Draft

Rapid Assessment of Rural Water Supply & Sanitation in Eritrea

2006

Water Resources Department
Ministry of Land, Water and Environment

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Foreword

(to be finalised)

This Rapid Assessment has been possible because of the collective efforts of a large number of people.

The field level data collection was done under difficult logistical conditions by Zoba and Sub-Zoba Administrations across the country and staff from the Ministries of Agriculture, Health and Education in the Zobas, with the fullest cooperation from Zoba Governors, Heads of Infrastructure and other senior staff.

The responsibility for the supervision of the fieldwork rested with Zoba authorities supported by WRD staff specifically deployed to oversee the Assessment's data collection. Data entry and processing was done by WRD at Asmara.

The management of the Assessment rested with WRD Technical assistance in different aspects of the Assessment was by supported by UNICEF.

The data collected in this Assessment looks a basic demography of all villages in Eritrea, and though the original purpose of the Assessment was limited to enumeration of drinking water and functionality and utilisation of these sources, the Assessment provides much more factual information which may find wider a much wider application than was originally thought of.

We are sure that other organisations in Eritrea will also find the data from this Assessment relevant to their work.

Director General
Water Resources Department

UNICEF

Asmara

XX February 2007

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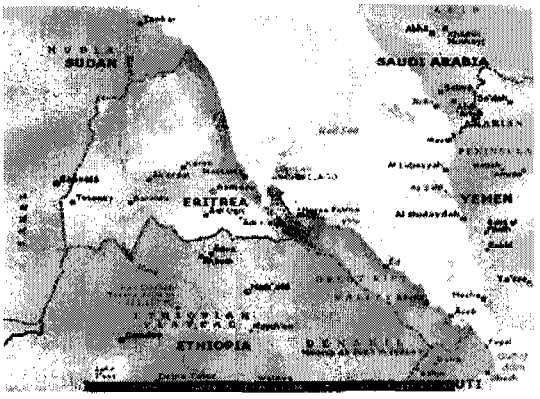
Executive Summary

Eritrea is a young country located in the Horn of Africa at about 12°22', and 18°02' north and between 36°26' and 43°13' east. It borders with Ethiopia to the South, Sudan to the west and north, Djibouti to southeast and the Red Sea to the east. It has more than 350 Islands in the Red Sea with a coastline extending to more than 1,200 Km. The total area of the country is about 124,000 Km^2.



The current estimated population, as projected from 2000 at a growth rate of 3% per annum, is 3.3 million (Ministry of Local Government, 2000). About 80% of Eritrean population depends on agriculture and related activities for its livelihood.

Eritrea is in the arid and semi-arid region of Africa with poor water resources. The rainfall is very low (mean annual rainfall in the highlands is in the range of 400- 500 mm and in the arid lowlands it is below 300 mm) and erratic in nature. In Eritrea, the lack of water is a threat to agriculture, rural domestic life, and industrial and other related development activity.[1]

The country is divided into 6 administrative Zones or Zobas – Anseba, Debub, Gashbarka, Maekel, Northern Red Sea (NRS) and Southern Red Sea (SRS).

In mid 2006 the Water Resources Department, Ministry of Land Water and Environment decided to update its information base on drinking water supply sources in the country with a Rapid Assessment of Water supply Coverage and System Functionality Status, or the **Rapid Assessment**. The fieldwork for the Assessment was completed by October 2006 and its preliminary analysis was completed in Jan 2007. These were present to the six Zoba authorities of the country to validate the data and discuss the findings.

Section 4 to 7 of this report presents the findings of the Assessment under the following headings. For easy reference, the serial numbers and the table numbering used below are the same as that used in the main report:

4.1 Demography
4.2 Community Management of Water Supply
4.3 Tariff Systems for Drinking Water
4.4 Maintenance of Water Supply Systems – Service Providers, Spare Parts, Payment for Services
4.5 Presence of Household Toilets
5. Water Supply
6. Water Quality
7. Data Reliability

[1] Source: The State of Eritrea - Integrated Water Resources Management (IWRM) Plan, Situation Analysis: The State of Water Resources In Eritrea

The findings in each of the above areas are summarized below.

4.1 *Demography*

- As compared to the initial scope of the assessment, which listed 58 Sub-Zobas, the assessment was carried out in 53 Sub-Zobas (four Sub-Zobas were not rural and one Zoba had one Sub-Zoba less than the initial original list).
- As against the original expectation of 2,591 villages, data recording was completed for 2,750 villages.
- The 2,750 villages found in the assessment, had 436,991 families and a population of 1,958,442 as summarized in below Table 418. This constituted the overall scope of the assessment

Table 418: Villages, Populations and Number of Families recorded

Zoba	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Sub-Zoba	11	12	14	3	9	4	53
Villages	559	990	670	84	334	113	2,750
Numbers of Families	73,330	140,509	119,478	32,340	61,299	10,035	436,991
Population	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442
Average Family Size	4.76	4.33	4.23	3.95	4.88	5.43	4.45

- The summary and detailed lists of villages in each Sub-Zoba and Zoba, with corresponding information on village names, Place Codes, numbers of families in each villages and village populations are provided in Annex 411 and 412.
- Of the 2,750 villages covered in the assessment, Table 412 shows that 2,157 villages were from Village Lists (of 2002), of which data was collected by visiting 2,104 (97.5%) villages. Information for the remaining 53 villages from the Village Lists was collected from records at respective Zoba or Sub-Zoba offices.
- About 75% of the villages in the country fall in the population range of [>100, ≤1000]. Small numbers of villages fall in the range of [≤100] and [>2000] (Table 417).

4.2 Community Management of Water Supply

- Maintenance management systems (refer Table 421 to 424) were evaluated by setting up a number of indicators, discussed below:
- **Water/ WASH Committee** were present in 42.2% (1,161 out of the 2,750) villages.
- **Tariff collection systems** were found in 29.6% (815) villages.
- **Bank accounts** to manage tariff collection were found in 9.5% (261) villages.
- **Exemption from Tariff to** some families was found in 12.4% (341) villages.
- **Water Guards, Tariff collectors** and **Maintenance operators** were found in 24.3% (667), 15.2 % (419), 2.8% (76) villages, respectively.
- **Bank accounts to manage tariff collection** from 240 villages across the country (refer Table 425) showed that the total sum of money accumulated from tariff collections was Nakfa 24,752,092.
- The **maximum** and **minimum** bank balances ranged from Nakfa 8,006,017[2] (in Gashbarka) to Nakfa 13 (in NRS).
- The average bank balance for the 240 villages with bank accounts was Nakfa 103,134. Gashbarka reported the most (171) villages with bank accounts and NRS and Maekel both had the least number (8) villages with bank accounts. SRS

[2] This figure is presently under debate.

reported no villages with a bank account for water tariff, which could be due to a lack of data (rather than a lack of bank accounts).

- 413 villages reported that there were **No bank accounts** for tariff collections (refer Table 426). In such cases, a majority of responses indicated that funds were kept with Water/ WASH Committee (239 villages) and the Village Administration (68).
- Payment of tariff was generally in cash, with rare cases of payment in kind and a combination of cash and kind also being reported (Table 427).
- **Tariff exemption** to some degree was reported from 12.4% of the villages across the country (refer Table 423) with the highest proportion of such villages in Gashbarka (21%) followed by Anseba (18%).
- The **most common reason for tariff exemption** was poverty (refer Table 428).
- Exemptions on account of families being female headed and child headed were low.
- On the issue of **Water supply coverage to institutions,** it was generally high in Zoba Debub and low in SRS (refer Table 429).
- 52% (410 out of 781) of **schools**, 63% (207 out of 330) of **health centres**, 35% (281 out of 810) of **mosques**, 50% (486 out of 974) of **churches** and 59% (133 out of 224) of **other institutions** were reported to have water supply.

4.3 Tariff Systems for Drinking Water

- Three types of measures are commonly used to provide the basis for water tariff. These are plastic Jerry Cans of 20 litres capacity, the "Jirba" (a locally made bladder of 60 to 80 litres, carried by donkeys or camels), and a barrel of 200 litres capacity.
- A fourth measure found was for different sizes of water tankers from over 16,000 litres capacity to 400 litres.
- Median costs across the country for the four common units by which water was sold are given in Table 434, below.

Table 434: Median Costs of Water for different units of measure

	Jerry Can	Jirba	Barrel	Other Measures
Capacity/ Unit (litres)	20	60	200	1,000
Median Costs per Unit - Nakfa	0.25	1.50	4.60	5.00

4.4. Maintenance of Water Supply Systems – Service Providers, Spare Parts, Payment for Services

Maintenance service providers - on a countrywide basis:

- For hand pump maintenance, local private technicians (30%) and Zoba Technicians (32%) were the most frequent service providers (Table 4412).
- for maintenance of engine driven pumps, local private technicians (33%) were the most frequent service providers (Table 4413).
- For maintenance of motorised pumps, local private technicians (37%) were the most frequent service providers (Table 4414).
- Most "other" maintenance was mostly carried out by local private technicians (35%) and Zoba technicians (30%) (Table 4415).
- Hence, local private technicians were the main service providers for maintenance in most cases, with Zoba technicians also contributing substantially.

Sources of Spare Parts - on a countrywide basis:

- For hand pumps Private sources and Zobas were the two main sources of spare parts (25.8% and 36.7% respectively -Table 4422).
- For engine driven pumps, private (37.5%) and "other" (27.5%) were the significant sources (Table 4423).

- For motorised pumps, Asmara (22.4%), private (30.4%) and Zobas (28.2%) were significant sources of spare parts (Table 4424).

Payment for Maintenance - on a countrywide basis:

- For hand pumps, 50% of all payments for maintenance were made by Water/ WASH Committees (Table 4432).
- For maintenance of engine drive pumps, 60% of all payments were made by Water/ WASH Committees across the country (Table 4433).
- For maintenance of motorised pumps. 71.5% of all payments for this group were made by Water/ WASH Committees across the country (Table 4434).
- For other repairs, 64.7% of all payments were made by Water/ WASH Committees (Table 4435).
- Charitable organisations in Debub and Sub-Zoba and Zoba authorities in SRS were also significant contributors to meeting maintenance costs.
- Hence, Water/ WASH Committees paid for most maintenance costs.

The above findings show that community management systems for maintenance of water supply systems were quite strong. However, while Committees did pay, the fact remained (as shown in later sections of water supply systems) that payment for maintenance was not the same thing as a high number of functional pumps. This indicates the need for greater attention on building up maintenance service capability and making spare parts available in order for the willingness of Committees to bear costs to be translated into higher number of working installations.

4.5 Presence of Household Toilets (refer Tables 452 to 455.)

The types of household toilets found were:

- Pour Flush toilets were found in 50 villages across the county.
- VIP toilets were found in a total of 80 villages.
- Simple Pit toilets were found in 115 villages.
- Open Pit toilets were found in 47 villages.
- Public toilets were found in 38 villages.
- A village could have more that one type of toilet design.

On the presence of toilets in villages:

- A total of 254 villages in the country (9.24% of the total of 2,750 villages) had toilets of any kind.
- No Latrine were found in 2496 (90.76%) of the total of 2750 villages in the country.
- On a percentage basis, the highest village-wise coverage was in Maekel (54% - 48 villages out a total of 84 villages) and the lowest is in SRS (5.31% - 6 villages out of 113).

Regarding total numbers of toilets:

- The country had a total of 5,697 toilets, with the maximum number (2,643) in Maekel, probably because of urbanization and the influence of Asmara city.
- Anseba and Debub had nearly the same total numbers of toilets (1,036 and 1,154, respectively), Gashbarka and NRS had half this number (520 and 597 respectively) while SRS had a very small number of toilets, only 17.

Coverage:

- As mentioned earlier, 9.24% (254 out of 2,750) villages had toilets of any kind.
- There is a possibility of under-reporting of the numbers of villages with toilets by about 10% (refer Section 7).
- If the total number of toilets in each Zoba were to be compared with the number of families in each Zoba, then the Percentage of Families with toilets varies between the highest of 8.00% in Maekel, to the lowest of 0.17% in SRS.

- The presence of toilets is abysmally low, that open defecation is a very dominant practice and that "coverage" measured by access of toilets to families is very, very low.

5. Water Supply

Findings for water supply are presented in four sub-sections:

5.1 Access to Water
5.2 Dependence on Multiple Water Sources
5.3 Age of Water Supply Sources/ Installations
5.4 Functionality and Utilisation of water supply systems

5.1 Access to Water

Table 5116 summarises the question of physical access to the three main types of drinking water sources – protected, unprotected and water trucking.

Table 5116: Summary of Access to water sources

	Villages - Nos. & Percentage	Populations - Nos. & Percentage	Total No. of Sources	Average Consumption - lpcd	Most common source type	Nos. & Percentage
Total Villages & Population	2,750	1,958,442				
	100%	100%				
With PWS	1,278	1,169,793	1,912	12.0	Hand pumps	864
	46.50%	59.7%				45.20%
With UPWS	2,360	1,658,009	3,264	8.7	Unprotected dug well/ spring	1,625
	85.8%	84.7%				49.8%
Water trucking						
Not fully dependent	52	97,151		13.5		
Fully dependent	50	58,790		14.8		

The numbers, coverage and consumption of each of these categories are summarised below:

Protected Water Sources (PWS)

- Protected water facilities have been constructed in 46.5% of the villages and provide access to 59.7% of the population. 53% of the villages had no protected water source.
- There were a total of 1,912 protected water source recorded in the assessment with the following break-up of source/ system types:
  - 864 Hand pumps
  - 30 water supply systems based on pumps driven by Electric Motors,
  - 222 systems with Electric Motor & Generator driven pumps
  - 207 systems with Engine driven pumps
  - 247 systems based on Solar Powered pumps
  - 261 Protected dug wells
  - 81 Protected springs

- In terms of percentage of villages in a Zoba with PWS systems, Maekel had the highest coverage of 85.7%, followed by Gashbarka (60.7%), Anseba (51.2%), Debub (40.6%), SRS (22.8%) and lastly, NRS (31%).
- The average consumption of water from protected sources was 12 lpcd.

Coverage with Protected Water Sources

In the absence of norms for rural water supply in Eritrea, physical coverage of villaes and populations with protected water sources has been estimated on the basis of the following assumptions:

- A hand pump would meet the needs of 500 persons.
- A PWS with a powered pump system (motor, engine or solar powered) would meet the needs of 1000 persons per day.
- A PWS without a powered pump system (protected dug well or protected spring) would meet the needs of 1000 persons per day.
- A shared system of any kind would provide for 500 persons per day.

Based on the above assumptions, villages and populations in villages have been categorized into three main groups:

- **Fully Covered Villages/ Populations:** Those villages/ populations where the service levels of water supply have been met, based on the above assumptions.
- **Partially Covered Villages/ Populations:** Those villages where there are PWS but the service levels of water supply are lower that the above norms. Within Partially Covered Villages, a part of the population is assumed to be served in accordance with the norms. This part of the population has been categorised as "**Partly covered - Served**". The remaining population of the village, whose needs can not be met by the above norms has been grouped as "**Partly covered - Not Served**".
- The third category is **Not Covered - No PWS,** where the entire population of the village is not served because the village has no PWS.

By the above catergorisation, the details of coverage of villages and village populations with protected water sources were:

- 29.7% of the villages in the country were fully covered, 16% of the villages were partially covered and 53.4% of the villages were not covered with protected water sources (total number of villages – 2750, Table 511).
- A total of 38% of the total population in the country was fully covered, 20% from fully covered villages and an additional 18% from partially covered villages (total population - 1,958,442, Table 511).
- A total of 61% of the total population was uncovered, comprising of 21% from partially covered villages and 40% from villages with no PWS.

Water Trucking (WT)

- 52 villages with a population of 97,151 people were partially dependent on water trucking and showed and average consumption of 13.5 lpcd.
- 50 villages with a population of 58,790 people were fully dependent on water trucking and showed and average consumption of 14.8 lpcd.

Unprotected Water Sources (UPWS)

- Four main categories of UPWS were found in the country: Cisterns, Pond/ Reservoir, River/ Stream and Unprotected dug well/ spring.

- Unprotected water facilities were available in 85.8% of the villages with 84.7% of the population.
- There were a total of 3,276 unprotected water sources recorded in the assessment.
- Dug wells and springs were the most common UPWS alternative (1,625 sources, 49.8% of the total number of sources).
- Rivers/ streams constituted 32.5% of UPWS, ponds/ reservoirs accounted for 17.6%. Cisterns collecting rain water from the land surface were found only in SRS and made up for 0.2% of UPWS.
- The largest number (1,389) of sources in Debub and the lowest number (99) in SRS.
- Average consumption from unprotected sources across the country was 8.7 lpcd, with the highest consumption from NRS (12.5 lpcd) and the lowest from Anseba (7.3%).
- Sharing of UPWS was reported from 12 villages across the country and 390 villages reported the absence of any UPWS source.

5.2 Dependence on Multiple Water Sources

The assessment clearly indicates that communities depend on a combination of water sources for their drinking water needs. A cross-tabulation of the possible combinations of the three main categories of sources – PWS, UPWS and WT against numbers of villages and populations (Table 521) reveals that:

- 51.5% of the villages have access to **Unprotected water sources only**
- 32.3% have access to a mix of **Protected** and **Unprotected sources**
- 12.4% of the villages have access to **only Protected water sources**
- Numbers of villages in each of the remaining combinations of water access was generally of the order of 1% of the villages.
- Only three villages in the entire country have a record of no water source at all. Two of these villages were found abandoned at the time of the assessment and data was not recorded for one village.

Table 522 below is an abbreviated version of Table 521 and summarises the country-wide status of use of multiple water sources.

Table 522: *Multiple Water Source Use Patterns*

Zoba	Combinations of Water Source Usage by numbers of Villages							
	No P, WT, U	Only U	Only WT	Only P	U+WT	P+WT	P+U	P+WT+U
Total	3	1,416	25	342	24	20	887	33
Percentage	0.1%	51.5%	0.9%	12.4%	0.9%	0.7%	32.3%	1.2%
	Combinations of Water Source Usage by Population							
Total	370	742,320	15,066	245,784	28,174	39,213	815,042	72,473
Percentage	0.02%	37.90%	0.77%	12.55%	1.44%	2.00%	41.62%	3.70%

* P= Protected Water Supply Systems, U= Unprotected Water Supply Systems, WT= Water Trucking

Roof Water Harvesting was an important component of multiple water use missed by the assessment. Field visits during data collection indicated that roof water collection was a significant supplement to domestic water needs and a common practice in the highlands especially from roofs built with corrugated galvanized iron sheets. Case studies presented in Annex 1.04 substantiate this especially where conventional PWS and UPWS are unavailable or difficult to access.

Some evidence of **Rain Water Harvesting** was evident form the existence of Cisterns (under UPWS) in SRS.

5.3 Age of Water Supply Sources/ Installations

For hand pumps the average and median periods for which pumps were not working was quite long – 2.83 year's average and 1.65 years median. This fact, coupled with the fact that 42.9% of hand pumps were not working (Table 5411 in Section 5.4), means that more that 40% hand pumps have been out of order for an average period of 2.83 years or a median period of 1.65 years. This leads to the conclusion that broken down hand pumps remain in a non-functional condition for between 20 to 30 months. This indicates an obvious weakness in the maintenance service and also raises the question as to whether a large number of hand pump installations are no more repairable and may have to be written off. The adverse implication of this on reinterpretation of physical coverage is quite clear.

For water supply systems based on Powered pumps the analysis of age of installations and period under broken down condition shows quite different patterns as compared to hand pumps. The average and median values for durations which pumps had remained out of order is smaller, implying that broken down systems are repaired more quickly and regularly. This fact is borne out by the relatively large fraction of working pumps in this group (78.9% working pumps from Table 5412) as compared to hand pumps (52.1% working from Table 5411) discussed in Section 5.4.

5.4 Working Status of Pumps

The analysis of the working status of all the 864 hand pumps in the country indicates that at country level, 52.1% of the hand pumps were found working by the assessment and 42.9% were not working (Table 541) .

The status of PWS systems using powered pumps showed that 78.9% of the 706 pumps were working and 17.3% were not working (Table 542). These pumps comprised of Electric motor driven pumps (30), Electric motor/ Generator driven pumps (222), Engine driven pumps (207), Solar powered pumps (247)

5.5 Functionality and Utilisation of water supply systems – F&U

In order to differentiate between access and use, this assessment has used indicators in two broad groups of Functionality and Utilisation to determine the extent to which protected water sources provided safe and sustainable water supply to users, and if users actually used these sources for meeting their drinking water needs.

The Functionality & Utilisation (F&U) analysis in this assessment has used four indicators with positive and negative responses to each indicator, which are:

Source:	Perennial (+) as against Seasonal (-)
Pump:	Working (+) as against Not Working (-)
Reliable:	Yes (+), No (-)
Used:	Yes (+), No (-)

F&U of Hand pumps

Out of the total of 864 hand pumps in the country, information on the four indicators of F&U was available for 522 hand pumps or 60% of the pumps.

The F&U analysis for hand pumps (Table 5512) had 39% (or 204 out of 522) hand pumps in the "perfect pump" group, i.e., where all four F&U indicators were favourable – Source was Perennial, Pump was Working, the installations was considered Reliable and the sources were Used.

The analysis also showed that even when source and pump indicators were not favourable (sources were seasonal and/or the pump was not working), 35% pumps showed favourable utilisation indicators. A possible explanation could be that the pumps had gone out of order in the time period immediately before the data collection. The seasonality question could have the possible explanation that the villages were in such difficult situations of access to drinking water, that even a seasonal source was considered valuable, because the assessment was done at a time when a long period of drought had just finished

The above findings indicate that conventional parameters of providing access and assuring the working status of water sources are inadequate to understand the reasoning behind use or rejection by user communities.

So while a total of 864 hand pumps may have been installed; and 450 (52%) of them may be working (Table 541); and while this may eventually result in actions that will make the maintenance system more responsive; the F&U analysis shows that only 204 (23.6% of 864) hand pumps meet all the favourable indicators of F&U. Another 56 (6%) hand pumps were on sustainable sources with working pumps that were considered as reliable sources by the community but are not regularly used.

In effect roughly 30% of the installed hand pumps appear to be valued as drinking water sources to user communities.

F& U of PWS systems based on Powered pumps

In the case of PWS systems based powered pumps (OPWS), the F&U analysis was made separately for each pump type. F&U indicators for 215 motor (motor and motor with generator, taken together) driven pumps, 161 engine driven pumps and 170 solar powered pumps were analysed.

66% of motor driven, 69.6% of engine driven and 73.5% of solar powered pumps fell into the "perfect" pump group, meeting the criteria of source sustainability, good pump functionality, considered as reliable water source by users and also were also used regularly.

"Not Working" condition of pumps affected between 12% to 15% installations from each of the three pump groups.

Seasonality of the sources as the common factor, affected around 12% to 18% of installations.

OPWS systems where all indicators were negative, were very low, a total of 3 out of 215 systems (1.7%) which was remarkable.

F& U of Protected Dug Wells and Protected Springs

The F&U analysis for Protected Dug Wells (PDW) and Protected Springs (PS) done on 217 (out of 261) PDWs and 74 (out of 81) PSs. 46.5% of PDWs and 47.3% of PSs fell into the "perfect" category of F&U. 7.8% of PDWs and 10.8% of PSs fell in the "worst" category of F&U with seasonal source, considered unreliable and not used by communities. Between 30% to 40% of PDWs and PSs were regularly used even though the sources were reported to be seasonal and unreliable.

The above analysis would lead to the conclusion that PDWs and PSs are considered as valuable water sources and are generally well-used even if the sources are seasonal and unreliable. This is probably due to the fact that the access to water from these sources is not dependent on a pumping device.

6. Water Quality

While H_2S vials are indicative of the presence of bacteria and are not a definitive test for pathogenic bacteria, they are a fairly good indicator of the possibility of bacteriological contamination. Bacteriological quality of water sources was estimated in the assessment using H_2S vials on 215 water samples from PWS sources and 12 samples from water trucks. The results of the tests were:

- 60.5% of the test results from PWS sources showed no reaction or the absence of bacteriological contamination, 39.5% samples indicated contamination from PWS sources.
- 33.3% samples from water trucks were safe and 66.6% of the samples indicated contamination.

The above test results show that bacteriological contamination is present in both PWS systems and in Water Trucking. Expectedly, the extent of contamination is higher in Water Trucking than in PWS systems. It would indicate the need for better water handling and disinfection practices for Water Trucks and for monitoring and disinfection for PWS sources.

While not specifically identified in this assessment, there are other chemical quality related problems with water sources. One such problem is the occurrence of high fluorides in drinking water around Keren.

This problem was easily apparent by the evidence of stained teeth enamel of children when visiting a hand pump about 15 Km from Keren on the Agordat road after the Zoba Workshop for Gashbarka. .

The problems caused by high fluorides in drinking water are well-known (starting from dental fluorosis in children,(as seen in photo above, taken on 18 Jan 2007) to skeletal fluorosis in old people. It is necessary to take note of this problem now and seek remedial measures. The problems caused by fluorosis and the solutions for it are very well documented with experiences from other parts of the world.

7. Data Reliability

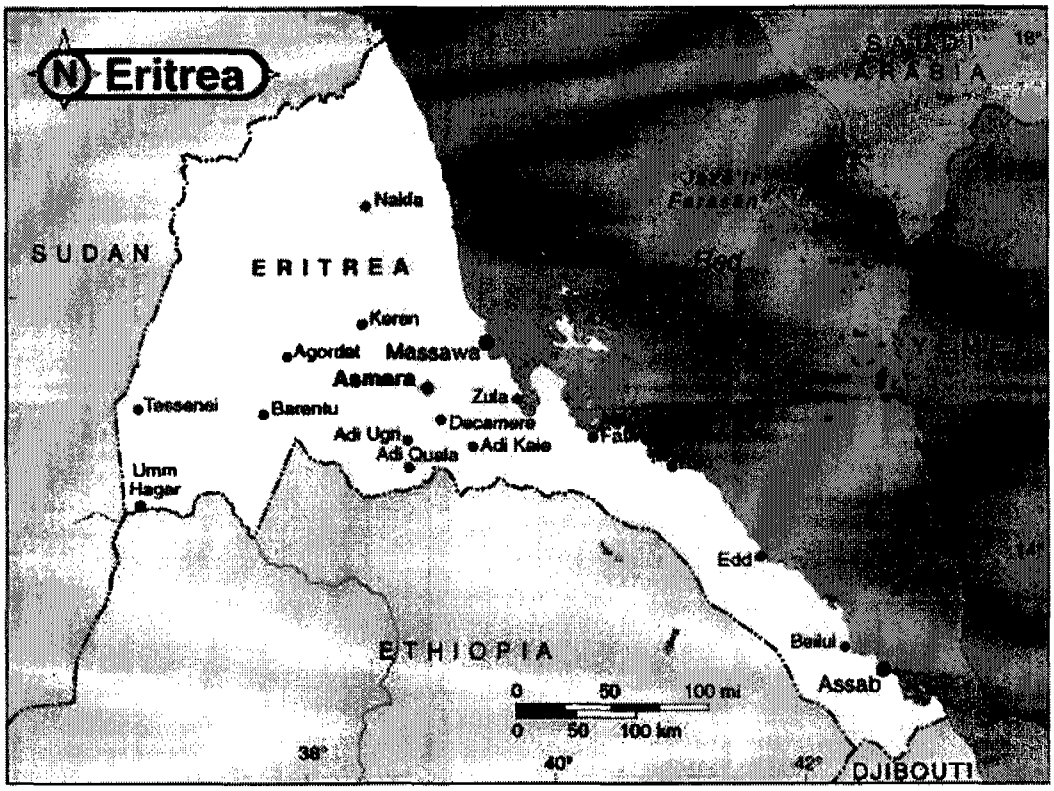
226 villages (8.2% of the total number of villages) across five Zobas were visited by Zoba level supervisors for cross-checking data collected in the main assessment. The Zoba supervisors completed the same questionnaire that was used in the main data collection process. The sample data was computerised for comparison with the main database for consistency. The cross-checking did not occur in NRS.

Critical data fields were picked up from the same villages in both the main and sample data bases and compared for consistency of responses. The results indicated a very high degree of consistency in demographic, community management and water source data. The analysis of Sanitation data indicated the possibility of under-reporting occurrence of toilets in the main data base of the order of 10%. Comparison Functionality & Utilisation indicators showed the majority of the data was quite consistent with some possibility of over-reporting of not-working and not-known records on the working condition of pumps and on usage. This might have affected F&U interpretations adversely from the main data base.

1. Background

1.1 Eritrea in brief

Eritrea is located in the north-eastern most tip of the Horn of Africa, along the widest part of the Red Sea on its western side, with a coastline of approximately 1,200 Km. The southern-eastern side of the country is a narrow strip, widening towards the northwestern direction. To the southeast of Eritrea is Djibouti, Ethiopia is along most of the southwestern border and Sudan is to the north west.



Source: UNICEF, Asmara

The boundaries and names used do not imply official endorsement by the United Nations

Fig. 1: Map of Eritrea and surrounding countries

The total population of Eritrea is estimated at 3.3 million. The country's capital city is Asmara, with an estimated population of 400,000. The national language is Tigrinya with Arabic spoken in the northern areas and areas located near to the Sudanese border. Italian and English are widely spoken.

Half of Eritrea's population lives in the central highlands, which rise to about 2200 meters above sea level. Here, the climate is moderate (up to 61 cm of rainfall annually), the land quite productive, and communications facilities relatively well developed. The other half of the population lives in the western and eastern lowlands where the climatic conditions are semi-arid and more demanding, and infrastructure is limited.

Eritrea has two rainy seasons: the short rains in March and April and the main rains from June to early September. Rainfall is heaviest in Eritrea from June to September, except in coastal areas, where it rains in December and January. For the remainder of the year, Eritrea's Red Sea coastline remains dry, and is particularly hot and humid from May to September.

Climatically the country can be divided into three major zones, the central highlands, the coastal region and western lowlands. The hottest month is usually May with highs at around 30 degrees centigrade in the central highlands and much hotter along the coast. On the coast, including the port town of Massawa, the months from June to September are extremely hot with day-time temperatures ranging from 40 to 50 degrees centigrade. Winter is between December and February with lows at night that can be near freezing point in the highlands.

The country is divided into six administrative zones, called Zobas (Fig. 2) . The coastal belt of the country comprises the two Zobas of Northern Red Sea (also called Semienawai Keih Bahri) and Southern Red Sea (Debuawi Keih Bahri) commonly referred to as NRS and SRS respectively. These two Zobas occupy the continuous long strip of arid low lands with the Red Sea as their eastern boundary.

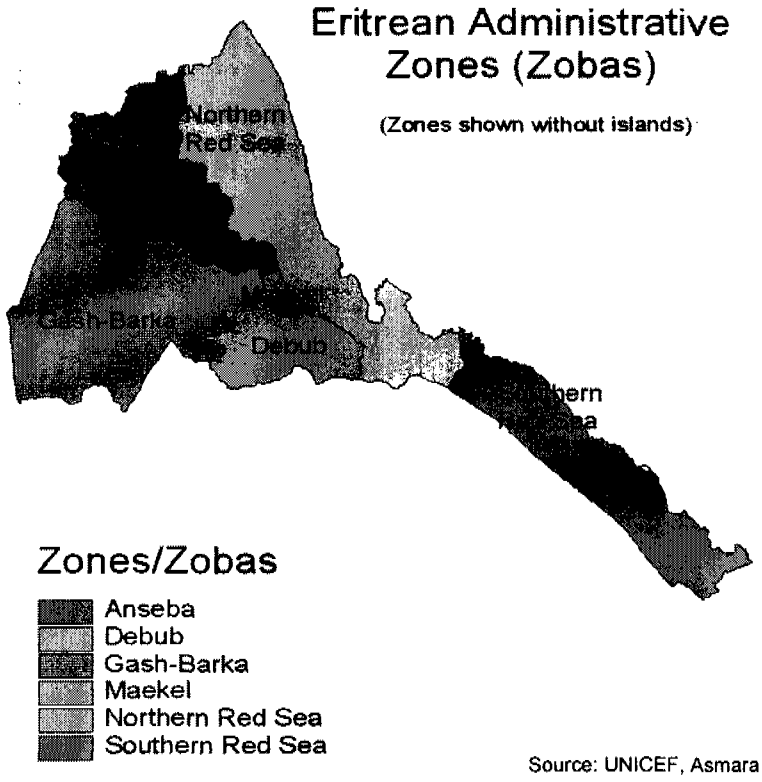


Fig. 2: Map of Zones or Zobas of Eritrea

The four remaining Zobas are Maekel, roughly in the middle of the country, with Zoba Anseba to the north, stretching up to Sudan, Zoba Gashbarka to the west and Debub to the south. The capital city, Asmara, is situated in Maekel, on a plateau at an elevation of about 2300 meters above sea level. Zoba Maekel is the smallest of the six Zobas and is in mountainous terrain with the least number of villages. In area, Zoba Debub is much smaller that Gashbarka and Anseba, but supports most of the country's population. Gashbarka and Anseba are territorially large, but topographically different. Gashbarka has the western low lands while Anseba is partly mountainous.

1.2 The Assessment

In June 2006 Water Resources Department (WRD) of the Ministry of Land, Water and Environment, responsible for the country level planning of provision of drinking water supply, proposed a countrywide Water Supply Coverage and System Functionality Status Survey. The field level data collection would be through a simple questionnaire, completed by students on summer vacation. The survey would be supervised and coordinated by Zoba and Sub-Zoba staff with assistance from WRD. The main purpose of the survey was to provide current factual information for a fresh basis for planning water supply interventions in the country, which, so far, had been done based on a similar survey in 2002.

WRD's proposal for the survey was supported in principle by UNICEF and the work of providing technical assistance to WRD for this purpose was assigned to a consultant engaged by UNICEF. Following a series of discussions between WRD and UNICEF, a detailed methodology for the survey was agreed upon and a budget was approved. A document called: Water Supply Coverage and System Functionality Status Survey - Methodology for a Rapid Assessment was drawn up to outline the details of the survey, hereafter referred to as the Rapid Assessment or simply, the assessment. An abbreviated version of the Methodology document is attached to this report as Annex 1.01.

The original objectives of the assessment, as stated in the proposal of June 06 from WRD, were:

1. Assess the safe water supply coverage in rural and urban areas
2. Assess functionality status of the existing water supply systems
3. Assess the existing operation and maintenance system.
4. Assess water consumption level.

During subsequent discussion, these objectives have been modified leave out urban area from its scope, to include the enumeration of household toilets and to record demographic details of villages in some detail, since reliable base-line demographic information of villages was not readily available.

The Methodology document detailed the following areas:

- defined the purpose and objectives of the assessment
- outlined its scope, coverage and implementation time frame
- drew up the assessment questionnaire
- outline responsibilities at Zoba and Sub-Zoba levels
- formulated a management plan naming national and Zoba level coordinators
- formulated the training content and a training schedule supervisors and data collectors
- specified reporting formats from sub-Zoba level to the national level at WRD, Asmara to monitor the progress of the assessment's field data collection
- proposed a draft tabulation plan for data analysis

Data entry and analysis would be done with the in-house data processing capabilities of WRD.

To assure reliability of data, it was agreed that Zoba level supervisors would revisit 10% of the villages in their respective areas, chosen at random, complete the same questionnaire, draw water samples from protected water sources and incubate them in H_2S[1] vials for indications of bacteriological contamination. This sample data would be compared with the main data to understand the level of consistency of the data and identify areas of possible error.

An orientation in the methodology of the assessment was conducted in July 2006 in Asmara for WRD staff designated as supervisors. These supervisors then conducted training programmes in the six Zobas for Zoba and Sub-Zoba level staff. By the time these preparatory activities were completed in July 2006, it was too late to recruit and train students for the fieldwork. Therefore, Zoba and Sub-Zoba staff was given the task to undertake the actual data collection from villages of their respective work areas. Annex 1.02 provides the list of supervisors and data collectors who carried out the actual field data collection.

In the absence of official census data of the country, the starting point for identifying villages for the assessment was the village lists of the survey of 2002. These lists were supplemented with information from the Zoba level, where a listing of some basic demographic parameters had been completed in mid- 2006. A system of assigning numerical "Place Codes" to villages was designed to provide a basic numerical reference system for the incoming data.

Field level data collection started in August 06. A data management system was created in MS Access at WRD to record and process the data. This system used a series of eight data entry forms in tables, as per data fields shown in Annex 1.03, which followed the same structure as the village level questionnaire to facilitate data entry and later processing.

The progress of the assessment was monitored on a regular basis until early Sept. 06. A number of problems that arose required attention, the main one being the lack of fuel and vehicles for transportation of data collectors to villages. This resulted in some delays and cost over-runs, but largely, data collection was completed by mid-October 2006. A group of ten WRD staff were trained for data entry and worked from WRD Asmara. By November 06, data entry had been completed and at that stage it was clear while data was robust for most of the country, there was weakness in the data quality from NRS. However, it was agreed that the analysis of the data should proceed.

The initial findings of the assessment were presented to an audience of WRD, Ministry of Health and UNICEF in early Jan 2007. Subsequently, findings relevant to each Zoba were presented to respective Zobas in a series of Zoba-level workshops with the intention of getting a degree of validation of the data and reactions to the findings. Most Zoba workshops indicated a high degree of agreement with the data. Zoba level data and analysis was provided to the Zoba authorities in a CD for their use later,

This report presents the main findings of the assessment. In presenting the findings, at some places it became necessary to elaborate on the analytical methodology since well-established procedures are not readily available for quantifying some aspects of the assessment such as Community management or Functionality & Utilisation. The lack of well-defined norms for terms like "coverage" with water supply in the Eritrean context also required the assessment analysis to set some its own indicators and methods for data analysis.

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[1] A separate note on H_2S vials and their use was provided in the Methodology document, Annex 1.01

2. Structure of the Report

The Executive Summary of this report is followed by Section 1, Introduction, which provides a brief description of Eritrea and background information on the Assessment. Section 2 of the report is a description of the Structure of the report. Section 3 outlines the Scope of the Assessment, providing summary information on the coverage of the villages and populations in the Assessment.

Sections 4, 5 and 6 deal with the analysis and findings of the assessment.

Section 4, Analysis & Findings Part 1, discusses five main areas of findings, as listed below:

4.1 Demography
4.2 Community based management of drinking water
4.3 Water tariff structures
4.4 Maintenance systems of water supply systems
4.5 Occurrence of household toilets

Section 5, Analysis & Findings Part 2, deals with findings of the assessment with reference water supply. It is divided into the following sub-sections:

5.1 Access to Water
5.2 Dependence on Multiple Water Sources
5.3 Age of Water Supply Sources/ Installations
5.4 Working Status of Hand Pumps
5.5 Functionality and Utilisation of water supply systems

The report also has two more sections, Section 6, on Water Quality and Section 7 on Data Reliability.

Section 6 presents the results of water quality tests for bacteriological contamination done with H_2S vials. These tests were done by Supervisors of the assessment in a manner described the Methodology document.

Section 7 documents the results of comparison of important components of the main database with the sample crosscheck by Supervisors. The results of this comparison and implications related to the reliability of the main database have been discussed in this section.

There are four annexes attached to the text of this report. They are:

Annex 1.01: Methodology Document
Annex 1.02: Coordinators, Supervisors and Data Collectors for the Assessment
Annex 1.03: Data Fields
Annex 1.04: Case Studies

Apart from the above four annexes, references have been given to a number of annexes that provide detailed data on the basis of which analytical tables have been prepared.

A CD is attached to this report where all the data annexes to this report have been recorded in MS Excel workbooks. The nomenclature of these annex files follow the sequence that has been used in this report.

Apart from this report, an abridged version of this report has also been written for use at the Zoba level in the country, where the focus is on Zoba level data interpretations, eliminating the country level analysis to the extent possible.

The naming and numbering sub-sections, tables, figure and data annexes for both this main report and the abridged report are common. The first one or two worksheets in each annex file contain the comprehensive country level data analysis, and are followed by subsequent worksheets for Zoba data for each data area.

The CD also contains this main report and the abridged report.

The comprehensive database, where all village level observations of the Rapid Assessment for each village in each Sub-Zoba and Zoba in the country have been computerised, and on the basis of which the main report and this report have been written, is available with WRD at Asmara.

3. Scope of the Assessment

The initial scope of the Assessment was to collect data related to numbers and functional condition of dinking water sources on all the villages of Eritrea. A questionnaire was to be used to elicit information on functionality and utilisation of drinking water sources, both "protected"[2] and "unprotected". The assessment aimed to cover all six Zones or Zobas of the country, which had 58 Sub-Zobas with a total of 2,591 villages, as detailed in Table 311, below.

Table 311: Scope of the Assessment

Zoba	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Sub-Zoba	11	12	14	7	10	4	58
Villages	415	886	792	102	324	72	2,591

The assessment was actually completed in all the six Zobas of the country, covering a total of 53 sub-Zobas. As compared to the initial intent to cover 58 Sub-Zobas, the assessment actually covered 53 sub-Zobas (leaving out four Sub-Zobas of Maekel which constitute Asmara city and its suburbs, and only nine Sub-Zobas were found in Northern Red Sea). As compared to the expectation of 2,591 villages in the six Zobas, the assessment found 2,750 villages.

An examination of the data indicated that possibility of inclusion of a number of towns for which data had been collected. One possible way of distinguishing towns from villages is identify their administration system: towns have municipalities while villages have village administrations. However, there was no clear demarcation of town limits and sometimes, and often the situation was unclear in cases of villages on the edge of towns, which had village administrations but received water supply from the town. In some instances, existing villages on the periphery of towns were in the process of being included in plans for expansion of town services.

In the absence of a clear indicator for the difference between a town and a village, names of all villages with populations exceeding 4,000 were extracted from the database. This list was further examined against the possibility of being within the vicinity of an existing town and therefore, being more a peri-urban group rather than a village, or being a large settlement, not clearly defined as a town or a village, such as some Sub-Zoba head quarters. The final list of "villages" for which data was collected, but which were classified as "towns" is provided in Annex 321 and is summarised in Table 321, below. This list, consisting of 23 locations, has been passed on to the appropriate authorities for their opinion. In the meantime, this list of "towns" has been separated from the database and from further analysis. However, the data has been preserved.

Table 321: Numbers of Towns found in the database

Zoba	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Towns found	6	1		9	7		23

[2] This categorisation is derived from the definitions of "Improved" and "Unimproved" drinking water sources used in "Meeting the MDG Drinking Water and Sanitation Target – A Mid-Term Assessment of Progress", published by UNICEF and WHO, August 2004 (Page 4).

4. Analysis & Findings Part 1: Demography, Community Management, Tariff, Maintenance & Household Toilets

As mentioned in Section 2, this section deals with the main areas of query of the assessment except water supply. It is divided into the following sub-sections:

4.1 Demography
4.2 Community based management of drinking water
4.3 Water tariff structures
4.4 Maintenance systems of water supply systems
4.5 Occurrence of household toilets

The data analysis presented in each sub-section deals with the country level and Zoba level analysis of that particular data group and provides references to Annexes where village-wise details are provided.

4.1 Demography

4.1.1 Village - Listed & Unlisted

The first group of queries addressed in the assessment, as shown below, was to record the basic location and demography of a village being visited for data collection, as shown in Table 411 below:

Table 411: Demographic Queries

101 Zoba: Anseba/ Debub/ Gash Barka/ Maekel/ NRS/ SRS
102 Sub Zoba: _____
103 Village: _____
104 IDP Camp: (1)Yes No(2)
105 Population: _____ 106 Number of families: _____
107 Distance from Sub Zoba: _____Km

Place Code ☐☐☐☐☐☐
Visited by Animator ☐Yes ☐No

The assessment proceeded on the basis of existing Village Lists of each Sub-Zoba within a Zoba, prepared in about 2002 for a similar survey of water sources. It was anticipated that existing village lists needed to be updated from more recent and reliable records available at the Zoba level.

The existing Village Lists were arranged alphabetically, grouped by Sub-Zoba and assigned a unique six digit numerical "Place Code" for each village on the list. The first digit in the Place Code was used the Zoba (using numbers 1 to 6 for the six Zobas), the next two digits were used for the Sub-Zoba (01 to 99 to accommodate the expected 58 Sub-Zobas), and last three digits (001 to 999) were used to designate the villages within a Sub-Zoba.

Additional villages found after compilation of the Village Lists of 2002, were also given Place Codes after adding these extra village names (from Zoba records) to a revised village list. The final detailed list 2,750 villages (Village List of 2002 + unlisted villages from Zoba records) for which the assessment collected information is summarised on the basis of country and Zobas/ Sub-Zobas in Table 412. Annex 411 and 412 provides Zoba-wise summary and full lists of village with listing status, numbers of families and populations.

Table 412: Listed & Unlisted Villages, Visited & Not-visited Villages

Listed & Unlisted Villages Visited and not visited Villages	Zobas						Total
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	
Listed Villages ...							
...where data was collected by village visit	341	831	505	80	245	102	2,104
...where data was collected by from secondary records	22	4	14		11	2	53
...where data was not collected at all							0
Sub Total	363	835	519	80	256	104	2,157
Unlisted Villages (additional villages found from Zoba records) ...							
...where data was collected by village visit	169	155	148	4	70	8	554
...where data was collected by from secondary records	27		3		8	1	39
...where data was not collected at all							0
Sub Total	196	155	151	4	78	9	593
Total data							
Total number of as per village List	363	835	519	80	256	104	2,157
Additional villages found	196	155	151	4	78	9	593
Total number of villages	**559**	**990**	**670**	**84**	**334**	**113**	**2,750**

A question that would arise is: why did the Village Lists differ from the current number of villages and what was the degree this difference.

As detailed in Table 412, out of the total 2,750 villages in the assessment, the Village Lists had names of 2,157 (78.4%) villages and 593 (21.6%) additional villages found from Zoba records.

The reasons for the existence of additional villages are not quite clear. In the absence of any official or published census data for the country, there is the question of the completeness of the Village Lists of 2002. It also appears that there have been moves for "villagisation", which implies a consolidation of small hamlets into larger villages, in order to make the logistics and delivery of basic infrastructural services (education, heath care, accessibility, etc.) simpler. However, this would tend to lower the number of villages rather than increase it.

A certain extent of territorial reorganisation and rationalisation is also supposed to be responsible for changes in the numbers of villages. It appears that some villages, earlier listed in a particular Zoba, because of proximity to that Zoba's administrative head quarters, had not taken physical accessibility into question. For example, Village A, belonging to Zoba X, because of proximity, could only be accessed by traveling through Zoba Y. In the rationalisation process, Village A was reassigned to be a part of Zoba Y. This process is currently ongoing and to that extent, poses a problem, in terms of correctness of the data recorded.

An important factor in the compilation of Sub-Zoba and Zoba village lists was the fact that during 2006, Zobas had conducted surveys of the villages under their jurisdiction listing some important demographic information such as populations and numbers of families. These figures have been used in the assessment data. However, it is necessary to record that this Zoba level data has not been complied or consolidated and does not have the status of officially published data. Fortunately, in the course of the assessment, there were no "disputed" villages between Zobas. There is, however, the possibility that very small habitations, which did not have the official status of a village, with a village name on the Zoba records, have not been recorded in the assessment. Unfortunately, there is no means by which this kind of an omission, if it has occurred, can be quantified.

A great advantage of the 2002 Village Lists was that each village was geo-referenced into a computerised map. While the current assessment probably provides the lists of villages by Sub-Zoba and Zoba more accurately than the list of 2002, the new village lists, resulting from this assessment can not be accurately located on maps immediately, primarily because re-mapping of villages was not the objective of the assessment (and perhaps because a great degree of variance from the list of 2002 was not anticipated).

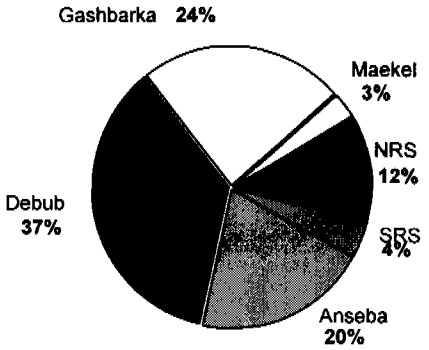
4.1.2 Numbers of Families and Populations & Corrections

The overall coverage of the assessment is summarised on the basis of Zobas in Table 413 below from Annexes 411 and 412. This table shows that the assessment covered:

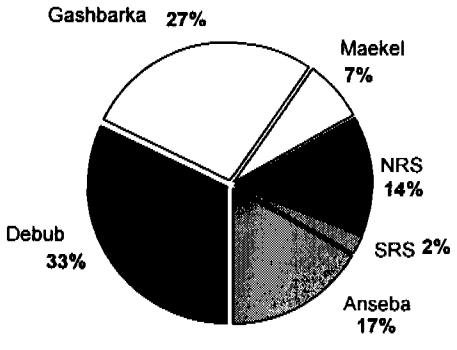
- **6 Zobas**
- **53 Sub-Zobas**
- **2750 villages**
- **436,991 families**
- **1,958,442 people**

Table 413: Coverage Statistics by Zoba

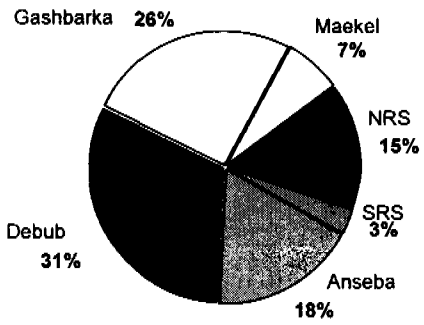
Zoba	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Sub-Zoba	11	12	14	3	9	4	**53**
Villages	559	990	670	84	334	113	**2,750**
Families	73,330	140,509	119,478	32,340	61,299	10,035	**436,991**
Population	349,087	615,748	505,256	134,781	299,033	54,537	**1,958,442**



Total Villages



Total Families



Total Population

Fig. 412: Distribution of Villages, Families & Population by Zobas

With reference to the country as a whole, Fig. 412 shows the percentage of Villages, Families and Populations in each Zoba.

As mentioned earlier, the assessment has recorded numbers of families and the population of in each village based on information from respective Zobas. Apart from a degree of uncertainty about the correctness of these figures, for reasons elaborated earlier, the data on numbers of families and the village population was not recorded by the data collectors in a small number of villages. However, since some of the analysis of the assessment is based on computations using population figures and numbers of families, these two figures have been "corrected" to compensate for the lack of data. The method of correction of these figures was by the following procedure:

- The average numbers of families in a village in a Zoba was computed, for the number of villages where this information was recorded.
- This average number of families in a village of a Zoba was then assigned to those villages in that Zoba, where family figures had not been recorded.
- By this method, all villages in a Zoba had numbers of families and the new total number of families for the Zoba constituted the "corrected" number.
- In a similar manner, average populations figures for a Zoba were assigned to villages in that Zoba, where population data was missing to give "corrected" population lists.
- The same procedure, for both numbers of families and populations was used with median values of numbers of families and populations.

This procedure to compensate for missing information on numbers of families and population was done, using both average and median values, in order to understand the magnitude of the change that such "corrections" implied.

The results from using the above procedure to "correct" the family figures and population are given below in Tables 414 and 415, with details in Annex 414.

Table 414: Corrected Computations for Numbers of Families

Sl. No.	Numbers of ...	Zoba						
		Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
1	Village responding	559	990	670	84	334	113	2,750
2	Families recorded	73,330	140,509	119,478	32,340	61,299	10,035	436,991
3	Villages showing Families – NK	1	15	38	3	8	1	66
4.1	Average Nos. of Families per Village	131	144	189	399	188	90	162
4.2	Families added (Row 3x Row 4.1)	131	2,162	7,184	1,198	1,504	90	12,269
4.3	Families – Corrected, using Average values- [(Row 2+ Row 4.2)]	73,461	142,671	126,662	33,538	62,803	10,125	449,260
4.4	Families Corrected - as % of Families Recorded [(Row 4.3/ Row 2)x100]	100.2%	101.5%	106.0%	103.7%	102.5%	100.9%	102.8%
5.1	Median values of Families per Village	85	100	100	239	107	64	100
5.2	Families added (Row 3x Row 5.1)	85	1,500	3,800	717	856	64	7,022
5.3	Families – Corrected, using Median values - [Row 2+ Row 5.2)	73,415	142,009	123,278	33,057	62,155	10,099	444,013
5.4	Families Corrected - as % of Families Recorded [(Row 5.3/ Row 2) x 100]	100.1%	101.1%	103.2%	102.2%	101.4%	100.6%	101.6%

The above table shows that data was recorded for a total of 2750 villages, with 434,991 families. However, a total of 66 villages had not recorded the number of families. Correcting the figures of numbers of families using the procedure explained earlier resulted in increases in the country's number of rural families by 12,269 (using averages) and by 7,022 (using median values).

While these absolute numbers appear large, they actually represent only a small fraction of the total number of families, 2.8% (using averages) and 1.6% (using median values), using the recorded number of 436,991 families as the base for this calculation.

When looked at the level of individual Zobas, the highest variation occurred in Zoba Gashbarka, which had the most number of villages (38) without information on the numbers of families. This resulted in an addition of 7,184 families (6.0%, using averages) or 3,800 families (3.2%, using median values) to Gashbarka's recorded number of families. In the case of most other Zobas, the increase by using averages of medians varied from 0.1% to less than 3% (except in the case of Maekel, using averages, where it was 3.7%).

Table 415: Corrected Computations for Populations

Sl. No.	Numbers of ...	Zoba						
		Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
1	Village responding	559	990	670	84	334	113	2,750
2	Population recorded	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442
3	Villages showing Population – NK	2	7	36		8	1	54
4.1	Average Population per Village	627	626	797	1,605	917	487	724
4.2	Population added (Row 3x Row 4.1)	1,253	4,385	28,690		7,338	487	41,526
4.3	Population – Corrected, using Average values- [(Row 2+ Row 4.2)]	350,340	620,133	533,946	134,781	306,371	55,024	1,999,968
4.4	Population Corrected – as % of Families Recorded [(Row 4.3/ Row 2)x100]	100.4%	100.7%	105.7%	100.0%	102.5%	100.9%	102.1%
5.1	Median values of Population per Village	400	462	420	1,117	553	323	450
5.2	Population added (Row 3x Row 5.1)	800	3,234	15,102		4,424	323	23,483
5.3	Population – Corrected, using Median values - [Row 2+ Row 5.2)	349,887	618,982	520,358	134,781	303,457	54,860	1,981,925
5.4	Population Corrected – as % of Families Recorded [(Row 5.3/ Row 2) x 100]	100.2%	100.5%	103.0%	100.0%	101.5%	100.6%	101.2%

Table 415 above shows that data was recorded for a total population of 1,958,442. However, a total of 54 villages had not recorded village populations. Correcting the population figures using the same procedure as before, increases the country's population by 41,256 (using averages) and by 23,483 (using median values).

Again while these absolute numbers appear large, they actually represent only a small fraction of the total population, 2.1% (using averages) and 1.2% (using median values) using the recorded population of 1,958,442 as the base for these calculations.

Again, the highest variation occurred in Zoba Gashbarka, which had the most number of villages (36) without information on village population, resulting in an addition of 28,690 people (5.7%), using averages or 15,102 people (3.0%), using median values, to this Zoba's

recorded population. In the case of most other Zobas, the increase by using averages of medians varied from nil (in Maekel) to 2.5% (for NRS, using averages).

Implications

It is possible that the correction to the figures of families and population have little bearing on the eventual computations of coverage with water and sanitation facilities since the net effect of the correction is only by small sums, up to maximums of 6.0% increase for families and 5.7% increase in population (in both cases, for Gashbarka, using averages), with a majority of the increases in values remaining within 1%. However, the significance (or insignificance) of these corrections could only be commented upon when its magnitude has been computed, which is small in this case and which was the reason for this exercise.

For purposes of any further computations related numbers of families and population, the corrected values using median values will be used, since median computations are a more accurate method of computation where there is a high degree of variation in the data, as is the case in the demographic data here.
Hence, the corrected family and population data used for further analysis will be as per the figures shown in Table 416 below:

Table 416: Corrections to Numbers of Families and Populations

Sl. No.	Numbers of ...	Zoba						
		Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
1	Families recorded	73,330	140,509	119,478	32,340	61,299	10,035	436,991
2	Families – corrected	73,415	142,009	123,278	33,057	62,155	10,099	444,013
3	Population recorded	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442
4	Population - corrected	349,887	618,982	520,358	134,781	303,457	54,860	1,981,925

In demographic terms, a "household" or a "family" may have a strict definition. However, in this assessment, information on the numbers of families was recorded from information available at the Zoba. To that extent, this information is not gathered first-hand and may be an approximation to some extent.

4.1.3 Distribution of Villages by Population Groupings

Table 417 below (with details in Annex 417) shows numbers of villages falling in different population ranges. About 75% of the villages in the country fall in the population range of [>100, ≤1000]. Small numbers of villages fall in the range of [≤100] and [>2000], showing that villages with very low and very high populations do occur but are low in number. This again justifies the use of median values of populations rather than average values. Fig. 417 illustrates this distribution pattern.

Table 417: Classification of Villages by Population Groups

Population Groups	Nos. of villages in each population group in the Zoba						Totals	Per-centage
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS		
≤50 persons	2	20	4		1		27	1.0%
>50, ≤100	17	31	18	1	20	10	97	3.5%
>100, ≤250	135	196	138	3	53	30	557	20.3%
>250, ≤500	190	281	209	10	81	35	806	29.3%
>500, ≤1000	138	291	146	24	81	23	703	25.6%
>1000, ≤2000	52	136	63	28	57	12	348	12.7%
>2000, ≤5000	19	22	43	13	27	2	126	4.6%
>5000	4	4	13	5	6		32	1.2%
Not known	2	7	36		8	1	54	2.0%
Totals	559	990	670	84	334	113	2,750	100.0%

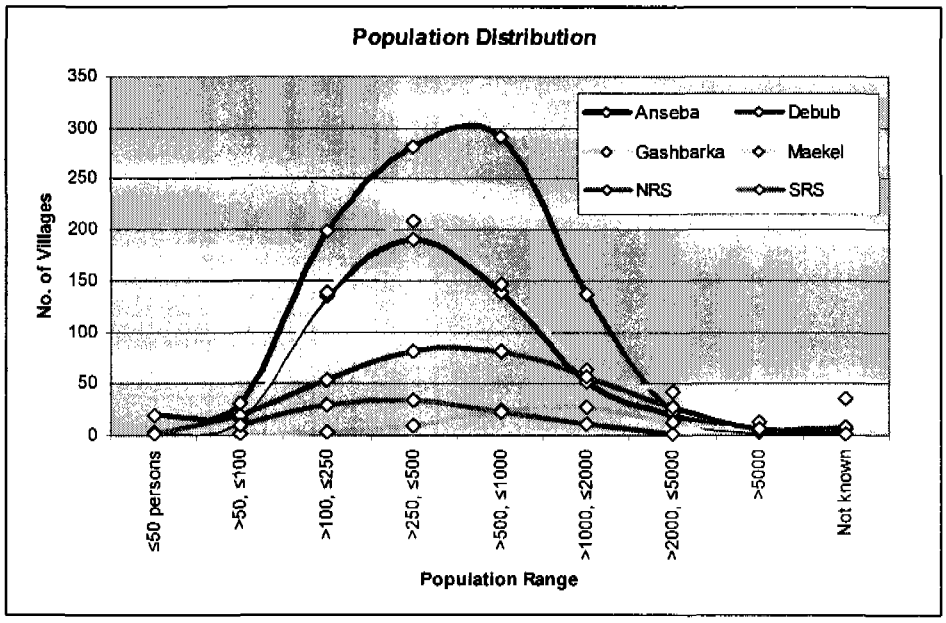


Fig. 417: Distribution of Villages in different Zobas, classified by population ranges

4.2 Community based management of water supply

The second group of queries addressed in the assessment, as shown below, was to record the characteristics of community based management of drinking water systems. This was done by establishing a number of indicators for gauging levels and spread of community based management. Table 421 lists these indicators at village level.

Table 421: Indicators for Community based management systems

	Indicator						
201	Is there a Water/ WASH Committee?			Yes (1)		No (2)	
202	Is there a Water Tariff system?			Yes (1)		No (2)	
203	If there is a Tariff system, is it in ....?			Cash (1)		In kind (2)	Both (3)
204	Are any families exempt from tariff?			Yes (1)		No (2)	
205	Basis for tariff exemption? HH is headed by..?			Female (1)	Child (2)	Poor Family (3)	.....(4)
206	Does the Committee have a bank account?			Yes (1)		No (2)	
207	Present Bank balance?			.....Nkf		.....(date: mm/yy)	
208	If no bank A/c, where are funds kept?			.....			
209	Is there a	Water Guard? (1)		Tariff Collector? (2)		Maintenance operator? (3)	
210	In the village, is there...	School? (1)	Health Centre? (2)	Mosque? (3)	Church? (4)	Any other institution? (5)	
211	Do they get water?	Yes (1) No (2)	Yes (1) No (2)	Yes (1) No (2)	Yes (1) No (2)	Yes (1) No (2)	

The countrywide and Zoba-wise consolidated response to some of the above questions are given in Table 422 and Table 423 below and are detailed on a village-wise basis in Annex 422. Out of the total of 2,750 villages covered in the assessment:

Table 422: Consolidated Response to some Indicators

Number of villages responding to: Is there a...	Total						Total Nos.
	Yes		No		NK		
	Nos.	%	Nos.	%	Nos.	%	
Water/ WASH Committee	1,161	42.2%	1,546	56.2%	43	1.6%	2,750
Water Guard	667	24.3%	422	15.3%	1,661	60.4%	2,750
Tariff Collector	419	15.2%	452	16.4%	1,879	68.3%	2,750
Maintenance Operator	76	2.8%	513	18.7%	2,161	78.6%	2,750
Tariff System	815	29.6%	1,868	67.9%	67	2.4%	2,750
Bank Account	261	9.5%	1,088	39.6%	1,401	50.9%	2,750
Families exempted from Tariff	341	12.4%	956	34.8%	1,453	52.8%	2,750

Table 423: Zoba-wise "Yes" responses to some Indicators

Percentage of villages responding "Yes" to ...	Zobas						Total
	Anseba	Debub	Gash-barka	Maekel	NRS	SRS	
Water/ WASH committee	35.8%	47.3%	52.7%	77.4%	15.3%	21.2%	42.2%
Water guard	20.8%	24.1%	37.5%	35.7%	6.6%	8.0%	24.3%
Tariff collector	14.3%	10.6%	26.4%	36.9%	7.8%	0.0%	15.2%
Maintenance operator	0.5%	2.1%	4.3%	19.0%	2.1%		2.8%
Tariff collection system	29.7%	24.4%	44.6%	53.6%	15.0%	11.5%	29.6%
Bank account	5.9%	4.1%	25.5%	9.5%	2.4%		9.5%
Families exempted from Tariff	17.5%	6.2%	20.9%	13.1%	6.6%	8.0%	12.4%

Responses to the Indicators shown in Table 421 are summarised in Table 422 and Table 423, detailed in Table 424 and discussed below. The Indicators not included in Table 421 are also discussed below with additional analysis:

Table 424: Zoba-wise consolidated responses to existence of Committees, Functionaries & Tariff Systems

Number of villages responding to: Is there a Water/WASH committee	Zobas											
	Anseba			Debub			Gashbarka			Maekel		
	Yes	No	NK	Yes	No	NK	Yes	No	NK	Yes	No	NK
	200	354	5	468	517	5	353	309	8	65	19	
Water guard	116	59	384	239	151	600	251	98	321	30	26	28
Tariff collector	80	57	422	105	164	721	177	119	374	31	27	26
Maintenance operator	3	62	494	21	181	788	29	146	495	16	36	32
Tariff system	166	384	9	242	737	11	299	359	12	45	39	
Bank account	33	225	301	41	405	544	171	275	224	8	63	13
Families exempted from Tariff	98	134	327	61	359	570	140	292	238	11	59	14

Table 424 (Contd.)

Number of villages responding to: Is there a Water/WASH committee	Zobas						Total			Cross check
	NRS			SRS						
	Yes	No	NK	Yes	No	NK	Yes	No	NK	
	51	261	22	24	86	3	1,161	1,546	43	2,750
Water guard	22	57	255	9	31	73	667	422	1,661	2,750
Tariff collector	26	53	255		32	81	419	452	1,879	2,750
Maintenance operator	7	54	273		34	79	76	513	2,161	2,750
Tariff system	50	253	31	13	96	4	815	1,868	67	2,750
Bank account	8	80	246		40	73	261	1,088	1,401	2,750
Families exempted from Tariff	22	78	234	9	34	70	341	956	1,453	2,750

Water/ WASH Committees

- 42.2% of the villages had Water/ WASH Committees.
- Zobas Gashbarka and Maekel showed a relatively high percentage of villages (above 50%) with Water/ WASH Committees. Anseba and Debub had committees in about 36% to 47% of villages. Committees were relatively less (15% to 21% of villages) in Zoba Northern Red Sea and Zoba Southern Red Sea.

Water Guards

- 24.3% of the villages had Water Guards.
- Zobas Gashbarka and Maekel showed a relatively high percentage of villages (above 38% to 36%) with Water Guards. Anseba and Debub had guards in about 21% to 24% of villages. Guards were relatively less (7% to 8% of villages) in Northern Red Sea and Southern Red Sea.

Tariff Collectors

- 15.2% of the villages had Tariff Collectors.
- Zobas Gashbarka and Maekel showed a relatively high percentage of villages (above 26% to 37%) with Tariff Collectors. Anseba and Debub had Tariff Collectors in about 14% to 11% of villages. Guards were relatively less (8% of villages) in Northern Red Sea. Southern Red Sea did not record the presence of Tariff Collectors.

Maintenance operator

- 2.8% of the villages had Maintenance Operator.
- Only Zoba Maekel showed a relatively high percentage of villages (19%) with Maintenance Operators. Debub and NRS had operators in about 2% of villages. Presence of Maintenance Operators was negligible (0.5% of villages) in Anseba. Southern Red Sea did not record the presence of operators.

Was there a Water Tariff system?

- 29.6% of the villages had a Tariff system.
- Zobas Gashbarka and Maekel had a relatively high percentage of villages (45% and 54%) with Tariff collection system. Anseba and Debub reported tariff collection systems in 30% and 24% villages. Tariff collection systems were relatively less (15% and 12% of villages) in Northern Red Sea and Southern Red Sea.

Bank account

- 9.5% of the villages had Bank accounts for tariff funds.
- The highest figures of bank accounts for tariff collection was found in Gashbarka (21%) and Anseba (18%), followed by Maekel (13%). Lesser proportion of villages had bank accounts in NRS (10%) and Debub (4% of villages). No village in SRS reported a bank account.

Bank balance

Table 425 provides a summary of 261 villages (village-wise details are provided in Annex 425) that reported that they had bank accounts for their tariff collection and shows that:

- Of the 261 villages that reported having bank accounts for water tariff collection, 240 villages provided details of bank balances.
- The total sum of money available in the bank accounts of the 240 villages was Nakfa 24,752,092.

- The maximum and minimum bank balances were Nakfa 8,006,017[3] from a village in Gashbarka and Nakfa 13 from NRS, respectively.
- The highest and lowest average bank balance were Nakfa 269,563 in Maekel and Nakfa 8,685 in NRS.
- The average balance for the 240 villages was Nakfa 103,134.
- Gashbarka reported the most (171) villages with bank accounts and NRS and Maekel both had the least number (8) villages with bank accounts.
- SRS reported no villages with a bank account for water tariff, which could be due to a lack of data (rather than a lack of bank accounts). Whether this was due to the lack of convenient banking facilities in SRS or whether was due to a lack of data not being recorded, needs to be confirmed.

Table 425: Bank Accounts for Water Tariff Collection

	Zoba						Totals
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	
Total Villages responding	33	41	171	8	8		261
Villages with no response – NK	1	6	14				21
Village with known Bank balance	32	35	157	8	8		240
Total sum of money in Banks – Nakfa	4,515,871	914,273	17,095,973	2,156,500	69,476		24,752,092
Maximum Bank Balance – Nakfa	368,000	352,558	8,006,017	1,300,000	40,000		
Minimum Bank Balance – Nakfa	788	788	180	200	13		
Median of Bank Balance – Nakfa	28,875	28,875	20,000	100,000	2,683		20,000
Average Bank Balance – Nakfa	141,121	26,122	108,892	269,563	8,685		103,134

[3] When the possibility of a village having 8 million Nakfa as accumulated tariff was discussed at the Zoba Workshop for Gashbarka at Keren on 17 Jan 06, the response was that the particular village was "rich". While it was possible that the village had "a few million" Nakfa in their water tariff account, the sum of 8 million Nakfa was thought to be rather inflated.

If there was no bank A/c, where were funds kept?

Table 426 provides a summary (with details in Annex 426) of where tariff funds are kept, where they are not kept in bank accounts. This information is described below.

- 413 villages reported that water tariff collections were kept with people and places other than in bank accounts.
- A total of 8 such alternative were recorded, mostly within local communities, with a majority indicating that funds were kept with Water/ WASH Committee (239 villages) and the Village Administration (68).
- Unfortunately, only 15 out of the 413 villages responding indicated the sums of money accumulated from tariff collections, which is very small fraction to make a reliable comment on the volume of funds kept outside bank accounts.
- However, computations from the balances reported by these 15 villages indicated a total accumulation of Nakfa 414, 950, with average and median balances of Nakfa 27,663 and Nakfa 1,200 respectively.
- The substantial difference between the average (Nakfa 27,633)and median values (Nakfa 1200) indicate that there was a wide variation in the accumulated funds at village-level.

Table 426: Water Tariff funds not kept in Bank Accounts

Sl. No.	Where Tariff is not kept in a Bank, tariff collections were kept with ...	Anseba	Debub	Gash-barka	Maekel	NRS	SRS	Totals
1	Water Committee member	7	3	4	7			**21**
2	Village Administration	4	31	25	3	5		**68**
3	Water/ WASH Committee	86	52	70	16	15		**239**
4	Administrator	6	7	4				**17**
5	Tariff Collector/ Guard	2	14	1	4			**21**
6	Church	4	1					**5**
7	Individual		15	3	1			**19**
8	Sub Zoba/ Municipality	6	6	8		2		**22**
9	Zoba			1				**1**
10	**Total responding**	**115**	**129**	**116**	**31**	**22**		**413**
11	Villages responding with balance							15
12	Total balance accumulated in Nakfa							414,950
13	Average balance in Nakfa							27,663
14	Median balance in Nakfa							1,200

Modes of payment of Tariff

Table 427 below indicates while there were occasional cases of payment of tariff in kind and a combination of cash and kind, such modes of payment were generally rare. Cash was the most common mode of tariff payment.

Table 427: Modes of Payment of Tariff

Types of tariff payment	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Cash	161	208	289	42	46	13	759
Kind	1	27	1	2	1		32
Both	1	4	4	1			10
Total	163	239	294	45	47	13	801

Families exempted from paying tariff

- 12.4% of the villages across the country (Table 423) had some families at least, exempted from paying tariff.
- All Zoba have some villages where some families were exempted from payment of tariff for various reasons. The highest proportion of such villages was found in Gashbarka (21%) followed by Anseba (18%), Maekel (13%). Lower fractions of villages are found in Debub (6.2%), NRS (7%) and SRS (8%).

Basis for exemption from Tariff?

- Table 428 shows numbers of villages where tariff exemptions were recorded against the three main reasons for exemption from payment of water tariff.
- The most common reason for tariff exemption was poverty, recording its occurrence in 289 villages (out of a total of 341 responses) across the country, with the high figures from Gashbarka (117 villages) and Anseba (82).
- Exemptions on account of families being female headed and child headed were low in general and not recorded in Gashbarka and Maekel.

Table 428: Reasons for exemption from tariff

Reason	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Family headed by Child	3	1			2	1	7
Family headed by Female	10	15			2	1	28
Poor Family	82	54	117	11	18	7	289
NK	3	6	8				17
Totals	**98**	**76**	**125**	**11**	**22**	**9**	**341**

Water supply to Institutions

Table 429 below gives the water supply status to institutions, summarized by Zobas. The detailed information on a village-wise basis is provided in Annex 429.

Table 429: Water supply to Institutions

Zoba	Schools			Health Centers			Mosques			Churches			Other Institutions		
	Total	Get water	Percentage	Total	Get water	Percentage	Total	Get water	Percentage	Total	Get water	Percentage	Total	Get water	Percentage
Anseba	74	33	45%	25	14	56%	101	27	27%	63	19	30%	18	8	44%
Debub	238	131	55%	72	48	67%	237	104	44%	650	355	55%	115	65	57%
Gashbarka	324	176	54%	172	111	65%	337	112	33%	173	66	38%	37	20	54%
Maekel	53	24	45%	16	9	56%	25	10	40%	80	42	53%	39	30	77%
NRS	53	33	62%	29	19	66%	43	17	40%	8	4	50%	11	7	64%
SRS	39	13	33%	16	6	38%	67	11	16%				4	3	75%
Totals	**781**	**410**	**52%**	**330**	**207**	**63%**	**810**	**281**	**35%**	**974**	**486**	**50%**	**224**	**133**	**59%**

Schools
Out of a total of 781 Schools recorded for the country, water supply was reported in 410 schools, or 52%. The highest and lowest coverage were 62% and 33% for NRS and SRS, respectively[4].

Health Centers
Out of a total of 330 Health Centres recorded for the country, water supply was reported in 207 centres, or 63%. The highest and lowest coverage were 67% and 38% for Debub and SRS, respectively.

Mosques
Out of a total of 810 Mosques recorded for the country, water supply was reported in 281 mosques, or 35%. The highest and lowest coverage were 44% and 16% for Debub and SRS, respectively.

Churches
Out of a total of 974 Churches recorded for the country, water supply was reported in 486 churches, or 50%. The highest and lowest coverage were 55% and 30% for Debub and Anseba, respectively. SRS recorded and absence of information on the number of churches.

Other Institutions
For the country, the water supply coverage of other institutions was 59% or 133 out of a total of 233 such institutions. Gashbarka recorded the highest percentage of coverage, 77%, of "Other Institutions" and Anseba had the lowest, 44%.

Coverage in Zobas
By and large, water supply coverage of water supply to most institutions was high in Debub where as it was low in the case of SRS.

[4] At the Zoba Workshop for NRS and SRS in Massawa on 15 Jan 06, both Zoba stated that the number of schools had been under-reported.

4.3 Water Tariff Structures

Sub-Section 3 of the assessment questionnaire addressed queries related to tariff structures, as shown below in **Table 430** where the questions asked at village level were:

Table 430: Queries on Water Tariff

301	What is the Unit of measure for the Tariff?	Jerry Cans? (1)	Any Other? (2)	Any Other? (3)	Approx. ..... litres
302	What is the charge?	.....Nkf	.....Nkf	.....Nkf	

Summary findings on the Water Tariff systems are given in **Table 431** for the country as a whole, in **Table 432** on a Zoba-wise basis, and in **Annex 432** for each village.

Table 431: Cost of Water (Tariffs) - Summary

Max/ Min/ Median values	Jerry Can				Jirba[5]			
	Villages responding	Charge - Nkf	Capacity - Litres	Nkf/ Litre	Villages responding	Charge - Nkf	Capacity - Litres	Nkf/ Litre
Max	607 (22%)	12.00	20	0.600	74 (3%)	15.00	80	0.214
Min		0.05	20	0.003		0.10	60	0.002
Median		0.25	20	0.013		2.00	70	0.025
	Barrel				Other Measures			
Max	79 (3%)	40.00	200	0.200	35 (1%)	4120.00	16,200	0.417
Min		2.00	200	0.010		0.05	1	0.004
Median		4.50	200	0.023		5.00	400	0.013

Table 431 and Table 432 are discussed below:

- Three types of measures were commonly used to provide the basis for water tariff. These were plastic Jerry Cans of 20 litres capacity, the "Jirba" with a capacity between 60 to 80 liters (3 to 4 Jerry Cans), and a barrel of 200 litres capacity. A fourth group consisted of different sizes of water tankers with capacities varying from over 16,000 litres capacity to 400 litres.
- From the total of 2,750 villages surveyed, the highest response (607 or 22%) was for tariff based on Jerry Can. For Jirba based tariff, the response was from 74 villages or 3% and this was nearly the same for Barrel based tariff with responses (79 villages or 3%). For tariff based on other measures, the response was quite low, 35 villages or 1%.
- The charges for Jerry Cans varied from a maximum of Nakfa12 to Nakfa 0.05. The median value of tariff was Nakfa 0.25 per Jerry Can, indicating the wide variation in costs.
- For Jirbas (photo), the maximum and minimum charges again varied widely and the capacities varied from 60 to 80 litres. On the basis of the median value of the tariff, a Jirba of 60 liters would cost Nakfa 0.12, with maximum and minimum values ranging between Nakfa 12.80 to Nakfa 1.50 per Jirba of 60 litres capacity.

[5] A "Jirba" is a locally made bladder, sometimes from old tire tubes, or from canvas, like a saddlebag that goes over on both sides of a donkey's back, with a total capacity of about 3 Jerry cans or 60 litres. In NRS and SRS, larger Jirbas are carried by camels.

Table 432: Units and Basis of Water Tariff – by Zobas

Zoba	Max/ Min/ Median values	Jerry Can				Jirba				Barrel				Other			
		Villages responding	Charge	Capacity (lit)	Nkf per Litre	Villages responding	Charge	Capacity (lit)	Nkf per Litre	Villages responding	Charge	Capacity (lit)	Nkf per Litre	Villages responding	Charge	Capacity (lit)	Nkf per Litre
Anseba	Max	110	5	20	0.250	1	8	70	0.114	6	7	200	0.035	1	20	1000	0.020
	Min		0.1	20	0.005		8	70	0.114		5	200	0.025		20	1000	0.020
	Median		0.25	20	0.013		8	70	0.114		5	200	0.025		20	1000	0.020
Debub	Max	158	3	20	0.150	30	1.25	80	0.018	2	4	200	0.020	5	11	120	0.092
	Min		0.05	20	0.003		0.2	60	0.003		4	200	0.020		0.3	60	0.005
	Median		0.25	20	0.013		0.5	70	0.007		4	200	0.020		5.65	60	0.048
Gashbarka	Max	264	4	20	0.200	18	3	80	0.043	53	15	200	0.075	19	4120	16200	0.417
	Min		0.05	20	0.003		0.2	60	0.003		2	200	0.010		4	10	0.005
	Median		0.25	20	0.013		2	70	0.029		3	200	0.015		5	400	0.013
Maekel	Max	42	1.25	20	0.063	16	1.5	70	0.025	4	6	200	0.030				
	Min		0.1	20	0.005		0.25	60	0.004		2.5	200	0.013				
	Median		0.25	20	0.013		1	70	0.014		3	200	0.015				
NRS	Max	31	4	20	0.200	9	15	80	0.214	8	40	200	0.200	10	6	1000	0.050
	Min		0.15	20	0.008		0.1	60	0.002		4	200	0.020		0.05	1	0.004
	Median		0.35	20	0.018		2	70	0.025		8	200	0.040		4	1000	0.004
SRS	Max	2	12	20	0.600					6	17	200	0.09				
	Min		12	20	0.600						10	200	0.05				
	Median		12	20	0.600						10.5	200	0.05				
Total Villages		607				74				79				35			
Total	Max		12	20	0.6		15	80	0.21		40	200	0.2		4120	16200	0.42
	Min		0.05	20	0.0025		0.1	60	0		2	200	0.01		0.05	1	0
	Median		0.25	20	0.0125		2	70	0.03		4.5	200	0.02		5.325	700	0.02

- In the case of the standard lubricant barrel of 200 litres, the charges varied between maximum and minimum costs of Nakfa 40 to Nakfa 2 per barrel and the median value was Nakfa 4.50 per barrel.
- For other measures, the volumes varied considerably and it would be easier to reduce the costs to Nakfa per litre, which varied between Nakfa 0.417 to Nakfa 0.004 per litre, with a median value of Nakfa 0.013 per litre.
- Table 433 below, derived from Table 431, summarises the maximum, minimum and median costs per litre of water from the four groups of measures (Jerry Can, Jirba Barrel and Other Measures) and then gives the cost of each of these measures (except in the case of Other Measures, where the calculations has been done on the basis of cost per 1000 litres of water).

Table 433: Comparison of Costs per litre of Water for different units of measure

Max/ Min/ Median values	Cost per Litre of Water in Nakfa			
	Jerry Can	Jirba	Barrel	Other Measures
Max	0.600	0.214	0.200	0.417
Min	0.003	0.002	0.010	0.004
Median	0.013	0.025	0.023	0.013
Capacity/ Unit (litres)	20	60	200	1,000
Median Costs per Unit - Nakfa	0.25	1.50	4.60	5.00

- It can be seen that the wide variation in the cost is not just within the same unit of measure but also across different units of water measure. As Table 433 shows:
  - The cost per litre of water from Jerry Cans can vary from 0.60 Nakfa to 0.013 Nakfa, a variation of about 5 times
  - In the case of Jirbas, the variation is from 0.214 Nakfa per litre to 0.025 Nakfa, about 8 times.
  - In the case of water by barrels, the cost varies from 0.20 Nakfa to 0.01 Nakfa per litre, a variation of about 20 times. The range of variation for Other Measures is from 0.417 Nakfa to 0.004 Nakfa per litre, or about 100 times.
- Not enough responses were available for some of the cost computations (for example only 2 responses were available for Jerry Cans for SRS or only 1 response was available for Jirba in Anseba). Generalizations on the basis of such low responses could be erroneous, especially if these values were on the extremes. This could explain the high degree of variation in costs to some extent. Therefore, median values across the country (last row of Table 433, above and repeated below as Table 434) would probably be more representative of the general tariff structures.

Table 434: Median Costs of Water for different units of measure

	Jerry Can	Jirba	Barrel	Other Measures
Capacity/ Unit (litres)	20	60	200	1,000
Median Costs per Unit - Nakfa	0.25	1.50	4.60	5.00

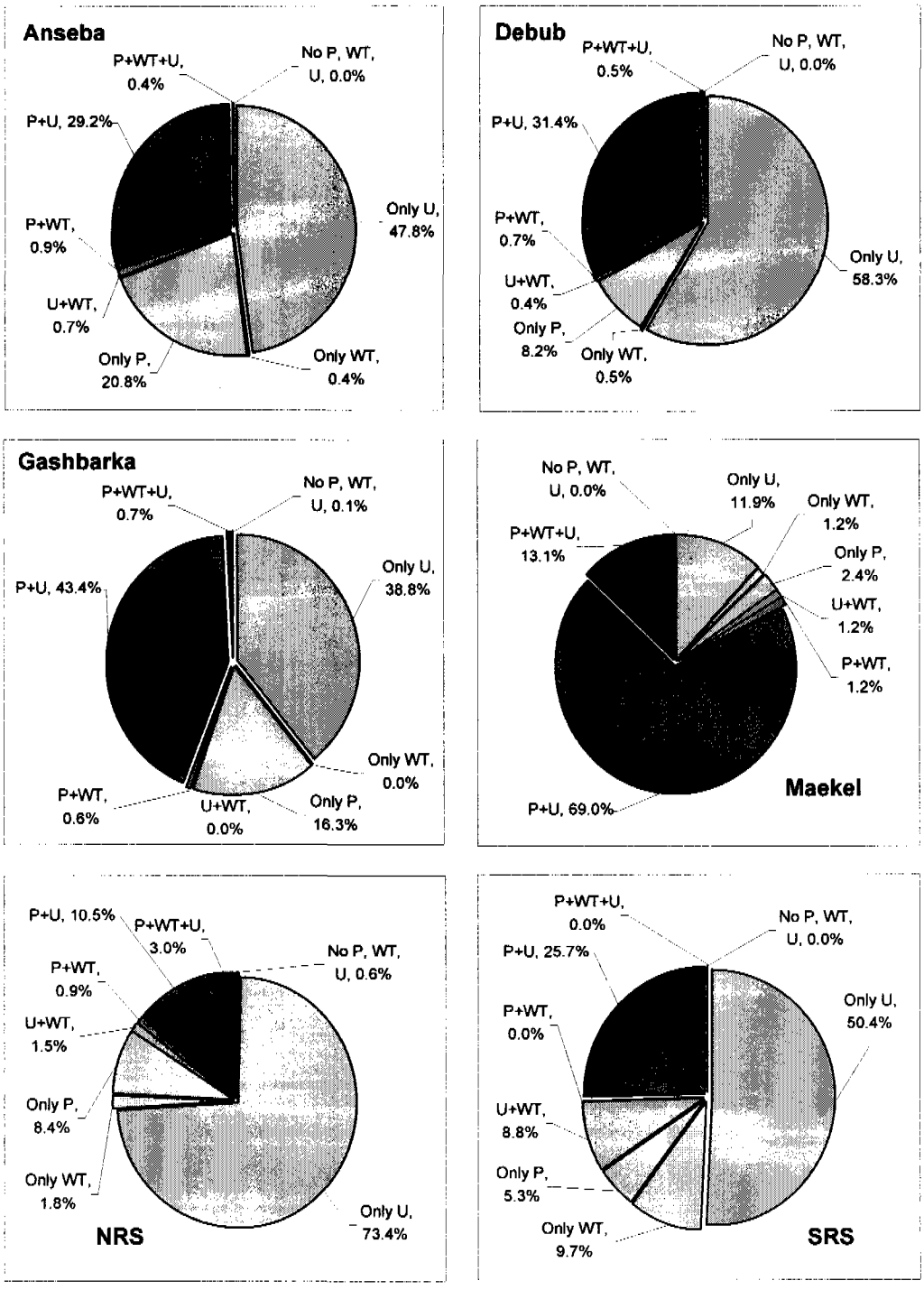


Fig. 521: Multiple Water Source Use Patterns in different Zobas

A deeper analysis of the data on of multiple water source use indicates that there were variations in the combinations between Zobas and these differences are clearly evident on the Zoba-wise data analysis presented at Zoba workshops. The detailed data analysis of use of multiple water sources for each Zoba independently is provided in Fig. 521 and Annex 522.

The existence of Cisterns (under UPWS) in SRS shows that rain water harvesting was a source of drinking water supply. However, cisterns were found in only 5 locations and only in SRS, indicating that this was not a very common water source.

An important part on the issue of multiple water source use was missed by the assessment and became apparent only during the field data collection. This was **Roof Water Harvesting**.

During field visits in Maekel and Debub, roof water drains and collection systems were seen in on many households. It appears roof water collection and its use to supplement domestic water needs is a common phenomenon in the highlands especially from roofs built with corrugated galvanized iron sheets. Case studies presented in Annex 1.04 indicate that perceptions on the suitability of roof water vary substantially but also give a distinct indication that roof water is clearly considered as a water source, especially in situations where conventional PWS and UPWS are difficult to access.

5.3 Age of Water Supply Sources/ Installations

Like all machines, water supply systems have a limited life. In addition, if systems do no received regular maintenance attention, they break down. If they lie un-repaired for long durations or are not regularly used, they deteriorate. In order to gain some understanding of some of these aspects, the age of installations and the period of non-functioning were studied.

5.3.1 Age of Hand Pumps

Table 5311 gives the age in years for working and not working hand pumps and also the period for which non-working hand pumps had remained in this condition. As a point of reference, the ages have been calculated till 1 September 2006, when most of the field work for the assessment was completed. Table 5311 has been prepared on the basis of detailed pump-wise information on dates of installation and breakdown given in Annex 531.

Table 5311: Installation Age of Working & Not working Hand pumps, periods of Not working

	Anseba			Debub			Gashbarka		
Age Values	I Age Working	I Age NW	NW Age	I Age Working	I Age NW	NW Age	I Age Working	I Age NW	NW Age
Max	24.68	49.45	12.67	38.69	47.69	31.69	19.49	21.59	10.42
Min	0.10	0.34	0.09	0.10	0.12	0.13	0.16	0.31	0.08
Average	9.08	13.05	1.98	7.99	9.64	3.60	7.72	9.82	1.98
Median	10.15	12.51	0.67	7.37	10.18	1.65	8.75	10.67	1.42
	Maekel			NRS			SRS		
Max	41.69	76.21	23.68	66.71	18.68	13.67	13.51	13.67	5.65
Min	0.17	1.39	0.25	0.08	4.67	1.23	0.42	1.59	0.69
Average	16.88	22.51	4.54	14.71	12.79	5.45	6.69	8.87	2.95
Median	19.43	20.62	2.73	14.66	12.67	4.09	6.67	8.67	2.67

	Totals		
Age Values	I Age Working	I Age NW	NW Age
Max	66.71	76.21	31.69
Min	0.08	0.12	0.08
Average	9.08	11.12	2.83
Median	9.12	10.76	1.65

I Age Working = Age of Working Hips in years since installation till 1 Sept 2006.

I Age NW = Age of Not Working Hips in years since installation till 1 Sept 2006.

NW Age = *Period in years since the HP stopped* functioning till 1 Sept 2006

From the Totals table above, it is seen that the maximum age of both working and not working installation were quite high, 66 years and 76 years respectively and maximum duration of not working conditions was 32 years. When this question was raised at Zoba workshops, it was clarified that while there were old water sources, the pumps on them were not that old. Since the assessment questionnaire did not make a distinction between the age of the source and age of the pump, the age of the source had been recorded.

The Totals table also shows generally working pumps had lower maximum, minimum, average and median age values than not-working pumps. The average and median values of ages for working and not-working pumps and period of not-working condition, were also near to each other, 9.08/ 9.12 and 11.2/ 10.76. implying that there was not a great degree of variation in age of installations.

Lastly and most importantly, the Totals table shows that average and median period for which pumps were not working was quite long – 2.83 years average and 1.65 years median. This fact, coupled with the fact that 42.9% of hand pumps were not working (Table 541 in the Section 5.4, which follows), means that more that 40% hand pumps have been out of order for an average period of 2.83 years or a median period of 1.65 years. Hence, regardless of whether one chooses to use the average or the median value, one must reach the conclusion that generally broken down pumps have remained broken down for between 20 to 30 months. Apart from the obvious weakness that this indicates in the maintenance service, it also raises the question as to whether this 40% of hand pump installations are repairable at all or have to be written off.

Table 5312, and Fig. 5312 below, derived from Table 5311, using median ages show: Median ages of working HPs are generally lower (except in the case of NRS) than not-working HPs, i.e., pumps installed more recently are working in larger numbers than older pumps. This is an expected situation.

Table 5312: Median Ages of Installation of Working & Not working Hand pumps, periods of Not working

Median Ages in Years	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
IAge* - Working HPs	10.2	7.4	8.8	19.4	14.7	6.7	9.1
IAge - Not Working HPs	12.5	10.2	10.7	20.6	12.7	8.7	10.8
Age of NW Status of NW HPs	0.7	1.6	1.4	2.7	4.1	2.7	1.6

* IAge is Installation Age, counted in years, from the reported date (mm/yy) of installation of the HP to 1 Sept. 2006. when the assessment data collection ended.

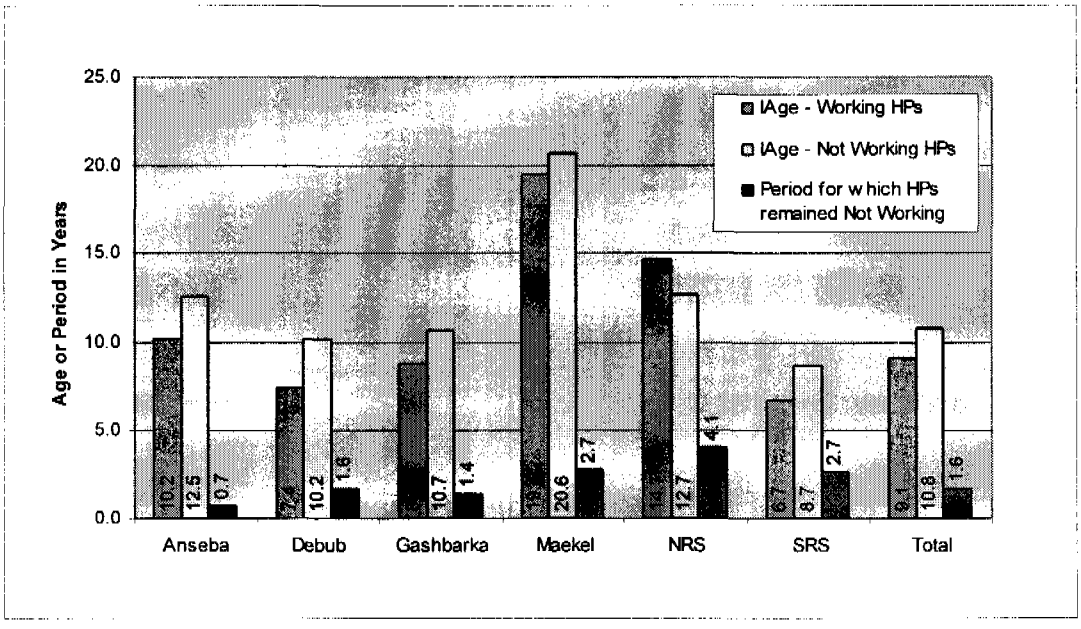


Fig. 5312: Median Ages of Installation of Working & Not working Hand pumps, Periods for which Hand Pumps remained Not working

Hand pumps, both working and not working, in Debub, Gashbarka and SRS have median ages of around 10 years (ranging from 6.7 years in SRS to 12.5

5.3.2 Age of PWS systems with Powered pumps

Table 532 gives the age in years for working and not working PWS systems with Powered pumps and also the period for which non-working systems had remained in this condition. As a point of reference, the ages have been calculated till 1 September 2006, when most of the field work for the assessment was completed. Table 532 has been prepared on the basis of detailed pump-wise information on dates of installation and breakdown given in Annex 532.

Table 532: Installation Age of Working & Not working PWS with Powered pumps and periods of Not working

	Anseba			Debub			Gashbarka		
Age Values	I Age Working	I Age NW	NW Age	I Age Working	I Age NW	NW Age	I Age Working	I Age NW	NW Age
Max	34.68	12.35	2.58	22.68	32.69	18.68	71.72	13.82	3.67
Min	0.17	0.75	0.17	0.01	0.95	0.15	0.11	0.33	0.01
Average	7.66	4.86	0.92	3.50	6.93	2.11	5.96	6.01	1.29
Median	6.34	3.75	0.58	1.75	5.10	0.66	3.52	4.23	0.65
	Maekel			NRS			SRS		
Max	34.68	19.68	2.67	67.71	13.65	3.67	18.68	9.67	2.67
Min	0.95	0.67	0.50	0.34	1.46	0.24	2.13	9.67	2.67
Average	8.14	6.68	1.43	32.57	7.35	1.22	9.08	9.67	2.67
Median	3.61	1.92	0.66	16.18	5.77	0.79	9.17	9.67	2.67

	Totals		
	I Age Working	I Age NW	NW Age
Max	71.72	32.69	18.68
Min	0.01	0.33	0.01
Average	7.92	6.06	1.35
Median	3.55	4.65	0.66

I Age Working = Age of Working HPs in years since installation till 1 Sept 2006.

I Age NW = Age of Not Working HPs in years since installation till 1 Sept 2006.

NW Age = Period in years since the HP stopped functioning till 1 Sept 2006

The Totals table shows quite different patterns as compared to hand pumps. The oldest working powered pump was almost double the age of the oldest not-working pump (71.72 years as compared to 32.69 years in hand pumps). The difference between all average median values are much wider, showing that the variations in I Age Working is much larger. The average and median values for durations which pumps have remained out of order, NW Age, is smaller, implying that broken down systems are repaired more quickly and regularly. This fact is borne out by the relatively large fraction of working pumps in this group (78.9% working pumps from Table 5412 as compared to hand pumps - 52.1% working from Table 5411, discussed in Section 5.4).

5.4 Working Status of Water Supply Systems

5.4.1 Working Status of Hand Pumps

In analyzing the working condition of pumps, hand pumps (HP) have been treated as a separate group from other (OPWS) since they constitute a major part of the protected water supply systems. The OPWS group has then been divided further into two groups: OPWS with Power pumps (electric, engine and solar powered) and OPWS with no pumps, i.e., Protected Dug Wells (PDW) and Protected Springs (PS). The analysis of working condition has been done for PWS with HPs and with powered pumps.

Table 541 below gives the working status of hand pumps for all six Zobas, accounting for all the 864 hand pumps in the country. The table and Fig. 541 indicate that at country level, 52.1% of the hand pumps were found working by the assessment. This figure varied within Zobas from a maximum of 61.9% for SRS to 47.4% in Gashbarka. These figures have an adverse significance, since SRS, with the lowest number of hand pumps has the lowest percentage of not-working whereas Gashbarka, with the highest number of pumps has nearly the highest percentage of not-working pumps in the country.

Table 541: Working status of all Hand pumps

Zoba	Not Known	Working: Yes/ No		Totals	Working %: Yes/ No	
		Yes	No		Yes	No
Anseba	20	63	32	115	54.8%	27.8%
Debub	12	171	126	309	55.3%	40.8%
Gashbarka	8	154	163	325	47.4%	50.2%
Maekel	1	38	28	67	56.7%	41.8%
NRS	2	11	14	27	40.7%	51.9%
SRS		13	8	21	61.9%	38.1%
Totals	43	450	371	864		
	5.0%	52.1%	42.9%	100.0%		

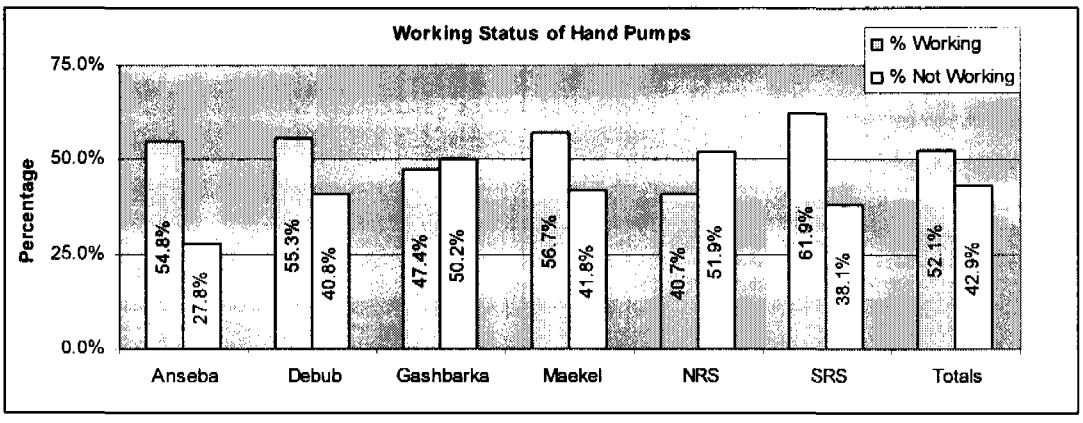


Fig. 541: Median Ages of Installation of Working & Not working Hand pumps, Periods for which Hand Pumps remained Not working

5.4.2 Working Status of Powered Pumps

Table 542 gives the working condition of PWS systems with powered pumps. It is seen that on an overall basis, 78.9% of these pumps were found working, with the highest percentage (82.9%) in the Electric motor/ Generator driven pumps group and the lowest (63.3%) in the Electric motor driven pumps group.

Table 542: Working status of PWS with Powered pumps

PWS with powered Pumps	NK	Working No/ Yes		Totals	Working No/ Yes %	
		Yes	No		Yes	No
Electric motor driven pumps	6	19	5	30	63.3%	16.7%
Electric motor/ Generator driven pumps	4	184	34	222	82.9%	15.3%
Engine driven pumps	7	160	40	207	77.3%	19.3%
Solar powered pumps	10	194	43	247	78.5%	17.4%
Totals	27	557	122	706	78.9%	17.3%

Annex 541-542 provides the details of the working status all PWS

5.5 Functionality & Utilisation

Section 4.6 dealt with the existence of water supply facilities in villages. However, it is now a well-accepted fact that access to safe drinking water does not necessarily result in its use. A number of factors can influence the usage of safe drinking water. Some of these factors are listed below:

- There may be a technical design flaw due to which water is not delivered to the desired quantity.
- There may be power or fuel shortage which could adversely influence the duration of operation of the pump, resulting in pumping lower quantities of water.
- The source may deteriorate over time both in yield and water quality for a variety of reasons, making the system gradually unreliable or not preferred.
- The storage or distribution system may malfunction or deteriorate.
- An efficient maintenance system would be needed to be available to keep the system technically functional.
- The user group may not be ready, capable or willing to take over management of a water supply system, even if the system performed well on technical considerations.
- A tariff system may have been put in place, which might not be affordable by a significant number of users.
- Alternative water source, safe or unsafe, may be more affordable and/or more convenient, lessening the drudgery of fetching water every day for the family.
- While users may agree that safe water is necessary for good health, they may have a variety of perfectly valid reasons for not using safe water, or may simply not feel the need to do so.
- The layout of the system may be such that the system provides preferential access to particular communities or habitations and excludes others.

In this section a set of indicators have been used to determine the extent to which protected water sources meet the objective with which they were created, i.e., firstly, provide safe and sustainable water supply to users, and secondly, and secondly, if users actually perceive these as valuable water sources and use them to meet their drinking water needs. The indicators can be categorised into two broad groups of Functionality and Utilisation.

Functionality attempts to assess the physical performance of the water supply system by two sub-indicators – source sustainability (i.e. whether the source is perennial or seasonal) and if the pump is working or not (approximating a working pump as equal to the system delivering water).

Source sustainability would have been a more accurate measure if it had included assessment of both yield and quality of water (since the intention is to deliver adequate quantities of potable water). However, in the present assessment, yield was not assessed. Water quality was assessed in a rudimentary manner on a small sample, primarily due to the lack of infrastructure for addressing this issue and because this assessment was supposed to be "rapid" as opposed to a more detailed assessment. A small sample of the Protected water sources (PWSs) were examined for bacteriological quality, using H_2S vials, which is not an accurate method of measuring bacteriological quality of water, but in the absence of any other facilities, serves as a good indicator for identifying bacteriological contamination. The issue of working status of pumps has already been discussed in detail in Section 5.4 and this data has been used again in the F&U analysis.

The second main indicator, Utilisation, was assessed by two sub-indicators of Reliability and Use. Reliability was a subjective indicator, dependent on the user community's perception on whether a water source was "reliable" or a preferred source. The usage question was much easier to get an answer.

Distance of the source from the user would be an important consideration that would influence user preference. However, given the fact that this was a "rapid assessment" and that data collectors would not visit or verify the existence water sources, distance to water sources was not recorded. Hence it is not possible to comment on the effect of distance of source on use.

In summary, the Functionality & Utilisation (F&U) assessment used four indicators with positive and negative responses:

Indicators	Functionality		Utilisation	
	Source	Pump	Reliable	Regularly Used
Positive	**Perennial - P**	**Working - W**	**Yes - Y**	**Yes - Y**
Negative	Seasonal- S	Not Working - N	No - N	No - N

The questionnaire, in the sections addressing water sources, asked the above questions against each source (**Tables 5011-5013**).

The numbers and percentages of PWS for which F&U data was recorded are provided below in **Table 551**. This table shows that F&U data was recorded for 60% (522 out of 864) hand pumps, 85% of Motor driven (with and without generators) pumps, 78% of engine driven pumps, 69% of solar powered pumps, 83% of protected dug wells and 91% of protected springs.

Table 551: Numbers & Percentages of PWS installations reporting F&U data

Type of PWS	Total no. of installations		Reported on for F&U	
			Numbers	% of Total
Hand Pumps		864	522	60%
Motor driven	222	252	215	85%
Motor driven + Generator	30			
Engine driven		207	161	78%
Solar powered		247	170	69%
Protected Dug Wells		261	217	83%
Protected Springs		81	74	91%
Totals		**1912**	**1359**	**71%**

The findings of the Functionality and Utilisation analysis are presented in three parts. The first part is for hand pumps which constitute a large number of PWS systems. The second part examines all other PWS systems with powered pumps, i.e., engine driven, electric motor driven, or solar powered. The third group considers Protected Dug Wells and Protected Springs, where there are no pumps and where the pump functionality indicator has no relevance.

Villages with Shared pipelines, Shared protected sources have not been considered in the F&U analysis.

In the first two of the groups mentioned above, which have pumps, information on all the four indicators of F&U were available, which is not the case for the third (wells and springs) where there were no pumps. Corresponding annexes (Annex 551 and Annex 552), have much more detailed information where villages and corresponding populations have also been incorporated in the analysis.

5.5.1 Functionality & Utilisation of Hand pumps

The results of the F&U analysis for hand pumps are presented is presented in Tables 5511, 5512 on the country level. Table 5513 and Fig. 5513 provide the analysis at Zoba level.

Table 5511 below shows that out of the total of 864 hand pumps in the country, information on the four indicators of F&U was available for 522 hand pumps or 60% of the pumps. Zoba-wise information on the numbers of villages and corresponding populations where these 522 hand pumps were located, is also provided in Annex 551.

Table 5511: Numbers of Hand pumps for Functionality & Utilisation Analysis

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total	
Total numbers with information for F&U analysis							**Numbers**	**%**
Nos. HPs	56	198	198	44	12	14	522	60%
Villages	51	166	166	37	11	14	445	16%
Population	52,628	112,035	112,035	50,636	22,084	9,417	358,835	18%
Total numbers in the Zoba								
Nos. HPs	115	309	325	67	27	21	864	100%
Villages	559	990	670	84	334	113	2,750	100%
Pop	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442	100%

Table 5512 below categorises the above 522 hand pumps into different combinations of the four indicators used to judge F&U.

Table 5512: F&U of Hand pumps

Row No.	Indicators				Hand Pumps in all Zobas	
	Functionality		Utilisation			
	Source	Pump	Reliable	Regularly Used		
	Perennial	Working	Yes	Yes		
	Seasonal	Not Working	No	No	Nos.	%
1.	P	W	Y	Y	204	39%
2.	P	W	Y	N	56	11%
3.	P	W	N	N	16	3%
4.	P	N	N	N	29	6%
5.	P	N	Y	Y	71	14%
6.	S	N	Y	Y	51	10%
7.	S	W	Y	Y	55	11%
			Totals for all Zobas		522	100%

The first combination of the four indicators of F&U (Row no. 1) is the best possible combination where all indicators are favourable - the Source is Perennial (P), the Pump is Working (W), the users responded to Reliability with a Yes (Y) and to Usage also with a Yes (Y).

The table shows that 39% hand pumps (or 204 out of 522 hand pumps) fall in this category. These could be called the "perfect" hand pumps meeting the criteria of source sustainability, good pump functionality, considered as reliable water source by users and also were also used regularly.

The second combination of indicators (Row 2) retains the first three indicators as favourable but changes the usage indicator to negative, i.e., a "No" response to "Regularly Used". The results are that 11% of the hand pumps fall into this group.

The process of progressively changing the indicators to unfavorable conditions is shown in Rows 3 and 4, where the pumps in each group become 3% and 6% respectively.

In Rows 5 and 6 the pump functionality indicator is negative, i.e., the pump is "Not working", but the user responses of reliability and usage remain positive for 14% and 10% of the pumps, respectively.

Rows 6 and 7 deal with the source indicator being negative, i.e., Seasonal, with user responses remaining positive in 10% and 11%, respectively, in each of these combinations of indicators.

The results of Rows 5, 6 and 7, with 14%, 10% and 11% hand pumps respectively, are quite unexpected, since the utilisation indicators are favourable for pumps that are not working (Rows 5 & 6) and for sources that are seasonal (Rows 6 & 7). These results pose an anomaly, because it is difficult to understand how users can have favourable perceptions about pumps that were not working or sources that were seasonal.

A possible explanation could be that the pumps had gone out of order in the time period immediately before the data collection, or that repair services were reliable and quick. However, the possibility of a quick and reliable maintenance response would be low, as indicated in Section 4.7. The seasonality question can have the possible explanation that the villages were in such difficult situations for access to water, that even a seasonal source was considered valuable at least for the period that they had water. The last possibility is that the data collectors did not understand the inherent contradictions in these responses.

In any case, the above table indicates that conventional parameters of providing access and assuring a working status of water sources are inadequate to understand water use and that there is significant differences between providing access, keeping systems functional\and finally communities using the systems. .

So while a total of 864 hand pumps may have been installed; and 450 (52%) of them may be working (Table 541); and while this may be a matter of concern in itself, demanding more attention to maintenance; 204 (24% of 864) hand pumps meet all the favourable indicators of F&U. Another 56 (6%) hand pumps are on sustainable sources with working pumps that are considered as reliable sources by the community but are not regularly used.

In effect, roughly 30% of the installed hand pumps appear to be valued as drinking water sources to user communities.

Table 5513 provides the Zoba level analysis for F&U of hand pumps. From the Pie Charts in Fig. 5513 it is seen that:

- Functionality of hand pumps are relatively good (perennial, working, reliable and used/ not used) in Anseba, Debub and Gashbarka and Maekel.
- Not-working hand pumps on perennial and seasonal sources, but considered reliable and used, were high in Debub and Gashbarka.

Table 5513: F&U Analysis of Hand pumps for Zobas

Indicators				Numbers of	Aneeba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Functionality		Utilisation									
Source	Pump	Reliable	Regularly Used								
Perennial	Working	Yes	Yes								
Seasonal	Not Working	No	No								
P	W	Y	Y	HPs	41	69	61	16	7	10	204
				Villages	36	66	48	15	6	10	181
				Population	35694	40454	36818	18595	3366	6050	140977
P	W	Y	N	HPs	2	24	15	14	1		56
				Villages	2	23	14	11	1		51
				Population	4039	23989	14449	19033	10647		72157
P	W	N	N	HPs		10	5	1			16
				Villages		9	5	1			15
				Population		5059	9137	1345			15541
P	N	N	N	HPs	2	4	20	2		1	29
				Villages	2	4	18	2		1	27
				Population	4027	3853	8449	1176		2150	19655
P	N	Y	Y	HPs	7	25	32	4	1	2	71
				Villages	7	25	31	4	1	2	70
				Population	6505	19156	11153	4315	4400	821	46350
S	N	Y	Y	HPs		6	37	7	1		51
				Villages		6	25	4	1		36
				Population		4361	10399	6172	1300		22232
S	W	Y	Y	HPs	4	20	28		2	1	55
				Villages	4	18	25		2	1	50
				Population	2363	23352	21630		2371	396	50112

Hand Pumps	In F&U Analysis	56	198	198	44	12	14	522	60.4%
	Nos. HP	115	309	325	67	27	21	864	100%
Villages with HPs	In F&U Analysis	51	166	166	37	11	14	445	16.2%
	Nos. HP	559	990	670	84	334	113	2,750	100%
Populations with HPs	In F&U Analysis	52,628	112,035	112,035	50,636	22,084	9,417	358,835	18.3%
	Nos. HP	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442	100%

Table 5514 below has been derived from Table 5513, taking only the data on pumps and reducing the numbers to percentages of the total numbers of pumps found in each Zoba in the different combinations of F&U parameters. The colour coding used in the table below is from BLUE to indicate desirable combinations to RED for undesirable combinations and YELLOW and ORANGE to indicate combinations in between.

Table 5514: Distribution of Hand Pumps in F&U Combinations

Functionality		Utilisation	
Source	Pump	Reliable	Regularly Used
Perennial - P	Working - W	Yes - Y	Yes – Y
Seasonal- S	Not Working - N	No - N	No – N

Combinations of F&U Indicators	Zoba												Totals	
	Anseba		Debub		Gashbarka		Maekel		NRS		SRS			
	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%	Nos.	%
PWYY	41	73.2%	69	43.7%	61	30.8%	16	36.4%	7	58.3%	10	71.4%	204	42.3%
PWYN	2	3.6%	24	15.2%	15	7.6%	14	31.8%	1	8.3%			56	11.6%
PWNN			10	6.3%	5	2.5%	1	2.3%					16	3.3%
PNNN	2		4		20		2				1		29	
PNYY	7	12.5%	25	15.8%	32	16.2%	4	9.1%	1	8.3%	2	14.3%	71	14.7%
SNYY			6	3.8%	37	18.7%	7	15.9%	1	8.3%			51	10.6%
SWYY	4	7.1%	20	12.7%	28	14.1%			2	16.7%	1	7.1%	55	11.4%
Totals	56	100%	158	100%	198	100%	44	100%	12	100%	14	100%	482	100%

The data in Table 5513 has been represented in Pie Charts in Fig. 5513, which show that:

- F&U of hand pumps are relatively good (the "perfect" pump, or the PWYY combination represented by the blue segments in the Pie Charts below) in Anseba, Debub and SRS and NRS. These segments are relatively smaller in Gashbarka and Maekel.
- The yellow segments representing PNYY (Perennial, Not Working, Reliable & Used) and PWYN (Perennial, Working, Reliable but Not Used), both combinations representing anomalies, represent significantly large numbers of pumps in Maekel and Debub.
- The pink and tan segments (SNYY – Seasonal, Not Working but Reliable & Used and SWYY - Seasonal, Working, Reliable & Used), again anomalies to some degree, are significant in Debub,
- Not-working hand pumps on perennial and seasonal sources, but considered reliable and used, were high in Debub and Gashbarka and NRS.
- The Orange (PWNN) and Red (PNNN) are the segments where perennial sources have been rejected by user communities and these combinations are the pronounced significant in Gashbarka.

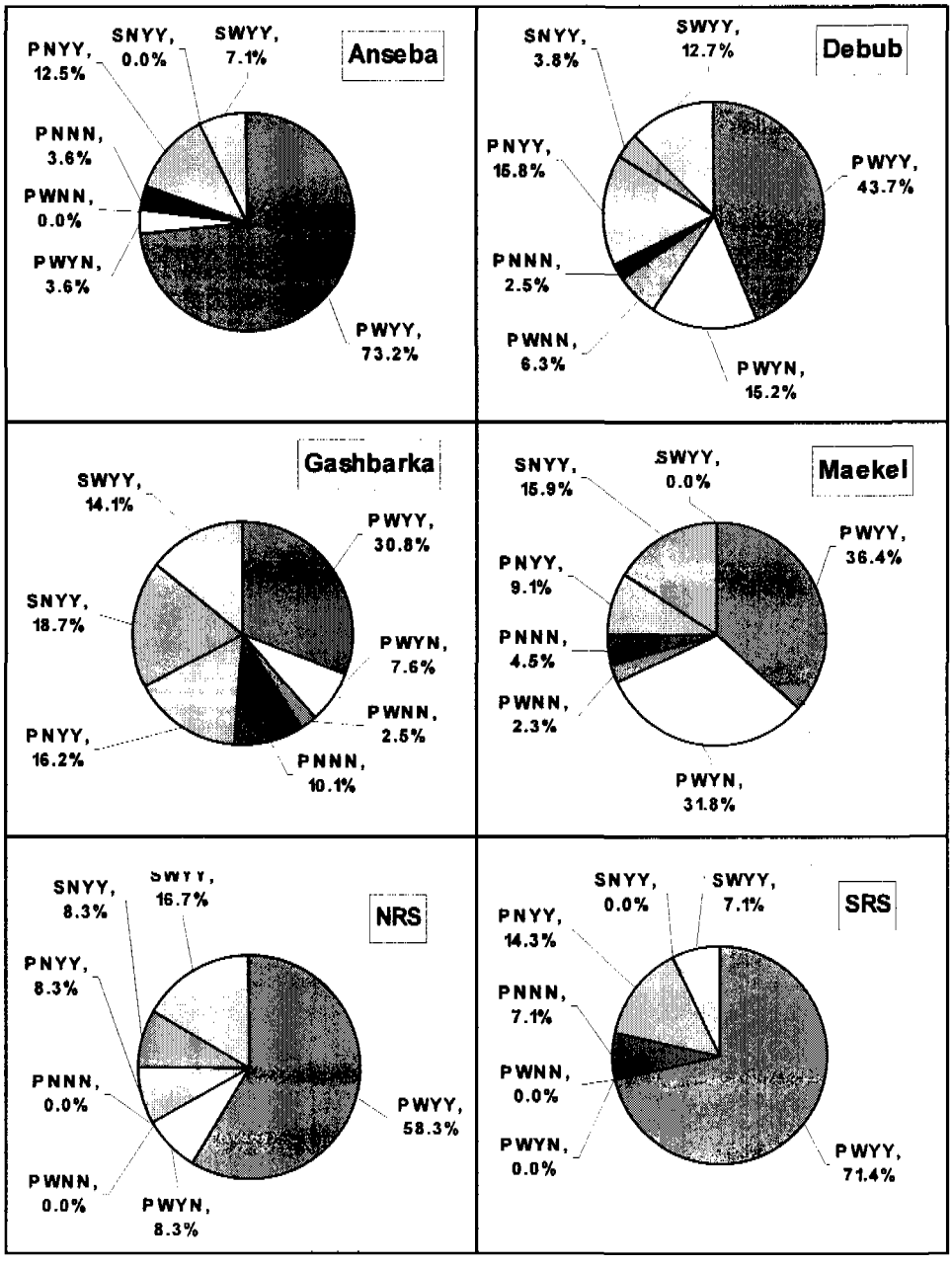


Fig 5513: F&U Analysis of Hand pumps for Zobas

5.5.2 Functionality & Utilisation of PWS systems based on Powered pumps

In the case of PWS systems based powered pumps (i.e., Other PWS or OPWS), the F&U table has been made for each pump type, since the performance of each pump type is governed to a large extent by its prime mover and energy source.

Table 5521 presents the F&U analysis for the OPWS category with details in Annex 552. For simplicity Motor driven pumps and Motor driven pumps with Generators have been grouped together in one category. Rows at the bottom of the table give the **"Nos. of Pump reported on for F&U"** and total numbers of corresponding installations in the country, to give an understanding of the extent to which the analysis has been applied to each pump type.

As in the case of hand pumps, the first combination of indicators (Row no. 1) is the best possible combination where all indicators are favourable - the Source is Perennial (P), the users respond to Reliability and Usage with a Yes (Y) in both cases. A Zoba level analysis, similar to the Pie Charts for F&U of hand pumps is possible from the data in Annex 552, but has not been attempted here.

Table 5521: F&U of PWS systems using Powered pumps

Row No.	Indicators				OPWS Pump Types					
	Source	Pump	Reliable	Reg. Used	Motor		Engine		Solar	
	Perennial	Working	Yes	Yes	Nos.	%	Nos.	%	Nos.	%
	Seasonal	Not Working	No	No						
1	P	W	Y	Y	142	66.0%	112	69.6%	125	73.5%
2	P	W	Y	N	6	2.8%	5	3.1%	3	1.8%
3	P	W	N	N					1	0.6%
4	P	N	N	N	10	4.7%	1	0.6%	2	1.2%
5	P	N	Y	Y	19	8.8%	14	8.7%	19	11.2%
6	S	N	Y	Y	1	0.5%	1	0.6%	2	1.2%
7	S	W	Y	Y	36	16.7%	26	16.1%	18	10.6%
8	S	N	N	N	1	0.5%	2	1.2%		
	Nos. of Pump reported on for F&U				**215**	100.0%	**161**	100.0%	**170**	100.0%
	Total no. of installations				30	Generator	**207**	**Engine**	**247**	**Solar**
					222	Motor				
					252	**Total**				

- The table shows that 66% (or 142 out of 215) of motor driven 69.6% (112 out of 161) of engine driven and 73.5% (125 out of 170) of solar powered pumps fell into the category of the "perfect" pump, meeting the criteria of source sustainability, good pump functionality, considered as reliable water source by users and also were also used regularly.

- Rows 4, 5 and 6, where the common indicator is the "Not Working" condition of pumps, between 12% to 15% installations suffer from this drawback in each of the three pump groups.

- Rows 6 and 7, with Seasonal sources as the common factor, affected around 17% to 18% of installations of motor and engine driven pumps, and a lower figure of about 12% installations for solar powered pumps.

- OPWS systems where all indicators are negative, are very low, a total of 3 out of 546 (215+ 161+ 170) systems (1.7%) and this is a commendable record especially for pump maintenance and source sustainability.

5.5.3 Functionality & Utilisation of Protected Dug Wells and Protected Springs

Table 5531 provides the F&U analysis for Protected Dug Wells (PDW) and Protected Springs (PS). Since these systems do not use pumps, the pump functionality indicator does not feature in the analysis.

Out of the total of 261 PDWs and 81 PSs, data on F&U indicators were available for 217 PDWs and 74 PSs.

- Row 1 shows that 46.5% of PDWs and 47.3% of PSs fall in the "perfect" category of F&U.
- Row 7 shows that 7.8% of PDWs and 10.8% of PSs fall in the "worst" category of F&U.
- Rows 2&3 indicated that about 9% of PDWs and 8% of PSs are not used though they are perennial and reliable sources.
- Rows 4, 5 & 6 indicate that between 30% to 40% of PDWs and PSs are regularly used even though the sources may be seasonal and not reliable.

The above analysis would lead to the conclusion that PDWs and PSs are considered as valuable water sources and are generally well-used even if the sources are seasonal and unreliable. This is probably due to the fact that the access to water from these sources is not dependent on a pumping device.

Table 5531: F&U of Protected Dug Wells and Protected Springs

Row No.	Indicators			Protected Dug Wells		Protected Springs	
	Source	Reliable	Reg. Used				
	Perennial	Yes	Yes				
	Seasonal	No	No	Nos.	%	Nos.	%
1	P	Y	Y	101	46.5%	35	47.3%
2	P	Y	N	13	6.0%	4	5.4%
3	P	N	N	7	3.2%	2	2.7%
4	P	N	Y	20	9.2%	3	4.1%
5	S	N	Y	41	18.9%	11	14.9%
6	S	Y	Y	18	8.3%	11	14.9%
7	S	N	N	17	7.8%	8	10.8%
			Nos. reported on	217	100%	74	100%
			Total no. of installations	261		81	

6. Water Quality

In order to understand the extent of reliability of the data gathered in this assessment, the Methodology document (Annex 1.01) had outlined a procedure for repeating data collection on 10% of the villages across the country to provide a basis for comparison with the main database. The 10% sample was to be drawn for village lists of each Zoba and the same questionnaire used for the general data collection, was to be used once again by Supervisors. The supervisors were given the additional responsibility of drawing water samples from Protected Water Sources and incubate the water samples in H_2S vials*, to get an impression on the possibility of bacteriological contamination of PWSs.

Bacteriological Quality of Water Sources

H_2S vials are indicative test for the presence of bacteria. Since bacterial presence in water is often pathogenic, H_2S vials serve as a useful indicator of pathogenic bacterial presence, which can then be confirmed, with more sophisticated and accurate tests..

Table 601 provides the summary of results (with details in Annex 601) from the water quality tests using H_2S vials.

- A total of 215 samples were drawn from PWS.
- 60.5% of the test results showed no reaction or the absence of bacteriological contamination, 39.5% samples indicated contamination.
- A total of 12 samples were drawn from water trucks.
- 33.3% of these samples were safe and 66.6% of the samples indicated contamination

Table 601: Results from the water quality tests using H2S vials.

Test Result	Protected Water Sources		Water Trucking	
	Nos.	%	Nos.	%
No reaction (safe)	130	60.5%	4	33.3%
Black (contaminated)	85	39.5%	8	66.7%
Total	215	100%	12	100%

The above test results show that bacteriological contamination is present in both PWS systems and in Water Trucking. Expectedly, the extent of contamination is higher in Water Trucking than in PWS systems. It would indicate the need for better water handling and disinfection practices for Water Trucks and for monitoring and disinfection for PWS sources.

* A separate note on H_2S vials and their use was provided in the Methodology document, Annex 1.01.

7. Data Reliability

As stated Section 6, Zoba level supervisors for the assessment were to visit approximately 10% of village in their respective areas for cross-checking data. Table 701 gives the summary (with details in Annex 701) of the 226 villages across five Zobas visited for this purpose. From the table it is seen that the cross-check sample size worked out to 8.2% of the villages in the country. It is not clear why the cross-checking exercise did not happen in NRS. Village level data from the cross-check sample was computerised in the same manner as the main database.

Table 701: Villages revisited for Data Crosscheck

Sl. No.	Zoba	Total Number of Villages	Villages revisited for Crosscheck	
			Number	Percentage
1	Anseba	559	55	9.8%
2	Debub	990	93	9.4%
3	Gashbarka	670	62	9.3%
4	Maekel	84	8	9.5%
5	NRS	334		0.0%
6	SRS	113	8	7.1%
	Totals	**2,750**	**226**	8.2%

The original intention was to subject the sample database to the same analysis as the main database. However time and resource constraints did not allow this detailed analysis. Therefore critical data fields were picked up from the same villages in both the main and sample data bases and compared for consistency of responses. Data from the sample data base was used as the basis against which the variances in the same records from the main data base were computed. The results of this comparison are discussed below:

Demography

A comparison of data on population and numbers of families, on a village to village basis, shows 96.5% of the data recorded by data collectors fall within the limit of ± 2 % variation, using the Supervisor's data as the basis for the analysis. This shows a very high degree of consistency.

Sanitation

Table 702 shows a comparison in the Yes and No responses to the question of whether a village had household toilets. The comparison, measured by the ratio of responses of the data collectors to the data from Supervisors showed that the Yes to Yes ratio was and the 108.5% No to No ratio was 82.7%.

Table 702: Comparison of Sanitation Data

Comparison parameter	Main Data Count		Main to Supv. ratio	Supervisors Count	
	No	Yes		No	Yes
Sanitation counts	166	62		153	75
Yes ratio			108.5%		
No ratio			82.7%		

The Sanitation comparison could be interpreted as lower reporting of "Yes" responses and a correspondingly higher reporting of "No" responses by data collector. This might mean that the data collectors have under-reported on the occurrence
of toilets in villages to the extent of about 10.25% (the average of the differences in the Yes and No ratios). It could also mean that a more accurate estimate of the number of villages with latrine would be by increasing the number by 10.25%.

In this particular case it would mean that Table 451 in Section 4.5 would be revised slightly as shown.

Table 451 (revised) : Distribution of Household Toilets

	Original Totals	Revised Totals
Total Villages Surveyed	2,750	2,750
Villages with any latrine	254	286
Coverage in Percentages	9.24%	10.4%
Villages without any latrine	2,496	2,464

Community Management

A comparison on reporting the presence of Water/ WASH Committees in villages is used as an indicator for judging the reliability of this data group. The results of the comparison is given in Table 703 below.

Table 703: Comparison of Community Management Data

Comparison parameter	Main Data Count		Main to Supv. ratio	Supervisors Count	
	No	Yes		No	Yes
Water/ WASH Committee counts					
Anseba	11	44		11	44
Debub	21	73		21	73
Gashbarka	11	52		9	54
Maekel	3	5		3	5
SRS	2	6		2	6
Total	48	180		46	182
Yes ratio			98.9%		
No ratio			104.3%		

The "Yes" and "No" ratios compare very well and are within 5% variance, as is seen above. Therefore the conclusion is that the data on Community Management is highly reliable.

Water Sources

As can be seen from Table 704, the data ratios are very good, within 3%, for most counts, except for Motors & Motors + Generators where it is 7.5% higher and for Protected Dug Wells where it falls below by more than 10%

Table 704: Comparison of Water Source Counts

Comparisons	Main Data Count	Main to Supv. ratio	Supervisors Count
UPWS count	231	99.6%	232
PWS Counts			
Hand pumps	147	98.7%	149
NK	2		0
Protected Dug Well	30	83.3%	36
Protected Spring	5	100.0%	5
Motor & Motor + Generator	57	107.5%	53
Engine	44	93.6%	47
Solar	58	98.3%	59
Shared?	1		0
Total	344	98.6%	349

The data consistency and reliability can be considered as good for the numbers of water sources

Functionality & Utilisation Indicators

F&U indicators for hand pumps and OPWS have been compared in Table 705.

Table 705: Comparison of F&U Indicators of PWS

F&U Indicator		Main Data Count	Main to Supv. ratio	Supervisors Count
Source	NK	13	162.5%	8
	Perennial	238	94.4%	252
	Seasonal	93	104.5%	89
HP Working	NK	9	300.0%	3
	No	48	98.0%	49
	Yes	90	92.8%	97
OPWS Working	NK	25	92.6%	27
	No	40	133.3%	30
	Yes	132	92.3%	143
Reliable	NK	19	126.7%	15
	No	85	106.3%	80
	Yes	240	94.5%	254
Used	NK	28	116.7%	24
	No	72	114.3%	63
	Yes	244	93.1%	262

A majority of the comparison ratios lie in the 10% range of variance. There are noticeably high variance in "Not Known" values of Source and Reliability indicators, showing that the main data base recorded more "Not Known" s than supervisors did. While the Usage comparison is good on the "Yes" response, it varies more than 10% on the NK and No responses, showing an inconsistency that might affect F&U interpretations adversely from the main data base. This observation is even more relevant to Not Working OPWS where the variance is over 30%. Again it would mean that the main database may have over-reported on not-working OPWS.

Annex 1.01 Methodology Document

MINISTRY OF LAND, WATER AND ENVIRONMENT
DEPARTMENT OF WATER RESOURCES

Water Supply Coverage and

System Functionality Status Survey

Methodology for a Rapid Assessment

A Supplementary Note

Ver: 25 July 2006

Contents

Attachments

Water supply Coverage and System Functionality Status Survey – A Rapid Assessment

Methodology: Supplementary Note to proposal from WRD

1. Purpose:

The purpose of this note is to outline the methodology of the Rapid Assessment in detail within the framework of the proposal for this Assessment. It will outline the steps by which accurate information in drinking water supply sources in all the villages of all the Zobas of Eritrea will be collected.

2. General Objectives:

As stated in the main proposal, the general objectives of the Raid Assessment are:

- To improve the performance of implementation institutions (national, Zoba and Sob-Zoba levels) to plan for meeting the national Millennium Development Goals (MDGs) for water supply and sanitation.
- To monitor the functionality of already established water supply systems in the rural areas.
- To help draw up plans for an appropriate water management system

3. Immediate Objectives:

To get village-wise information on the following:

- Basic demographic data, limited to approximate population and number of households.
- Status of the Water Committee, its financial position, details of the water tariff system.
- General information on maintenance of drinking water systems.
- Number and types of household/ public/ shared latrines.
- Sample information on household size related to water use.
- Types of protected and unprotected water sources in use by the village.
- Dependence of the village on water trucking.

4. Methodology:

4.1 Scope and Coverage

- The assessment will cover all villages of Eritrea following the administrative hierarchy of the country, i.e. village level information, consolidated progressively to, Sub-Zoba, Zoba and then country level.

Sl. No.	Zoba	Sub-Zobas	Villages	Animators needed	Sub-Zoba Supervisors	Zoba Supervisors
1.	Anseba	11	415	54	22	2
2.	Debub	12	886	78	24	2
3.	Gash Barka	14	792	69	28	2
4.	Maekel	7	102	12	6	2
5.	NRS	10	324	37	20	2
6.	SRS	4	72	12	4	2
	Totals	**58**	**2591**	**262**	**104**	**12**

- Animators collecting data at village level will be deployed under the supervision of Sub-Zoba level supervisors, who in turn, will be responsible to Zoba level supervisors.
- At no stage what-so-ever, will an animator put himself/ herself at personal risk. An animator will not approach villages where there is the risk of land mines and will not go in the vicinity of villages in the Temporary Security Zone. Where village level information can not be collected by a visit to the village, Sub-Zoba level supervisors will complete such village questionnaires with data available with them from their records. These questionnaires will be marked clearly indicating that they were not visited.
- The basic scope of the Assessment is given below, detailing the approximate number of villages to be covered, and the corresponding deployment of animators and supervisors :

4.2 Implementation Time Schedule

The mile-stones of the Assessment and their respective timing are outlined in the time schedule below. The preparatory activities of the Assessment will start in early July and field data collection is expected to be completed by the end of August, 2006. Data compilation will progress as each Sub-Zoba's information is received and will be analysed when all the data has been computerized. The Assessment Report is scheduled for completion by mid-September and will be followed by presentation of the findings of the Assessment at Zoba level workshops.

- The total time required to conduct this survey including reporting is 90 days.

Sl. No.	Activity	July 06				Aug. 06				Sept. 06				Oct. 06			
1.	Orientation Asmara Level																
2.	Training Zoba Level / Sub-Zoba level																
3.	Database design, data entry																
4.	Recruit of animators																
5.	Training of animators																
6.	Data collection, monitoring & validation																
7.	Data analysis																
8.	Compilation & report writing																
9.	Zoba/ National level workshops of Findings																

4.3 Assessment Tool – the Questionnaire

- A village level questionnaire will be used to collect the required information.
- This questionnaire will be canvassed by high school students and teachers, hereafter referred to as ANIMATORS, during their annual school break.
- The questions will be addressed to WASH Committee members or to village administrator/ influential community leaders if members of the WASH Committee are not available.
- Also, in each village, the animator will talk to 10 households selected at random, to assess their daily water needs from different sources.
- As a method of verifying the correctness of the data being collected, Supervisors at the Sub-Zoba level will regularly check questionnaires for the quality of the information collected.
- Supervisors will also INDEPENDENTLY SURVEY 10% of the villages, randomly selected at Sub-Zoba level. This group of information will be used to cross-check the consistency of the primary data group (collected by the animators) during the process of data analysis.

5. Preparatory activities

- At national level, WRD will be responsible organization, with assistance from UNICEF.
- Based upon WRD's request UNICEF will transfer funds for the Assessment to respective Zobas and to WRD.
- WRD will delegate its own staff to Zoba and Sub-Zoba levels for supervision of the Assessment and will identify Zoba and Sub-Zoba Administration staff/ teachers/ environmental sanitation experts who will also act as supervisors of the animators.
- WRD will arrange a training/ orientation programme for Zoba level supervisors, who in turn will train Sub-Zoba supervisors. The purpose of the training will be to clearly convey the objectives of the Assessment to all levels of participants in the Assessment process, its management plan and to elaborate the methodology of data collection using the document **Explanatory note to Questionnaire** as the main training document.
- WRD will prepare villages lists, categorized by Zoba and Sub-Zoba, with their respective **P Codes** (Place Codes)*, in keeping with the national codification system. WRD will provide these lists in multiple copies, along with Sub-Zoba level maps, to Zoba and Sub-Zoba levels.
- These lists will serve as the master checklists for recording completion of a village questionnaire by animators and a 10% sample cross checking by Sub-Zoba supervisors.
- A work planning exercise will be carried out by Zoba and Sub-Zoba supervisors, to decide on the sequence of village visits at Sub-Zoba level, the deployment of animators, time frames and other aspects of the field work.
- The Scope and Coverage table (in item 3.2 above), further analysed and given below, shows that 262 Animators, 104 Sub-Zoba level and 12 Zoba level supervisors are required for the Assessment. The actual work load on each animator will be between 6 (in SRS) to 11 (in Debub) villages and Sub-Zoba supervisors will be required to look after 2 to 3 animators. The actual field level work-plan has to be drawn up within this framework.
- The animators will be recruited from the high school students and teachers in each Sub-Zoba. The recruitment process will be done by the Zoba Supervisors in close collaboration with the Ministry of Education branch offices of each Zoba based on the local language skills and acquired knowledge to the respective Sub-Zobas.
-

Sl. No.	Zoba	Sub-Zobas	Villages	Animators needed	Villages per Animator	Sub-Zoba Super-visors	Animator per Sub-Zoba Supv.	Zoba Supervisors
1.	Anseba	11	415	54	8	22	2	2
2.	Debub	12	886	78	11	24	3	2
3.	Gash Barka	14	792	69	11	28	2	2
4.	Maekel	7	102	12	9	6	2	2
5.	NRS	10	324	37	9	20	2	2
6.	SRS	4	72	12	6	4	3	2
	Totals	**58**	**2591**	**262**	10 (Avg.)	**104**		**12**

- Both Zoba and Sub-Zoba level supervisors will train the animators. As mentioned earlier, the purpose of the training of animators will be to clearly convey the objectives of the Assessment to all levels of participants in the Assessment process, since they will need to convey this to the villagers that they interview and to

* The **P Code** or Place Code is a series of numbers of six digits, where the first digit represents the Zoba, the next two digits designate the Sub Zoba and the last three digits represent the village. It is an unique number for every village in the country.

4.4 Maintenance Systems

Section 4.4 addresses queries related to the maintenance infrastructure, as shown below in Table 441. *The questions asked at village level were:*

Table 441: Maintenance Service Providers, Source of Spare Parts and Responsibility for Service Charges

400	Maintenance information	-01 Who normally repairs	-02 Where do you get spare parts	-03 Who pays
401	Hand pumps			
402	Motorised pumps(with or without generator)			
403	Engine driven pumps			
404	Other repairs (leaks, etc.)			

4.4.1 Who normally repairs pumps?

Table 4411: Maintenance Service Providers

Source of Maintenance service	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
	Hand pumps							Engine driven pumps						
Asmara pvt. tech.	5%	5%	1%	2%			3%							
Mahber[8]														
Other	14%	31%	3%		14%		13%	25%	40%					15%
Private	24%	16%	41%	35%	14%	20%	30%	44%	40%	50%	50%	8%		33%
Sub-Zoba tech.	14%	8%	26%	9%	14%	10%	17%	13%	20%			17%		13%
Water/ Wash Committee	2%													
WRD		5%	3%	37%			6%					67%		20%
Zoba tech.	42%	37%	26%	16%	57%	70%	32%	19%		50%	50%	8%	100%	20%
Total Responses	59	172	234	43	14	10	100%	16	5	4	2	12	1	100%
	Motorised pumps							Other repairs						
Asmara pvt. tech.	14%	4%	3%	5%	11%		6%	6%	1%		11%			2%
Mahber	2%						0.3%							
Other	7%	30%	3%				7%	8%	34%	6%	11%	15%		15%
Private	43%	34%	39%	62%	11%	11%	37%	27%	28%	43%	63%	20%		35%
Water/ Wash committee					4%		0.3%							
Sub-Zoba tech.	5%	9%	21%	5%	22%	33%	16%	13%	7%	13%		10%	50%	10%
WRD	7%	6%	6%	14%	30%		8%		7%	5%		40%		7%
Zoba tech.	23%	17%	28%	14%	22%	56%	25%	46%	23%	33%	16%	15%	50%	30%
Total Responses	44	47	178	21	27	9	100%	52	74	102	19	20	2	100%

[8] Mahber is a term that means a "society". In the context of maintenance of pumps, it probably means something like a collective group people capable of providing maintenance service.

Table 4411 provides Zoba level summaries (with details in Annex 441) of the different Maintenance Service Providers in different Zobas for different kinds of water supply systems.

Four main types of water supply systems have been reported on in the following analysis:

- hand pumps
- piped water supply systems run by engine driven pumps
- piped water supply systems run by motorized pumps
- "other" repairs (such as repairs to pipe-lines, plumbing, electrical systems, masonry, etc.).

Eight main service providers were identified – Private technician from Asmara, Mahber, Other, Private (local) technician, Sub-Zoba technician, Water/ Wash Committee, WRD and Zoba technician (in alphabetical order).

The findings on Maintenance Service Providers for each of the four groups (above) are discussed below.

Maintenance of Hand pumps

For hand pump maintenance, local private technicians (30%) and Zoba Technicians (32%) were the most frequent service providers as seen from Table 4412 below.

Table 4412: Maintenance Service Providers for Hand pumps

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Private technician from Asmara.	5%	5%	1%	2%			3%
Mahber							
Other	14%	31%	3%		14%		13%
Private (local) technician	24%	16%	41%	35%	14%	20%	30%
Sub-Zoba technician	14%	8%	26%	9%	14%	10%	17%
Water/ Wash Committee	2%						
WRD		5%	3%	37%			6%
Zoba technician	42%	37%	26%	16%	57%	70%	32%
Total Responses	59	172	234	43	14	10	100%

- Zoba level technicians were dominant service providers for hand pump maintenance across 5 Zobas (varying from 70% in SRS to 26% in Gashbarka), except in Maekel.
- In NRS and SRS, Zoba level technicians, (57% and 70% respectively) completely overshadowed other service providers.
- Private technicians were the next most important group across 3 Zobas with the exception of Debub, NRS and SRS.
- In Debub, other service providers were significant (31%).
- In Maekel, WRD played a significant part (37%).

Maintenance of Engine driven pumps

On a countrywide basis, for maintenance of engine driven pumps, local private technicians (33%) were the most frequent service providers as seen from Table 4413 below.

- Anseba and Debub were dominated by local private technicians.
- Gashbarka, Maekel and SRS reported on very few numbers of water supply systems to make any significant conclusions.
- NRS depended heavily (67%) on WRD for maintenance service

Table 4413: Maintenance Service Providers for Engine driven pumps

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Private technician from Asmara.							
Mahber							
Other	25%	40%					15%
Private (local) technician	44%	40%	50%	50%	8%		33%
Sub-Zoba technician	13%	20%			17%		13%
Water/ Wash Committee							
WRD					67%		20%
Zoba technician	19%		50%	50%	8%	100%	20%
	16	5	4	2	12	1	100%

Maintenance of Motorised pumps

On a countrywide basis, for maintenance of motorised pumps, local private technicians (37%) were the most frequent service providers as seen from Table 4414 below.

- This was true across Zobas Anseba, Debub, Gashbarka and Maekel.
- In NRS, Water Committees, WRD and Zoba technicians were significant service providers.
- In SRS, Water Committees (33%) and Zoba technicians (56%) were the main service providers.

Table 4414: Maintenance Service Providers for Motorised pumps

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Private technician from Asmara.	14%	4%	3%	5%	11%		6%
Mahber	2%						0.3%
Other	7%	30%	3%				7%
Private (local) technician	43%	34%	39%	62%	11%	11%	37%
Sub-Zoba technician					4%		0.3%
Water/ Wash Committee	5%	9%	21%	5%	22%	33%	16%
WRD	7%	6%	6%	14%	30%		8%
Zoba technician	23%	17%	28%	14%	22%	56%	25%
Total Responses	44	47	178	21	27	9	100%

Other Maintenance

As seen from Table 4415 below, on a countrywide basis, other maintenance was mostly carried out by local private technicians (35%) and Zoba technicians (30%).

- This was true for Zobas Anseba, Debub, Gashbarka and Maekel.
- In NRS, WRD (40%) was the main service provider.
- There were too few responses from SRS to draw a substantial conclusion.

Table 4415: Maintenance Service Providers for Other Repairs

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Private technician from Asmara.	6%	1%		11%			2%
Mahber							
Other	8%	34%	6%	11%	15%		15%
Private (local) technician	27%	28%	43%	63%	20%		35%
Sub-Zoba technician							
Water/ Wash Committee	13%	7%	13%		10%	50%	10%
WRD		7%	5%		40%		7%
Zoba technician	46%	23%	33%	16%	15%	50%	30%
Total Responses	52	74	102	19	20	2	100%

4.4.2 Source of Spare Parts

Table 4421 presents the consolidated findings on the sources of spare parts for water supply maintenance, with details in Annex 442. As in the case of Service Providers for maintenance, the analysis for sources of spare parts has been made under four sub-heads – hand pumps, engine driven pumps, motorised pumps and other repairs. The findings under each of the sub heads are discussed in Tables 4422, 4423, 4424 and 4425.

Table 4421: Source of Spare Parts

Source of Spares	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Hand pumps							
Asmara	11.9%	10.5%	7.7%	41.9%			11.5%
Other	3.4%	30.2%	0.9%	4.7%			10.9%
Private	18.6%	11.0%	40.2%	25.6%	14.3%		25.8%
Sub-Zoba	13.6%	6.4%	21.4%	7.0%	21.4%	60.0%	15.2%
Zoba	53%	42%	30%	21%	64%	40%	36.7%
Totals	59	172	234	43	14	10	100.0%
Engine driven pumps							
Asmara		20.0%	25.0%	50.0%	8.3%		10.0%
Other	18.8%				66.7%		27.5%
Private	50.0%	80.0%	25.0%		16.7%		37.5%
Sub-Zoba	12.5%			50.0%			7.5%
Zoba	18.8%		50.0%		8.3%	100.0%	17.5%
Totals	16	5	4	2	12	1	100.0%
Motorised pumps							
Asmara	27.3%	23.4%	16.9%	57.1%	25.9%	11.1%	22.4%
Asmara & Zoba	9.1%	2.1%					1.5%
Mahber	2.3%						0.3%
Other	9.1%	21.3%	5.6%		29.6%		9.8%
Private	27.3%	27.7%	37.1%	33.3%	3.7%		30.4%
Sub-Zoba	11.4%	12.8%	3.4%	4.8%	11.1%	33.3%	7.4%
Zoba	13.6%	12.8%	37.1%	4.8%	29.6%	55.6%	28.2%
Totals	44	47	178	21	27	9	100.0%

Table 4422, on sources of spare parts for hand pumps, shows that on a countrywide basis:

- Private and Zobas were the two main sources of spare parts (25.8% and 36.7% respectively).
- Zobas were the main source of hand pump spares for Anseba (53%) Debub (42%), Gashbarka (30%) and NRS (64%).
- Private sources of spare parts were significant in Gashbarka (40.2%) and Maekel (25.6%). Quite obviously, Asmara was an important source of spare parts for Maekel.
- SRS did not follow the pattern of the other Zobas and reported that Sub-Zobas were the main source of spare parts.
- There were a fairly large number of villages responding to this query (varying from 234 from Gashbarka to 10 from SRS) which would make this data fairly representative.

Table 4422: Source of Spare Parts for Hand pumps

Source of Spares	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Asmara	11.9%	10.5%	7.7%	41.9%			11.5%
Other	3.4%	30.2%	0.9%	4.7%			10.9%
Private	18.6%	11.0%	40.2%	25.6%	14.3%		25.8%
Sub-Zoba	13.6%	6.4%	21.4%	7.0%	21.4%	60.0%	15.2%
Zoba	53%	42%	30%	21%	64%	40%	36.7%
Totals	59	172	234	43	14	10	100.0%

Table 4423 below gives details of the source of spare parts for engine driven pumps.

- Private (37.5%) and Other (27.5%) were the significant sources on a countrywide basis.
- Relative high level of responses was received from Anseba (16) and NRS (12) and these two Zobas reflect strong dependence on private (50% for Anseba) and other (66.7% for NRS) sources.
- The response from the remaining four Zobas is rather low to make broad generalizations.

Table 4423: Source of Spare Parts for Engine driven pumps

Source of Spares	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Asmara		20.0%	25.0%	50.0%	8.3%		10.0%
Other	18.8%				66.7%		27.5%
Private	50.0%	80.0%	25.0%		16.7%		37.5%
Sub-Zoba	12.5%			50.0%			7.5%
Zoba	18.8%		50.0%		8.3%	100.0%	17.5%
Totals	16	5	4	2	12	1	100.0%

Table 4424 below on the source of spare parts for motorised pumps indicates that:

- Asmara (22.4%), private (30.4%) and Zobas (28.2%) were significant sources of spare parts for motorised pumps on a countrywide basis.
- Asmara was a major source for Anseba, Debub Maekel and NRS.
- Other sources were significant for Debub and NRS.
- Private sources were important in Anseba, Debub, Gashbarka and Maekel.
- Sub-Zobas were an important source only in SRS. Zobas were significant sources for Gashbarka, NRS and SRS.

Table 4424: Source of Spare Parts for Motorised pumps

Source of Spares	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Asmara	27.3%	23.4%	16.9%	57.1%	25.9%	11.1%	22.4%
Asmara & Zoba	9.1%	2.1%					1.5%
Mahber	2.3%						0.3%
Other	9.1%	21.3%	5.6%		29.6%		9.8%
Private	27.3%	27.7%	37.1%	33.3%	3.7%		30.4%
Sub-Zoba	11.4%	12.8%	3.4%	4.8%	11.1%	33.3%	7.4%
Zoba	13.6%	12.8%	37.1%	4.8%	29.6%	55.6%	28.2%
Totals	44	47	178	21	27	9	100.0%

4.4.3 Payment for Maintenance

As in the case of Service Providers for maintenance, the analysis for payment of maintenance has been made under four sub-heads – hand pumps, engine driven pumps, motorised pumps and other repairs. Table 4431 gives the consolidated picture for all the four sub-head and details are provided in Annex 443.

Table 4431: Payment for Maintenance

Maintenance is paid by	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Hand pumps							
Charitable Organisation	13.6%	19.8%	0.4%	18.6%			9.6%
Other	20.3%	22.7%	6.4%	7.0%	14.3%		13.3%
Rich Individual	1.7%	5.2%	8.5%	4.7%	7.1%	10.0%	6.4%
Sub-Zoba		7.0%	2.1%	2.3%	21.4%		3.9%
Water/ WASH Committee	61.0%	13.4%	79.1%	46.5%	28.6%	20.0%	50.8%
Zoba	3.4%	32.0%	3.4%	20.9%	28.6%	70.0%	16.0%
Totals	59	172	234	43	14	10	532
Engine driven pumps							
Charitable Organisation	43.8%						17.5%
Other	12.5%	20.0%					7.5%
Sub-Zoba	6.3%				16.7%		7.5%
Water/ WASH Committee	37.5%	80.0%	100.0%	50.0%	75.0%		60.0%
Zoba				50.0%	8.3%	100.0%	7.5%
Totals	16	5	4	2	12	1	40
Motorised pumps							
Charitable Organisation	9.1%	21.3%	3.4%	19.0%			7.4%
Other	4.5%	8.5%	5.1%		3.7%		4.9%
Rich Individual	2.3%	2.1%	2.2%	9.5%		22.2%	3.1%
Sub-Zoba	4.5%	6.4%	3.4%		7.4%	33.3%	4.9%
Water/ WASH Committee	79.5%	51.1%	79.2%	57.1%	77.8%		71.5%
Zoba		10.6%	6.7%	14.3%	11.1%	44.4%	8.3%
Totals	44	47	178	21	27	9	326
Other repairs							
Charitable Organisation	11.5%	23.0%		15.8%	5.0%		10.0%
Other	3.8%	16.2%	8.8%	10.5%			9.3%
Rich Individual		2.7%	4.9%	5.3%			3.0%
Sub-Zoba	3.8%	10.8%	2.0%		5.0%	50.0%	5.2%
Water/ WASH Committee	80.8%	32.4%	79.4%	52.6%	85.0%		64.7%
Zoba		14.9%	4.9%	15.8%	5.0%	50.0%	7.8%
Totals	52	74	102	19	20	2	269

Table 4432 below gives details of who pays for maintenance of hand pumps.

- 50% of all payments for this group are made by Water/ WASH Committees across the country.
- This pattern is true across Anseba (61%), Gashbarka (79.1%), Maekel (46.5%) and NRS (28.6%). Zoba authorities were a main source of payment for maintenance of hand pumps
- In Debub (32%), Maekel (20.9%), NRS (28.6%) and SRS (70%). T

Table 4432: Payment for Maintenance of Hand pumps

Maintenance is paid by	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Charitable Organisation	13.6%	19.8%	0.4%	18.6%			9.6%
Other	20.3%	22.7%	6.4%	7.0%	14.3%		13.3%
Rich Individual	1.7%	5.2%	8.5%	4.7%	7.1%	10.0%	6.4%
Sub-Zoba		7.0%	2.1%	2.3%	21.4%		3.9%
Water/ WASH Committee	61.0%	13.4%	79.1%	46.5%	28.6%	20.0%	50.8%
Zoba	3.4%	32.0%	3.4%	20.9%	28.6%	70.0%	16.0%
Totals	59	172	234	43	14	10	532

Table 4433 below gives details of the payment for maintenance of engine drive pumps.

- 60% of all payments for this group were made by Water/ WASH Committees across the country.
- This pattern is true across Anseba (37.5%), Debub (80%), Gashbarka (100%) and NRS (75%).
- In Anseba, charitable organisations also made a significant contribution towards maintenance costs of engine driven pumps.

Table 4433: Payment for Maintenance of Engine driven pumps

Maintenance is paid by	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Charitable Organisation	43.8%						17.5%
Other	12.5%	20.0%					7.5%
Sub-Zoba	6.3%				16.7%		7.5%
Water/ WASH Committee	37.5%	80.0%	100.0%	50.0%	75.0%		60.0%
Zoba				50.0%	8.3%	100.0%	7.5%
Totals	16	5	4	2	12	1	40

Table 4434 below gives details of the payment for maintenance of motorised pumps.

- 71.5% of all payments for this group were made by Water/ WASH Committees across the country.
- This pattern is true across Anseba (79.5%), Debub (51.1%), Gashbarka (79.2%), Maekel (57.1%) and NRS (77.8%).
- Other significant contribution came from charitable organisations in Debub (21.3%), and Sub-Zoba and Zoba authorities in SRS (33.3% and 44.4%, respectively).

Table 4434: Payment for Maintenance of Motorised pumps

Maintenance is paid by	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Charitable Organisation	9.1%	21.3%	3.4%	19.0%			7.4%
Other	4.5%	8.5%	5.1%		3.7%		4.9%
Rich Individual	2.3%	2.1%	2.2%	9.5%		22.2%	3.1%
Sub-Zoba	4.5%	6.4%	3.4%		7.4%	33.3%	4.9%
Water/ WASH Committee	79.5%	51.1%	79.2%	57.1%	77.8%		71.5%
Zoba		10.6%	6.7%	14.3%	11.1%	44.4%	8.3%
Totals	44	47	178	21	27	9	326

Table 4435 below gives details of the payment for other repairs.

- 64.7% of all payments for this group were made by Water/ WASH Committees across the country.
- This pattern is true across Anseba (80.8%), Debub (32.4%), Gashbarka (79.4%), Maekel (52.6%) and NRS (85%).
- Other significant contributions came from charitable organisations in Debub (23%), and Sub-Zoba and Zoba authorities in SRS (50% each).

Table 4435: Payment for Other repairs

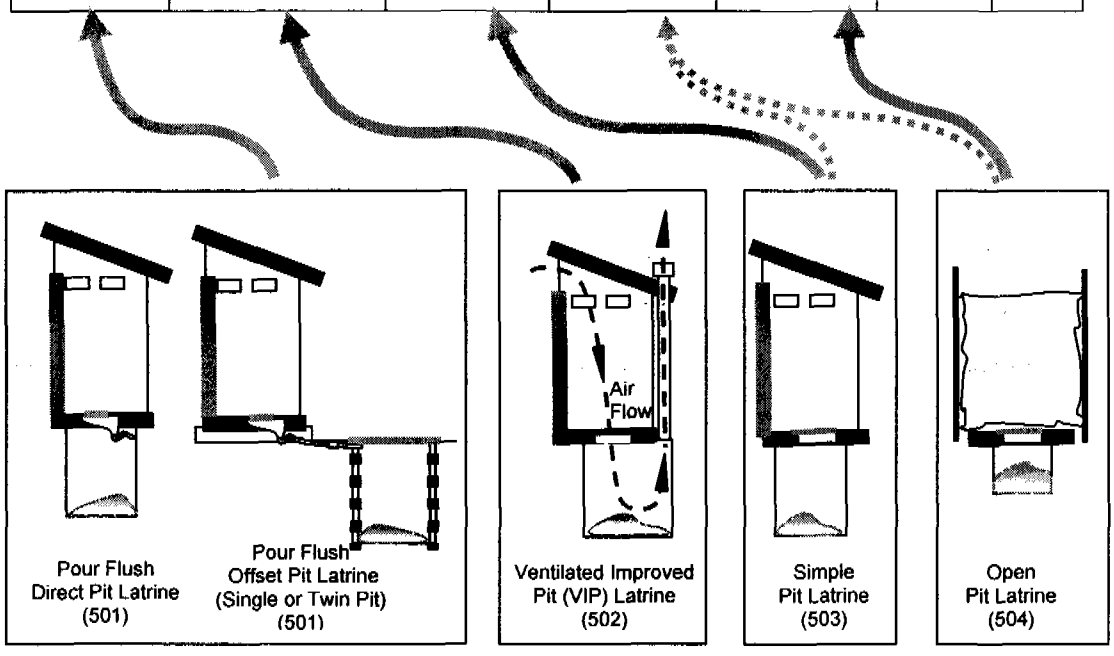
Maintenance is paid by	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Charitable Organisation	11.5%	23.0%		15.8%	5.0%		10.0%
Other	3.8%	16.2%	8.8%	10.5%			9.3%
Rich Individual		2.7%	4.9%	5.3%			3.0%
Sub-Zoba	3.8%	10.8%	2.0%		5.0%	50.0%	5.2%
Water/ WASH Committee	80.8%	32.4%	79.4%	52.6%	85.0%		64.7%
Zoba		14.9%	4.9%	15.8%	5.0%	50.0%	7.8%
Totals	52	74	102	19	20	2	269

4.5 Presence of Household Toilets

Section 4.5 seeks to enumerate the types and distribution of household toilets in the country through the query shown in Table 451 below and used cross-sectional sketches of the common types of household toilets found the village, in the village level questionnaire to distinguish between different types of toilets.

Table 451: How many toilets are there in the village?

Pour flush latrine (501)	Ventilated Improved Pit latrine (502)	Simple Pit latrine (503)	Public/ Shared latrine (504)	Open Pit latrine (505)	Any other (506)	None (507)



The response to the question in Table 451 is analysed in Table 452, 453 and 454 below and detailed in Annex 452.

- Table 452 shows that within the country, 254 villages (9.24% of the total of 2,750 villages) had household toilets of any kind. The highest village-wise coverage was in Maekel (57.14% - 48 villages out a total of 84 villages) and the lowest was in SRS (5.31% - 6 villages out of 113).
- No Latrine were found in 2496 (90.76%) of the total of 2750 villages in the country. The highest number (900 villages) was in Debub and the lowest number in Maekel (36).

Table 452: Distribution of Household Toilets in Villages

	Numbers of villages in Zoba...						Totals
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	
Total Villages Surveyed	559	990	670	84	334	113	**2,750**
Villages with any latrine	44	90	36	48	30	6	**254**
Coverage in Percentages	7.87%	9.09%	5.37%	57.14%	8.98%	5.31%	**9.24%**
Villages without any latrine	515	900	634	36	304	107	**2,496**

Table 453 below shows that:

- Pour Flush (or water sealed) toilets were found in 50 villages across the county, with between 11 to 14 villages each in Anseba, Debub, Maekel and NRS. Gashbarka had only one village with Pour Flush toilets and SRS had none.
- VIP (Ventilated Improved Pit) toilets were found in a total of 80 villages, with the highest numbers of villages in Debub (20) and Gashbarka (27), and with only one village in SRS.
- Simple Pit toilets were found in the highest number of villages across the country (115 villages) with high figures in Debub (45 villages) and Maekel (34 villages)
- Open Pit toilets were found in 47 villages in the country, with relatively higher numbers of villages in Anseba (17), Debub (9) and Gashbarka (10). Maekel showed only 1 village with this type of toilet.
- Public toilets were found in 38 villages, the highest in Debub (17 villages) and the lowest in SRS (1 village).
- As expected, more than one type of toilet design was found in some village (because of which Table 453 cannot be totaled vertically).

Table 453: Numbers of Villages with different types of Household Toilets

Type of Latrine	Numbers of villages in Zoba...						Totals
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	
Pour Flush	11	14	1	12	12		50
VIP	7	20	27	13	12	1	80
Simple Pit	17	45	2	34	17		115
Open Pit	17	9	10	1	5	5	47
Public	4	17	6	2	8	1	38

Table 454 below gives the numbers of toilets of each different type to be found in each Zoba. The country had a total of 5,697 toilets, with the maximum number (2643) in Maekel, probably because of higher degree of urbanisation and the influence of the capital city, Asmara, in this Zoba. Anseba and Debub had nearly the same total numbers (1,036 and 1,154, respectively); Gashbarka and NRS had half this number (520 and 597 respectively) while SRS had a very small total number of toilets, only 17.

Table 454: Numbers of Different types of Toilets by Zobas

Type of Latrine	Numbers of Toilets in Zoba...						Totals
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	
Number of villages with any latrine	44	90	36	48	30	6	**254**
Pour Flush	372	104	2	1,378	38		1,894
VIP	112	536	380	148	36	1	1,213
Simple Pit	285	407	32	1,086	355		2,165
Open Pit	205	64	92	29	114	12	516
Public	62	43	14	2	54	4	179
Totals by Zoba	1,036	1,154	520	2,643	597	17	**5,967**

If the total number of toilets in each Zoba were to be compared with the number of families in each Zoba, as shown in Table 455 below, then Percentage of Families with toilets varied between the highest of 8.00% in Maekel, to the lowest of 0.17% in SRS.

There may be some uncertainty about what does a "family" mean in this assessment. Since this survey was not very rigorous of the definition of a family, perhaps an analysis based on numbers of families might not be entirely accurate. Further, Section 7 indicates that there is

a possibility of under-reporting of numbers of villages with toilets (to the extent of about 10% more that what has been reported).

Nevertheless, even if the total numbers families reported was somewhat inflated and the number of toilets under-reported, the fact still remains that the presence of toilets is abysmally low, and that "coverage" assessed by access of toilets to families is extremely low. It follows that open defecation is probably a very dominant practice, putting water sources, especially unprotected water sources, at the risk of contamination.

Table 455: Coverage of Toilets by Families

	Numbers of Toilets in Zoba...						Totals
	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	
Totals by Zoba	1,036	1,154	520	2,643	597	17	**5,967**
Corrected Numbers of families by median values	73,415	142,009	123,278	33,057	62,155	10,099	444,013
Percentage of Families covered	1.41%	0.81%	0.42%	8.00%	0.96%	0.17%	1.34%

5. Analysis & Findings Part 2 – Drinking Water Supply

This section classifies drinking water sources into three main categories*[*] – Protected (PWS or P), Unprotected (UPWS or U) and Water Trucking (WT or W). The types of sources under each of the categories are detailed in Table 501 below.

Table 501: Classification of Water Sources

Protected Water Sources	Unprotected Water Sources	Water trucking
Hand pump	Cistern	Partially dependent
Protected dug well	Pond/ Reservoir	Fully dependent
Protected spring	River/ Stream	No Water Trucking
PSP* with Electric Motor	Shared Unprotected source	
PSP with Electric Motor/ Generator	Unprotected dug well/ spring	
PSP with Engine driven Pump	No Unprotected Source	
PSP with Solar Pumping System		
Shared pipeline		
Shared PWS		
Shared ?		
No Protected Source		
Not Known		

* PSP : Public Stand Post

Under the category of Protected Water Sources, apart from the commonly accepted source types such as hand pumps to solar pumping systems, additional groups of Shared pipeline, Shared PWS, Shared?, No Protected Source and Not Known had to be created to account for all the villages in the country. The two groups, Shared PWS and Shared?, had to be created to accommodate information on villages which reported access to protected water sources but did not indicate the existence on one within their village.

The village level questionnaire (Annex 1.01) sought responses related to the existence and use of water thorough four different questions. Three of these queries were at village level, on details of PWS (Questions series 600), on WT (Questions series 700) and UPWS (Questions series 800). These queries are discussed below.

[*] As mentioned earlier, this categorisation is derived from the definitions of "Improved" and "Unimproved" drinking water sources used in "Meeting the MDG Drinking Water and Sanitation Target – A Mid-Term Assessment of Progress", published by UNICEF and WHO, August 2004 (refer Page 4). In these definitions tanker truck water is categorized as unimproved. However, in this assessment Water Trucking is considered as an independent group since the country was just emerging from a long drought and water trucking was expected to be a significant source of drinking water.

Questions series 600 (6011 – 6020) shown in **Table 5011** below, were asked to record the details of Protected Water Sources (Household Connection/ Public Standpost (PSP)/ Bore hole (BH) with pump/ Protected Dug Well (DW), Protected Spring, Rainwater collection) in a village. Against each of the sources, responses were recoded for 11 questions listed below. The eleventh question on H2S vials was to be answered by the Assessment Supervisors only.

Table 5011: Questions on Protected Water Sources

Code	Type of Water Point
6011	Public Standpost (PSP) with Motor & Generator at Source
6012	PS with Motor
6013	PS with Solar pump
6014	Hand pump 1
6015	Hand pump 2
6016	Protected Dug well 1
6017	Protected Dug well 2
6018	Protected Spring
6019	
6020	

01	Construction date	.....(mm/yy)
02	Source Type	BH/ DW
03	Source is Seasonal/ Perennial?	S/ P
04	Is there a storage tank?	Y/N
05	Pump is working?	Y/N
06	Not working since?	.....(mm/ yy)
07	Pump was last repaired?	.....(mm/yy)
08	Repair cost?	. ....Nkf
09	Source is reliable?	Y/N
10	Regularly used?	Y/N
11	Remarks, Results from H_2S vial sampling - by Supervisor	(No reaction /Black)

Questions series 700 asked 11 questions related to Water Trucking, as shown, **Table 5012** below

Table 5012: Questions on Water Trucking

01	Is the village fully depending on water trucking?	Y/ N
02	Last year, trucking supply was for how many months?	.....
03	Average no. of trips per week?	.....
04	Truck Capacity .....(Litres)	
05	Source to village distance?	.....Km
06	Tariff per Jerry can	..... (Nkf)
07	Tariff per Barrel	..... (Nkf)
08	Tariff per Truck	..... (Nkf)
09	*Truck from Zoba / Pvt.*	(1 / 2)
10	How was it paid? Individually? Committee?	(1/2)
11	Remarks , Results from H_2S vial sampling, by Supervisor	(No reaction /Black)

Question series 800 recorded details of **Unprotected Water Sources** (Unprotected well/ spring, River, Pond) in a villages. Against each source, responses were recorded for 9 questions listed below in **Table 5013**.

Table 5013: Questions on Protected Water Sources

Code	Type of Water Point - 01
8001	Unprotected Dug Well/ Spring
8002	River/ Stream
8003	Pond/ Reservoir
8004	

02	Seasonal/ Perennial	S/ P
03	Used as Drinking/ Cooking water source?	Y/ N
04	Used for other purposes ?	Y/ N
05	Distance from village?	.....Km
06	Source is reliable?	Y/N
07	Source is regularly used?	Y/N
08	Not used since	.....(mm/yy).
09	Remarks	

Apart from Question groups 600, 700 and 800 on PWS, WT and UPWS, respectively, a fourth query was made to understand the consumption pattern of water from different water sources – PWS, UPWS and WT. Question series 900 given below in Table 5014 were asked to 10 families in each village as outlined in Annex 1.01.

Table 5014: Questions on Consumption of Water from different Sources

Code		Family Serial Number							
		-1	-2	-3	...	...	-8	-9	-10
901	Name of Head of Family & Sex (Male/ Female/ Child male/ Child Female-1/2/3/4)								
902	No. of members in the Family								
903	Water drawn from Protected Source (lit)								
904	...from water truck (lit)								
905	..from Unprotected Source (lit)								

Data from Table 5014 was used to arrive at average consumption, expressed in **litres per capita per day (lpcd)**, from each type of water source. Computations of average consumption were based on information from over 26,000 families interviewed from the 2,750 villages covered in this assessment.

5.1 Access to Water

5.1.1 Protected Water Sources

Fig. 5111 shows the different types of Protected Water Sources recorded in the assessment.

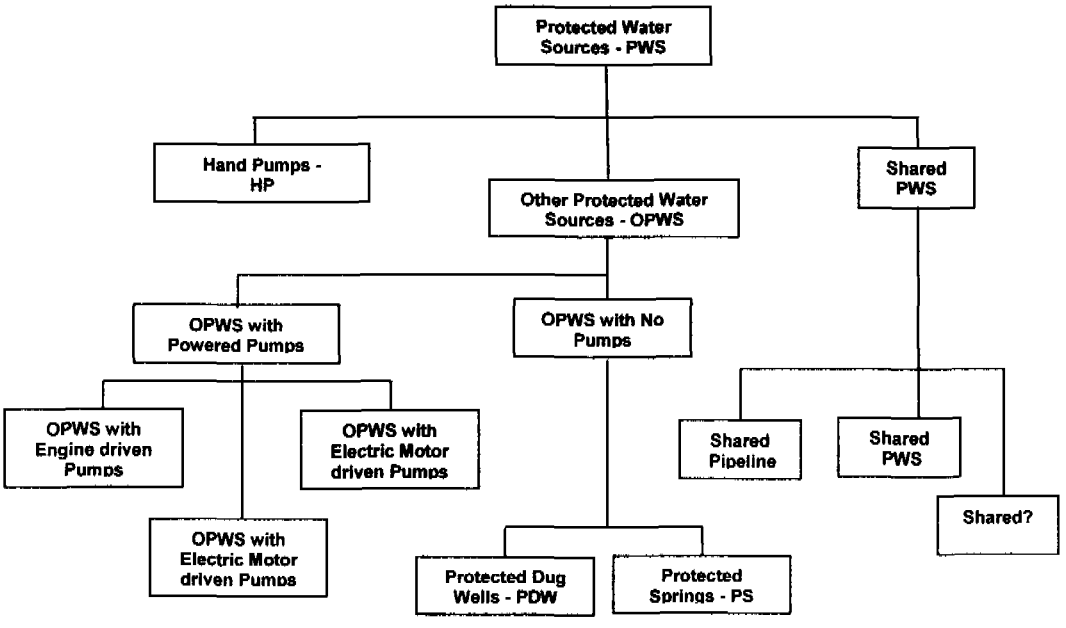


Fig. 5111: Classification of Protected Water Sources

Table 511 on Protected water sources (with details in Annex 511) indicates that, in terms of physical facilities created:

- 1,278 villages out of 2,750 villages, or 46.5% of the villages had some form of protected water source.
- The above 1,278 villages had a population of 1,169,793 people, which constituted 59.7% of the total population found in the assessment.
- 1,467 (or 53%) of the villages had no protected water source.
- The highest level of coverage of villages with PWS was 85.7% in Maekel and the lowest level was 22.8% in NRS.
- The status of one village was not known.
- There were a total of 261 Protected dug wells, 81 Protected springs in the six Zobas.
- There were 864 Hand pumps, 30 water supply systems based on pumps driven by Electric Motors, 222 systems with Electric Motor & Generator driven pumps, 207 systems with Engine driven pumps, 247 systems based on Solar Powered pumps.

Table 511: Villages & Populations with Protected Water Sources - Zoba Summary

								Percentages	
Zoba	**Anseba**	**Debub**	**Gashbarka**	**Maekel**	**NRS**	**SRS**	**Total**	**Villages/ Population**	**Sources**
Villages with PWS	286	402	407	72	76	35	1,278		
Total Villages	559	990	670	84	334	113	2,750		
% of Villages Covered	51.2%	40.6%	60.7%	85.7%	22.8%	31.0%	46.5%		
Populations with PWS	220,501	313,746	368,311	123,898	125,454	17,883	1,169,793		
Total Populations	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442		
% of Pop. Covered	63.2%	51.0%	72.9%	91.9%	42.0%	32.8%	59.7%		
Numbers of Sources									
Hand pump	115	309	325	67	27	21	864		45.20%
Protected dug well	86	33	84	17	35	6	261		13.70%
Protected spring	49	7	8	4	12	1	81		4.20%
PSP with Electric Motor	4	10	6	4	5	1	30		1.60%
PSP with Electric Motor & Generator	40	42	107	16	14	3	222		11.60%
PSP with Engine driven pump	23	49	94	16	23	2	207		10.80%
PSP – Solar Powered	50	71	103	3	15	5	247		12.90%
Total No. of Sources	367	521	727	127	131	39	1,912		100%
Numbers of Villages with...									
Shared pipeline	15	1					16	0.6%	
Shared protected source	10	2	4		1		17	0.6%	
Shared ?	9	5	4	2			20	0.7%	
Not Known	1						1	0.04%	
No PWS	272	586	261	12	258	78	1,467	53.0%	
Average Consumption - lpcd	11.1	10.7	13.3	10.9	14.5	14.9	12		

- Protected dug wells, springs, hand pumps and different types of powered pumping systems, made up a total of 1,912 protected water supply sources/ systems in the country. Over and above this, there were 16 villages with Shared pipelines from another village, 17 villages sharing a protected water source from an adjoining village, and 20 villages with a possibility of sharing (Share?) a source, but not clearly known.
- The Average Consumption of water from protected sources varied from 10.7 lpcd in Debub to 14.9 lpcd in SRS with a country average of 12.0 lpcd.

Fig 5112, derived from Table 5111 represents the physical coverage levels in each Zoba

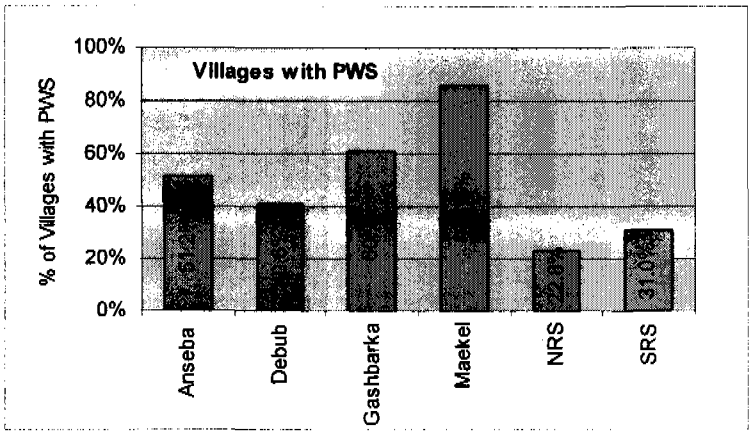


Fig. 5112: Percentage of Villages with PWS

5.1.2 Coverage of Villages & Population with Protected Water Sources

The absence of norms for rural water supply in Eritrea makes it difficult to establish the extent of physical coverage b y existing PWS. Current literature indicates that people fetch water from protected sources if the whole process of going and coming from the source does not take more that 30 minutes. This is quite a comprehensive parameter to judge coverage because it takes distance to the source and the differenc e in elevation between the source and the habitation into consideration. However, the assessment did not record the distance to the source or the time taken for a round trip to and from the water source.

In the absence of any point of reference in time or distance to base an analysis for assessing coverage, a few simplified assumptions, which have some relationship with the actual consumption levels, have been made. These are:

- A hand pump would meet the needs of 500 persons[9].
- A PWS with a powered pump system (motor, engine or solar powered) would meet the needs of 1000 persons per day.
- A PWS without a powered pump system (protected dug well or protected spring) would meet the needs of 1000 persons per day.
- A shared system of any kind would provide for 500 persons per day.

Based on the above assumptions, the analysis has been done in the following manner.

- **Fully Covered Villages/ Populations:** Those villages/ populations where the above assumptions of service levels of water supply have been met, are considered **Fully Covered**. This computation has been done by taking the population of each village and comparing it against the numbers and types of water sources.
- **Partially Covered Villages/ Populations:** Those villages where there are PWS but the service levels of water supply are lower that the assumed norms, are considered **Partially Covered**. Within Partially Covered Villages, computations have been made to calculate the part of the population of a village that would get water at the assumed service levels. This part of the village's population has been categorised as "**Partly covered - Served**". The remaining population of the village has been grouped as "**Partly covered - Not Served**".
- The third category is **Not Covered - No PWS,** where the entire population of the village is not served because the village has no PWS.

The results from applying the above methodology of analysis to all the 2750 villages found in the assessment are given in Tables 5121 to 5124 and Fig. 5121.

Table 5121: Coverage with PWS – Analysis by Numbers of Villages

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Not Known	2	2	19		3	1	27
Fully covered	176	243	293	35	42	27	816
Partly covered	108	159	97	37	31	7	439
No coverage - No PWS	273	586	261	12	258	78	1,468
Totals	559	990	670	84	334	113	2,750

[9] In actual fact, a hand pump yields about 720 litres per hours, and if it worked for 10 hours per day, it would provide 14.4 litres per head per day for 500 persons. This is roughly the consumption of water from PWS estimated in Table 511, where average consumption ranges from 10.7 litres to 14.9 litres per person per day, and an average across the 6 Zobas is about 14.7 lpcd.

Table 5122: Coverage with PWS – Analysis by Percentages of Villages

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Totals
Not Known	0.4%	0.2%	2.8%		0.9%	0.9%	1.0%
Fully covered	31.5%	24.5%	43.7%	41.7%	12.6%	23.9%	29.7%
Partly covered	19.3%	16.1%	14.5%	44.0%	9.3%	6.2%	16.0%
No coverage - No PWS	48.8%	59.2%	39.0%	14.3%	77.2%	69.0%	53.4%
Totals	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Tables 5121 and 5122, dealing with coverage and number of villages, show that:

- 29.7% of the villages in the country were fully covered, 16% of the villages were partially covered and 53.4% of the villages were not covered with protected water sources.
- Full coverage was the highest in Gashbaraka (43.7% or 293 out of 670 villages) and the lowest in NRS (12.6% or 42 out of 334 villages).
- Partial coverage was the highest in Maekel (44%) and lowest in SRS (6.2%).
- No coverage was the highest in NRS (77.2% of the villages) and the lowest in Maekel (14.3%).

Table 5123: Coverage with PWS – Analysis by Populations

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Fully covered	86,777	106,489	127,462	29,636	39,192	9,314	398,870
Partly covered -Served	32,000	124,000	108,000	41,500	43,000	5,000	353,500
Partly covered - Not Served	101,724	84,413	134,412	52,762	43,262	3,569	420,142
Not Covered - No PWS	128,586	300,846	135,382	10,883	173579	36,654	785,930
Totals	349,087	615,748	505,256	134,781	299,033	54,537	1,958,442

Table 5124: Coverage with PWS – Analysis by Percentages of Populations

	Anseba	Debub	Gashbarka	Maekel	NRS	SRS	Total
Fully covered	25%	17%	25%	22%	13%	17%	20%
Partly covered -Served	9%	20%	21%	31%	14%	9%	18%
Partly covered - Not Served	29%	14%	27%	39%	14%	7%	21%
Not Covered - No PWS	37%	49%	27%	8%	58%	67%	40%
Totals	100%	100%	100%	100%	100%	100%	100%

Tables 5123 and 5124, dealing with coverage of population groups, show that:

- A total of 38% of the total population in the country was fully covered, 20% from fully covered villages and an additional 18% from partially covered villages.
- A total of 61% of the total population was uncovered, comprising of 21% from partially covered villages and 40% from villages with no PWS.
- Full coverage varied from 25% of the Zoba populations (in Anseba and Gashbarka) to 13% in NRS.
- Partial coverage and served populations was high in Maekel (31%) to a low of 9% in Anseba and SRS.
- Partial coverage but not-served populations was high in Maekel (39%) to a low of 7% in SRS.
- Not covered population figures ranged from a high of 67% in NRS to a low of 8% in Maekel.
- Fig. 5121 illustrates Table 5124 in Pie Charts

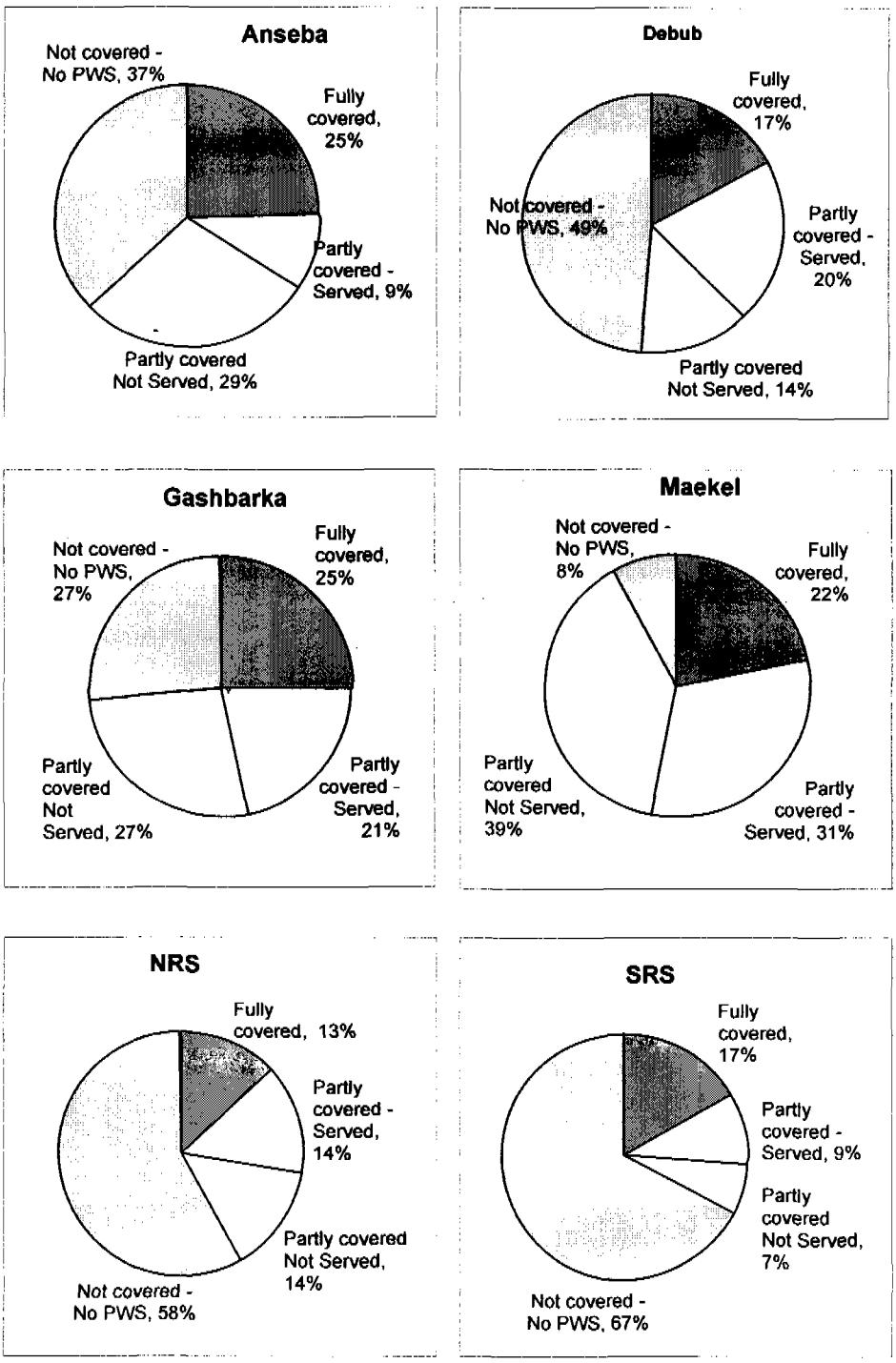


Fig. 5121: Zoba level Coverage with PWS – Analysis by Percentages of Populations

5.1.3 Villages without Protected Water Sources

The distribution of villages categorised by population groupings without PWS is similar the overall distribution of villages for the country as shown in Table 513 and Fig. 5131 below, with details in Annex 513. As is the case for the country, most villages without PWS are in the population range of 250 to 1000 people.

Table 513: Villages without Protected Water Sources

		Population Groups										
		≤50 persons	>50, ≤100	>100, ≤250	>250, ≤500	>500, ≤1000	>1000, ≤2000	>2000, ≤5000	>5000	Not known	Totals	Percentage of villages without PWS
Zoba		**Nos. of villages in each population group**										
Anseba	without PWS	2	9	77	90	80	11	4			273	48.8%
	Total	2	17	135	190	138	52	19	4	2	559	
Debub	without PWS	11	24	141	176	156	60	8		5	581	58.7%
	Total	20	31	198	281	291	136	22	4	7	990	
Gashbarka	without PWS	1	5	51	94	63	25	5		17	261	39.0%
	Total	4	18	138	209	146	63	43	13	36	670	
Maekel	without PWS		1		4	3	3	1			12	14.3%
	Total		1	3	10	24	28	13	5		84	
NRS	without PWS	1	19	49	73	62	37	10	2	5	258	77.2%
	Total	1	20	53	81	81	57	27	6	8	334	
SRS	without PWS		9	22	22	17	7	1			78	69.0%
	Total		10	30	35	23	12	2		1	113	
All Zobas	without PWS	15	67	340	459	381	143	29	2	27	1463	53.2%
	Total	27	97	557	806	703	348	126	32	54	2,750	
	Percentage	55.6%	69.1%	61.0%	56.9%	54.2%	41.1%	23.0%	6.3%	50.0%	53.2%	

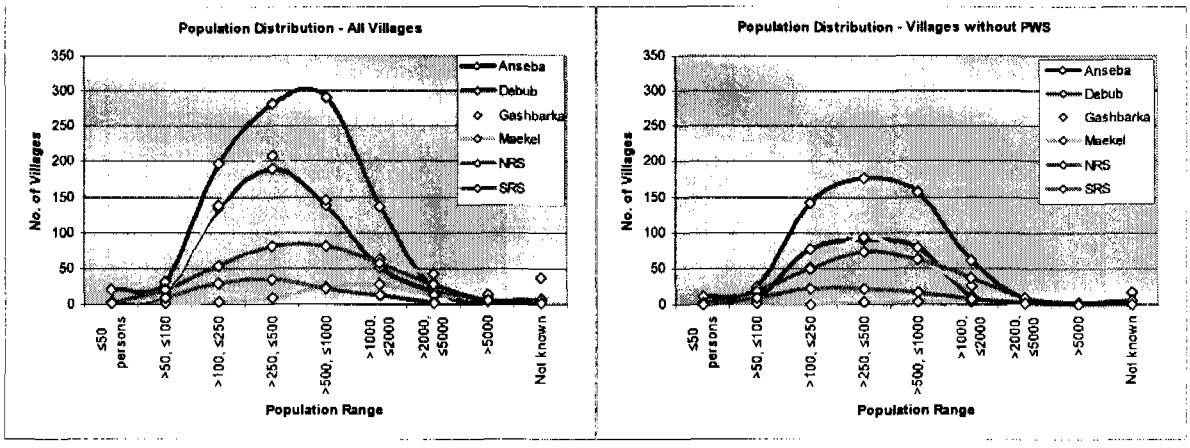


Fig. 5131: Population based distribution patterns of villages - All villages in the country (left), Villages without PWS (right)

In terms of non-availability of PWS:

- For the country, 53.2% of the villages do not have PWS.
- Maekel is the best-covered Zoba with only 14.3% villages not covered by PWS.
- NRS has the lowest coverage, with 77.2% villages not covered.
- While SRS has a relatively high percentage of villages (69%). However, it has a relatively lesser number of villages.
- Debub, with the highest number of villages among the Zobas, has 58.7% villages without PWS.

When Table 5131 is converted to percentages of villages without PWS in each Zoba compared to the total number of villages in each group, the results are presented in Table 5132.

Table 5132: Percentages of villages without PWS in each Zoba

	Population Groupings of Villages without PWS									
Zoba	NK	≤50 persons	>50, ≤100	>100, ≤250	>250, ≤500	>500, ≤1000	>1000, ≤2000	>2000, ≤5000	>5000	Totals
Anseba	0.0%	0.4%	1.6%	13.8%	16.1%	14.3%	2.0%	0.7%	0.0%	48.8%
Debub	0.5%	1.1%	2.4%	14.2%	17.8%	15.8%	6.1%	0.8%	0.0%	58.7%
Gashbarka	2.5%	0.1%	0.7%	7.6%	14.0%	9.4%	3.7%	0.7%	0.0%	39.0%
Maekel	0.0%	0.0%	1.2%	0.0%	4.8%	3.6%	3.6%	1.2%	0.0%	14.3%
NRS	0.9%	0.2%	3.4%	8.8%	13.1%	11.1%	6.6%	1.8%	0.4%	77.2%
SRS	0.0%	0.0%	8.0%	19.5%	19.5%	15.0%	6.2%	0.9%	0.0%	69.0%
Grand Total	1.0%	0.5%	2.4%	12.4%	16.7%	13.9%	5.2%	1.1%	0.1%	53.2%

The information in Table 5132 is plotted in Pie Charts for each Zoba in Fig. 5132.

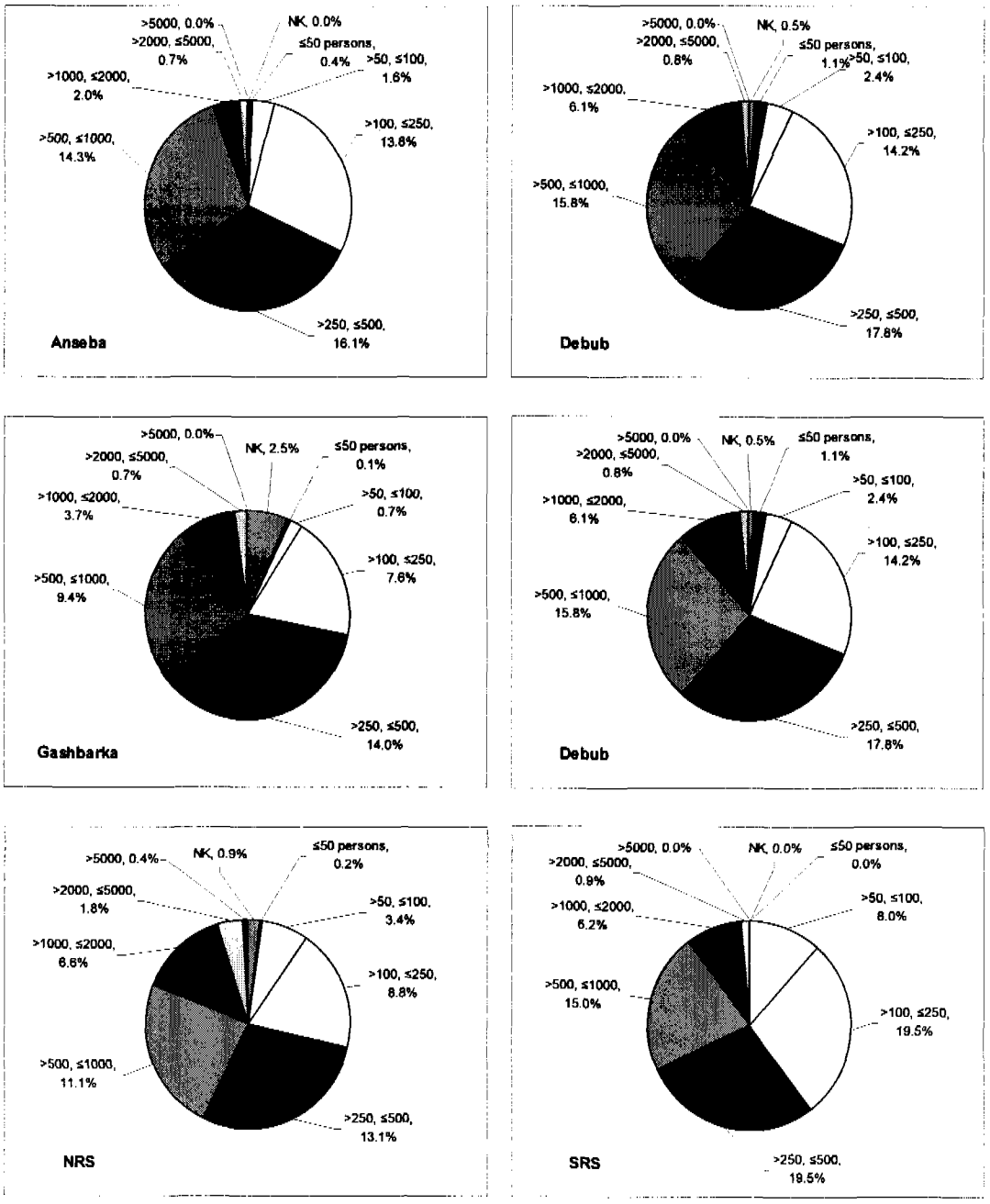


Fig. 5132: Distribution of Villages without PWS in each Zoba by Village Population Groupings

5.1.4 Water Trucking

The extent of water trucking in the country is reported in Table 514 and village-wise details are provided in Annex 514.

- A total of 52 villages reported partial dependence on water trucking and 50 villages were fully dependent on this.
- For villages partially dependent on Water Trucking, the average consumption ranged from 16.8 lpcd (in SRS) to 6.2 lpcd (in Debub), with 13,5 lpcd as the country's average consumption in this category.
- For villages fully dependent on water trucking, the highest consumption was in NRS (18.1 lpcd) and the lowest was from Maekel (6.7 lpcd) and the overall average consumption was 14.8 lpcd.

Table 514: Summary of Water Trucking

Zoba	Total Villages	Not full dependent				Fully dependent			
		No. of Villages	Percentage of Villages	Population	Avg. Consumption - Lpcd	No. of Villages	Percentage of Villages	Population	Avg. Consumption - Lpcd
Anseba	559	8	1.4%	8,172	7.8	5	0.9%	6,828	13.2
Debub	990	10	1.0%	14,757	6.2	11	1.1%	14,483	12.2
Gashbarka	670	9	1.3%	22,727	28.6		0.0%		
Maekel	84	12	14.3%	35,337	11.1	2	2.4%	7,594	6.7
NRS	334	9	2.7%	14,505	13.3	15	4.5%	19,444	18.1
SRS	113	4	3.5%	1,653	16.8	17	15.0%	10,441	15.1
Totals	2,750	52	1.9%	97,151	13.5	50	1.8%	58,790	14.8
	100%	2%				2%			

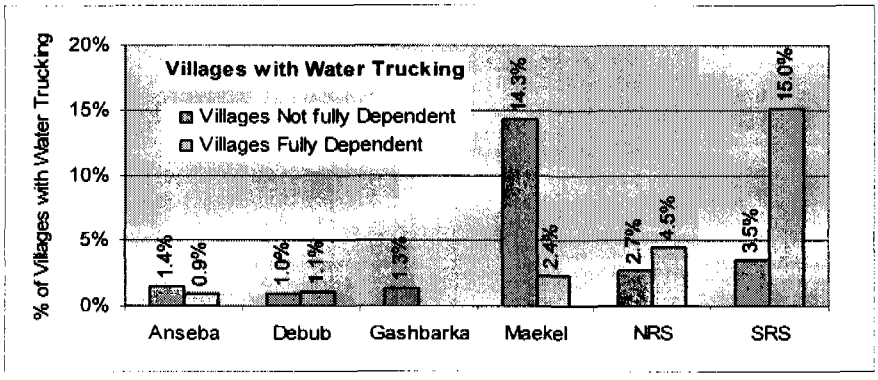


Fig. 514: Percentage of Villages dependent on Water Trucking

Fig. 514 shows the extent to which villages depend (both partially and fully) on Water Trucking in each Zoba.

- SRS has the highest proportion of villages, 15.0%, fully dependent on WT.
- Maekel, surprisingly, showed the highest level of partial dependence in WT. The explanation to this may be that Maekel has a high level of urbanisation and the convenience of having water delivered to homes, where piped water is not available, may have led to this high level of partial dependence on WT.

5.1.5 Unprotected Water Sources

Table 5151: Villages & Populations with Unprotected Water Sources - Zoba Summary

Zoba	Total no. of Villages	Villages with UPWS	Percentage of Villages with UPWS	Villages with No Unprotected Source	Total Population	Population with UPWS	Percentage of Population with UPWS	Totals no. of Sources	Avg. Consumption - Lpcd
Anseba	559	436	78.0%	123	349,087	262,042	75.1%	612	7.3
Debub	990	897	90.6%	93	615,748	556,444	90.4%	1,389	7.7
Gashbarka	670	556	83.0%	114	505,256	403,675	79.9%	714	9.8
Maekel	84	80	95.2%	4	134,781	130,875	97.1%	132	7.9
NRS	334	295	88.3%	39	299,033	258,763	86.5%	330	12.5
SRS	113	96	85.0%	17	54,537	46,210	84.7%	99	12.0
Total	2,750	2,360	**85.8%**	390	1,958,442	1,658,009	84.7%	3,276	8.7

Table 5152: Types of Unprotected Water Sources - Zoba Summary

Zoba	Villages with UPWS	Population with UPWS	Cistern	Pond/ Reservoir	River/ Stream	Unprotected dug well/ spring	Shared Unprotected source	No Unprotected Source	Totals no. of Sources
Anseba	436	262,042		79	225	306	2	123	612
Debub	897	556,444		334	418	631	6	93	1,389
Gashbarka	556	403,675		85	203	426		114	714
Maekel	80	130,875		53	37	42		4	132
NRS	295	258,763		19	167	140	4	39	330
SRS	96	46,210	5	3	11	80		17	99
Total	2,360	1,658,009	5	573	1,061	1,625	12	390	3,276
Percentages	85.8%	84.7%	0.2%	17.5%	32.4%	**49.6%**			100%

Table 5151 & 5152on unprotected water sources, with details in Annex 515 indicate the following:

- Four main categories of UPWS were found in the country: Cisterns, Pond/ Reservoir, River/ Stream and Unprotected dug well/ spring.
- 2,360 or 85.8% of the villages had UPWS.
- There were a total of 3,276 UPWS in the country, with the largest number (1,389) of sources in Debub and the lowest number (99) in SRS.
- The countrywide average consumption of UPWS for domestic needs was 8.7 lpcd, with the highest from NRS (12.5 lpcd) and the lowest from Anseba (7.3%).
- Unprotected dug wells were the most common (49.6%) form of UPWS, with rivers/ streams constituting sources for 32.4% villages, ponds/ reservoirs accounting for 17.5%. Cisterns collecting rain water from the land surface were found only in SRS and made up for 0.2%.
- Sharing of UPWS was reported from 12 villages across the country and 390 villages reported the absence of any UPWS source.

– Fig. 515 below, shows the percentages of villages in each Zoba with access to UPWS.

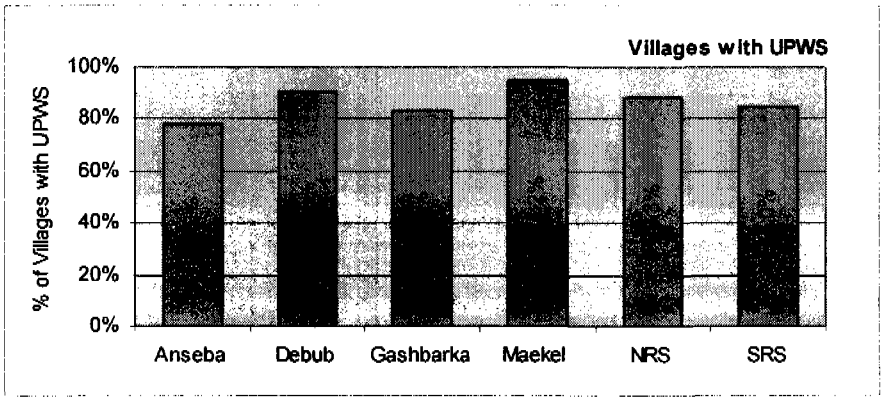


Fig. 515: Percentage of Villages with UPWS

5.2 Dependence on Multiple Water Sources

From Section 5.1, it is apparent that people and communities depend on a number of sources for meeting their drinking water needs. Examining the data for all villages against the possibility of simultaneous use of water from different source categories (PWS, UPWS & WT) (Annex 521) and types of sources within these three categories clearly reveals this phenomenon. In order to understand this better, the data on water sources was analysed to provide the numbers of villages using the different possible combinations of the three main categories of sources – PWS, UPWS and WT.

Table 521 provides the cross-tabulation of numbers of villages and populations in each Zoba using each of the possible combinations of the three main categories of sources – PWS, UPWS and WT, from villages with no source at all in any of the three categories at one extreme, to villages having all the three categories of water sources at the other extreme, and all other combinations in between.

As can be seen from Table 521 above, the bulk of the villages are dependent on only Unprotected water sources (Only U = 51.5% villages) and the next highest group of villages is dependent on a mix of Protected and Unprotected sources (P+U = 32.3%). 12.4% of the villages are dependent on only Protected water sources (Only P). The remaining four combinations of water sources each account for about 1% of the villages. Three villages (0.1%) recorded no water source at all. Two of these villages in NRS, were found abandoned at the time of the assessment (probably the villagers had migrated with their cattle with the season, a normal practice) and data had not been recorded for one village in Gashbarka.

Table 521: Multiple Water Source Use Patterns

Zoba	Combinations of Water Source Usage by numbers of Villages							
	No P, WT, U	Only U	Only WT	Only P	U+WT	P+WT	P+U	P+WT+U
Anseba		267	2	116	4	5	163	2
Debub		577	5	81	4	7	311	5
Gashbarka	1	260		109		4	291	5
Maekel		10	1	2	1	1	58	11
NRS	2	245	6	28	5	3	35	10
SRS		57	11	6	10		29	
Total	3	1,416	25	342	24	20	887	33
Percentage	0.1%	51.5%	0.9%	12.4%	0.9%	0.7%	32.3%	1.2%

Zoba	Combinations of Water Source Usage by Population							
	No P, WT, U	Only U	Only WT	Only P	U+WT	P+WT	P+U	P+WT+U
Anseba		121,656	4,844	76,334	2,086	5,867	136,097	2,203
Debub		291,530	2,267	44,014	7,049	13,023	251,426	6,439
Gashbarka	370	135,012		86,384		14,827	260,763	7,900
Maekel		6,812	1,061	1,355	3,010	1,490	83,683	37,370
NRS		162,750	3,814	32,450	7,015	4,006	70,437	18,561
SRS		24,560	3,080	5,247	9,014		12,636	
Total	370	742,320	15,066	245,784	28,174	39,213	815,042	72,473
Percentage	0.02%	37.90%	0.77%	12.55%	1.44%	2.00%	41.62%	3.70%

* P= Protected Water Supply Systems, U= Unprotected Water Supply Systems, WT= Water Trucking

understand the methodology of data collection using the document **Explanatory note to Questionnaire.**

- Once the identification and training process of animators has been completed, master lists of animators (with a two digit numerical animator code, based on an alphabetical list of names) will be prepared at Zoba level and animators will be assigned to Sub-Zoba supervisors.
- The Sub-Zoba supervisor, in turn, will allot lists of villages to animators based on geographical contiguity or access. When this list is considered against an allotment of dates to complete the field work, it would constitute the Sub-Zoba level work plan.
- Zoba level supervisors will assist the Sub-Zoba supervisors to formulate the Sub-Zoba work plan, and will consolidate it into the Zoba's work plans.
- In order for Sub-Zoba supervisors to check and go through village questionnaires with corresponding animators, at least two breaks in the field work of each animator, of one day each must, be scheduled in the work plan.
- Similarly, Zoba supervisors should schedule at least one meeting with Sub- Zoba supervisors to review progress of the field work.
- It will be apparent that the training and work planning exercises will be simultaneous. Hence, the work plans at Zoba and Sub-Zoba levels should be considered as an output of the training of supervisors.
- Apart from the initial training of animators, Sub-Zoba Supervisors will work with groups of animators for at least the first two days, taking the animators through the process completion of the Assessment questionnaires. Initially, easy-to-reach villages should be chosen so that supervision and field training logistics are easier.

6. Supervision and Quality of Data

- The work plan for each Sub-Zoba will be the basic tool for management of the field work of animators.
- The village lists, provided to Sub-Zoba Supervisors, will be used to monitor physical progress of the Assessment. The village lists will also be used to review work done each day, at the end of each day, and assigning work to animators for the next day, and make necessary day-to-day adjustments to the work plan.
- Supervisors must fix a time and place for each day's meeting with the concerned animators.
- Since each Sub-Zoba supervisor will be responsible for the data of an average of about 25 villages and 2 to 3 animators, the supervision must be very thorough at all stages, with no relaxation what-so-ever on the quality of data. Supervisors will examine each questionnaire in detail with each animator, to verify the quality of data being collected. This will mean scheduling gaps in the field work days of each animator, but there is adequate time for field work. These "gaps" in field work must also be scheduled in the work plan. It will also entail random verification of data collected by animators against data available with the Sub-Zoba and the supervisor's own knowledge of the villages in his/ her jurisdiction.
- Supervisors must also write down the **P Code** for each completed questionnaire on a daily basis and verify the number of villages completed by marking these villages against the respective village lists assigned to the supervisor.
- Where questionnaires appear substantially incomplete or there is serious doubt on the information collected, the supervisor will reassign the data collection of that village to another animator.
- If some animators persistently (for 2 to 3 days) submit poor quality information, they should be relieved of their work, with proportionate financial penalty.
- A certificate will be issued by WRD to all the animators who participate in the Assessment.

7. Data consistency check

- Apart from the questionnaire completed by animators, Sub-Zoba supervisors will be required to complete the Assessment questionnaire themselves on 10% of the villages in their respective Sub-Zobas. The choice of this 10% sample will be randomised.
- Information on this 10% sample of the villages will be collected a second time, by the Sub-Zoba supervisory level, as a data reliability check against the information collected by the animators. In completing these questionnaires, the supervisor should not, beforehand, refer to the village questionnaire completed by field animators. This part of the assessment will be completed independently and data from this survey will be analysed separately.
- In the process of the 10% sample survey, supervisors will draw water samples for **PROTECTED** water sources only, and incubate these samples for 24 to 48 hours in the H_2S vials that will be provided. (Read separate note on H_2S vials).
- Zoba level supervisors should examine a minimum of 3 questionnaires of each Sub-Zoba, chosen at random, against available information, to look for significant variances. In case of doubt, Zoba level supervisors can ask for a re-survey of the concerned village.
- Zoba and Sub-Zoba supervisors will write separate reports on the data quality checks that they make, in the formats provided.

8. Completion of Field Work

- An animator's field work will be considered complete he/ she has completed the allotted number of village level questionnaires to the satisfaction of the supervisor.
- Sub-Zoba level supervisors will complete the following and send the corresponding documents to the Zoba supervisor.
  - assign **P Code** number to each questionnaire.
  - mark the code number of the animator on the village list where data collection has been satisfactorily completed.
  - complete questionnaires on villages, which could not be visited by animators (e.g. villages in the Temporary Security Zone) from available records.
  - indicate the reason for absence of data on any village/s on the village list.
  - mark on the same village list, villages that they have resurveyed, as a part of the 10% sample check.
  - write a summary report in the formats provided.
  - attach the village questionnaires, both those completed by the animator and those completed by the supervisor, made into separate bundles, each bundle arranged as per the village list.
- In a similar fashion, the Zoba supervisor will consolidate data and documents by Sub-Zoba, in the formats provided, and pass this information on the documents to WRD at Asmara (National Coordinators).

9. Responsibility list at Sub-Zoba level

- Preparation of work plan within the given time frame (20-25 July 2006), including separation (marking on the village list) of villages in the Temporary Security Zone.
- Training of animators, including initial field training (28-29 July 2006).
- Daily work allocation.
- Daily/ periodical work meeting.
- Engagement and allocation of transport.
- Progress monitoring of field work against target.
- Results of data quality check.
- Identification of villages that can not be visited, indicating reason, in the village list.
- Completion of questionnaires for villages in the Temporary Security Zone.
- Random checks on animators.

- Consolidation of village data sheets against village lists, with completion of **P Codes**.
- Selection of 10% village sample, field visits for completion of these questionnaires.
- Collection of water samples from protected sources in the 10% village sample, in H_2S vials with source & village identity and recording results of this test on appropriate questionnaires.
- Consolidation of data sheets against village lists.
- Completion of reporting formats for Zoba.
- Payments to animators, transport, etc.
- Completion of work report and financial utilization report.

10. Responsibility list at Zoba level

- Training of Sub-Zoba supervisors.
- Assisting Sub-Zoba supervisors with training of animators and formulation of Sub-Zoba work plans.
- Random field checks done with/ without Sub-Zoba supervisors.
- Random checks on at least 3 village level questionnaires against available data.
- Completion of Zoba level report as specified.
- Passing on village questionnaire of the Zoba with Sub-Zoba and Zoba reports to WRD Asmara.
- Consolidation of Sub-Zoba work reports and financial report into the Zoba's work and financial report.

11. Data Compilation & Analysis

- The questionnaire has been designed to facilitate computerised numerical data values for most of the data fields.
- The database will be created on MS Access.
- A tabulation plan or a list of queries will be detailed, as per the expected output of the data analysis.
- WRD will dedicate at least 4 data entry operators exclusively data entry.
- WRD will generate the analytical tables as per the tabulation plan.
- The questionnaires completed by animators and by supervisors will treated as two different data groups but will be subjected to the same analysis and tabulation plan.
- All the data will be preserved in multiple copies on CDs, stored at WRD, UNICEF and may be shared with other Government agencies on request.

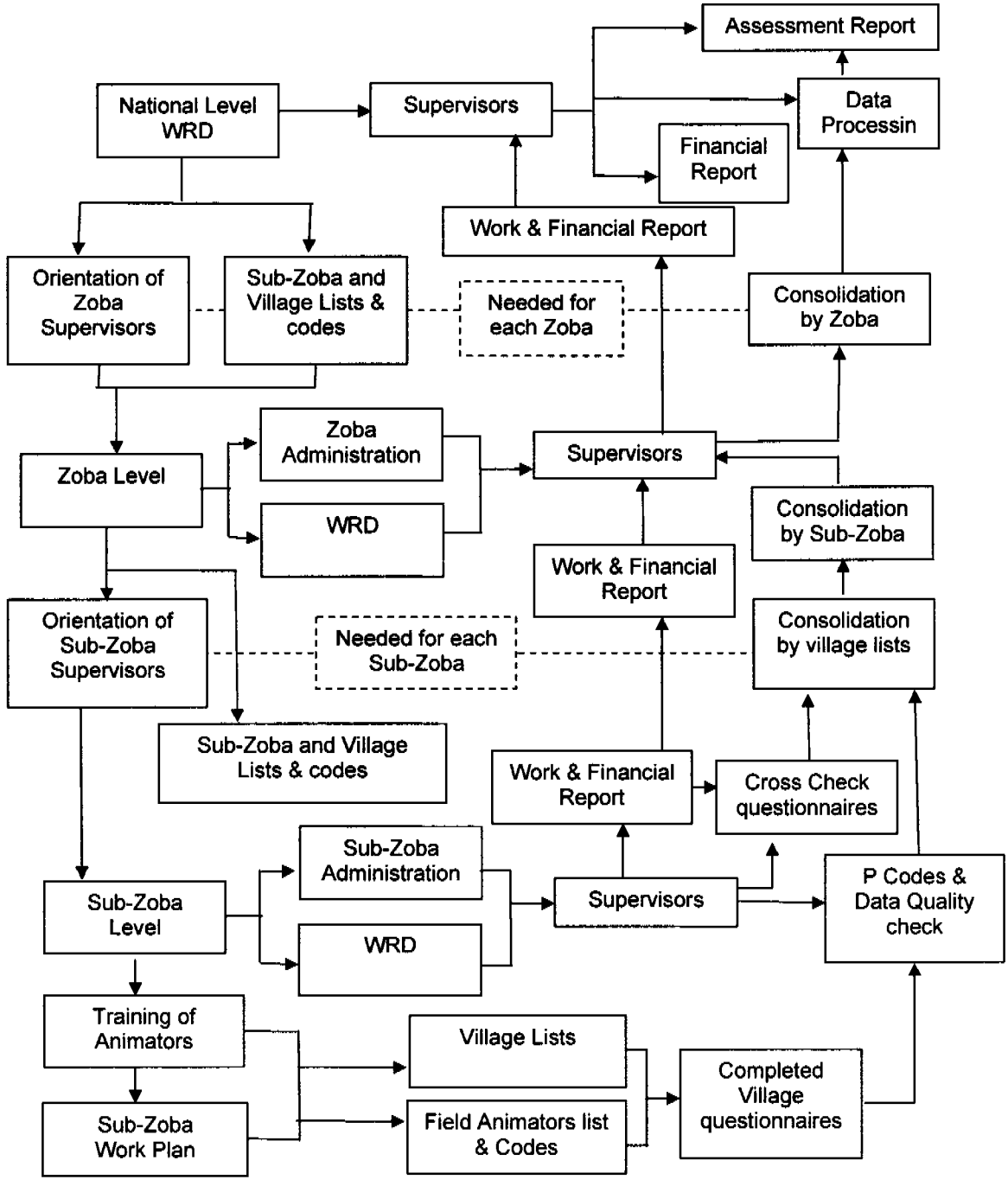
12. Reporting

- WRD will complete the report with UNICEF's participation. The findings of the Assessment will be presented in Zoba level workshops and in a national seminar. The findings of the Assessment will also be used to update the National Water Supply & Sanitation Emergency Action Plan, 2004-07.
- The data analysis and findings will address the Specific Objectives stated in the proposal from WRD, namely:
    1. Assess the coverage of safe water supply to rural areas.
    2. Assess the functionality status of existing water supply systems
    3. Assess the existing operation and maintenance system
    4. Assess the water consumption level

Attachments

10. Management Plan
11. Explanatory note to Questionnaire (not included)
12. The Questionnaire
13. Zoba, Sub-Zoba, Village lists (not included)
14. Training Schedules and content – Asmara , Zoba levels and Sub-Zoba level and for animators, Training plan for Animators (not included)
15. H_2S vials
16. Sub-Zoba and Zoba level report formats (not included)
17. Zoba level budgets for the Assessment (not included)
18. Draft tabulation Plan (not included)

Management Plan



(tick √) **Place Code** ☐☐☐☐☐☐

01 Zoba: Anseba/ Debub/ Gashbarka/ Maekel/ NRS/ SRS Visited by Animator Yes ☐ No ☐

102 Sub-Zoba: _____ (tick √)

103 Village: _____ 104 IDP Camp: (1)Yes ☐ / No(2) ☐

105 Population: _____ 106 Number of familles: _____ 106 Distance from Sub-Zoba: _____Km

201	Is there a Water/ WASH Committee?			Yes (1)		No (2)	
202	Is there a Water Tariff system?			Yes (1)		No (2)	
203	If there is a Tariff system, is it in ....?			Cash (1)	In kind (2)	Both (3)	
204	Are any families exempt from tariff?			Yes (1)		No (2)	
205	Basis for tariff exemption? HH is headed by..?			Female (1)	Child (2)	Poor Family (3)	..... (4)
206	*Does the Committee have a bank account?*			Yes (1)		No (2)	
207	Present Bank balance?			.....Nkf		.....(date: mm/yy)	
208	If no bank A/c, where are funds kept?			.....			
209	In the village, is there...	Water Guard? (1)		Tariff Collector? (2)		Maintenance operator? (3)	
210	In the village, is there...	School? (1)	Health Centre? (2)	Mosque? (3)	Church? (4)	Any other institution? (5)	
211	Do they get water?	Yes (1) No (2)	Yes (1) No (2)	Yes (1) No (2)	Yes (1) No (2)	Yes (1) No (2)	

301	What is the Unit of measure for the Tariff?	Jerry Cans? (1)	Any Other? (2)	Any Other? (3)	Approx. ..... litres
302	What is the charge?	.....Nkf	.....Nkf	.....Nkf	

400	Maintenance information	Who normally repairs -01 Pvt (1), Sub-Zoba technician (2), Zoba technician (3) WRD (4) Asmara Pvt(5), ...(6)	Where do you get spare parts -02 Pvt (1), Sub-Zoba (2), Zoba (3) Asmara (4),....(5)	Who pays -03 WASH Committee (1), Sub-Zoba (2), Zoba (3), Charity org. (4), rich individual (5) .....(6)
401	Hand pumps			
402	Motorised pumps(with or without generator)			
403	Engine driven pumps			
404	Other repairs (leaks, etc.)			

500 How many latrines are there in the village (write numbers of latrines according to latrine types)

Pour flush latrine (501)	Ventilated Improve Pit latrine (502)	Simple Pit latrine (503)	Public/ Shared latrine (504)	Open Pit latrine (505)	(506)

600 Protected Water Sources (Household Connection/ Public Standpost (PS)/ Bore hole (BH) with pump/ Protected Dug Well (DW), Protected Spring, Rainwater collection)

Code	Type of Water Point	Construc-tion date (mm/yy)	Source Type BH/ DW (1/2)	Source is Seasonal/ Perennial? S/ P (1/2)	Is there a storage tank? Y/N (1/2)	Pump is working? Y/N (1/2)	Not working since? (mm/ yy)	Pump was last repaired? (mm/yy)	Repair cost? ....Nkf	Source is reliable? Y/N (1/2)	Regularl y used? Y/N (1/2)	Remarks (H_2S vial – No reaction /Black (1/2)
		-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11
6011	Public Standpost (PS) with Motor & Generator at Source											
6012	PS with Motor											
6013	PS with Solar pump											
6014	Hand pump 1											
6015	Hand pump 2											
6016	Protected Dug well 1		2									
6017	Protected Dug well 2		2									
6018	Protected Spring											
6019												
6020												

700: If the village is dependent on water trucking (water brought by trucks/ tankers):

Code	Is the village fully depending on water trucking? Y/ N (1/2)	Last year, trucking supply was for how many months?	Avg. no. of trips per week?	Truck Capacity(L itres)	Source to village distance? ....Km	Tariff per... (Nkf)			Truck from Zoba / Pvt. (1 / 2)	How was it paid? Individually? Committee? (1/2)	Remarks (H_2S vial – No reaction /Black (1/2)
						Jerry can	Barrel	Truck			
	-01	-02	-03	-04	-05	-06	-07	-08	-09	-10	-11
7001											

800 Unprotected Water Sources (Unprotected well/ spring, River, Pond, Trucking)

Code	Type of Water Point (Describe)	Seasonal/ Perennial S/ P (1/2)	Used as Drinking/ Cooking water source? Y/ N (1/2)	Used for other purposes ? Y/ N (1/2)	Distance from village? .....Km	Source is reliable? Y/N (1/2)	Source is regularly used? Y/N (1/2)	Not used since .....(mm/ yy).	Remarks
	-01	-02	-03	-04	-05	-06	-07	-08	-09
8001	Unprotected Dug Well/ Spring								
8002	River/ Stream								
8003	Pond/ Reservoir								
8004									

Names of WASH Committee members/ Villagers interviewed for 201-800:

900 *You will visit 10 households/ families of different sizes in the village and record the litres of water that they have drawn yesterday from Protected and Unprotected sources. Five of the 10 families should have 5 or less members in the family, the other five families should have 6 or more members in the family.*
Protected Water Sources are *Household Connection/ Public Standpost / Bore hole with hand pump/ Protected Dug Well , Protected Spring, Rainwater collection.* ***Unprotected Water Sources*** *are Unprotected well/ spring, River, Pond). Water Trucks may or may not be protected and so has been treated separately.*

Code		Family Serial Number									
		-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
901	Name of Head of Family & Sex (Male/ Female/ Child male/ Child Female-1/2/3/4)										
902	No. of members in the Family										
903	Water drawn from Protected Source (lit)										
904	...from water truck (lit)										
905	..from Unprotected Source (lit)										

Animator's Name:..... Code:(1101) ..... Date: dd/mm/yy ..... Supervisor's Name:(1103) ..... OK/Redo (1/2):(1104).....

Supv.'s Cross Check Village: (1103) (Y/N) (1/2)

H_2S Vials

The H_2S vial is an easy to use, cost-effective, reliable means to test the microbiological quality of drinking water.

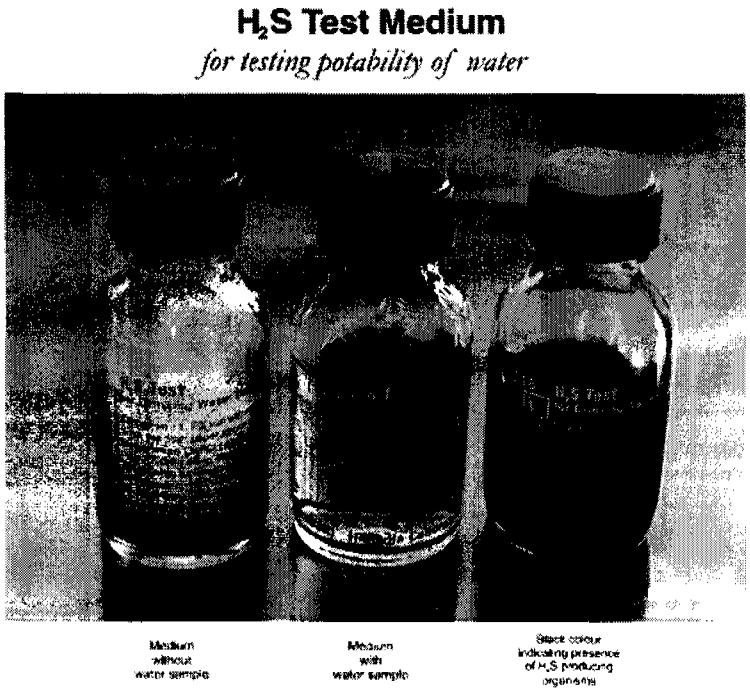
Waterborne diseases like Typhoid, Cholera, Diarrhoea, and Jaundice are caused by polluted water supply. The conventional method of testing the microbiological quality of water in most countries is the Most Probable Number (MPN) test or the Membrane Filtration method– but these need the services of a skilled microbiologist, laboratory facilities and take several days to assess the final result.

The H_2S vial, however, is much easier to use, does not need additional equipment or skilled personnel and can detect microbial contamination, in 24 to 48 hours.

The Hydrogen Sulphide Strip test is a simple, inexpensive and reliable tool to detect the presence or absence of bacteriological organisms in drinking water. However, whilst the test is simple to perform and easy to evaluate, it is necessary to recognize that H_2S vial detects the presence of bacteria and is not specific to pathogenic (harmful) bacteria alone. To that extent the H_2S vial is an indicative test and not a definitive test for pathogens such as Coliform bacteria and e-Coli.

Over the past decade, the H_2S vial has gained importance because contamination often varies both over time and with reference to the supply point and may not be revealed by the examination of a single sample. The impression of security given by microbiological testing of water at infrequent intervals may therefore be quite false. Indeed the value of microbiological tests is dependent upon their frequent and regular use.

Bacteriological water quality tests presently used in most parts of the world, have several disadvantages for routine use in developing countries. Firstly, the test equipment is not easily portable for use in rural areas. The test procedures require trained technicians, sophisticated laboratory equipment or expensive supplies, most of which are not readily available in developing countries. In some instances, the long incubation time required for some tests before results can be obtained is a hindrance. These limitations seriously inhibit the effectiveness of most water quality control programmes.



In comparison, the H_2S vial test has been found to be very convenient, in that, it comes in prepacked small sterile sealed bottles of media can be transported anywhere without refrigeration and that water

samples can be collected and tested by untrained personnel. These factors, coupled with its low cost and minimal storage requirements, make it ideal as an indicative test bacteriological presence in water.

The H_2S vial relies on the presence of bacteria in the water sample. This would include Citrobacter, Salmonella, Proteus, Arizona, Klebsiella, Coliform bacteria, e-coli, and other H_2S producing anaerobes.

Test Procedure

Dry and sterile media are provided in the screw capped bottles, which are ready for use. Fill (with approx. 20 ml) water to be tested up to the upper level marked on the bottle. Shake the bottle gently after 5 minutes. Keep the bottle at a room temperature of 22 to 38 deg C, preferably in an incubator at 37 deg C. If none of these are available, the bottle can be kept in the pocket, next to the skin, while sleeping in the night.

The following changes may be seen:

No change in colour of water in the bottle	Water does not have bacteria
Water in the bottle turns black	Water has bacteria and is probably unfit for drinking

Test Medium

The medium consists of 20 gm of Peptone, 1.5 gm of Di-potassium Hydrogen Phosphate, 0.75 gm of Ferric Ammonium Citrate, 1 gm of Sodium Thiosulfate, 1 ml of Teepol and 50 ml of water. A folded tissue paper of 80 cm square is used to absorb 1 ml of this concentrated medium. This folded tissue paper strip containing medium is kept in a 30 ml bottle and sterilized. If long term storage or long distance transportation is required, then the contents of the bottle can be dried at 50 deg C under aseptic conditions. Water to be tested is poured into the bottle up to a calibrated level, which is 20 ml and kept at a room temperature of 22 to 38 deg C. More recently, the media has also been developed in powder form (shown in the photograph above).

Annex 1.02 Coordinators, Supervisors and Data Collectors for the Assessment

National Level

Function	Name	Occupation
National Coordinator	Yohannes Micheal	WRD Staff
National Coordinator	Tecle Yemane	WRD Staff
Data Analyst	Selamwit Tsegai	Statistician, Data Analyst

Zoba Supervisors

Zoba	Name	Occupation
Anseba	Bahta Russom	WRD Staff
Debub	Daniel Zemenfes	WRD Staff
Gashbarka	Adhanom Berhe	WRD Staff
Maekel	Kibrom Zemui	WRD Staff
NRS	Yosief Mered	WRD Staff
SRS	Michael Yosef	WRD Staff

Sub-Zoba Supervisors and Animators (Data collectors)

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Anseba	Adi Tekelezan	Yonas Tekle	Segen Construction	Tesfahiwet Youannes	Teacher
Anseba	Adi Tekelezan	Zerisenay Gebru	Teacher	-do-	
Anseba	Adi Tekelezan	Rusom Gebreab	Administration	Yonas Misgina	Cashier
Anseba	Adi Tekelezan	Solomun Tsegay	Student	-do-	
Anseba	Asmat	Ibrahim Salih	Student	Bahta Russom	Teacher
Anseba	Asmat	Mohamedsied Mohammed Oumer	Administration	-do-	
Anseba	Asmat	Idris Abdela	Student	Semere Kiflemariam	S-Z Admin. Staff
Anseba	Asmat	Mohamedsalih Antal	Administration	-do-	
Anseba	Asmat	Musa Osman	Student	-do-	
Anseba	Elabered	Mengis Tareqe	Teacher	Amanuel Abraha	Teacher
Anseba	Elabered	Negash Tekile	Teacher	-do-	
Anseba	Elabered	Teame Tekilemariam	Teacher	-do-	
Anseba	Elabered	Biniam Kiflay	Teacher	Eyob Solomun	Teacher
Anseba	Elabered	Tesfamariam Kahsay	Teacher	-do-	
Anseba	Elabered	Tesfamichael Kidane	Teacher	-do-	
Anseba	Elabered	Mekonen Kiflay	Teacher	Fishaye Tesfay	Teacher
Anseba	Elabered	Weini Abrha	Teacher	-do-	
Anseba	Gheleb	Gdewon Zerom	Teacher	Aliker Redie	Teacher
Anseba	Gheleb	Jemal Jabir	Student	-do-	
Anseba	Gheleb	Damr Woldemichael	Teacher	Weldeab Ghebremariam	Teacher
Anseba	Gheleb	Mussa Adem	Student	-do-	
Anseba	Gheleb	Sereke Gebremariam	Teacher	-do-	

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Anseba	Habero	Salih Ahmed	Teacher	Mohammed Ali Ahmed	Teacher
Anseba	Habero	Salih Mohamed	Teacher	-do-	
Anseba	Habero	Maekele Gebreyosus	Teacher	Tekie Askale	S-Z Admin. Staff
Anseba	Habero	Teklehaymanot Misael	Administration	-do-	
Anseba	Hagaz	Debretsion Gunbot	Administration	Idris Abdela	Teacher
Anseba	Hagaz	Eyob Salih	Administration	-do-	
Anseba	Hagaz	Hamd Mohammed	Administration	-do-	
Anseba	Hagaz	Mustofa Yasin	Teacher	Mebrahtom Haile	Teacher
Anseba	Hagaz	Nesredin Yalkekit	Administration	-do-	
Anseba	Hagaz	Tedros Araya	Teacher	-do-	
Anseba	Hagaz	Aregay Ghebremichael	Administration	Tekie Habte	Teacher
Anseba	Hagaz	Said Ibrahim	Administration	-do-	
Anseba	Hagaz	Zekarias Youhannes	Teacher	-do-	
Anseba	Halhal	Abraham Gebru	Student	Biniam Zerom	Teacher
Anseba	Halhal	Mohammed Afa	Student	-do-	
Anseba	Halhal	Mohammed Hamid	Student	Kidane Brhane	S-Z Admin. Staff
Anseba	Halhal	Osman Hamid	Teacher	-do-	
Anseba	Hamelmalo	Merhawi Baire	Teacher	Ibrahim Romedan	Teacher
Anseba	Hamelmalo	Samiel Goitom	Finance	-do-	
Anseba	Hamelmalo	Abdelreqb Adem	Student	Tumzghi Youhannes	Teacher
Anseba	Hamelmalo	Hagi Yasin	Student	-do-	
Anseba	Hamelmalo	Mussa Idris	Student	-do-	
Anseba	Keren	Ghebremeskel	Lab.Techincian	Yacob Tesfay	Teacher
Anseba	Keren	Haileab Birhane	Teacher	-do-	
Anseba	Keren	Tesfamariam Goitom	Teacher	-do-	
Anseba	Kerkebet	Mesaud Abdelkadir	MOA	Gherensea Weldu	Teacher
Anseba	Kerkebet	Berhane Kahsay	Administration	Kiflay Kidane	Teacher
Anseba	Sela	Gebreslasie Birhane	Administration	Zere Woldetnsae	S-Z Admin. Staff
Anseba	Sela	Ghrmatsion Abrha	Administration	-do-	
Anseba	Sela	Jabr Mohmmednur	Administration	-do-	
Debub	Adikeih	Ahmed Mohammed Gimie	Teacher	Goitom Tsegay	S-Z Admin. Staff
Debub	Adikeih	Bereqe Ghebresilase	Teacher	-do-	
Debub	Adikeih	Mahmud Mohammed Said	Teacher	-do-	
Debub	Adikeih	Misgun Girmai	Teacher	-do-	
Debub	Adikeih	Tesfalem Zewde	Teacher	-do-	
Debub	Adikeih	Yasinnur Ahmed	Teacher	-do-	
Debub	Adikeih	Yosief Tesfamariam	Teacher	-do-	
Debub	Adiquala	Asefaw Woldu	Teacher	Fishatsion Okubaslase	S-Z Admin. Staff
Debub	Adiquala	Birhane Mokonene	Teacher	-do-	
Debub	Adiquala	Gheberezigabiher Woldu	Teacher	-do-	
Debub	Adiquala	Ghebremichael Woldesilase	Teacher	-do-	
Debub	Adiquala	Kokeb Ghebremichael	Teacher	-do-	
Debub	Adiquala	Niguse Tesfay	Teacher	-do-	

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Debub	Adiquala	Siare Eyob	Student	-do-	
Debub	Adiquala	Tekile Berhe	Teacher	-do-	
Debub	Adiquala	Tekileab Kidane	Teacher	-do-	
Debub	Adiquala	Tewolde Ghebresilasie	Teacher	-do-	
Debub	Areza	Tesfazughi Mizelo	Agriculture	Tesfay Gebru	
Debub	Areza	Ghebretinsae Tadese	Administraion	Tedros Abede	
Debub	Areza	Tafere Tsegay	Student	-do-	
Debub	Areza	Tekilay Abriham	Agriculture	-do-	
Debub	Areza	Tekileweini Tesfay	Administraion	-do-	
Debub	Areza	Tesheme Asefaw	Administraion	-do-	
Debub	Areza	Tsegay Sium	Administraion	-do-	
Debub	Areza	Youhanns Abriha	Administraion	-do-	
Debub	Debarwa	Abrahale Sium	Administraion	Debru Gebremichael	S-Z Admin. Staff
Debub	Debarwa	Alde Karmelo	Administraion	-do-	
Debub	Debarwa	Estifanos Sium	Administraion	-do-	
Debub	Debarwa	Gebreamlak Semere	Teacher	-do-	
Debub	Debarwa	Gebru Ghebremichael	Administraion	-do-	
Debub	Debarwa	Kahsay Bahta	Teacher	-do-	
Debub	Debarwa	Samsom Ghebretinsae	Administraion	-do-	
Debub	Debarwa	Tekle Andu	Teacher	-do-	
Debub	Debarwa	Tesfazighi Ekube	Administraion	-do-	
Debub	Dekemhare	Abham Ghebremariam	Teacher	Tesfay Abrha	Town Water Supply
Debub	Dekemhare	Andemeskel Woldemichael	Teacher	-do-	Town Water Supply
Debub	Dekemhare	Demsas Ghebrehiwet	Teacher	-do-	Town Water Supply
Debub	Dekemhare	Haile Misgna	Teacher	-do-	Town Water Supply
Debub	Dekemhare	Tesfalem Ghebremariam	Teacher	-do-	Town Water Supply
Debub	Emnihaili	Debesay Ghebreab	Teacher	Tadese Beraki	S-Z Admin. Staff
Debub	Emnihaili	Kesete Beraki	Teacher	-do-	
Debub	Emnihaili	Megos Ghebreab	Administraion	-do-	
Debub	Emnihaili	Mulugeta Ghebrenugus	Teacher	-do-	
Debub	Emnihaili	Mulugeta Haile	Teacher	-do-	
Debub	Emnihaili	Tadese Ghebreyosus	Teacher	-do-	
Debub	Emnihaili	Tesfom Girmay	Teacher	-do-	
Debub	Emnihaili	Tuemzgi Resom	Teacher	-do-	
Debub	Maiayni	Abrhale Habtom	Student	Gebrekidan Debas	S-Z Admin. Staff
Debub	Maiayni	Asefa Mebrahtu	Student	-do-	
Debub	Maiayni	Yikalo Tesfay	Student	-do-	
Debub	Maiayni	Bokre Girmalalem	Teacher	Okubazgi Tsegay	S-Z Admin. Staff
Debub	Maiayni	Tesfaldet Tesfay	Teacher		do
Debub	Maiayni	Yemane Berhe	Student		do
Debub	Maimine	Amine Ghebrenigus	Student	Measho Brhane	S-Z Admin. Staff
Debub	Maimine	Asmerom Araya	Student	-do-	
Debub	Maimine	Bahre Kebede	Teacher	-do-	

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Debub	Maimine	Berhiwa Amare	Teacher	-do-	
Debub	Maimine	Habtom Tadese	Teacher	-do-	
Debub	Maimine	Michael Ghebreyonas	Teacher	-do-	
Debub	Maimine	Sisay Tekile	Teacher	-do-	
Debub	Maimine	Youhanes Medhaniye	Teacher	-do-	
Debub	Mendefera	Efrem Asfha	Teacher	Tadese Haile	Town Water Supply
Debub	Mendefera	Estifanos Brhane	Teacher	-do-	Town Water Supply
Debub	Mendefera	Ghebremichael Embaye	Teacher	-do-	Town Water Supply
Debub	Mendefera	Mihreteab Tikabo	University Student	-do-	Town Water Supply
Debub	Mendefera	Zeriaburuk Ayinialem		-do-	Town Water Supply
Debub	Segheneiti	Saba Haile	Student	Kidane Woldetinsae	S-Z Admin. Staff
Debub	Segheneiti	Salih Mohammed Said	Student	-do-	S-Z Admin. Staff
Debub	Segheneiti	Teklemichael Tesfai	Teacher	-do-	S-Z Admin. Staff
Debub	Segheneiti	Tesfamichael Hagos	University Student	-do-	S-Z Admin. Staff
Debub	Segheneiti	Zeriemaraiam Tuemezgi	University Student	-do-	S-Z Admin. Staff
Debub	Senafe	Abraham Weledemichael	Teacher	Idris Hasen	S-Z Admin. Staff
Debub	Senafe	Angosom Amare	University Student	-do-	S-Z Admin. Staff
Debub	Senafe	Daniel Tesfamichael	Teacher	-do-	S-Z Admin. Staff
Debub	Senafe	Esmael Ali Mohammed	University Student	-do-	S-Z Admin. Staff
Debub	Senafe	Jamih Mohammed	University Student	-do-	S-Z Admin. Staff
Debub	Senafe	Mahdi Ibrahim	Teacher	-do-	S-Z Admin. Staff
Debub	Senafe	Mulubrhan Gezae	University Student	-do-	S-Z Admin. Staff
Debub	Senafe	Nugusse Siltan	University Student	-do-	S-Z Admin. Staff
Debub	Senafe	Solomun Berhane	Teacher	-do-	S-Z Admin. Staff
Debub	Tsorena	Amaniuel Desbele	Teacher	Woldu Medhane	S-Z Admin. Staff
Debub	Tsorena	Debas Mebrahtom	Teacher	-do-	S-Z Admin. Staff
Debub	Tsorena	Kahsay Teumzigi	Student	-do-	S-Z Admin. Staff
Debub	Tsorena	Mihretb Fishaye	Student	-do-	S-Z Admin. Staff
Debub	Tsorena	Osman Abdela	Teacher	-do-	S-Z Admin. Staff
Debub	Tsorena	Semere Kahse	Administraion	-do-	S-Z Admin. Staff
Debub	Tsorena	Shumay Tesfay	Teacher	-do-	S-Z Admin. Staff
Debub	Tsorena	Siele Negash	Administraion	-do-	S-Z Admin. Staff
Gashbarka	Agordat	Hellen Yohannes		Tesfay Andemichael	
Gashbarka	Agordat	Osman Mehammed		-do-	
Gashbarka	Agordat	Adem Osman		Abrehaley Tesfamichael	
Gashbarka	Agordat	Musse Abdela		-do-	
Gashbarka	Barentu	Kesetebirhan Mekonnen		Yonas Gebre	
Gashbarka	Dighe	Kidane Musse		Tewolde Mehari	
Gashbarka	Dighe	Hammid ShekAli		-do-	
Gashbarka	Dighe	Woldegebriel Belew		-do-	
Gashbarka	Dighe	Teklezgi Tsegay		-do-	
Gashbarka	Dighe	Esmael Adem		Mohammed Edris	
Gashbarka	Dighe	Selamawit Marga		-do-	

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Gashbarka	Dighe	Yonas Aderob		-do-	
Gashbarka	Dighe	Abdurahman Abdulahi		-do-	
Gashbarka	Fortosawa	Medhane Andemeskel		Tewoldemedhin Gebremedhin	
Gashbarka	Fortosawa	Elias Jemal		-do-	
Gashbarka	Fortosawa	Semere Berhe		-do-	
Gashbarka	Fortosawa	Hagos Gebrezgiabhier		-do-	
Gashbarka	Fortosawa	Yemane Kidane		-do-	
Gashbarka	Fortosawa	Kifle Tesfamariam		-do-	
Gashbarka	Fortosawa	Gidey Kiflay		-do-	
Gashbarka	Fortosawa	Dawit Manna		-do-	
Gashbarka	Gogne	Abdurahman Mussa	Ministry of Health	Abubeker Mehammed	Other
Gashbarka	Gogne	Abubeker Mehammed	Other	-do-	
Gashbarka	Gogne	Jemati Ali	Agriculture	-do-	
Gashbarka	Gogne	Mikea Tekle	Other	-do-	
Gashbarka	Gogne	Fikadu Habtemichael	Other	Nassir Edris	Other
Gashbarka	Gogne	Nassir Edris	Other	-do-	
Gashbarka	Gogne	Niamin	Education	-do-	
Gashbarka	Gogne	Russom Okbazghi	Other	-do-	
Gashbarka	Goluj	Debretsion Tsighe	Other	Kiflom Andom	Other
Gashbarka	Goluj	Hassen Shenkay	Other	-do-	
Gashbarka	Goluj	Hummed Osman	Other	-do-	
Gashbarka	Goluj	Kiflom Andom	Other	-do-	
Gashbarka	Goluj	Okbazghi Okbatsion	Other	-do-	
Gashbarka	Goluj	Beyene Gebremariam	Other	Shimwele Woldegergish	Other
Gashbarka	Goluj	Merhawi Essay	Other	-do-	
Gashbarka	Goluj	Shimwele Woldegergish	Other	-do-	
Gashbarka	Goluj	Sultan Seyoum	Other	-do-	
Gashbarka	Haikota	Akberom Teklay	Other	Akberom Teklay	Other
Gashbarka	Haikota	Ali Salih	Other	-do-	
Gashbarka	Haikota	Awot Gebrehiwot	Other	-do-	
Gashbarka	Haikota	Hisabu Gebrehiwot	Other	-do-	
Gashbarka	Haikota	Yassin Ibrahim	Other	-do-	
Gashbarka	Haikota	Hiriyti Woldu	Other	Yikaalo Fissehaye	Other
Gashbarka	Haikota	Shishay Tesfamichael	Other	-do-	
Gashbarka	Haikota	Yikaalo Fissehaye	Other	-do-	
Gashbarka	Lalay Gash	Gebriel Tsegai		Desale	
Gashbarka	Lalay Gash	Yohannes Melake		-do-	
Gashbarka	Lalay Gash	Andom Tsegay		-do-	
Gashbarka	Lalay Gash	Birhane Bahta		-do-	
Gashbarka	Lalay Gash	Yonas Gebreab		-do-	
Gashbarka	Lalay Gash	Kebedom Fikadu		Debesay	
Gashbarka	Lalay Gash	Merhawi Gebremedhin		-do-	
Gashbarka	Lalay Gash	Efriem Hidray		-do-	
Gashbarka	Lalay Gash	Yohannes Arefayne		-do-	

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Gashbarka	Logoanseba	Bayru Kidane	Other	Negede Teferi	Other
Gashbarka	Logoanseba	Birhane Wolday	Other	-do-	
Gashbarka	Logoanseba	Negede Teferi	Other	-do-	
Gashbarka	Logoanseba	Teklezghi Okbab	Other	-do-	
Gashbarka	Logoanseba	Tewolde Tesfay	Other	-do-	
Gashbarka	Mensura	Girmay Habte	Administraion	Mesfin Gebretinsae	Other
Gashbarka	Mensura	Mesfin Gebretinsae	Other	-do-	Other
Gashbarka	Mensura	Tesfasillase Gebresillase	Administraion	-do-	Other
Gashbarka	Mensura	Mehammed Salih	Administraion	-do-	Other
Gashbarka	Mensura	Tesfalem Abraham	Administraion	-do-	Other
Gashbarka	Mensura	Tiabe Zeru	Other	-do-	Other
Gashbarka	Mogolo	Dawit Mihreteab	Finance	Dini Alihaji	Other
Gashbarka	Mogolo	Hadish Yohannes	Operator	-do-	
Gashbarka	Mogolo	Mehammed Ismaiel	Ministry of Health	-do-	
Gashbarka	Mogolo	Ruta Gebremeskel	Student	-do-	
Gashbarka	Mulki	Asmerom Gide	Other	Haile Tesfamariam	Other
Gashbarka	Mulki	Haile Tesfamariam	Other	-do-	
Gashbarka	Mulki	Woldu Habte	Other	-do-	
Gashbarka	Mulki	Asmerom Tewolde	Other	Kifle Sibhatu	Other
Gashbarka	Mulki	Hadish Gebrehiwot	Other	-do-	
Gashbarka	Mulki	Kifle Sibhatu	Other	-do-	
Gashbarka	Mulki	Luqa Agostino	Other	-do-	
Gashbarka	Shambiko	Emhatsien Teklebirhan	Other	Habte Mihreteab	Other
Gashbarka	Shambiko	Habte Mihreteab	Other	-do-	
Gashbarka	Shambiko	Kelifa Beku	Other	-do-	
Gashbarka	Shambiko	Russom Seyoum	Other	-do-	
Gashbarka	Tesenei	Habtemichael Abraham	Other	Dini Tsadwa	Other
Gashbarka	Tesenei	Kidane Gebremichael	Other	-do-	
Gashbarka	Tesenei	Yonas Habte	Other	-do-	
Maekel	Berik	Tomas Teweldemedhin	Student	Brhane	SZ Admi Member
Maekel	Berik	Tesfalem Bereket	Student	Ermias Mihretab	Univ. student
Maekel	Berik	Tesfalem Merhatsion	Student	-do-	
Maekel	Berik	Yosief Tesfaldet	Student	-do-	
Maekel	Berik	Youhans Issak	Student	-do-	
Maekel	Galanefhi	Amanuel Issac	Student	Mehari Tesfamariam	Teacher
Maekel	Galanefhi	Daniel Ghile	Student	-do-	
Maekel	Galanefhi	Ghirmay Ghebru	Student	-do-	
Maekel	Galanefhi	Issak Beyene	Student	-do-	
Maekel	Galanefhi	Mihreteab Tesfamichael	Student	Suleman Yosuf	SZ Admi Member
Maekel	Galanefhi	Tekie Tesfamicheal	Student	-do-	
Maekel	Galanefhi	Zerit Yemane	Student	-do-	
Maekel	Serejeka	Eyob Ghebrekidan	Student	Brhane	SZ Admi Member
Maekel	Serejeka	Semhar Fitsum	Student	-do-	

Zoba	Sub Zoba	Animator's Name	Animator's Occupation	Sub-Zoba Supervisor's Name	S Zoba Supv. Occupation
Maekel	Serejeka	Tedros Ghebrezighi	Student	-do-	
Maekel	Serejeka	Tomas Teweldemedhin	Student	-do-	
Maekel	Serejeka	Tomas Teweldemedhn	Student	-do-	
Maekel	Serejeka	Abrehet Efrem	Secretary	Tinsaew Zereselassie	Univ. student
Maekel	Serejeka	Alem Fikadu	Student	-do-	
Maekel	Serejeka	Aster Ezra	Student	-do-	
Maekel	Serejeka	Dirar Ghebrehiwet	Student	-do-	
NRS	Adobha				
NRS	Afabet				
NRS	Foro				
NRS	Ghelalo				
NRS	Ghinda				
NRS	Karura				
NRS	Massawa				
NRS	Nakfa				
NRS	Shieb				
NRS	Shieb				
SRS	Araata	Ali Abubeker	Teacher	Mussie Ghirmay	S-Z Admin. Staff
SRS	Araata	Amanuel Gebre	Student	Resom T/mariam	Water Sanitaton Head
SRS	Aseb	Filmon Temesgen	Student	-do-	
SRS	Ddkbahri	Mohammed Idris Ali	Teacher	Ali Nure Ali	Teacher
SRS	Ddkbahri	Efrem Yemane	Student	Resom T/mariam	Water Sanitaton Head
SRS	Ddkbahri	Filmon Temesgen	Student	-do-	
SRS	Mdkbahri	Derder Ahmed Mohamed	Teacher	Mohammed Aliseid	Teacher
SRS	Mdkbahri	Efrem Yemane	Student	Resom T/mariam	Water Sanitation Head

Annex 1.03 Data Fields

Data fields

Table: AdditionalInfo_tbl

Field Name	Type	Size
ai_Id	Long Integer	4
ai_Ad_Id	Long Integer	4
ai_Animator	Text	50
ai_AOccupation	Text	20
ai_Code	Long Integer	4
ai_Date	Date/Time	8
ai_ZobaSupervisor	Text	50
ai_ZSOccupation	Text	20
ai_SubZobaSupervisor	Text	50
ai_SZSOccupation	Text	20
ai_QuestStatus	Text	4
ai_QuestCC	Text	3

Table: Consumption_tbl

Field Name	Type	Size
fm_Id	Long Integer	4
fm_Ad_ID	Long Integer	4
fm_HhdHead	Text	50
fm_HeadGender	Text	15
fm_HhdSize	Long Integer	4
fm_PWSource	Long Integer	4
fm_WTruck	Long Integer	4
fm_UPWSource	Long Integer	4

Table: ProtectedWS_tbl

Field Name	Type	Size
pws_Id	Long Integer	4
pws_Ad_Id	Long Integer	4
pws_WPType	Text	50
pws_ConstructionDate	Date/Time	8
pws_Type	Text	2
pws_Duration	Text	15
pws_Storage	Text	3
pws_PumpFunct	Text	3
pws_NFWhen	Date/Time	8
pws_LRepaired	Date/Time	8
pws_RepairCost	Currency	8
pws_Reliable	Text	3
pws_RegularlyUsed	Text	3
pws_H2STest	Text	15

Table: QuestInfo_tbl

Field Name	Type	Size
qi_Id	Long Integer	4
qi_Ad_Id	Long Integer	4
qi_Interv	Text	50
qi_Responsibility	Text	50

Table: UnprotectedWS_tbl

Field Name	Type	Size
upws_Id	Long Integer	4
upws_Ad_Id	Long Integer	4
upws_WPType	Text	30
upws_Duration	Text	12

Table: UnprotectedWS_tbl (Contd.)

Field Name	Type	Size
upws_Drinking	Text	3
upws_OtherPurpose	Text	3
upws_Distance	Single	4
upws_Reliable	Text	3
upws_RegularlyUsed	Text	3
upws_DateNUsed	Date/Time	8
upws_Remarks	Text	50

Table: VillageInfo_tbl

Field Name	Type	Size
vi_Id	Long Integer	4
vi_PlaceCodeId	Long Integer	4
vi_Listed	Text	3
vi_Visited	Text	3
vi_QuestData	Text	20
vi_NDReason	Text	50
vi_Population	Long Integer	4
vi_PopGroup	Text	50
vi_VillClass	Text	50
vi_TotFamilies	Long Integer	4
vi_IDP	Text	3
vi_Distance	Single	4
vi_School	Text	3
vi_SGetWater	Text	3
vi_HealthC	Text	3
vi_HCGetWater	Text	3
vi_Mosque	Text	3
vi_MGetWater	Text	3
vi_Church	Text	3
vi_ChGetWater	Text	3
vi_Other	Text	3
vi_OGetWater	Text	3
vi_PFlush	Long Integer	4
vi_VIP	Long Integer	4
vi_Pit	Long Integer	4
vi_Public	Long Integer	4
vi_OpenPit	Long Integer	4
wc_WASHAvail	Text	3
wc_WTariffSys	Text	3
wc_WTariffType	Text	25
wc_Exempted	Text	3
wc_WhyExempted	Text	25
wc_BankAccount	Text	3
wc_Balance	Currency	8
wc_DateIssued	Date/Time	8
wc_FundKept	Text	50
wc_Amount	Long Integer	4
wc_WGuard	Text	3
wc_TCollector	Text	3
wc_MOperator	Text	3
wc_BarrelAmount	Single	4
wc_BarrelCharge	Currency	8
wc_JrycanAmount	Single	4
wc_JrycanCharge	Currency	8
wc_JirbaAmount	Single	4
wc_JirbaCharge	Currency	8
wc_OtherAmount	Single	4
wc_OtherCharge	Currency	8

Table: WSMaintain_tbl

Field Name	Type	Size
wsm_Id	Long Integer	4
wsm_Ad_Id	Long Integer	4
wsm_MaintainType	Text	50
wsm_WhoRepair	Text	50
wsm_SpareParts	Text	50
wsm_WhoPays	Text	50

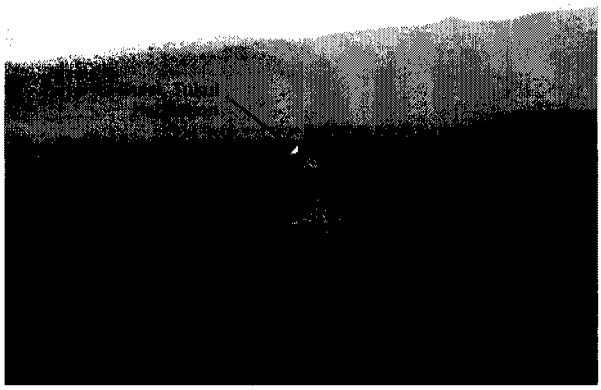
Table: WTrucking_tbl

Field Name	Type	Size
wt_Id	Long Integer	4
wt_Ad_Id	Long Integer	4
wt_FullyDepend	Text	3
wt_Duration	Long Integer	4
wt_Trips	Long Integer	4
wt_Capacity	Long Integer	4
wt_Distance	Single	4
wt_JerrycanTariff	Single	4
wt_BarrelTariff	Single	4
wt_TruckTariff	Single	4
wt_TruckFrom	Text	25
wt_Paid	Text	15
wt_H2STest	Text	15

Annex 1.04 Case Studies

Field visit to Gueli, Zoba Maekel for Rapid Assessment, 4 Aug. 2005

We traveled to Gueli, a village about 30 Km from Asmara, 20 Km on the Asmara- Massawa main road and then off the highway, northward, deep in the valley. Because of the recent rains, the seasonal road had been washed away at places and eventually, we had to leave the vehicles about 3 Km from the village and walk the rest of the way.



The main village is situated across a river bed, about 200 m uphill. The village's only water source is a shallow hand-dug well, with a concrete apron and a steel manhole opening.

A group of women and children were collecting water from the well and we stopped to talk with them. One of the women said that she made three trips a day to the well, for her family of four (husband and two small children). She carried a 20 lit. Jerry can to her back, had a 5 lit. container in her hand and her small daughter also carried 10 litres. Hence, the family drew about 160 to 180 litres per day. For washing, she did not come to the water source, but carried a donkey-bladder (Jirba) of water to her home.

The water source

The family returning from the well

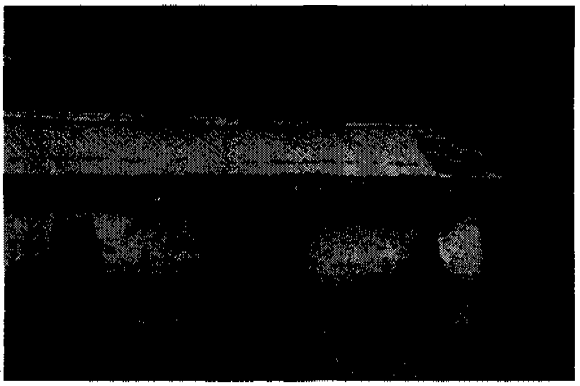
The well was just off the river bed, with the apron about 1.5 m above the river bed. It was about 3 m deep, with a manhole with a steel cover. The well was constructed by the government about 5 years ago. The water in the well was clear and there was some floating debris and a small wooden log in the water. The water lifting practice was to lower a small (5 lit) jerry can at the end of a rope through the manhole to draw water and fill larger (20 lit) containers. Hence, there is a good possibility of bacterial contamination in the water, even though the source could be called protected.

On the way to the village, there were agricultural lands with maize and guava trees and there was evidence of irrigation wells along the lands close to the river course. Higher up, the village had houses along the rising slopes of the hillside. The community was dominantly Muslim.

Roof water harvesting

A number of households showed crude roof water harvesting systems with gutters made from scrap metal sheet and a variety of collection containers including 200 litre lubricant barrels. One household said that they used the roof water exclusively for washing, since it lathered well. A woman from another household said that they drank the roof water.

We met with the village administrator. The interviews for the village information were conducted by an Animator, a student from Asmara. Apart from the administrator, a middle aged woman, who appeared to enjoy a position of respect, also participated in the discussions.



The village Gulei comprised of five habitations – Tukul (which was the main habitation, with 90 households and a population of 380 people, where we met the village administrator), Kokah, Tsebetat, Shikot, and Maerebeke. The other habitations of Gulei were spread along the river course, upstream from Tukul. It appears that this kind of a habitation pattern is unusual. The Animator collected information of the other habitations from the administrator and the lady respondent.

As we proceeded with the questionnaire, it was quite obvious that the nature of the water source effectively dictated the circumstances of the villages WatSan organisation.

Completing the Questionnaire

Since the village was dependent on one well and since every household fetched their own water, there was no formal WASH Committee, no single person was designated Tariff Collector, there was no formal tariff collection method and no organised O&M system. Despite this apparent lack of a community level watsan organisation, the habitation periodically

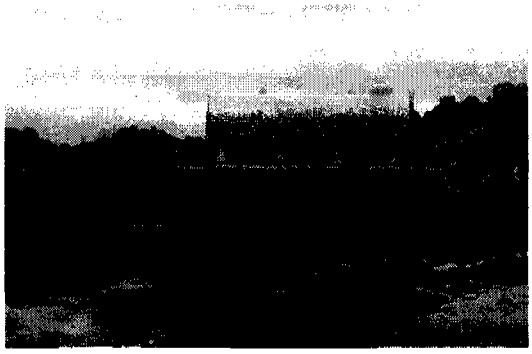
cleaned out its well and made minor repairs to the apron, etc. and did this by door to door collection of funds. Again, although the habitation was remote, small, and lacked basic infrastructure like a school, electricity, its mosque was unfinished, it apparently had a reasonable level of economic activity because there was some irrigated farming, horticulture and there was a constant traffic of donkeys carrying "belles" (cactus fruit) from the village.

Field visit to Awlietseru and Gurae villages, Sub Zoba Dekemhare, Zoba Debub for Rapid Assessment, 9 Aug. 2005

The town of Dekemhare is about 40 Km, one hour's drive, south of Asmara. Tesfaye, the Head of Water Supply for Dekemhare town, is the Sub-Zoba supervisor of the Rapid Assessment. 5 teachers had been trained as animators for the Assessment and had been assigned 5 villages each. We visited two villages, Awlietseru and Gurae.

Awlietseru

Coming from Asmara, this village is on a branch road to the west, 2 Km off the main road, about 3 Km before Dekemhare. We were met by Tsigheweini Fishatsion. She has been the Village Administrator for 10 years now.



Tsigheweini Fishatsion (top left)

Elevated Reservoir (top right)

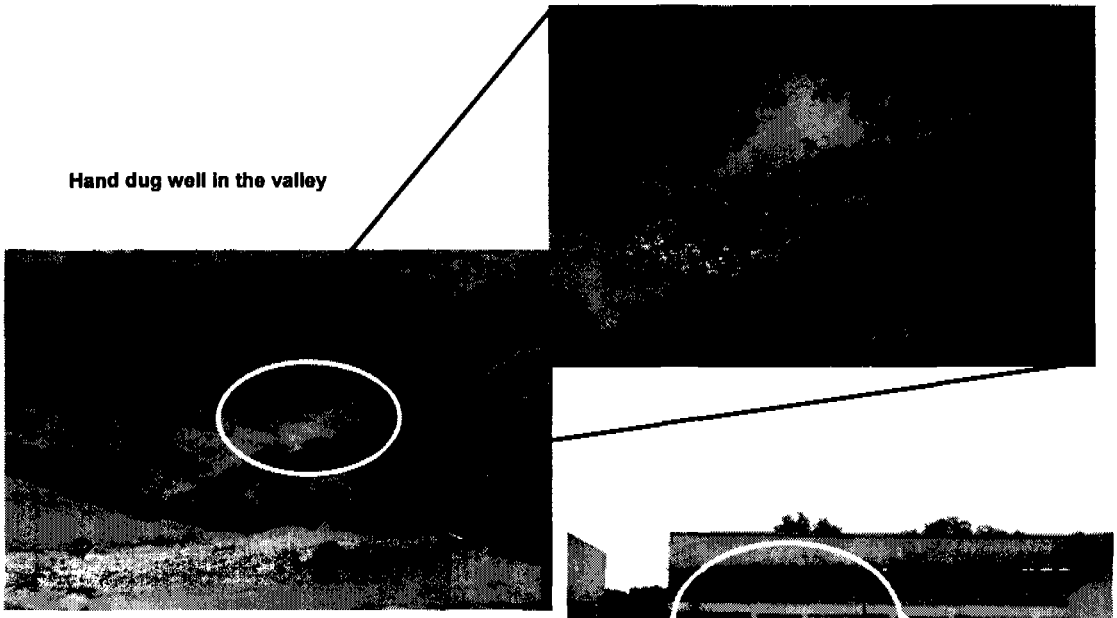
Locked Hand pump (right)

The water supply situation of the village is not very good. Missionaries had attempted to build a water supply system for the village. A well was drilled in October 1992 and turned out to be low yielding. An elevated steel tank of approximately 20,000 litres capacity, along with an incomplete multiple tap stand, built by the missionaries, lies idle. A second bore well has also been drilled recently and that has also failed.

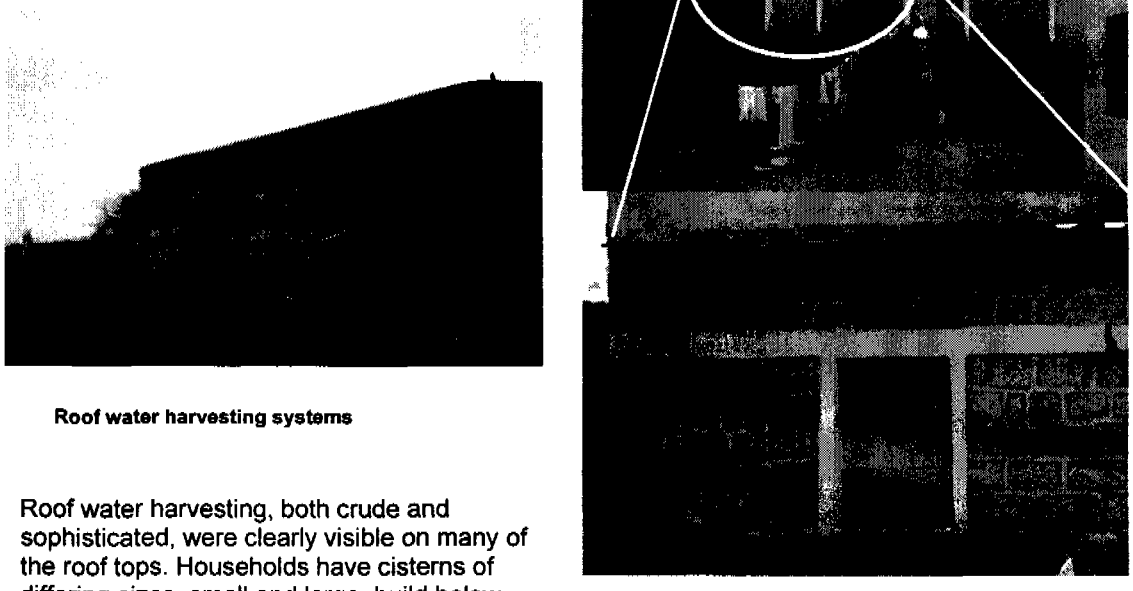
The first bore well now has an India Mark II hand pump, also installed in 1992, by WRD. The hand pump broke down 7 years ago. With great difficulty, the dropped pipes and rods were recovered. Since then, the hand pump has a guard, is kept locked, and has not needed any repairs. During the day, the pump is open to use from 7 am to 5 pm. However, the water in the pump gradually depletes during the day. Users are charged 10 cents per Jerry can (20 lit) and the daily collection ranges from 20 to 30 Nkf per day.

The village also gets water from the Dekemhare town, which has two water supply trucks. The town water supply truck comes to Awlietseru once a week, bringing 14,000 litres for which users have to pay 1.50 Nkf for a 200 litres' barrel. When the town water truck is not available, then the villagers get a private water truck, which collects between 16 to 20 Nkf. per barrel, depending upon the season and the need.

The only reliable water source for the village, which is used as a last resort, is an unprotected hand dug well, about 3 Km away, at the base of a steep hill side.



Hand dug well in the valley



Roof water harvesting systems

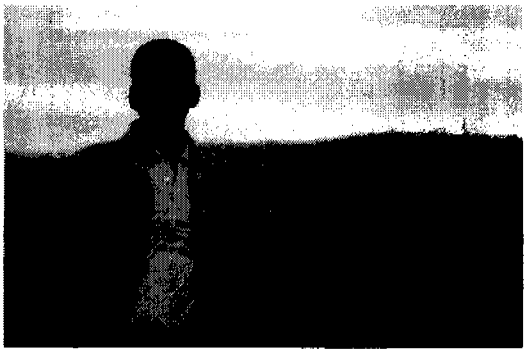
Roof water harvesting, both crude and sophisticated, were clearly visible on many of the roof tops. Households have cisterns of differing sizes, small and large, build below ground and above ground. We visited one household which had a very good system that was functional. It had a good galvanised gutter on the full lower edge of the roof, a proper down pipe, leading to a large ground level covered reservoir of 12,000 to 15,000 litres capacity. The family consisted of 9 members. The roof water was used for both drinking and washing. The reservoir was cleaned regularly at the start of the rainy season. Drinking water from the reservoir was chlorinated. The rain water lasts the family roughly up to May. Once the rains have stopped, the drinking water needs of the family are supplemented by 3 to 4 jerry cans of water from the hand pump. The rains in this area are in July and August only.

It had rained on the day of our visit, and though it was only 11 in the morning, the hand pump was locked. Because of the rain, most households had collected their daily water need from the rain and there was no demand for water on pump that day.

The village derives income from selling sand and from quarrying granite. It has a WASH committee and a school. The school has a toilet for the children, built by MoE with UNICEF assistance.

Gurae

Gurae is about 5 Km from Dekemhare, east of the town. It has a population of 1500, with a number of houses that are not occupied, built by people who had their origins in this village. By local standards, Gurae is a large village in this sub-Zoba. We were met by the village Administrator, Kidane Gebru, a relatively young man, and another much older Water Committee member. Later, when we were looking at the water source, we were joined by the water guard, Kudusan Gebresalassie, a middle aged woman. Some of the private houses had latrines, but this was not common.



Kidane Gebru and a Committer member

Kudusan Gebresalassie

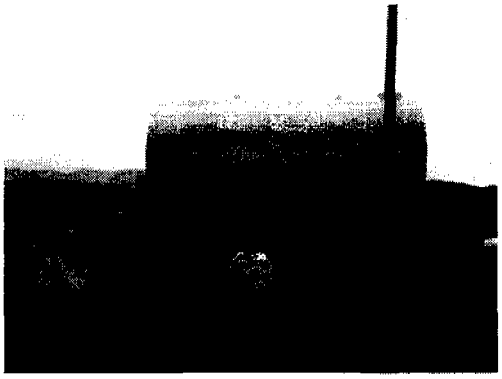
Like in the case of Awlietseru, the water supply system in Gurae was also built by missionaries. The source was a bore well, drilled 38 m deep, in the agricultural area behind the village administration office, with a submersible pump that fed an elevated steel reservoir, about 300 m from the source well, at the base of a hill, which had a church on top. There was a multiple tap stand post near the steel reservoir. A centrifugal pump, at the base of the steel reservoir, delivered water to a concrete reservoir of about 35,000 litres, constructed high on the hill, adjacent to the church. This reservoir fed the four other multiple tap stand posts around the village by gravity. The submersible pump at the source filled the steel reservoir in two hours of pumping. The concrete reservoir was filled once in two days. The stand posts were operated during 6 to 11 in the morning and 3 to 6 in the evening. The tariff from the stand posts was 20 cents per jerry can (20 litres) or 50 cents per "jirba" (a bladder made from truck tubes, with a capacity of about 3 jerry cans, carried by a donkey).

The concrete reservoir built on the hill near the church was from the villages own funds, built by giving the work out on contract. The reservoir shows small leakages on its sides.

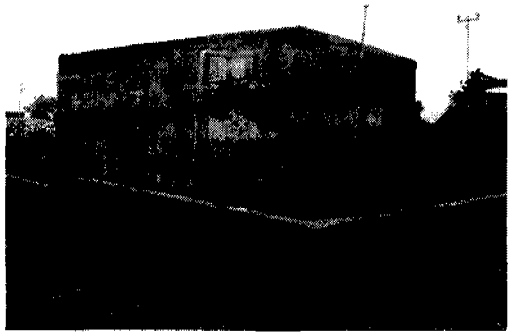
The water supply system was built 4 years ago. It has not needed any major attention, except for frequent replacement of taps (cheap Chinese taps, we were told) at the stand posts. Repairs were carried out by mechanics who were called from Dekemhare.

Before the construction of this water supply system, the village was dependent on a small but perennial stream, close to the village. The village has a kindergarten (built by the same missionaries), a schools up to the middle school level. A health clinic had been constructed by an individual in the village, but had never functioned.

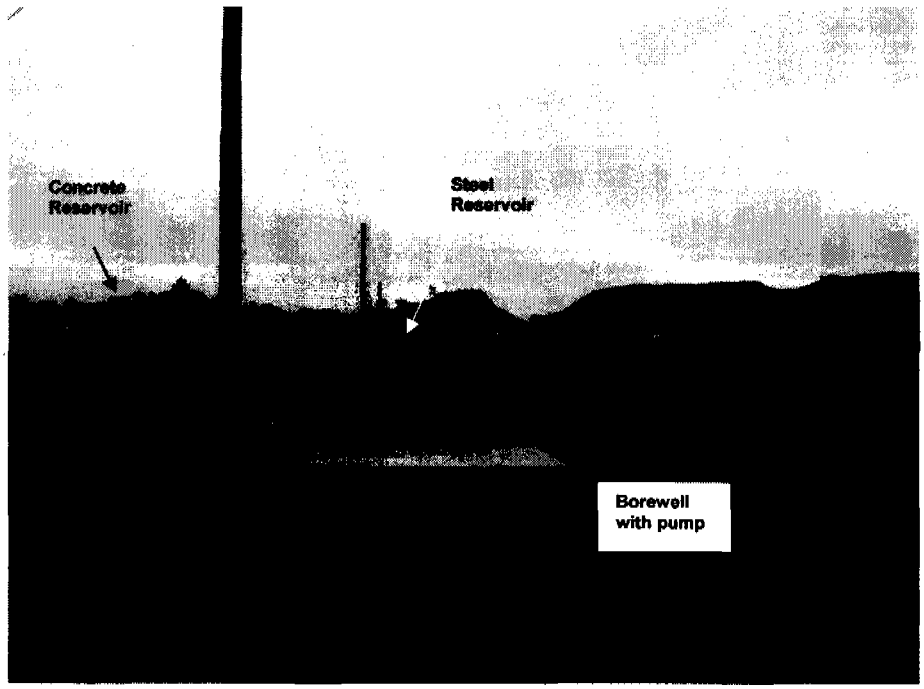
The income from the water tariff is banked in the village's common bank account which is administered by a village development committee. The electricity charges for the pumps, amounting about 1500 Nkf per month and other expenses for operating the water supply system, comes from this account. The village enjoys a very good financial position by auctioning its sand mining rights of 3 streams in the village for about 100,000 Nkf per year. The village purchases the mining rights from the Deptt. of Mines, pays about 25% taxes on the annual bid value.



Steel Reservoir



Concrete Reservoir



Gurae's water supply system