0

Comparison of the observed TTC counts with the period since chlorination suggests that the effects of disinfection are short-lived or that the procedure used is not effective on large diameter wells. Neither for conventionally protected wells with handpumps, nor for traditional wells, was any significant difference found in water quality between those which have been chlorinated and those which have not. (Figure 5.12 shows the similarity of water quality distribution whether wells have been treated in the past year or not). Whilst shock treatment may temporarily remove cholera *vibrio* and so be a justifiable intervention in this case, it does not seem to provide any longer term protection to source water in the samples analysed in terms of faecal contamination. Those that had been chlorinated in the past 6 months did however show a significantly larger proportion of wells with less than 10 TTC/100ml, but no fewer with the highest levels of contamination. A few wells owners were found to use salt as a disinfectant in their wells (especially in Meskan) to kill off worms (usually small red ones). Salt was added and the well water left to stand to kill the worms, and then the water bailed out until it no longer tasted salty and all worms had been removed.

Figure 5-12 Water quality in chlorinated and not chlorinated supplies

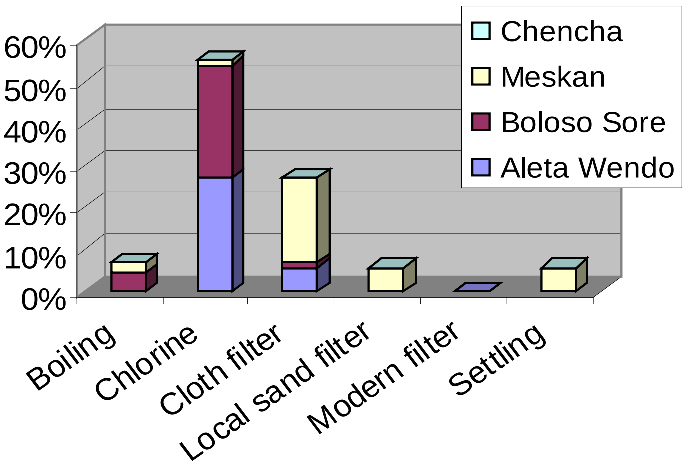


5.5 Household water treatment

Reducing sediment and bacterial loads in water for personal consumption and cooking is traditional in some areas, and is also being promoted, especially by the Ministry of Health and some semi-commercial organisations (e.g. PSI). Treatment is also being promoted in some areas for removal of fluoride. Almost half (49%) of households have some experience of household water treatment and of these 60% had used chlorine. Some had used a combination of chlorine and cloth filtering.

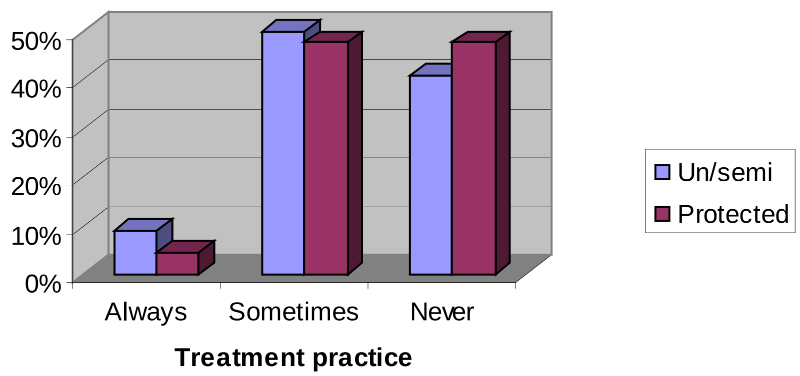
Household chlorination is the most common form of treatment (see Fig 5-13), reflecting the promotion of its use by the Ministry of Health, especially free distribution during outbreaks of Acute Watery Diarrhoea. However, of the 57 households who mention using chlorine, only 9 use it regularly and of these 8 are in Aleta Wendo. Some 90% of the households which have used chlorine have used Wahuagar / Waterguard, whilst two have been given PUR packets. Regular purchase of chlorine products is rare since the practice of handing them out has been normal until now. It appears that water treatment as a daily practice is very rare, with only 8% of households doing it. Of those 8%, 92% use chlorine and only one household always boiled its water. Others tend to treat water only when it is very cloudy with sediment, or when there are outbreaks of diarrhoeal disease. In some areas (e.g. Aleta Wendo) boiling is said to make the water unpalatable. There is a seasonality to water treatment for almost half of the households sampled. Just over half of households have never used any treatment at all.

Figure 5-13 Methods of treating water



Those owning wells are almost twice as likely to treat their water in some way than sharers. Since more of the sharing households took their water from protected communal supplies this observation may be related to the perception of the safety of these supplies. But both wealth ranking and protection level (see Fig 5-14) have little effect on whether the water is treated or not. The wealth ranking results do not suggest that wealth is the major factor in whether people take up water treatment or not, since there are as many people in the 'poor' quintile (2nd lowest) who treat their water as there are in the 'richest (5th quintile). This may be because in recent years much of the chlorine used has been handed out as part of campaigns against acute watery diarrhoea, and so has been available to everyone. It can be speculated that this observation may therefore relate to the initiative shown and openness to new ideas by certain household heads or family members. This is reflected in taking the initiative to improve their access to water by digging their own well in the beginning.

Figure 5-14 Household water treatment related to source type



So few people say they always treat their water, that it is difficult to reach significant conclusions over their characteristics. They are fairly equally found among the rich and the poor by the criteria chosen.

Three households remarked that they don't treat the water because they have seen that the well is chlorinated, but apparently not realising that this does not provide long-term protection.

The more recent sampling (May 2011) identified households undertaking household water treatment on a regular basis. 36 households treated their water at the time of sampling and of these 95% used traditional methods of filtering, either with cloth or fibre. The level of contamination in the stored water before treatment is not known. Comparing the difference in water quality at the source and at the point of consumption for water which has been filtered and water which has not, suggests that on the whole the local treatment practice does reduce the health risk (see Table 5-4). This shows that some 74% of households using filtering techniques consumed water with better or equal quality to the source, while only 34% of those not treating the water did so. It is not possible to tell whether those for whom water quality was significantly worse after filtering contaminated the water through the filtering process or simply from the way they transported and stored the water beforehand.

Table 5-4 Change in water quality from source to point of consumption, with and without traditional household treatment

Level of change in faecal contamination	Change with traditional treatment	Change without treatment
Reduced by >50 TTC/100ml	14%	6%
Reduced by 10-49 TTC/100ml	17%	5%
Reduced by 0-10 TTC/100ml	40%	23%
Increased by <10 TTC/100ml	14%	14%
Increased by 10-50 TTC/100ml	9%	23%
Increased by >50 TTC/100ml	6%	14%
TNC all the time	3%	15%

Respondents were asked from whom they got information on good water storage and treatment practices. A large proportion (82%) had received some education on HWTS, and of these 75% identified health personnel as the main source of information. Some 25% had heard messages on the radio, and in addition just under 10% had received information at school, or had it passed on from pupils. NGOs and the Water Bureau were not commonly acting as channels for passing on this information to households in the focal *woredas*, being cited by less than 5% of the respondents.

5.6 Supply reliability (see also Section 3.3)

There were several questions in the survey relating to reliability of supply delivery. These related to recent history (last year and last five years), moves made to improve performance (deepening and repairs), length of time not functioning, and the adequacy of supply. Differentiation needs to be made between non-delivery of water through equipment failure (pumps/ buckets) and through drying up of the source. Such differentiation is easier with open family wells than with conventional hand pump supplies, where no discharge of water may be for either reason.

5.6.1 *Comparative reliability of water sources*

Variations in seasonal water availability were found amongst all source types, but most of the communal wells with hand pumps did not appear to dry up. These are all either lined wells with full protection or mechanically drilled shallow wells. It may be that some respondents could not tell the difference between pumps breaking down and sources going dry for conventional supplies, but 3 out of 12 who said the source had gone dry also said the pump itself had not broken down, suggesting that on rare occasions there are communal wells which are lined but which go dry. One was said to have been deepened since construction.

Rope pumps being put on traditional wells as well as conventionally lined ones, are more likely to go dry (see Table 5-5). Of the 9 which were found to dry at some time, 8 were mounted on traditional wells with little or no lining. Many wells have water all the year round only because they are regularly maintained. Once a pump is installed, such maintenance activities are much more difficult and tend to be neglected. Problems of accumulating debris and collapse are more likely to be overlooked, and may lead to some rope pump wells suffering increased periods without water over time. In Aleta Wendo however, visits to investigate well drying found that several of the wells were not dry but that the pump had been installed at a shallower depth than the dry season water level. Thus there was water in the well but the rope pump was unable to access it until levels recovered with the rains.

Table 5-5 Well reliability in past year

	Traditional wells	**Rope pump**
Dried for > 1 month	3%	3%
Dried for 1-3 months	9%	21%
Dried for > 3 months	7%	0%
Never dried.	81%	76%

5.6.2 *Supply functionality*

Variations in delivery from hand pump supplies are almost all due to mechanical failure. The speed with which they are repaired depends very much on the capacities of the *woreda* concerned and the availability of spares. Although sample numbers are small for each *woreda*, it would appear that performance of hand pumps in Aleta Wendo is significantly poorer than in Meskan and Boloso Sore (See Table 5-6). Only 50% of pumps in Aleta Wendo have had no breakdown in the past year, and over a fifth (22%) were still not working after three months. Conversely in the other two *woredas* over 80% of pumps worked all year, and in Meskan most that broke down had been repaired within five days (see table). Some repairs seem to be problematic and to take months to bring a pump back into operation.

Table 5-6 Supply functionality of protected wells in the last year

	Aleta Wendo HP	**Bolos Sore HP**	**Meskan HP**	**Total**
Always worked in last year	50%	89%	82%	72%
<5 days not working	0%	0%	9%	2%
5-10 days	0%	0%	0%	0%
10-30 days	11%	0%	0%	4%
30-60 days	6%	0%	9%	4%
60-90 days	11%	0%	0%	4%
>90 days not working	22%	11%	0%	13%

The sample population is skewed by only including pumps and sources that are operating at present, so results need to be compared with other data. BoWR figures (see Table 5-7) cover all hand pumps in each *woreda*, not just a select few. It seems from the 2010 survey figures that Boloso Sore performance is more like that seen in Aleta Wendo, but the larger data set suggest that Aleta Wendo and Meskan are more reliable than the small samples in this study suggested.

Table 5-7 BoWR functionality data for whole *woredas*

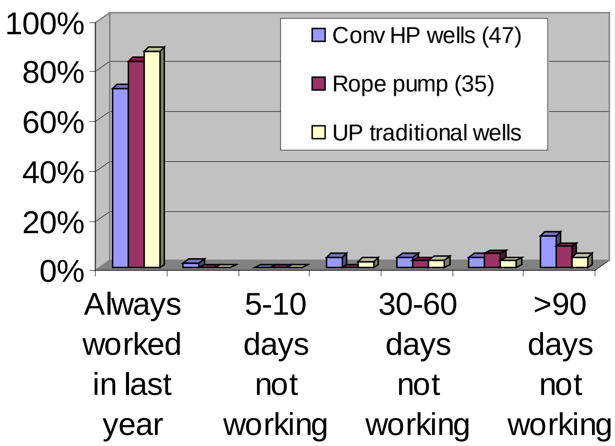
Percentage functioning	Aleta Wendo	Boloso Sore	Meskan	Chencha
Hand pump	71%	48%	98%	67%
Spot springs	83%	47%	92%	69%
Rope pumps	50%			67%

Source BoWR 2010

Spot springs which are more like traditional hand-dug wells in their dependence on shallow groundwater seem to have particular reliability problems in Boloso Sore.

Overall the survey suggests that conventional supplies are generally not more reliable in delivering water than traditional wells, and in the case of spot springs may be significantly less so. This is true even where pump maintenance systems are working relatively well.

Figure 5-15 Reliability of source wells



5.7 Adequacy of supply

Reliability reflects the time when there is water or no water available. But number of users and seasonal fluctuations in water level may mean that there are times when the source or yield from a pump is not sufficient for all users or all purposes. This may lead to more queuing or people having to go elsewhere for some of their water.

In terms of adequacy there seems to be little difference between supply types, (see Table 5.8) although there appears to be slightly more pressure on community handpumps which means slightly fewer people feel they provide adequate amounts all the time, but the difference is not significant.

Table 5-8 Adequacy of supply

	Traditional source (321)	Rope pump (34)	Conventional HP (47)
Adequate always	75%	74%	70%
Part of the year enough	24%	23%	30%
Never enough	2%	3%	0%

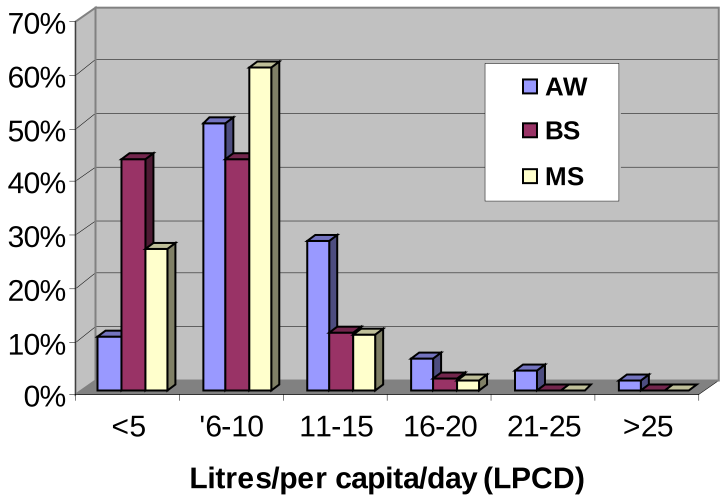
The results suggest that numbers of users are perhaps self-regulating, since as queues lengthen, no-one wants to spend more time than necessary collecting water. This appears to be equally true for public and private supplies.

5.8 Water consumption

Supply delivery is shown to be largely reliable and, to a slightly lesser extent, adequate. However, the study also examined to what extent actual use compares with the national UAP (MOWR 2005) guideline supply of 15 litres per capita per day (lpcd). Consumption was measured by the amount of water people carry to, and store in, their houses for domestic purposes (volume of containers times number of trips for each container on previous day).

As Figure 5.16 below shows, very few households carry as much as 15 lpcd to their homes, with most carrying less than 10 lpcd. Those surveyed in Aleta Wendo appear to use slightly more than those in the other two woredas. There may be several reasons for these low figures of consumption:

Figure 5-16 Average personal water consumption



- People feel they do not require more than this volume of water per day
- People with sources close to their houses (family wells) wash clothes, utensils and their bodies with water taken directly from the well to fill buckets and bowls for washing outside of the house. This water use would not have been included in the volumes counted
- People who take drinking water from communal wells at greater distance may still use closer sources for bulk water uses.

Households were therefore also asked about their use of alternative sources (see also Section 3.6). Mostly alternative sources are used when a well dries up or pressure on its use means that queuing makes water collection time too long (see Table 5-9). Few traditional well owners regularly also take water from other sources (3%) but most do use water directly from their well without bringing it into their houses. Of those using communal supplies, 20% use other sources regularly to augment their supply, when supply is reduced in the dry season or when the pump breaks down. Use of water at the site of communal wells is usually discouraged, suggesting that in this case the observed rates of water consumption are likely to reflect actual usage. This is supported by the findings in Table 4.10 which show less than 20% of communal well users taking water for washing clothes, bathing or productive uses from the handpump. Users of communal supplies average 8.3 lpcd, which is sufficient for drinking and cooking but leaves little remaining for other hygiene purposes (reflected also in water use data in Table 4.10). Traditional well owners average almost the same (8.5 lpcd), which may also reflect limited or suppressed demand, but more likely additional use of water at or near the site of the well which is so close to the house.

Table 5-9 Uses of alternative water sources

Times at which users of these supplies use an alternative			
	Traditional wells	Rope pumps	Conventional HP
All year	3%	12%	20%
If usual supply reduces/ dries	69%	58%	51%
Wet season	21%	4%	2%
Other (mainly breakdown)	6%	27%	27%

It appears that traditional wells act as an additional source of bulk water for some communal well users and provide an 'insurance policy' for when the more complicated systems breakdown or provide a reduced service. However, as a whole, domestic water consumption appears to be low. What is not yet clear is whether people using communal sources are constrained in water usage by their own wishes and practices (as appears to be the case for traditional wells), or whether it is the availability at the source which is a significant constraint. Since most traditional wells are used for all purposes including animal watering, it would appear that for these at least, adequate water is usually available for as much domestic use as owners require.

One factor affecting amounts of water consumed from storage in the house is the amount of storage available. Houses with more containers and more time to collect water are likely to use more water. There was a direct correlation between wealth ranking and amount of water used in the house, with the wealthiest houses using an average of 10.5 lpcd whilst the poorest ones used an average of only 7.8 lpcd.

5.9 Summary and recommendations on water supply delivery and benchmarking

1. Hand pumps on protected wells provided the best quality water, but still only 47% had no contamination. However three quarters had only very low contamination (<10 TTC/100ml), with handpumps on drilled boreholes providing higher quality, suggesting that improved environmental sanitation is necessary to ensure safer water, especially around hand-dug wells.

Recommendations: Guidelines on good site hygiene around the well and water collection practices linking to model houses, CLTS and other health initiatives are essential for all source types including protected communal wells, not just un/semi protected ones.

2. Small changes to traditional wells (provision of a parapet, cover and apron) can significantly improve their performance in terms of water quality. Provision of a wider apron, and one with a lip and drainage channel could improve things further. An apron of 60 cm width and a lip made of rendered bricks (see Figure 6.3), covered and with a drainage channel also of rendered bricks, can use only 1.5 bags of cement, and ensures no waste water will return to the well without being filtered by the ground.

   Further a pulley or rope pump can be added at a later date. An easily removable top slab or cover is necessary so that the well can continue to be cleaned out and re-deepened if necessary.

Recommendation: Promotion of low cost changes such as reduced diameter and cement/ or reinforcing-free concrete rings and top slabs is needed for household level supplies based on suitable guidelines. Good low cost apron designs, with lips and drainage channels using bricks in combination with screed are needed. Top slabs should be removable with a local A-frame and pulley or by hand. Designing top slabs for later installation of a rope pump or diesel engine and other aspects of incremental improvement should also be considered, and design examples drawn up.

3. Traditional wells and rope pumps have not been constructed or maintained with principles of contamination reduction in mind. Were this to be done, performance would undoubtedly improve. Such water quality performance may not quite reach levels possible with well-managed hand pumps, but offers advantages in cost, access and reliability plus simplicity of management which imply higher levels of sustainability and affordability compatible with household ownership.

Recommendation: Wellhead improvements should be encouraged by all partners in WASH. In particular installation of rope pumps should usually assume use also as a drinking water source. As a result the pump should be also made as a model with shorter legs so that it can be installed on a top slab mounted on a parapet of 0.5m (minimum) high). This should be in conjunction with a small lipped apron which will lead spilt and waste water to a soak away or sugar cane, banana etc. which will soak up the water productively.

Training should be available to local well-diggers and masons on good well head protection. So far this aspect is missing for household level supplies.

4. Sanitary scoring systems in present use reflect water quality in conventional sources quite well, but need modifying for use with rope pumps and traditional wells.

Recommendation: The sanitary surveillance scoring system developed in the UNICEF Oromia Self Supply Report, should be tested and adjusted to try and provide a usable system for assessing risks for traditional wells and rope pumps, and to highlight priority aspects for improvement.

5. Water quality deteriorates significantly between source and point of consumption in just over half of cases. Only some 6% of households appear to grossly contaminate their water during collection and storage. Since a significant proportion of well users do not contaminate their supplies at all it would seem that alongside promotion of household water treatment, there should also be further research on behavioural aspects to identify what particular practices are

reducing or increasing risks of contamination in transit/storage. Some small changes in behaviour may have major effects on point of consumption water quality without cost implications to users.

Recommendation: Further research should be carried out on households which do not contaminate water and those that contaminate it highly to try and identify key behavioural factors.

6. Water treatment in terms of source disinfection appears only to have short term effect, if any. A local form of disinfection is the addition of salt to kill worms. To date BoWR staff have not been involved in providing advice or implementing well disinfection for traditional wells.

Recommendation: Source disinfection is not generally cost effective on a regular basis, although often used in times of AWD outbreak to help break cycles of infection. However to provide successful disinfection it is necessary to calculate dosing carefully, mix with well water systematically and wash down the well structure. Normally it has proved more efficient to promote HWTS rather than regular disinfection since far less chlorine is needed.

7. To date BoWR are not much involved in promoting good HWTS practices but it is almost equally necessary for protected sources as for the lower levels of supply. About half of households had some experience of household water treatment and of these, over half (60%) have used chlorine products (mainly Waterguard/ Wahuagar). There is therefore quite a high familiarity with water disinfection practices and also reduction in turbidity, but little entrenched habit to employ such methods regularly. Such experience can be built on, and are not related to wealth but more to receptiveness to new ideas.

Recommendation: BoWR should consider advice and promotion of HWTS along the lines used by PSI for marketing Waterguard, targeting those model houses and innovators for adoption of unsubsidised disinfectant. Simultaneously, with MoH, ensure adequate stocks and selling points are available to make any such product(s) easily accessible. Further research should also be carried out on the effectiveness of filtering with cloth and fibre as a low cost and easily sustainable form of treatment.

8. Although traditional wells are not lined except sometimes near the surface, they are remarkably reliable in Meskan (92% never dried in last five years). In Boloso Sore three quarters have not dried up and in Aleta Wendo, two-thirds. Reliability is improved where wells are re-deepened or where they are regularly cleaned out.

Recommendation: In areas where wells go dry because of instability of the shaft above or below the water level, well-diggers and masons need to be trained in making and installing concrete rings or dry stone walling below water levels. Stabilisation of the shaft means that wells can be dug deeper in the dry season and if only a few rings are installed can be further deepened in times of drought. Rope pumps need to be installed in a way that allows easy removal of the top slab for access for cleaning and deepening.

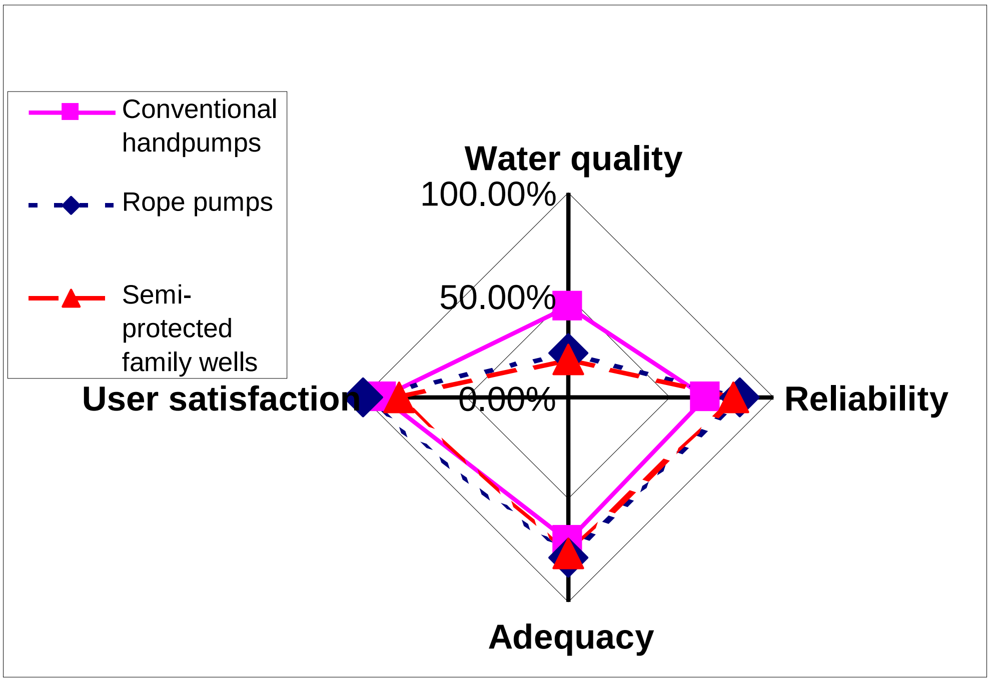
9. If the reliability of handpump performance is combined with source reliability, it is apparent that in all *woredas* surveyed the ability to deliver water in the last year has been no higher for protected sources with handpumps than for traditional sources. Similarly as far as adequacy of supply is concerned, traditional wells and rope pumps have shown themselves to be seasonally equal or slightly more able to provide an adequate supply for users over the past year, and most people have to turn to them when conventional supplies break down or to use them all the time.

Recommendation: At present traditional wells play an important part in augmenting conventional supplies when (as seems common) they suffer from too many users, which limits the amount of water each can take, or are not functioning for significant periods of time. The rural water sector needs to regard all supplies as contributing to provision of adequate and safe water in combination, whether for drinking or other purposes. Water quality and reliability needs to be improved in all types of water supply to provide wider coverage and adequate supplies for all purposes.

10. At present technologies are judged on theoretical ability to provide safe water if perfectly constructed and perfectly operated. Field evidence suggests this ideal is seldom achieved. It also suggests that in trying to establish sustainable systems it is not water quality which is the main factor, but user satisfaction, combined with reliability and adequacy (see Fig 5.17). In these, traditional sources and rope pumps in particular, are the equal of conventional hand-dug wells and handpumps, and so should be considered for the contribution they can make to coverage, but especially in the many values they give to their owners.

Recommendation: Supply delivery should be less regarded only in terms of water quality, and more in terms of the overall reliability and adequacy of supply and user satisfaction levels, since these are also vital for sustainability. Those users with any type of supply which is below standard in quality need to be helped with advice and a well trained public and private sector and also microfinance to support them in efforts to improve their supplies. Then they can play a significant role in the rural water sector.

Figure 5-17 Performance profile for three supply types



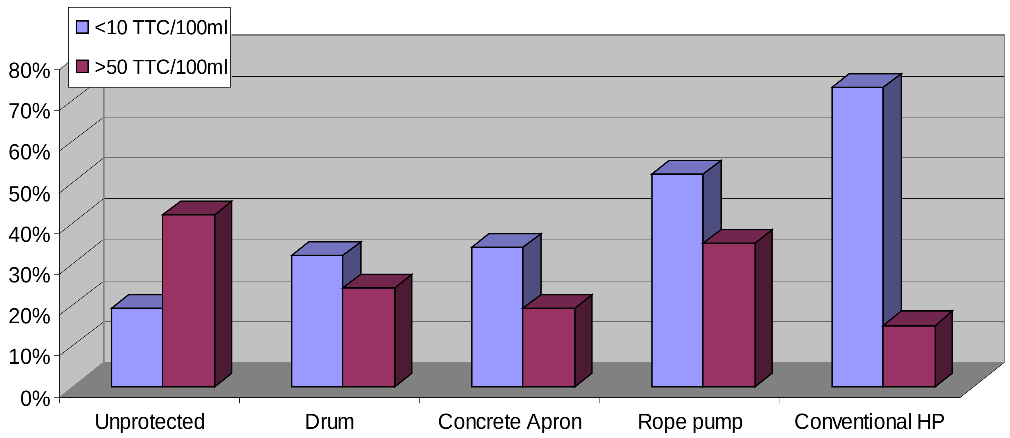
6 Overall summary and key recommendations

6.1 Progressive improvement in water quality with higher levels of technology

As one moves up the technology ladder of water supplies, water quality appears to improve, but not reaching the high levels of consistent good quality that national standards require (see Fig 6-1). This is partly because of the variable quality of construction, even of the higher technology options, but also because of poor practices in site hygiene around all water points, both traditional and conventional.

Even with low levels of protection (such as a drum or small apron) a significant proportion of family wells are found to be without contamination. A third of such wells have low levels of risk, and the results suggest that with basic protection and good site hygiene many more family wells could provide safe water. Highly protected sources do perform better in terms of quality, but still less than 50% of them were found without contamination. They also do not perform better in terms of reliability. In terms of highest risk (over 50 TTC/100ml) conventional hand pumps were only marginally (4%) better than traditional wells with a concrete apron.

Figure 6-1 Low risk and high risk levels for different sources



The largest anomaly seen here is for rope pump 'worst water quality' which might be otherwise expected to be around 10-15%, but is found to be 35%. As mentioned in 5.1.1 this anomaly is probably explicable by the installation and maintenance procedures in Chencha and Boloso Sore. Results in Aleta Wendo suggest that much better results are possible for rope pumps.

Recommendations: Progressive improvements in water quality can be promoted through up-grading of family wells as well as provision of supplies through higher technology community sources. However, it is absolutely vital that attention is given to quality of construction and site hygiene for all types of installation including handpumps.

6.2 Risks and costs of different technology options

Overall risks related to costs are summarised in Table 6-1 showing the relative levels of improved quality and the consequent increased costs. Movement up the ladder reduces health risks but it also increases costs (both capital and recurrent), complexity of management, and operation and maintenance which can all affect sustainability. At present moving up to a protected communal supply

(Level 5 in Table 6-1) does improve water quality but not consistently, and does not appear to improve reliability or adequacy of water supply in the areas surveyed

- Level 1 provides major improvements in access to water, and a convenience for household members, which encourages the initial investment.
- Level 2 increases well stability and safety from falling in and improves water quality by stopping surface water flowing back into the well, at little additional cost.
- Level 3 further improves water quality especially if the apron is properly sealed to the parapet and is extended further (minimum 0.7m wide). Use of a pulley and hanging the rope in the well or using a windlass reduce sources of contamination further.
- Level 4 potentially provides a sealed unit, which is seldom effective among the wells surveyed in the first sampling round, except in Aleta Wendo.
- Level 5. The highest performance in terms of water quality and availability is with handpumps on machine dug shallow wells mainly because of the small diameter, continuous lining, large apron, but also possibly their greater depth). Hand-dug wells are also regarded as an acceptable supply, by users and by policy makers, but are significantly less perfect in their delivery or a reliable and safe supply.

Table 6-1 Risk levels and costs of rural water supplies in SNNPR

Note. * Rope pump performance is poor as most are not well installed as drinking water sources. This is reflected particularly in high proportion (third) with high contamination levels.

Type	Picture	Definition	Low risk 0-10 TTC/100ml	High risk >50 TTC/100ml	Relative cost
1. Unprotected family well **(229)**		Unlined well shaft, bucket/ rope/ little well head protection	**<u>0TTC/100ml</u>** Average 5% **<u><10 TTC/100ml</u>** Average 22% (range 17% Meskan - 30% Aleta Wendo)	**High risk** 42% Basic first stage well	**Cost** Average $50-60 per owner or 10-12 per HH (5HH sharing) <$2 per head
2. Family well with drum wellhead **(80)**		As option 1 but with well head lining with oil drum	**<u>0TTC/100ml</u>** 15% **<u><10 TTC/100ml</u>** 32%	**High risk** 24% Three times safer than Option 1	**Cost** Average 1.2 times option 1 **Cost**

3. Family well with drum wellhead and apron **(26)**		As option 2 plus narrow apron but no drainage	**<u>0 TTC/100ml</u>** 19% **<u><10 TTC/100ml</u>** 35%	**High risk** 19% Four times safer than Option 1	**Cost** 1.5 times option 1
4. Family well with rope pump **(35)**		As above with rope pump on sealed top slab. Minimum lining to seat top slab (most with no drainage and some without spout).	**<u>0 TTC/100ml</u>** 22% * **<u><10 TTC/100ml</u>** 51%	**High risk** 35%* 3-5 times safer than Option 1	**Cost** 3-6 times Option 1 withaverag e cost about $4.5 per head
5. Lined hand dug well/ machine shallow well with handpump **(56)**		Concrete lined well, with sealed top slab and hand pump, but often no lip and drainage channel	**<u>0 TTC/100ml</u>** 47% **<u><10 TTC/100ml</u>** 74%	**High risk** 15% 9 times safer than Option 1. Just over twice as safe as Option 4. At present twice as safe as Option 4	**Cost** 100-150 times cost of Option 1. Average about $10-13 per head

Recommendations: Upgrading of family wells and better quality control and site hygiene of all sources is likely to be one of the lowest cost measures to reduce risks for all. In relation to extending new supplies, the huge *per capita* cost differences in provision of family wells and community sources need to be considered in efforts to reach universal access. Self supply is a cost effective intervention, and furthermore, the direct installation costs are met by families and not government.

6.3 Lowest level of acceptable supply

Even at the lowest levels of protection there are family wells which deliver uncontaminated water. Those with an apron and solid parapet are significantly safer and even without any user training, design improvements and promotion, a third provide reliable water at low risk (compared to about half of protected communal sources). The results of the survey suggest that many water quality problems relate to poor site hygiene for all technology levels, combined with inadequate sealing of head works from returning water. A third of those traditional wells with an impermeable parapet have low levels of contamination and slightly more of those with an apron. However the apron is not designed to provide real protection from returning surface water and improvement in design (requiring very little additional materials, see Fig 6-2 for an example) could have a large effect on water quality.

Figure 6-2 Example of parapet, apron with lip and drainage channel using 2 bags of cement. A minimum protection level?

Recommendation: A basic standard of family well protection (parapet, apron with lip and drainage channel) provides significant reduction in contamination with further improvements likely through design improvements and better behaviours. This level of protection could be regarded as a minimum level of family well protection at household level aiming for a water quality profile of <10 TTC/100ml initially in 50% of cases, and aiming for 90% within five years.

6.4 Rope pumps

Results from Aleta Wendo show that with correct rope pump installation and good site hygiene, contamination can be almost eliminated. However, results from other areas show that just the presence of a rope pump does not guarantee good quality water. Much more attention needs to be given to elevation of the top slab above ground level, and provision of at least one or two low cost rings with a small apron (total cement requirement being around two bags). This will increase costs, but lower levels of installation are not likely to provide major increases in water quality over the levels already obtainable with a rope, bucket and improved protection.

Recommendation: The rope pump should be promoted as a significant improvement on semi-protected traditional wells and an acceptable level of service, but only with new guidelines on installation and site hygiene. Present performance needs to be improved in every way, from well head protection to repair services for it to provide an acceptable community level supply. Whilst this is achievable it is suggested that initial efforts should be made in promoting it as a family level solution rather than for larger groups of people. This will help establish a market, supply chain and a status for the pump, upon which community level application can more easily be built.

6.5 Government roles

The overall aim of accelerating self supply is to move people up the ladder with the sources and resources at their disposal. This means enhancing the capacity of households to cover further investment and providing them with information both on risks and on simple technical solutions to reduce those risks. It also means building the capacity of the private sector to provide reliable, and affordable support services of good quality.

Regulation of acceptable levels of supply requires different standards for different types of service i.e community or household. A household supply generally cannot be realistically constructed to the same levels of safety as a communal supply. Government's role in the case of households may be more advisory than the regulatory role it takes for community supply for which it is clearly responsible. The need is to make the well owner aware of risks and how to reduce or eliminate them, as it would in relation to food hygiene or child care. The duty of care in the case of family wells should be with the family.

In the case of community supplies, the cost is mainly borne by government which has responsibility for the level of service provided and so per capita cost is the main concern. In the case of self-supplied supplies, the cost is borne by the home owner for whom affordability of the unit cost is of more concern. The two systems therefore require both different economic consideration and different roles for government.

Recommendations: There needs to be debate, awareness raising and training to clarify the role of government in self supply. The government role in community water supply development and maintenance is well-established but self supply requires different support. The new WASH implementation framework (MoWE, 2011) provides a good basis from which to start. To promote and support small scale private investment in water to improve service and increase coverage requires different roles and strategies at all levels of public service. Rather than the main emphasis being on planning, financing, contracting, procuring and regulating, the role of government may become more centred on promoting and marketing the concept of household supply improvements, providing information, training and micro-credit, and certifying service producers and products. These are all software aspects which build up an enabling environment within which those who wish to, can invest in better quality water supplies than they can at present achieve. The necessary public and private sector services can be partly linked to:

- the rural water supply maintenance services at *kebele* level which government is already planning to strengthen,
- existing micro-finance institutions,
- rope pump production for productive purposes which is planned to expand enormously
- health service initiatives centred on model houses and improved hygiene practices

Linking to these other initiatives could enable per capita costs of supporting household investment to be minimised in the early stages and are mostly taken over by the private sector in the medium and long term. This has been shown to work in the IDE rope pump promotion and will be further tested in the national effort to take this approach to scale (see Sutton & Hailu, T. 2011).

6.6 Piloting

The survey results suggest that there is potential to build on existing investment in household water supplies. However it also suggests that there is need to develop approaches in how to accelerate a process which is at present only moving slowly, and within an environment not conducive to family initiatives in water supply. The piloting of possible models of different government roles is especially important. Experience in other countries (Zimbabwe, Tanzania, Zambia, Nicaragua) as well as Ethiopia, suggests that developing such approaches can richly repay the investment that needs to be made initially. However such approaches need to be tested within several Woredas to see what works best and where flexibility is most needed.

Recommendation: At least two of the *woredas* identified as having most potential from the surveys in Oromia and SNNPR should be taken as preliminary areas for developing and testing the best ways to plan, accelerate and monitor private investment in household water supply.

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Annex 1 Field survey team members

Regional water Bureau	Position
Tiratu Beyene	Water quality analysis
Temesgen Mathewos	Water quality analysis
Mesfin Kebede	Water quality analysis
Fetia	
BOLOSO SORE	
Alemayehu Endale	Source surveyor
Yosefe Seifu	Source surveyor
Mesfen Mohammed	Water source surveyor
Melese Bunaro	Water quality sampler
Mekuria Yosef	Water quality sampler
Yirefu Yigezu	Household surveyor
Desta Maleko	Household surveyor
Mulalem Bikamo	Water source surveyor
MESKAN	
Awal Amza	Water source surveyor
Jemal Mohammed	Water source surveyor
Shafi Bedru	Source surveyor
Belaynen Geremu	Water quality sampler
Asma Ahmed	Household surveyor
Sofia Girma	Water quality sampler
Ahmedin Nuri	Household surveyor
ALETA WENDO	
Ejigu Hariso	Household surveyor
Abebayehu Kassaye	Water source surveyor
Birhanu Galfato	Water quality sampler
Mitiku Chomora	Water source surveyor
Belay Bogale	Water quality sampler
Melaku Mekonnen	Household surveyor
Kifle Kia	Water source surveyor
Hailu Hariso	Water source surveyor