Assessment of water quality of selected schemes and households in Shebedino Wereda, Southern Nations Nationalities and Peoples Region

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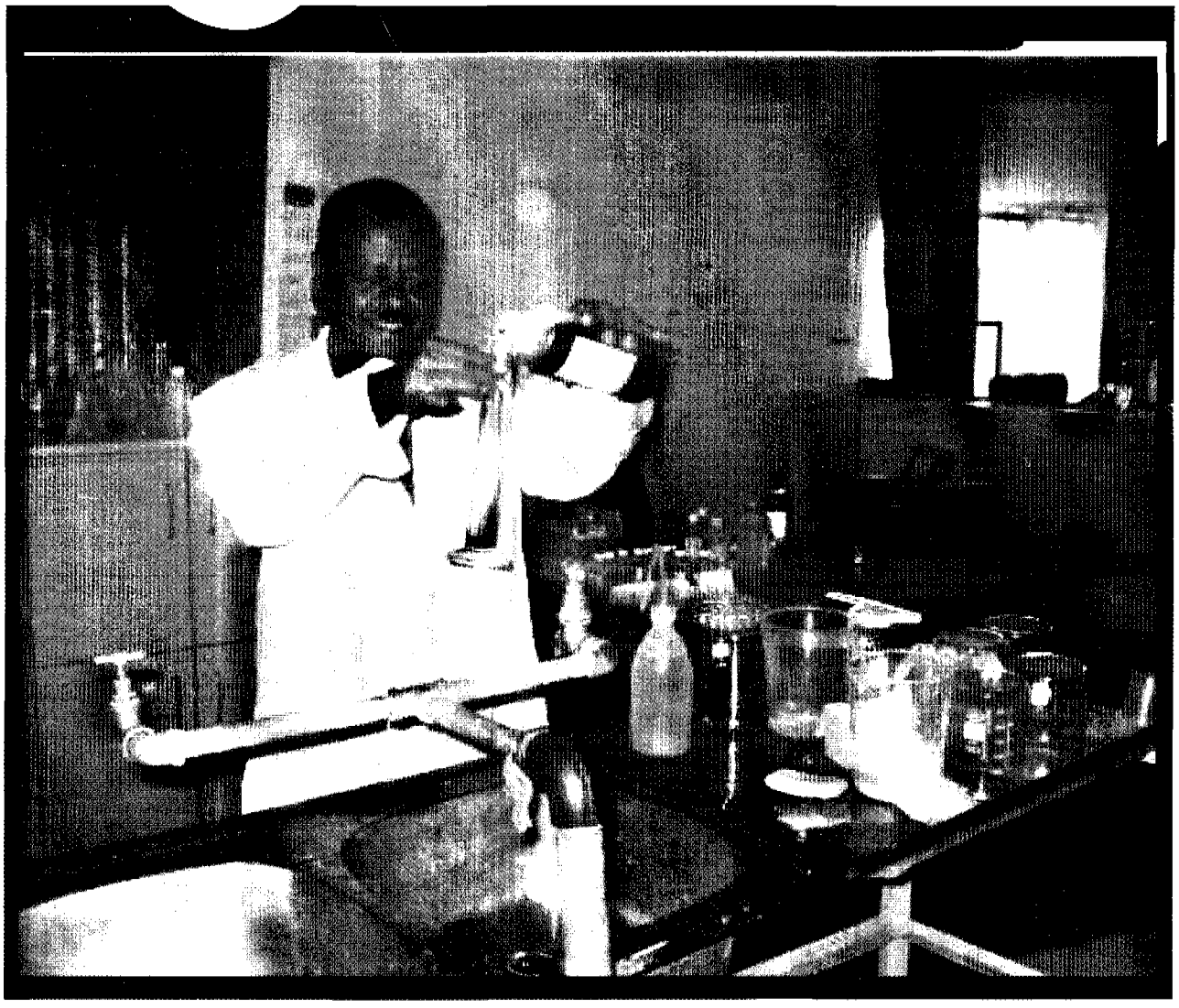

Research Report 3

Action Research for Scaling up Community-managed Water Supply, Sanitation and Hygiene in Shebedino Wereda, Southern Nations Nationalities and Peoples Region

Assessment of water quality of selected schemes and households in Shebedino Wereda, Southern Nations Nationalities and Peoples Region

Research Report 3

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Action Research for Scaling up Community-managed Water Supply, Sanitation and Hygiene in Shebedino Wereda, Southern Nations Nationalities and Peoples Region

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Photo caption and credit

- The photo on the front cover is a portrait of the investigator doing the laboratory work.
- The photo on the back cover shows potential of water pollution due to poor handling of jerrycans and barrels. Picture taken at Mermersa scheme, East Shewa Zone.
- The picture of the rig was obtained from Norwegian Church Aid.

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Acronyms and abbreviations

MDGs	Millennium Development Goals
MSW	Machine-drilled shallow well
HDW	Hand-dug well
SP	Spring (protected)
HH	Household
WP	Water point
WHO	World Health Organization
EC	Ethiopian calendar
SNNP	Southern Nations, Nationalities and Peoples
NGO	Non-governmental organization
NGLV	National guideline value
GPS	Geographic positioning system
TNTC	Too numerous to count
E. coli	*Escherichia coliform*
BH	Borehole
RES	Reservoir

Executive summary

We usually focus more on coverage of and access for water supply but less on quality of water. On Learning Workshop I of the Action Research for Scaling up Water Supply, Sanitation and Hygiene that was held 5-7 December 2005 at Adama/Nazeret, the participants thoroughly discussed on water quality problems and decided that detail assessment of water quality should be carried out. The purpose was to have verifiable water quality data which helps to make meaningful intervention for scaling up community-managed water supply and sanitation services in Shebedino wereda.

The water quality assessment was conducted on water samples taken from safe water supply sources. The samples were tested for physico-chemical and bacteriological parameters. In addition, water samples from the corresponding water points, reservoirs and household storages were tested for bacteria.

Altogether, 500 sampling points were visited by two water quality experts. Chemical analysis was carried out on 100 samples collected from improved bore holes, protected dug wells and springs. Samples were analyzed for major cations and anions by using spectrophotometer (DR 4000). Bacteriological analysis was made by using membrane filtration technique. About 53.7% of the total samples taken for bacteriological analysis were collected from individual households. Visual inspection was carried out to find out sources of contamination.

The result of chemical analysis showed that 79% of the drinking water supplies comply with WHO Guidelines Value and the Ethiopian Drinking Water Standard. The result of the chemical analysis of the samples from water supply sources revealed the water quality at sources in most areas of the wereda is good. However, either due to inaccessibility of alternative water resources or due to some other reasons, communities in Shebedino consume water from sources that have high iron level. The test for *Escherichia coliform* revealed that 52% of drinking water supplies comply with WHO Guidelines Value and the Ethiopian Drinking Water Standard. The level of bacterial contamination was high for hand-dug wells and low for deep wells.

Water fetched from bacteriologically safe supplies of drinking water was found bacteria positive in many households. The contamination took place during transportation and storage in homes. The detection of faecal coliform in particular is an evidence of faecal contamination at household level The results of bacteriological tests and of sanitary survey should be used to design and implement proper sanitation and hygiene practices to improve the quality of drinking water at household level.

1. Introduction

The United Nations envisaged the Millennium Development Goals (MDGs) in the year 2000. One of the goals is to reduce the proportion of people without sustainable access to safe drinking water and sanitation by half in 2015. It has to be realized that the success in reaching the MDGs would depend on proper integration of relevant sectors. This is particularly true in the case of water supply and sanitation services.

Water is a vital resource for all socio-economic activities and for development in general. Without water there is no life. Availability of adequate safe water supply is essential to human existence. Nonetheless, recognition of the importance of water quality developed slowly and the attention given to the issue of water quality is still little. In order to ensure sustainable water supply services, the quality of water should be properly monitored. Water quality is monitored and maintained according to the required standard.

The quality of water is evaluated by using selected physical and chemical parameters. For drinking purpose, the taste, colour, and odour of water and presence of some other chemicals and bacteria should be checked. Although most of the existing rural water supply sources are chemically fit for drinking, they may be bacteriologically unfit for drinking.

Verification of drinking water quality is needed to consistently ensure that safe water is provided to the community. Partners of the Action Research for Scaling up Community-managed Water Supply and Sanitation Services identified that water quality assessment should be carried out in the wereda as part of the project activities. Accordingly, Plan Ethiopia financed and supported this assessment of water quality in Shebedino Wereda of Sidama Zone. The assessment was conducted by the Water Resources Development Bureau of Southern Nations Nationalities and Peoples Region (WRDB of SNNPR).

The main objective of the assessment was to know about the quality of drinking water which communities in the wereda consume. This may be used as an input for the Action Research to address also other areas to minimize contamination of water sources through treatment and to plan actions that help prevent contamination during storage, distribution and handling of drinking water.

According to the 1995 E.C. estimates, population of the wereda is estimated at 315,271 out of which 44.6% have access to safe water. According to scheme inventory that was conducted in 2006 by the Action Research, the number of water supply schemes in 45 kebeles was 204, out of which 59 are shallow wells and hand-dug wells, 14 are bore holes, and 131 are tapped springs. At the time of the survey, only 174 of the total schemes were functional.

Although there is Water Resources Development Office at wereda level, it is not capable of testing physico-chemical as well as microbiological quality of water. Water quality analysis is undertaken at regional level, particularly when new water supplies are constructed, when wereda or NGOs request and when complaints are reported. Lack of budget, logistics and human resources including limitedness of availability of reagents makes conducting water quality analysis at wereda level difficult. Hence, it is desirable to strengthen the capacity of wereda water offices in order to have effective water quality monitoring.

2. Background

One of the objectives of scaling up community-managed water supply and sanitation services is to ensure sustainability of schemes, sanitation facilities and services. Community management of rural water supply and sanitation has proven to be an effective model for enhancing sustainability. Understanding the basic concept of water quality is essential for the community in the management of water supply and sanitation services.

For the benefit of human health in general, it is important that all water meant for human consumption should be of good quality from the point of supply to the point of consumption. Quality is assessed in terms of both microbiological and chemical parameters, although the microbiological quality has been identified as the most important aspect. Water from some sources is of good quality and needs little treatment; whereas, water from other sources, primarily surface water, may be unsuitable for domestic use unless it is first treated to improve its quality.

However, water treatment is often impractical in rural areas as it usually requires supervision by skilled personnel and as it can also be expensive. It is therefore common to select sources that can be protected against co ntamination. Some water sources like springs, wells, boreholes and rainwater should be free from microbiological pollution provided that adequate precautions are taken to prevent the water from contact with any potentially polluting material.

Most of the people in Shebedino do not have access to sustainable water piped into their homes. To meet their needs, they transport and store water within their homes. In these situations, recontamination of drinking water is often significant and is increasingly recognized as an important public health problem. Assessing the quality of water at households as well as at sources and piped supplies is therefore important.

Some water sources may be considered unsuitable by individuals or communities on the basis of personal or local preferences. However, the taste, odor and appearance of water must not be considered as the only criteria for water to be acceptable for human consumption. Perceptions about water quality, based on visual examination, taste and odor, are often unreliable. Water that looks clear and odorless may contain chemicals or bacteria that are harmful to human health. Objective techniques of water quality assessment are therefore necessary.

3. General principles and considerations

Most of the water-related health problems result from microbiological, i.e. bacterial, viral, protozoan or other biological contamination. Most of the pathogens involved are derived from human faeces. The principal faecal-oral diseases are cholera, typhoid, shigellosis, amoebic dysentery, hepatitis A and various types of diarrhea. Nevertheless, many serious health concerns may also result from chemical contamination of drinking water.

Health problems from chemicals in water occur when an individual consumes water containing a harmful amount of a toxic substance. Infant methaemoglobinae, caused by consumption of

water with a high nitrate concentration by infants, is an example. Fluorosis, damage to teeth and bones, results from long-term consumption of water containing excess fluoride.

3.1. Micro-biological quality of drinking water

Contamination either by sewage or human and animal excreta is the most dangerous form of contamination of drinking water supply. Therefore, drinking water supply should ideally not contain any pathogenic microorganisms. It should also be free from bacteria which is indicative of pollution with excreta. To ensure whether or not drinking water supply satisfies standards/guidelines of bacterial quality, samples should be regularly tested for faecal origin micro-organisms.

Since it would be practically impossible to test water for each of the variety of pathogens that may be present, monitoring microbiological quality of water is primarily based on tests for indicator organisms. A bacteria species or group to have sanitary significance and therefore to be useful as an indicator of pollution must be associated with human or animal wastes or related unsanitary conditions. Indicators most commonly used are of faecal or sewage origin. An ideal bacterial pollution indicator is defined as any organism:

a) which is always present in human or animal wastes,
b) which is always found in nature when enteric pathogenic bacteria are present, and
c) absence of which excludes the probability of the presence of any enteric bacteria.

3.2. Common indicator organisms

I. Escherichia (E. coli)

This species is a member of the group of faceal coliform bacteria. *E. coli* has important features of being highly specific for the feaces of humans and other warm-blooded animals. For all practical purposes, these bacteria cannot multiply in any natural water environment and they are, therefore, used as specific indicators of faecal pollution. The test method used in the assessment is the membrane filtration using mFC medium and incubation for 24 hours at 44.5°c. In the membrane filtration, individual colonies can be defined, and the presence of *E. coli* provides strong evidence of faecal pollution.

II. Coliform bacteria (total coliforms)

The term "coliform" bacteria refers to gram-negative, rod-shaped bacteria capable of growing in the presence of bile salts or other surface-active agents with similar growth-inhibiting properties and are able to ferment lactose at 35–37°c with the production of acid, gas and aldehyde within 24–48 hours. These bacteria can be determined by simple and inexpensive tests that are used as primary indicators of the general sanitary quality of finally treated and disinfected drinking water. The test method used in the assessement is the membrane filtration using mEndo medium and incubation for 24 hours at 35–37°c. The primary purpose of coliform tests is not to detect faecal pollution but to screen the general sanitary quality of drinking water supplies.

III. Enterococci (Faecal streptococci)

Enterococci, sometimes referred to as faecal streptococci, is a group of bacteria more closely related to faecal pollution than to total coliforms. This is because most members of the enterococci group do not replicate as readily in water environments. They are generally

present in the faeces of humans and animals. Faecal streptococci rarely multiply in polluted water, and they are more persistent than *E. coli* and coliform bacteria. In water quality examinations, presence or absence of faecal steptococci is therefore considered as an additional indicator of treatment efficiency. These gram-positive bacteria tend to be more resistant than gram-negative faecal coliforms, and are detectable by practical techniques such as membrane filtration using m-enterococcus agar and incubation at 44.5 ^{0}c for 48 hours.

3.3. Chemical quality of water

Analysis of water quality parameters is the basis for water quality monitoring. Different analytical procedures or methods have been developed to measure quantitatively water quality parameters. The procedure that is used in this assessment is mainly spectrophotometric.

3.4. Water quality standards

Water quality requirements vary according to the proposed use of water such as—drinking, irrigation, fishing and wild propagation, industrial, recreational, and power generation Standards for drinking water have evolved over the years as knowledge of the nature and effects of various contaminants has grown.

Water quality standards are set by governmental agencies and represent a statutory requirement. Generally, it is stated that drinking water should be free of suspended solid and turbidity, that is it has to be tasteless and odorless, that dissolved inorganic toxic substances and pathogens should be absent. The permissible limits of domestic water supply for drinking have been laid by WHO and Ethiopian Quality and Standard Authority (Annexes 1 and 2).

4. Scope of work

The assessment addressed representative water supply sources and households in selected kebeles of Shebedino Wereda. The survey area covered.The work involved selection of representative sites, water supply sources and households. Five hundred water samples were taken from 100 (57%) of the 174 functional schemes. The samples were analyzed to evaluate the chemical and bacteriological quality of water (Table 1).

Table 1. Number of water samples taken from sources for bacteriological and chemical analysis

Sampling unit	Samples analyzed			Remark
	Chemical	Bacteriological	Total	
Borehole	6	-	6	Bacteria test results of 51 samples were not included in data evaluation
Shallow well	29	29	58	
Hand-dug well	14	14	28	
Spring	51	51	102	
Water point	-	29	29	
Reservoir	-	11	11	
House hold	-	215	215	
TOTAL	**100**	**349**	**449**	

5 .Methods

- The water supply schemes/sources/ considered were selected by using the inventory data available and information collected from regional water laboratory and from the local community.
- Sample households were selected on the basis of their living standard (high, medium and low income group).
- Geographical proximity was considered (both for highland and lowland areas of the wereda).
- Location of investigation sites was determined by using Geographic Positioning System (GPS).

5.1. Sampling and analysis

- The water supply schemes/sources considered were 6 bore-holes, 29 shallow wells, 14 protected hand-dug wells and 51 springs.
- Samples taken from the sources were analyzed at the regional laboratory by spectrophotometer and titration procedures.
- Electrical conductivity and pH values were measured on site.
- Bacteriological analysis of all samples was carried out by using membrane filtration technique
- Most of the cations and anions were considered for chemical analysis.
- Samples were tested for Total coliform and *E. coli* bacteria.

6. Data analysis and interpretation

6.1. Bacteriological analysis

Total coliform compliance of 27% of the reservoirs, 20.6% of the shallow wells, and 13.8% of the water points was in line with the WHO guideline. No hand-dug well had total coliform compliance in line with the WHO guideline (Table 2). Out of 349 samples tested for *E. coli*, 192, that is 55%, met the requirement of both the national and WHO guidelines value (Table 3). Regarding *E. coli* compliance, 42.8% of the samples from hand-dug wells, 48% of the samples from shallow wells, and 56.8% of the samples from springs (Table 3 and Annex 3) comply with the national and WHO guidelines value.

Table 2. Total coliform compliance of samples

Parameters	BH*	SP	SW	HDW	WP	HH	RES	TOTAL
Number of samples	-	51	29	14	29	215	11	349
Compliance with WHO	-	3.9%	20.6%	0%	13.8%	3.7%	27%	6.6%

**BH stands for borehole; SP for spring; SW for shallow well; HDW for hand-dug well; WP for water point; HH for household; and RES for reservoir*

Table 3. *E. coli* compliance of samples

Parameters	BH*	SP	SW	HDW	WP	HH	RES	TOTAL
Number of samples	-	51	29	14	29	215	11	349
Compliance with WHO	-	56.8%	48%	42.8%	82.7%	51%	100%	55%

**BH stands for borehole; SP for spring; SW for shallow well; HDW for hand-dug well; WP for water point; HH for household; and RES for reservoir*

Table 4. *E. coli* compliance of water sources

Parameters	SP	SW	HDW	TOTAL
Number of samples	51	29	14	94
Compliance with WHO	56.8%	48%	42.8%	52.1%

** SP stands for spring; SW for shallow well; and HDW for hand-dug well*

- Out of 349 samples tested for *E. coli*, only 55% met the requirement of both the WHO guideline value and the national standard.
- Among the point sources, compliance was high for samples from boreholes (water points).
- Compliance level ranged between 82.7% for samples from boreholes and 42.8% for samples from hand-dug wells (Table 3)
- Compliance level for samples from bore holes was found to be logical and acceptable as bore holes are more protected than springs, shallow wells and hand-dug wells.
- Level of *E. coli* compliance was not satisfactory for all water sources (Table 4).
- The low level of compliance may be attributed to the poor construction conditions and lack of proper maintenance.

Classification of E. coli

Out of the total 152 samples that showed a positive result for *E. coli*, 95 (62.5%) fell in the count category of 1–10cf/100ml. From this, the proportion of households was about 58, that is 61.1%, and of springs was 17, that is 17.9%. Households had more shares of samples that can be classified in the category greater than 100cf/100ml (Table 5).

Table 5. Classification of *E. coli* count

Count category (cf/100ml)	HDW	SP	SW	WP	HH	RE	TOTAL
nil	6	29	14	24	110	11	55.6%
1–10	4	17	13	3	58	-	27.2%
11–100	3	4	2	2	31	-	12%
>100	1	1	-	-	16	-	5.2%
Total no. of samples	**14**	**51**	**29**	**29**	**215**	**11**	**349**

Household water quality

Quality of water consumed in households was tested (Pictures 1 and 2) in order to provide some indication of the degree of post-source changes or contamination. Household water was matched to the source and therefore household water was tested only in communities where a water supply was included in the assessment. Household samples were taken from containers. Out of 215 household samples, 106 (51%) comply with the national standard and WHO

guideline value for *E. coli*. Compliancy was lower for water from household containers than for water from the corresponding sources. Water samples from 106 households showed post-source contamination of faecal origin. This may be attributed to poor sanitation and hygiene practices of the rural community.

Picture 1. Poor handling of water storage

Picture 2. Investigators taking sample from a water source

About Out of 161 household water samples taken from bacteria-free sources, 55 (34%) comply with the national standard and WHO guideline value for *E. coli*.

6.2. Chemical analysis

A number of water chemical quality analyses were carried out (Picture 2) on samples taken from 100 sources. Of these samples, 6 were from boreholes, 26 from shallow wells, 54 from springs and 14 from hand-dug wells. Results showed that the water sources were not harmful to health. However, some water sources have Iron and Manganese higher than the required standards (NGLV, 0.4mg/L and 0.13mg/L, respectively) (Table 6). Iron level of 21% of the samples was beyond the required standard (Annex 4).

Table 8. NGLV compliance of major chemical parameters

Parameter	% of compliance				Remarks
	BH	SP	HDW	SW	
Iron(Total)	100	72.2	85.7	84.6	0.4mg/l–2.39mg/l
Manganese	66.7	62.9	57.1	50	0.13mg/l–1.05mg/l
Fluoride	100	100	100	100	
Nitrate	100	100	92.6	96	>50mg/l

Picture 2. The investigator and technicians analyzing water quality

7. Conclusion and recommendations

Out of the 349 samples tested for *E. coli*, 55% had overall compliance with the national standard. For effective controlling of contamination of water, providing hygiene education to communities is very important and promoting hygiene practices such as hand-washing can improve the quality of water which is transported to and stored at the household. Hygiene education should be integrated with improving sanitation and water quality. Promoting only the water supply aspect at a disregard of environmental sanitation and hygiene will get us no where.

A review of chemical test data for 100 water sources in the pilot wereda shows high compliance for toxic chemicals such as fluoride and nitrate. But, results of public opinion survey indicate that concentration of iron up to 0.3mg/L would be acceptable to the local people. Whereas, iron concentration higher than 0.3mg/L would cause them to revert to traditional unprotected source.

The test result also confirmed this opinion. The main water quality problems identified in the wereda were turbidity and objectionable taste and smell of water associated with excess iron. It is thus strongly recommended that detail investigation of the water quality has to be carried out prior to the development of any water supply system.

Annexes

Annex 1. Drinking water quality guidelines

Constituents	WHO guideline	Ethiopian Standard	MoWR guideline
pH	6.5 – 8.5	6.5 –8.5	6.5–8.5
Colour (TCU)	15	15	22
TDS (mg/L)	1000	1000	1776
Total alkalinity as CaCo3 (mg/L)	500	200	-
Total hardness as CaCO3 (mg/L)	300	300	392
Calcium hardness as CaCO3 (mg/L)	300	-	-
Na (mg/L)	200	200	358
K (mg/L)	10	1.5	-
Ca (mg/L)	100	75	-
Mg (mg/L)	30	50	-
Cl (mg/L)	250	250	533
SO_4 (mg/L)	250	250	483
F (mg/L)	<12°C =2.4 12.1–14.6 °C =2.2 14.7 – 17. 6°C =2.0 17.7 – 21. 4°C =1.8 21.5 – 26. 2°C =1.6 26.3 – 32. 5°C =1.4 >32. 5 °C <1.4	1.5	3.0
NO_3 (mg/L)	50	50	50
NO_2 (mg/L)	3	3	6.0
Al (mg/L)	0.2	0.2	0.4
Mn (mg/L)	0.1	0.5	0.13
Fe (mg/L)	0.3	0.3	0.4
NH_3 (mg/L)	1.5	1.5	2.0
Zn (mg/L)	5	5	6
Ni (mg/L)	0.02	-	-
As (mg/L)	0.05	0.01	0.01
Cd (mg/L)	0.005	0.003	0.003
Cr (mg/L)	0.05	0.05	0.1
Pb (mg/L)	0.01	0.01	0.02
Cu (mg/L)	1.0	0.1 – 0.2	5
CN (mg/L)	0.1	0.07	0.07
Hg (mg/L)	0.001	-	0.001
Total coliform/100 ml	0	0	0
E. coli	0	0	0

Annex 2. WHO guidelines for bacteriological quality of drinking water

Organisms	Guideline value
All water intended for drinking	
E. coli or thermotolorant coliform bacteria	Must not be detectable in any 100ml sample
Treated water entering the distribution system	
E. coli or thermotolorant coliform bacteria	Must not be detectable in any 100ml sample
Total coliform bacteria	Must not be detectable in any 100ml sample
Treated water in the distribution system	
E. coli or thermotolorant coliform bacteria	Must not be detectable in any 100ml sample
Total coliform bacteria	Must not be detectable in any 100ml sample In the case of large supplies, where sufficient samples are examined, must not be present in 95% of samples taken throughout any 12 month period

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
1	Teremesa	MSW	✓								065130	382731	Not Consum
2	Teremesa/ Hofa	MSW	✓	✓	10/1				✓	13/0	065123	382726	
3	Hobolso shibae	SP	✓	✓	60/14				✓	TNTC/20	065204	382849	
4	Hobolso/ Shokito	SP	✓	✓	10/1				✓	80/20	065229	382850	
5	Telamo/ Garsana	MSW	✓	✓	8/1				✓	TNTC/14	065037	382850	
6	Hobolso/ Gonowa	HDW	✓	✓	70/34				?		065210	382819	Not Consum.
7	Telamo/Dirka	MSW	✓	✓	TNTC/O				✓	TNTC/ TNTC	065018	382927	
8	Telamo/ Kintesa Town	MSW	✓	✓	TNTC/O				✓	TNTC/65	065009	382906	
9	Telamo/ Dirka	SP	✓	✓	TNTC/TNTC				✓	TNTC/ TNTC	065010	382940	
10	Telamo/ Harbake	SP	✓	✓	TNTC/3				✓	TNTC/13	065037	382932	
11	Telamo /Ketawo	SP	✓	✓	TNTC/40				✓	TNTC/ TNTC	064954	382913	
12	Telamo/ Alawo	SP	✓	✓	TNTC/10				1	TNTC/ TNTC	064958	382906	
			?	?					2	TNTC/ TNTC			
13	Dilla Aferara/Bada2	HDW	✓	✓	TNTC/ TNTC				✓	TNTC/ TNTC	065046	382339	
14	Dilla Aferara/Moko	MSW	✓	✓	0/0				✓	40/2	065138	382407	
15	Dilla Aferara/Shemeto	MSW	✓	✓	0/0				✓	45/0	065036	382349	

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No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
16	Dilla Gumbe/Shilla	MSW	✓	✓	0/0				(1)	2/0	065036	382451	
			?	?					(2)	13/Nill			
17	Dilla Gumbe/ Obito	MSW	✓	✓	0/0				✓	23/19	065013	382421	
18	Dilla Gumbe/ Abeyicho	MSW	✓	✓	42/17				(1)	TNTC/17	065030	382513	
			?	?					(2)	60/35			
19	Fuira/Bore	HDW	✓	✓	70/3				(1)	TNTC/24	065017	382554	
20	Fuira/ Bangude 1	MSW	✓	✓	TNTC/0				(1)	TNTC/20	064954	382533	
			?	?					(2)	TNTC/30			
21	Fuira/ Bangude 2	HDW	✓	✓	12/1				(1)	TNTC/ TNTC	064959	382539	
			?	?					(2)	TNTC/ TNTC			
22	Wome Bunamo/ Gurachito	SP	✓	?							065121	383452	Not Completed (New)
23	Wome Bunamo/ Borji	SP	✓	✓	40/0				(1)	TNTC/ TNTC	065154	383430	
			?	?					(2)	TNTC/ TNTC			
24	Wome Bunamo/Getano	SP	✓	✓	26/10				(1)	TNTC/ TNTC	065154	383330	
			?	?					(2)	54/15			
25	Harbe Shisho/ Suduwa	SP	✓	✓	TNTC/5				(1)	25/3	065142	383221	
			?						(2)	5/4			
26	Harbe Shisho/ Sawola		✓	✓	15/0				(1)	15/3	065112	383204	
			?						(2)	15/11			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli*	Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
												Northing	Easting	
27	Garagailo/Arosa	BH	✓					(1)	9/0	(1)	15/Nill	065441	382227	Catholic compound
			?							(2)	TNTC/70			Private HH near to the C.CPD
28	GaraGailo	SP	✓	✓	23/0					(1)	80/11	065431	383134	
			?	?						(2)	TNTC/10			
29	Murancho Gucho /Beto	SP	✓	✓	8/0					(1)	21/9	065257	383241	
			?	?						(2)	14/0			
30	Gobo Hebisha/ Choe	SP	✓	✓	28/14					(1)	30/16	065340	383112	
			?	?						(2)	28/20			
31	Gobo Hebisha/ Shmure	SP	✓	✓	TNTC/25					(1)	TNTC/ TNTC	065310	383137	
			?							(2)	TNTC/40			
32	Gobo Hebisha/ Wome	BH	?			✓	64/0	(1)	*i*	(1)	30/	065234	383052	
			?							(2)	71/			
			?					(2)	0/	(1)	6/			
			?							(2)	0/			
			? ?					(3)	2/	(1) (2)	40/ 29/			
			?					✓	2/	(1)	40/			
			?							(2)	29			
33	Shenodolo	BH	?					(1)	4/0	(1)	20/16	065439	382535	
			?							(2)	20/13			
			?					(2)	30/0					
			?							(1)	TNTC/40			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
			?						(2)	40/15			
			?				(3)	0/0					
			?				(4)	5/4					
			?						(1)	TNTC/12			
			?										
			?						(2)	TNTC/18			
			?				(5)	0/0					
34	Sedeka/ Seraweco	MSW	✓	✓	10/2				(1)	TNTC/0	065046	382709	
			?						(2)	TNTC/0			
35	Sedeka/ Shemeta	MSW	✓	✓	0/0				(1)	39/9	065018	282646	
			?	?					(2)	16/6			
			?	?					(3)	TNTC/60			
36	Sedeka/ Jewaro	MSW	✓	✓	4/0				(1)	TNTC/ TNTC	065039	382703	
			?	?					(2)	TNTC/40			
37	Konsore Ana/ Kilto	HDW	✓	✓	TNTC/0				(1)	TNTC/0	065410	382348	
			?	?									
38	Dobe Bute/ Goesare	SP	✓	✓	2/0				(1)	3/0	065221	383825	
			?	?					(2)	4/0			
39	Dobe Bute /Woyo	SP	✓	✓	12/7				(1)	40/25	065257	383814	
			?						(2)	50/20	065325	383623	
40	Haisa Wita /Korcho	SP	✓	✓	TNTC/0				(1)	TNTC/0			
			?	?					(2)	TNTC/0			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli*	Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
												Northing	Easting	
			?	?						(3)	TNTC/0			
41	Gemeso Kanera /Kenera Town	SP	✓	✓	2/0					(1)	12/	065143	383818	
			?	?						(2)	6/			
42	Gemeso Kanera/ Benana	SP	✓	✓	6/					(1)	TNTC/	065207	383804	
			?	?						(2)	TNTC/			*E. coli* not tested
43	Gemeso Kanera/ Gewane	SP	✓	✓	48/					(1)	60/	065219	383812	
			?	?						(2)	70/			
44	Haisa Wita/ Oigecho	SP	✓	✓	25/					(1)	40/	065355	383449	
			?	?						(2)	35/			
45	Faicho/ Shifa	SP	✓	✓	4/					(1)	8/	065108	383946	
			?	?						(2)	TNTC/			
46	Faicho/ Jegano	SP	✓	✓	2/					(1)	18/	065082	383942	
			?	?						(2)	9/			
47	Faicho/ Gojamo	SP	✓	✓	Nill/					(1)	Nill	065026	383941	
			?	?						(2)	TNTC/			
48	Galeco Haro/ Temeno	SP	✓	✓	29/					(1)	65/			
			?	?						(2)	65/			
49	Galoca Haro/ Kentero	SP	✓	✓	0/					(1)	0/	065412	382933	
			?							(2)	0/			
			?							(3)	22/			
50	Teremesa/ Sedine	MSW	✓	✓	0/					(1)	0/	065130	382704	
			?							(2)	0/			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli*	Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
												Northing	Easting	
51	Leku	BH	?			✓	0/	Wp. 8	0/	(1)	0/			
			?							(2)	TNTC/			
			?					Wp.6	7/	(1)	20/			
			?							(2)	TNTC/			
			?					Wp.4	3/	(1)	26/			
			?							(2)	0/			
			?					WP. 3	17	(1)	TNTC/			
			?							(2)	30/			
			?					Wp.1	27/					
	(HealthC)									(1)	15/			
	Ele. Sch.									(2)	8/			
	J.sec.sch									(3)	9/			
	Water desk									(4)	4/			
	Plan Eth.									(5)	1/			
	Police st.									(6)	6/			
	Hotel, 01		?							(7)	4/			
	Hotel, 02		?							(8)	7/			
	Shiro bet		?							(9)	27/			
	Shiro bet		?							(10)	45/			
	Shiro bet		?							(11)	14/			
	Keb.03		?							(1)	32/3			Households having private pipe stands
	Keb.03		?							(2)	5/2			
	Keb.03		?							(3)	75/30			
	Keb. 02		?							(4)	19/4			
	Keb. 02		?							(5)	50/20			
	Keb .02		?							(6)	21/20			
	Keb 01		?							(7)	4/0			
	keb. 01		?							(8)	TNTC/0			
	Keb 01		?							(9)	7/0			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
52	Leku	HDW							(1)	TNTC/TNTC			Open HDWs
		HDW							(2)	TNTC/TNTC			
		HDW							(3)	TNTC/TNTC			
			?										
			?										
53	Medregent	BH	?		✓	TNTC/0	(1)	TNTC/1	(1)	TNTC/3			
			?						(2)	12/5			
			?				(2)	120/10	(1)	TNTC/TNTC			
			?						(2)	96/50			
			?				(3)	25/0	(1)	95/37			
			?						(2)	TNTC/TNTC			
			?				(4)	TNTC/0	(1)	TNTC/40			
			?						(2)	TNTC/TNTC			
			?						(3)	TNTC/TNTC			
			?						(4)	TNTC/TNTC			
			?						(1)	TNTC/7			
			?				(5)	2/2	(1)	21/14			
			?						(2)	TNTC/TNTC			
54	Talamesa Sintaro	MSW	✓	✓	TNTC/ 10						065153	0382715	
55	Talamesa Awada	MSW	✓	✓	28/9				✓	39/2	065024	0382750	
56	Holboso Kutawo	SP	✓	✓	TNTC/2				✓	TNTC/6	065144	0382816	
57	Holboso Konsore	SP	✓	✓	TNTC/4				✓	TNTC/6	065152	0382827	
58	Holboso Konsore 2	SP	✓	✓	TNTC/ 10				✓	TNTC/10	065158	0382837	
59	Telamo Bade	MSW	✓	✓	TNTC/ 10				✓	TNTC/10	064944	0382830	

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
									✓	TNTC/10			
60	Telamo Gorsana 2	MSW	✓	✓	TNTC/5				✓	TNTC/9	064928	0382834	
									✓	TNTC/10			
61	Telamo Kerancho	MSW	✓	✓	10/0				✓	11/0	064935	0382846	
									✓	13/0			
62	Telamo Garsana 1	SP	✓	✓	TNTC/7				✓	TNTC/10	065000	0382812	
63	Telamo Tamene SP	SP	✓	✓	60/5				✓	71/12	064941	032900	
									✓	69/10			
64	Telamo Sintaro	SP	✓	✓	50/2				✓	56/7	064927	0382847	
									✓	60/5			
65	Taramesa Lilame	SP	✓	✓	TNTC/5				✓	TNTC/7	065052	0382753	
									✓	46/5			
66	Dela Anferara Shemeta 2	HDW	✓	✓	17/0				✓	19/0	065024	0382337	
67	Dela Anferara Bada 2	HDW	✓	✓	17/2				✓	20/5	065050	0382323	
68	Dela Anferara Shilla	MSW	✓	✓	40/2				✓	42/4	065123	0382321	
16	Dila Gumbe Abensa	MSW		✓	17/3				✓	21/3	065133	0382531	
									✓	23/4			
69	Dila Gumbe Hiyo	MSW	✓	✓	30/0				✓	30/0	065156	0382502	
									✓	32/0			
70	Dila Gumbe Himsaka	MSW	✓	✓	45/2				✓	55/3	065128	0382507	
									✓	50/0			
71	Dila Gumbe Gedime	MSW	✓	✓	61/15				✓	61/18	065113	0382513	

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
72	Fura Bogande	HDW	✓	✓	40/11				✓	40/13	065005	0382532	
									✓	45/2			
73	Fura Abecho	HDW	✓	✓	12/3				✓	15/4	064957	0382512	
									✓	20/3			
74	Deramo Anferara Ifala Bochesa	HDW	✓	✓	30/0				✓	30/2	064950	0382313	
75	wome bunamo keka	SP	✓	✓	5/0				✓	6/0	065126	0383454	
			?	?					✓	6/1			
76	wome bunamo Galano	SP	✓	✓	14/0				✓	16/1	065153	0383351	
77	Aarbe shusho Dafina	SP	✓	✓	5/1				✓	18/0	065106	0383140	
			?	?					✓	20/1			
78	Harbeshisho Jewaro	SP	✓	✓	30/1				✓	39/1	065052	0383116	
			?	?					✓	40/2			
79	Gonowa Godo Hodile	MSW	✓	✓	30/1				✓	30/2	065042	0383004	
			?	?					✓	30/2			
			?	?					✓	32/3			
80	Geragalo Loka	SP	✓	✓	32/2				✓	32/3	065506	0383231	
			?	?					✓	32/3			
81	Halabano Gonowa	HDW	✓	✓	30/0				✓	31/0	065235	0382306	
									✓	32/0			
82	diramo Anferara	HDW	✓	✓	18/0				✓	19/1	065011	0382357	
									✓	18/0			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli*	Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
												Northing	Easting	
83	Diramo Anferara	HDW	✓	✓	51/15					✓	58/16	065005	0382317	
	Diramo Bochisa									✓	59/16			
84	Murancho Guchol Loka	SP	✓	✓	58/8					✓	58/8	065232	0383133	
										✓	58/8			
85	Murancho Gucho	SP	✓	✓	41/2	?				✓	41/3	065241	0383127	
										✓	41/3			
86	Gonowa Gobelo Gemaycho	SP	✓	✓	20/3					✓	20/3	065110	0382848	
										✓	21/3			
87	Gonowa Gebelo Burema 2	BH	✓			✓	3/0	✓	3/0	✓	5/1	065108	0382919	
										✓	5/1			
	Gonowa Gabelo Burema							✓	3/0	✓	5/1			
										✓	5/1			
	Gonowa Gabelo Abicho							✓	3/0	✓	3/0			
										✓	3/0			
	Gonowa Gabelo Town							✓	3/0	✓	4/1			
										✓	4/1			
88	Abela Chefe	BH	✓			✓	3/0			✓	4/1	065451	0382937	
	Abelachefe Town							✓	3/0	✓ ✓	4/1 5/2			
89	Abela Lida Abela Town	BH	✓			✓	2/0					065543	0382809	
	Abela Lida Garano							✓	3/0					Bono No. 4
	Abela Lida Garano							✓	2/0	✓	3/0			Bono No. 3

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli* Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
											Northing	Easting	
									✓	4/1			
	Abela Lida Abela Town						✓	2/0	✓	3/0			
									✓	3/1			
	Abela Lida Abela Town						✓	2/	✓ ✓	2/ 2/			
90	Haysauta Regicho	SP	✓	✓	15/				✓	15/	065354	0383352	
									✓	16/			
91	Hayswtal Ikemo Anebo	SP	✓	✓	15/				✓	18/	065404	0383454	
									✓	15/			
									✓	16/			
									✓	15/			
92	Haysuta Dakole	SP	✓	✓	11/				✓	11/	065415	0383422	
									✓	11/			
									✓	12/			
									?				
93	Dobe Bute Gobero	SP	✓	✓	8/				✓	8/	065314	0383759	
									✓	8/			
94	Dobe Bute Tura	SP	✓	✓	7/				✓	7/	065318	0383747	
									✓	7/			
43	Dobe Dena Sita	SP	✓	✓	11/				✓ ✓	11/ 12/	065336	0383659	
95	Gemeso Kenera Kenera Town	HDW	✓	✓	20/				✓	22/	065135	0383809	
									✓	23/			
96	Geneso Kenera Sharana	SP	✓	✓	8/				✓	8/	065111	0383741	

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli*	Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
												Northing	Easting	
										✓	8/			
97	Geneso Fayecho Shifa	SP	✓	✓	11/					✓	11/	065130	0383949	
										✓	11/			
98	Gemeso Gayecho Fayecho (Fute)	SP	✓	✓	15/					✓	15/	065147	0383945	
99	Gemeso Weyicho Mata	SP	✓	✓	20/					✓ ✓	16/ 20/	065251	0383529	
										✓	20/0			
100	Gonesa Godo Hundare 1	SP	✓	✓	7/					✓	7/	064944	0383046	
			?	?						✓	8/			
101	Gonowagodo Kitawo	SP	✓	✓	15/					✓	20/	064950	0383021	
										✓	21/			
102	Murancho Kutera	BH	✓			✓	3/	?		?		065430	0382703	
	Murancho Kutera/shaaba							✓	3/	✓	4/			
	Murancho Kutera/Deneba Murancho Kutera/Deneba							✓ ✓	3/ 3/	✓ ✓ ✓ ✓	4/ 4/ 4/ 3/			
										✓	3/			
103	Diramo Anferara Anferar Town	BH	✓			✓	2/			?		065001	0382255	
	Diramo Anferara Anferar Town							✓	3/	?	3/			
											4/			

Annex 3. Results of bacteriological assessment of drinking water quality in Shebedino Wereda

No.	Kebele/village	Source type	Chem. test	Source	TC/*E. coli*	Res.	TC/ *E. coli*	Water point	TC/*E. coli*	Household	TC/*E. coli*	GPS location		Remark
												Northing	Easting	
	Diramo Anferara Bakay							✓	3/		4/			
											4/			
	Diramo I Anferara Liasa							✓	3/		4/			
											5/			
	Diramu Anferara Anferara Town							✓	3/		4/			
											5/			
								?			5/			
104	Abela lida kasa Ber	BH	✓					?		✓	3/	065545	0382811	
										✓	4/2			
105	Dulecha Teberak Teberako	BH	✓		?	✓	1/0	?				065642	0382551	
	Dulecha Teberak Teberako							✓	1/	✓	2/1			
								?		✓	2/1			
106	Bonoyameride school	BH	✓	✓	0/0							065524	0382506	
	Bonoyameride school					✓	0/0							
	Morocho shondolo shondolo					✓	0/0							
	Dobe negasha negasha					✓	1/							
	Dobe negasha harenzama					✓	1/							
	Dobe negasha kirite					?		✓	1/0	✓	3/0			
	Dobe negasha Hiyo							✓	1/0	✓	2/1			
	Bonoya/Imoshe									✓	3/1			
								✓	1/0	✓	1/0			

Annex 4. Results of chemical assessment of drinking water quality in Shebedino Wereda

Kebele/Village	Source	Fe+2 mg/l	Mn^{+2} mg/l	F^{-1} mg/l	No_3^{-1} mg/l	GPS Location				Remark
						Northing	Decimal	Easting	Decimal	
Teremesa	MSW	2.390	0	0	10.56	065130	6.86	382731	38.46	Not consumed
Teremesa/ Hofa	MSW	0.000	0	0.24	11.88	065123	6.86	382726	38.46	
Hobolso shibae	SP	0.164	0.4	0.14	25.52	065204	6.87	382849	38.48	
Hobolso/ Shokito	SP	0.124	0.2	0.53	24.64	065229	6.87	382850	38.48	
Telamo/ Garsana	MSW	2.410	0.2	0.18	18.48	065037	6.84	382850	38.48	
Hobolso/ Gonowa	HDW	0.053	0	0	25.52	065210	6.87	382819	38.47	Not consumed
Telamo/Dirka	MSW	0.072	0	0.2	7.92	065018	6.84	382927	38.49	
Telamo/ Kintesa Town	MSW	0.050	0.1	0.04	36.52	065009	6.84	382906	38.49	
Telamo/ Dirka	SP	0.215	0	0.22	13.2	065010	6.84	382940	38.49	
Telamo/ Harbake	SP	0.150	0.1	0	0.0079	065037	6.84	382932	38.49	
Telamo Ketawo	SP	1.200	0.2	0.19	13.64	064954	6.83	382913	38.49	
Telamo Alawo	SP	0.191	0.1	0	20.68	064958	6.83	382906	38.49	
Dilla Aferara	HDW	0.091	0.1	1.1	29.48	065046	6.85	382339	38.39	
Bada 2 Dilla Aferara	MSW	0.009	0	0.63	7.48	065138	6.86	382407	38.40	
Moko Dilla Aferara	MSW	0	0	0	15.84	065036	6.84	382349	38.40	
Shemato Goro Dilla Gumbe	MSW	0.165	0.2	0.09	18.04	065036	6.85	382451	38.41	
Dilla Gumbe Obito	MSW	0.096	0	0	22.88	065013	6.84	382421	38.41	
Dilla Gumbe Abeyicho	MSW	0.074	0.1	1.3	8.24	065030	6.84	382513	38.42	
Fuira/Bore	HDW	0	1.05	0	0.009	065017	6.84	382554	38.43	
Fuira/ Bangade 1	MSW	0.062	0	0.19	20.24	064954	6.83	382533	38.43	

Annex 4. Results of chemical assessment of drinking water quality in Shebedino Wereda

Fuira/ Bangade 2	HDW	0	0	0	24.64	064959	6.83	382539	38.43	
Wome Bunamo/ Guraticho	SP	0.034	0	0	18.04	065121	6.86	383452	38.58	Not completed (New)
Wome Bunamo/ Borji	SP	0.18	0.1	0	23.32	065154	6.87	383430	38.58	
Wome Bunamo	SP	0.03	0.1	0.26	32.56	065154	6.87	383330	38.56	
Harbe Shisho	SP	0	0	0.04	14.08	065142	6.86	383221	38.54	
Harbe Shisho	SP	0.054	0	0	36.52	065112	6.85	383204	38.53	
Gangailo	BH	0.135	0.1	0.25	22.44	065441	6.91	382227	38.37	Catholic compound
GaraGailo	SP	0.114	0.1	0.42	45.76	065431	6.91	383134	38.53	
Murancho Gucho	SP	.097	0	0	22.88	065257	6.88	383241	38.54	
Gobo Hebisha	SP	0.84	0.3	0	29.04	065340	6.89	383112	38.52	
Gobo Hebisha	SP	0.29	0	0	19.36	065310	6.89	383137	38.53	
Gobo Hebisha Wome	BH	0.328	0.1	0.42	17.52	065234	6.88	383052	38.51	
Shenodolo	BH	0.258	0.1	1.11	10.12	065439	6.91	382535	38.43	
Sedeka	MSW	0	0	0	14.96	065046	6.85	382709	38.45	
Sedeka (Shemeta)	MSW	0.176	0	0	50.6	065018	6.84	282646	38.45	
Sedeka	MSW	0.099	0	.06	32.12	065039	6.84	382703	38.45	
Konsore Ana/ Kilto	HDW	0.62	0.3	0.42	55.88	065410	6.90	382348	38.40	
Dobe Bute/ Goesare	SP	0.114	0	0	34.76	065221	6.87	383825	38.64	
Dobe Bute	SP	0.034	0.2	0	24.64	065257	6.88	383814	38.64	
Haisa Wita	SP	0.511	0	0	29.48	065325	6.89	383623	38.61	
Gemeso Kanera	SP	0	0	0	14.52	065143	6.86	383818	38.64	*E. coli* not tested
Gemeso Kanera	SP	0.78	0.4	0	18.48	065207	6.87	383804	38.63	
Gemeso Kanera	SP	0.705	0.1	0	23.76	065219	6.87	383812	38.64	

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Haisa Wita Oigecho	SP	0.065	0.1	0	22	065355	6.90	383449	38.58	
Faicho/ Shifa	SP	0.8	0.1	0	20.24	065108	6.85	383946	38.66	
Faicho/ Jegano	SP	0.14	0.1	0	26.84	065082	6.86	383942	38.66	
Faicho/ Gojamo	SP	0.43	0.2	0	19.8	065026	6.84	383941	38.66	
Galeco Haro/ Temeno	SP	0	0.1	0	22.44	065414	6.90	382919	38.49	
Galoca Haro/ Kentero	SP	0.089	0	0.7	25.08	065412	6.91	382933	38.45	
Teremesa/ Sedine	MSW	0.238	0	0.62	31.68	065130	6.86	382704	38.46	
Talamesa Sintaro	SW	0.07	1.7	0.27	7.48	065153	6.86	0382715	38.45	not used
Talamesa Awada	SW	0.56	0.3	0	14.08	065024	6.84	0382750	38.46	
Holboso Kutawo	SP	0.9	0.4	0	20.68	065144	6.86	0382750	38.47	
Holboso Konsore	SP	0.34	0.5	0	30.36	065152	6.86	0382827	38.47	
Holboso Konsore 2	SP	0.36	0.1	0	24.64	065158	6.87	0382837	38.48	
Telamo Bade	SW	0.15	0.2	0	24.64	064944	6.83	0382830	38.48	
Telamo Kerancho	SW	0.2	0.3	0	13.64	064928	6.82	0382834	38.48	
Telamo gorsana2	SW	0.85	0.2	0.2	29.04	064935	6.83	0382846	38.48	
Telamo Garsana 1	SP	0.387	0.3	0.15	15.84	065000	6.83	0382812	38.47	
Telamo Tamene SP	SP	0.25	0.041	0.12	16.28	064941	6.83	032900	38.48	
Telamo Sintaro	SP	0.1	0.1	0.18	0.18	064927	6.82	0382847	38.48	
Taramesa Lilame	SP	0.76	0.1	0	30.8	065052	6.85	0382753	38.46	
Dela Anferara Shemeta 2	HDW	0.4	0.2	0.27	7.92	065024	6.84	0382337	38.39	
Dela Anferara Bada 2	HDW	0.3	0.4	0.64	14.08	065050	6.85	0382323	38.39	
Dela Anferara Shilla	SW	0.3	0.2	0	22.44	062153	6.86	0382321	38.39	
Dila Gumbe Abensa	SW	0.1	0.2	0	8.8	065133	6.86	0382531	38.43	

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Dila Gumbe Hiyo	SW	0.329	0.6	0	10.12	065156	6.87	0382502	38.42	
Dila Gumbe Himsaka	SW	0.019	0.4	0	6.16	065128	6.86	0382507	38.42	
Dila Gumbe Gedime	SW	0.176	0.3	0	13.2	065113	6.85	0382513	38.42	
Fura Bogande	HDW	0.09	0	0.22	8.36	065005	6.83	0382532	38.43	
Fura Abecho	HDW	0.073	0.073	0.18	14.96	064957	6.83	0382512	38.42	
Deramo Anferara Ilala Bochesa	HDW	0.73	0.4	0.63	3.96	064950	6.83	0382313	38.39	
Wome Bunamo Keka	SP	0.166	0	0.4	26.84	065126	6.86	0383454	38.58	
Wome Bunamo Galano	SP	0.368	0.4	0.04	37.84	065153	6.86	0383351	38.56	
Aarbe shusho Dafina	SP	0.202	0.2	0.34	17.6	065106	6.85	0383140	38.53	
Harbeshisho Jewaro	SP	1.0	0.1	0	14.08	065052	6.85	0383116	38.52	
Gonowa Godo Hodile	MSW	0.115	0.2	0	19.8	065042	6.85	0383004	38.50	
Geragalo Loka	SP	0.48	0.1	0	35.2	065506	6.92	0383231	38.54	
Halabano Gonowa	HDW	0.005	0.2	0.8	33.88	065235	6.88	0382306	38.39	
diramo Anferara	HDW	0.1	0	0	28.6	065011	6.84	0382357	38.40	
Diramo Anferara	HDW	0.01	0.1	0	11.88	065005	6.83	0382317	38.39	
Murancho Guchol Loka	SP	1.6	0.2	0	3.52	065232	6.88	0383133	38.53	
Murancho Gucho	SP	1.0	0.3	0	28.6	065241	6.88	0383127	38.52	
Gonowa Gobelo Gemaycho	SP	0.5	0.3	0	26.84	065110	6.85	0382848	38.48	
Gonowa Gebelo Burema 2	BH	0.276	0.4	0.08	8.3	065108	6.85	0382919	38.50	
Abela Chefe	BH	0	0.2	0.8	12.32	065453	6.91	0382937	38.49	
Abela Lida Abela Town	BH	0.132	0	0.51	8.36	065543	6.93	0382809	38.47	
Haysauta Regicho	SP	0	0.2	0	8.8	065404	6.90	0383454	38.58	
Hayswtal Ikemo Anebo	SP	0.38	0	0	12.76	065354	6.90	0383357	38.57	

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Haysuta Dakole	SP	0.89	0.2	0	16.72	065415	6.90	0383422	38.57	
Dobe Bute Gobero	SP	0.66	0	0	33	065314	6.89	0383759	38.63	
Dobe Bute Tura	SP	0.06	0.09	0	22	065318	6.89	0383747	38.63	
Dobe Dena Sita	SP	0.12	0.1	0	23.32	065336	6.89	0383659	38.62	
Gemeso Kenera Kenera Town	HDW	0.01	0.04	0.27	10.56	065135	6.86	0383809	38.64	
Geneso Kenera Sharana	SP	0.044	0.3	0.33	10.12	065111	6.85	0383741	38.63	
Geneso Fayecho Shifa	SP	0.56	0.38	0.38	23.76	065130	6.86	0383949	38.66	
Gemeso Gayecho Fayecho (Fute)	SP	0.24	0.3	0.4	10.12	065147	6.86	0383945	38.66	
Gemeso Weyicho Mata	SP	0.09	0.1	0.73	42.24	065251	6.88	0383529	38.59	
							6.83		38.51	
Gonesa Godo Hundare 1	SP	0.03	0	0.4	21.56	064944	6.83	0383046	38.51	
Gonowagodo Kitawo	SP	0.02	0	0.77	24.2	064950	6.83	0383081	38.51	