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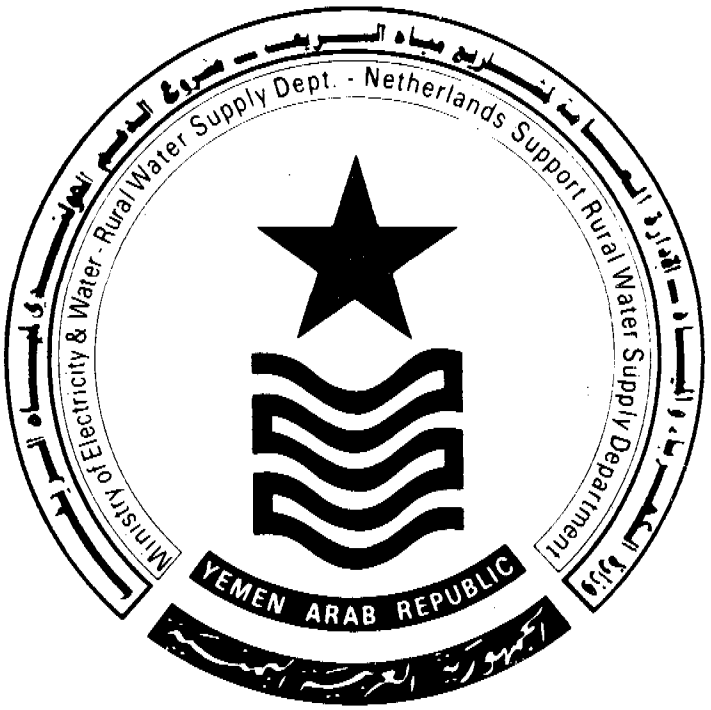

SUPPORT RURAL WATER SUPPLY
DEPARTMENT PROJECT

AN INVENTORY OF WATERSUPPLY AND SANITATION SCHEMES CONSTRUCTED BY SUPPORT RURAL WATER SUPPLY DEPARTMENT PROJECT

Draft

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CONTENTS

ANNEXES:

A: Watersupply schemes SRWSD project Dhamar.
B: Villages in general.
C: Summary of the SRWSD water supply schemes.
D: Costs of the schemes.
E: Contributions.
F: Watersources.
G: Reservoirs.
H: Pumping main and distribution system.
I: Public taps, cattle troughs.
J: Houseconnections.
K: Pumps and engines.
L: Pump and engine, the pumpoperator.
M: Organisation of the schemes.
N: Financial aspects of the schemes.
O: Watersources in the past, use of the waterscheme.
P: Watersources at present.
Q: Storage of water and sanitation.
R: Problems with the SRWSD water supply schemes.

S: Activities for watersupply of health centres/units.
T: Villages with small watersupplies (DHP).
U: Sanitation Projects (SAP).

V: Map with locations watersupply schemes SRWSD-project Dhamar.
W: ResultS of chemical wateranalyses.
X: Questionaire.

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Abbreviations

DHP	:	Dhamar Health Project
DRHP	:	Dhamar Rural Health Project
DPP	:	Dhamar Province Project
DRP	:	Dhamar Rada Project
HE	:	Health Education
HOD	:	Health office Dhamar
IWP	:	Integrated Water Project
LCD	:	Liter per Capita per Day
MAS	:	Masonry
NTF	:	New TransCentury Foundation
RC	:	Reinforced Concrete
RWP	:	Rural Water Project
RIRDP	:	Rada' Integrated Rural Development Project
RWSD	:	Rural Water Supply Department
SAP	:	Sanitation Project
SNV	:	Netherlands Development Organisation
SRWSD	:	Support Rural Water Supply Department Project
TIP	:	Tihama Project
WSP	:	Water Supply Project
YR	:	Yemen Riyal

1 INTRODUCTION

1.1 General

The "Support Rural Water Supply Department Project' (SRWSD) started in February 1983 with technical assistance to strengthen the Rural Water Supply Department. This resulted in the implementation of about 50 village water supply schemes and 36 sanitation facilities in the areas around Dhamar and Rada. At present the project is already in phase III and decisions about a possible new phase IV should be taken before the end of 1990. Up till now a systematic evaluation about functioning and use of the completed schemes has never been done. The monitoring mission of March 1989 recommended to carry out a investigation in order to gather information for the planning and implementation of future activities in water supply and sanitation.

The objectives of this investigation are:
- To provide RWSD/SRWSD/DGIS with an overview of the functioning of the water supply and sanitation systems completed under SRWSD and of the use made of these systems.
- To provide RWSD/SRWSD/DGIS with practical recommendations for the planning and implementation of future water supply and sanitation project activities.

Specific points of attention are:
- present state of civil and mechanical works;
- functioning of the systems;
- use and users of the systems;
- benefits of the new systems as perceived by the users;
- need for training in operation and maintenance of the systems at village level;
- need for government support and regulations to safeguard future functioning and use of the systems;
- selection criteria for village projects;
- possible ways to improve the efficiency and effectiveness of future water supply and sanitation systems.

It was planned to have this study carried out by one technical and one social professional with active involvement of the Yemeni authorities and SRWSD project staff. The last two points were fullfilled but the involvement of the social professional didn't take place due to problems in the recruitment procedure by the embassy in Sana'a.

This report gives the results of the study done in the period February 5 till April 25, 1990. The study was carried out by Mr Aart van der Horst (sanitary engineer RIRDP) and Mr Sammy Abu Bakr (civil engineer RWSD Sana'a) with assistance of Mrs Sylvia Bakker (ONV-Sana'a) and Mrs Erica Zwart (SRWSD-Dhamar). The team was almost always accompanied by a female facilitator and a male translator.

For this study a total of 42 water supply schemes with the related sanitation facilities have been visited. Additional information about the schemes have been collected from the staff of the SRWSD project.

A description of each scheme with the related sanitation and health education activities is given in chapter 10. This report gives a summary, but it is useful to read some of these desriptions in order to get an impression of the big differences between schemes of the different phases of the SRWSD project.
The information per item like costs of the schemes, prices of the water and condition of the civil works is gathered in the tables in the annexes A till R.
Annex V gives a map with the locations of the visited schemes.
Tables with the results of the chemical wateranalyses of the schemes are given in annex W.

1.2 Methodology.

The first two weeks of the mission were spent in the office in order to collect information from the project files. This information was gathered in a summary per village which mentioned the constructed items, the costs and information around the implementation. It also included the extensions, additions and improvements of each scheme. Collecting the information from the files was boring, but seemed to be very useful in the field.
After this, each day an average of two schemes was visited with a team of at least two man and a woman. In each village we introduced ourselves to the village leaders, explained the purpose of our monitoring visit and inquired about the operator of the pump. We also asked permission for the ladies of the mission to visit the houses.
In each village we talked with villagers and the pumpoperator and visited together the pump and engine, the reservoir and the main distribution lines with the public taps and houseconnections.
In the mean time the women visited a minimum of 6 houses and collected information about the use of the scheme, the price of the water and the storage of the water near the houses. They also asked about wastewater, toilets and health related subjects. In almost all cases we met each other after 1 or 2 hours and exchanged the information. In general we got the same information, only in a few cases we had to check again and ask more specific questions.
Most of the information was gathered by open talks and the questionaire (see annex X) was only used as a guideline and checklist at the end. The people want to tell the whole story from the start till the end and are not so much interested in a systematic way of data collection by using a questionaire. Besides, information from open talks is much more usefull because the people feel more comfortable and relaxed.
The information from the villages was put in village descriptions, which were distributed to the relevant project staff for comments. After revision, the information was collected in the tables in the annexes and based upon that this report was written.

2 WATER SUPPLY ACTIVITIES

2.1 General

The SRWSD-project has a long list with 213 project numbers divided over 11 types of projects. This list can be summarized to:
- about 50 water supply schemes (annex A);
- 28 small water supply systems, mainly based on springs (annex T);
- 18 projects for watersupply to the health centres and units of the Health Office Dhamar and the Dhamar Rural Health Project(annex S);
- 36 sanitation projects at mosques, schools, etc. (annex U).

Table 1 gives a summary of the visited watersupply schemes which will be discussed hereafter.

2.2 Phase I: Dhamar Rada Projects.

In the years 1980-1982 the Netherlands government drilled 16 boreholes in the area around Dhamar and Rada. The SRWSD used 12 of these boreholes for the construction of water supply schemes for 13 villages. The other 4 schemes were cancelled from the programme because the borehole was dry (As Shaqqab), the borehole was handed over to the RWSD (Ad Darb) or the borehole was filled up with stones (Bayt As Sunbuli and Al Azzan).
The designs for the schemes were made by ILACO and included a pumphouse, a pumping main, a reinforced concrete groundreservoir (50 or 100 m^3), public taps and a cattle trough. In the designs the reservoirs were located at a place lower than the houses in order to avoid houseconnections with the aim to keep the waterconsumption low. The public taps and the cattle trough were built near the reservoir. During the construction, some villages requested to shift the reservoir to a higher location. The project accepted this requests on condition that the villagers would contribute 50% of the extra costs for the pipes and the necassary heavier pump what was only done by two villages (Sirm al Banna and Jarf Isbil).
The twelve schemes were constructed by two contractors without any village contribution. Ten schemes have a shaft driven vertical pump with diesel engine installed by Sonidar Company from Sana'a.

The situation of the 12 schemes of phase I can be summarized as:
- 1 scheme was not completed because the people were not cooperative.
- 9 schemes are used for human consumption, 1 is only used for irrigation while 1 is abandoned because of the bad waterquality.
- From the 9 schemes used only 5 are working without big problems, 1 has problems with the water quantity, 2 with the water quality and 1 with the (not-project) pump.

None of these schemes has big problems with the organisation and the technical good schemes supply enough water for a flat rate of YR 2-5 per head per month.

Begrijp ik dat functioneren/use of systems dan't relate to origin?

* completed in phase III
Hanud never completed

actual or projected

Village name	Costs (YR) total	Costs (YR) per head	Inhabitants	Functioning	Problems (*)
Phase I					
1 Al Hususl	300,737	384	784	yes	some
2 Dafinah	272,815	279	977	yes	yes
3 Al Mayfa'ah	272,082	495	550	yes	some
4 Sama/Sufara	540,676	636	850	yes	no
5 Sirm al Banna	270,612	1,109	244	yes	no
6 Jarf Isbil	476,594	243	1959	no	-
7 Al Hajar	233,305	261	894	yes	no
8 Ar Rhawq	269,847	791	350	no	-
9 Al Garrar	210,936	1,055	200	yes	yes
10 Jawf al Nukabah	185,844	1,858	100	yes	yes
11 Hanakah al Masud	271,711	91	3000	no	-
12 Mawr	151,812	-	3000	no	-
Phase II					
13/14 Al Mihal/Joar	2,522,626	1,203	1750	yes	yes
15 Jebal al Ma'al	1,108,848	715	1350	yes	yes
16 Al Azan	615,500	264	2331	yes	no
*17 As Shaqqab	762,785	628	1215	no	-
18 Al Hajalah	1,177,515	3,317	355	yes	no
*19 Al Haruj	727,687	850	856	yes	yes
*20 Wastah	718,948	799	900	yes	yes
*21 Al Hasoon	838,706	749	1120	no	-
22 Hanud	186,002	-	1326	no	-
*23 Bidashy	832,956	1,129	738	no	-
*24 Bashar	832,980	1,157	720	yes	no
*25 Mangada	793,917	293	2713	yes	no
*26 Ar Raba'ah	809,947	901	899	yes	no
*27 Al Mithal	1,154,702	662	1744	no	-
*28 Adra'ah	1,466,710	474	3095	yes	no
*29 Dhi Sabil	130,011	262	496	no	-
*30 Dhafar	824,999	1,222	675	yes	yes
Phase III					
31 Sharafa	611,124	1,025	596	yes	no
32 Bayt as Shamy	544,831	1,816	300	yes	no
33 As Zuwab	744,331	886	840	yes	no
34 bani Muwallad	502,398	837	600	yes	no
35 Al Mashaa'hida	1,108,808	1,082	1025	yes	yes
36 Wathan	2,085,760	633	3297	yes	no
37/38 Al Saifer	253,129	625	405	yes	no
39 Al Miqdahah	641,711	2,292	280	yes	no
40 Magrabit al Anab	601,743	533	690	yes	yes
41 Bani Fallah	953,233	1,589	600	yes	no
42 Bani Zaydan	1,022,035	1,278	800	yes	no
Total YR	28,030,823	-	45,061	-	-

(*) problems only in the schemes that are functioning.

Table 1: summary of the visited SRWSD watersupply schemes.

3 without problems

6 without problems

5 with

6 non-func

RWS

close by

private

involvement of health office

IWP

AL HUSUL, Dhamar Rada Project 1, Sanitation Project 2.

This village (784 inhabitants) is located 17 kilometers (30 minutes driving) northeast of Dhamar at a hill in the Dhamar plain. Close to the village are a primary and secondary (3) school, there are electricity and telephone and the village is rich. There is no health unit and the people go to Dhamar for health services. The earthquake damage is big and the government built 40 new houses in the plain east of the village. The people don't want to live in the new houses because the distance to the old village is too big.
The scheme is working.

Water: There are private boreholes at a distance 15 minutes walking from the village. The ladies go there for washing clothes and blankets. When the people need a lot of water (wedding, building) they take water from these boreholes by car.
The amount of water of the scheme is limited and the water is mainly used for drinking, cooking and personal hygiene.

Waterscheme: In 1980 the Netherlands government drilled a borehole with a depth of 90 meter and a reasonable yield of good water of 2.7 l/sec. The well was drilled before the earthquake and the the yield of the well at the inlet of the reservoir was measured in March 1990 as 0.7 l/sec.
A contractor constructed a reservoir (100 m^3), a pumphouse, a pumping main, a cattle trough and 2 public fountains. A vertical pump with diesel engine was installed in February 1985. The scheme was completed in September 1985.
The village added a distribution system with houseconnections.

Contribution: distribution system.

Benefits: The amount of water in the borehole is limited and there is just enough water for drinking, cooking and personal hygiene. Water for cattle, washing and gardening should come from private boreholes.
The contractor made 10 public taps of which only one is in good condition. This tap is mainly used for filling the tank of the mosque. The cattle trough is used for washing clothes.
The houses lower than the reservoir made houseconnections without watermeters. The installation of watermeters was discussed but the result was that it would not be worth to spent money for watermeters while the amount of water is so small. Six houses are built at places higher than the reservoir and instead of houseconnections they made lines to metal tanks near the reservoir. The quality of the distribution system and the houseconnections is acceptable.
The price of the water is YR 3 per capita per month. There is only once every 4 days water in the village and the reservoir is emptied in circa 1 hour.
The estimated waterconsumption is 22 liter per capita per day. The estimated waterconsumption from the women information is only 15 liter per capita per day.

Organisation: Nobody asked for the scheme. The owner of the scheme is the village and there is an operator/cashier.

cannot be correct

Operation and maintenance: Every day the operator pumps 6 hours. Filling the reservoir takes 4 days.
Total amount of hours pumped is 1522, this means an average of 1 hour per day during four years. So there has been a long period that the scheme was not used. Nobody mentioned such a period.
The operator has experience with pumps from Saudi Arabia and there is no need for training.
The operator collects every month YR 1200. From this amount he spents YR 900 for diesel and YR 190 for oil. His salary is often not more than 200 riyals a month. The amount of people not paying is 100 (20%).
For repairs the people have to pay additonal money.

Inside the houses: All houses looked very clean. The women were complaining about the small amount of water. They all liked to show their houses and explained that the houses are much better since the men went to Saudi Arabia.
The watertanks without taps are situated outside the house and water is scooped out from the top. Small tanks inside the house are filled from the big tanks with jerry cans or tubes.
Some families have a garden which they water partly with wastewater or water from the the private boreholes (car).

Sanitation: Most houses have a baladih toilet. Wastewater goes to the back of the house and some houses made provisions for the disposal of wastewater. The houses are scattered and there are not many wastewater pools in the village.
The project constructed 2 toilets and a shower at the mosque. They are used, but not very clean.

Problems: The amount of water in the well is limited.

Not much about water use

Also no history maintenance only repairs

DAFINAH, Dhamar Rada Project 2.

The village (200 houses, 977 inhabitants) is located 12 kilometers west of Dhamar at the edge of the Dhamar plane. Driving to Dhamar takes 15 minutes. The village is wealthy and has a primary school with only boys. There is no health unit and the people can easily go to Dhamar for health services. The government built approximately 60 'earthquake houses', of which 90% is empty.

Water: In the past the village got water from a shallow well near the village (5 minutes) and a spring on a walking distance of 30 minutes.
The waterscheme gives a small amount of water and the ladies have to go with donkeys to one of the four private boreholes, 10 minutes from the village. The water from these boreholes is free. Clothes are washed near the boreholes.
The owners of a good borehole north of the village constructed pipes to the four mosques, their own houses and the house of the sjeich. They give the water free. Although there is a lot of water in this borehole, they don't agree to give water to private houses.

Waterscheme: The Netherlands government drilled a borehole(138 m deep) in 1982. A pumptest was carried out and the yield was less than 0.9 l/sec. The quality of the water was good. Another pumptest was recommended, but never carried out.
Despite the very low yield of the well, the contractor got instruction to construct a scheme with a reservoir (50 m³), a public fountain (8 taps) and a cattle trough at a low place inside the village. A vertical pump with diesel engine was installed in February 1985 and the scheme was completed in September 1985. In February 1987 the cattle trough and the public fountain were replaced by a bigger public fountain with 24 taps. The wastewater of this big public fountain drains to a large garden but it also causes dirty pools around the taps.

Contribution: no.

Benefits: Every four days there is water for approximately 1 hour. During that hour 60 ladies with their children gather around the public fountain and try to get as much water as possible. It is clear that this causes many problems and quarrels between the ladies. The distnace to the houses is maximum 800 meters.
The reservoir is located at a low place in the village and houseconnections are not possible. The low yield of the well makes it also not attractive to make houseconnections.
The price of the water is YR 3 per head per month. There is only once every 4 days water and the reservoir is emptied in circa 1 hour.
The estimated waterconsumption is 12 liter per capita per day.

Organisation: The initiative for the scheme was taken by the sjeich who requested the LCCD for assistance. The owner of the scheme is the village who appointed two years ago an immigrant of the village as scheme operator. Before there were about 10 other operators from inside the village. They all got big problems because the people were not satisfied with the amount of water. The present operator from outside has more trust from the villagers.

Operation and maintenance: The operator pumps three times a day 1 hour. After 4 days (12 hours pumping) the reservoir is full. This means that the yield of the well is 1.0 l/sec. Total amount of pumphours is 4039. This means an average of 2.9 hours a day during 46 months (53 months minus 7 months out of order).
The operator has experience with other pumps and seems to be able to carry out the necessary maintenance activities.
The total amount of money collected per month is YR 1200. The exenditures are: YR 550 for diesel, YR 100 for oil, YR 50 for filters etc. and YR 500 for salary of the operator.
The operator collects the money. He is illetarate and doesn't have an administration system. Only 400 people (41%) pay.
Repairs of the scheme are paid from additional collection from the people. Twice the pump broke down (2 and 5 months) and the villagers paid YR 50 per house for the repairs.

Inside the houses: The houses were acceptible clean, but some were dirty. Water is stored in small tanks in the houses and water is taken out from the top. Drinking water for the cattle is collected from the boreholes.
Only few houses have a small garden.

Sanitation: Almost all houses have a baladih toilet. Urine and faecal material go straight to the street causing a lot of nuisance in the village.

Problems: The limited amount of water.
Many people are not paying or using the scheme.

2.3 Phase II: Three new names of projects.

The projects of this phase (July 1985 till January 1988) will be discussed separately. All projects were constructed by contractors without considerable contributions of the villages. In this phase a start was made with the implementation of sanitary facilities at mosques, schools and health units.

Dhamar Province Projects.

Two schemes (Al Azan and As Shaqqab) were already in the programme of phase I, but due to problems with the boreholes not executed. The problems were solved and the schemes were built according to a revised design with the reservoirs at a higher location and more public taps scattered in the village. The scheme in Al Azan is in good condition, while the scheme in Shaqqab doesn't work due to big internal problems.

The two other projects were requested by the RWSD. The Joar project is a big scheme for 9 villages (2100 inhabitants) and includes three pumps and five reservoirs. The implementation of this scheme faced many difficulties because the borehole is located at land owned by only one of the villages. Due to technical shortcomings and problems with the organisation, the scheme was out of order for more than 1.5 years. Four months ago the main problems were solved and the scheme became operational. The level of service to the people is still rather low (only once a week water for YR 54 per house) and the technical problems are only solved temporarily.
The Jebal al Ma'al scheme covers 3 villages (1550 inhabitants) which are located far from each other. The scheme is controlled by the main village, while the other two villages have only once per month water.

Water Supply Projects.

The visited schemes (11) are constructed in villages which are affected by the earthquake of December 1982. In these villages the Yemeni government built a new village with 'eartquake' houses often including a mosque, a school and a watersupply scheme. The boreholes for these watersupply schemes were financed by an external donor while the SRWSD got the responsiblity to complete the civil works of the schemes. In general the schemes covered also the existing (old) village irrespective the fact if there was already a watersupply scheme. In some cases it would have been much easier and cheaper to connect the new villages to the schemes of the old villages instead of the other way round.
The schemes consist of a reservoir (on a high location or elevated) with public taps scattered in the village.
The situation of these schemes can be summarized as:
- 1 scheme not completed because of lack of interest of the village;
- 5 schemes are functioning well.
- 2 schemes are constructed well, but are not working due to internal problems which go beyond the influence of the project.
- 2 schemes have problems with the dieselengine, but it is not clear if this is truth or only a sign of internal disagreement.
- 1 scheme has difficulties because the waterqualty is bad.

Dhamar Health Projects.

Under this name, the SRWSD executed several activities with only in common the fact that they were in principle carried out in cooperation with the Dhamar Rural Health Project (DRHP).

One main group of activities is the watersupply for health centres and units of the Health Office Dhamar (HOD). It was impossible to visit all these projects and most information is collected from SRWSD staff. Annex S gives an overview of the present situation. Of the 17 centres, 9 have a good watersupply, 5 have problems with the pump or the watersource and 3 are not known. Moreover, another 8 units are included in the SRWSD water supply schemes for whole villages so the total amount of units with SRWSD watersupply is at least 17.

Another group of activities was the construction of several small water supply systems in villages nearby the health units in Bani Fadl and Magrabit Al Anab. The watersources are springs and the population was supposed to participate in the projects by the supply and construction of the pipes from the springs to the reservoir. This way of participation was not successful because the costs were too high in comparison to the benefits and the springs were often owned by other people. At the end of 1987 most systems were reported to be out of order (see annex T). In 1988 the SRWSD visited the areas and decided to complete the systems around Magrabit Al Anab as an Integrated Water Project. The situation around Bani Fadl was very complicated (water rights) and further project involvement was useless. This mission visited Magrabit al Anab and 61% of the population is nowadays using the systems.

2.4 Phase III: An integrated approach.

January 1988 phase III of the SRWSD-project started. During this phase more attention is given to the involvement and active participation of the local population and the cooperation with the Health Office Dhamar (HOD) and the Dhamar Rural health Project (DRHP). The plan includes two types of projects.

Integrated Water Projects.

These projects are carried out in or nearby villages where the DRHP and/or HOD has activities. The preparation and construction is arranged with village participation and accompanied by an intensive health education and sanitation programme. The designs are made by SRWSD and the schemes consist of a high reservoir and distribution lines. Public taps are in general not constructed and the villagers have to make the houseconnections by themselves. The contribution of the villagers should be 30% of the total construction costs excluding the watersource.
A total of 9 integrated water projects have been visited and 7 are in a good to very good condition. One scheme (Al Mashaa'hida, 7 villages) has financial problems because of the lack of watermeters. Another scheme (Magrabit Al Anab) is an improvement of old schemes based on springs and has problems with maintenance and waterrights (see 2.3).

Rural Water Projects.

The original plan included the construction of a limited amount of water supply schemes in villages where the RWSD has already drilled a successful borehole. These schemes would be constructed by a contractor and the input of health education and sanitation would be limited.
Up till now only one scheme (Dhafar) has been implemented by a contractor. This scheme includes only public taps and due to the fact that the village is very poor, the level of service with only once every two weeks water is very low. Houseconnections with watermeters would be much better so that everybody can control his own waterbill. The design for this scheme has been made in phase II, while the implementation was in phase III. For reasons of convenience, this report considers this scheme as a phase II scheme (implemetation by contractor, no participation nor health education).

The other Rural Water Projects are implemented with local participation and health education and the differences with the integrated water projects are in fact fading away. Three of these schemes were visited and they are all in a good condition. The completion of the schemes was just a short time ago and all schemes started up one or two weeks before our visit. All villages were still facing the normal starting-up problems and didn't agree yet about the price of the water, the salary of the operator etc.

2.5 Costs and contributions.

The costs of the schemes are given in annex D. Comparing costs is difficult because the schemes of the different phases differ a lot and the value of the Yemeni Riyal decreased considerably.
Table 2 compares the costs of schemes phase II and III.

Type of villages	no of villages	Costs (YR) Scheme	Per head
Phase II, all villages	17	900.000	710
Phase III, all villages	11	825.000	920

Table 2: costs of the schemes in phase II and III (excluding source).

The costs of a scheme are influenced by the location and the size of the village. The main costs are the pumps and these are the same for all sizes of villages. In the schemes of phase III, the reservoirs are much cheaper and the savings are more than enough to pay for the extra costs related to the village participation (transport, technicians).

The village contributions are presented in annex E.
The average contribution excluding three boreholes is 20% of the total construction costs. The contribution per head is average YR 205 with a maximum of YR 360. Houseconnections are not considered as contribution because they should be made in all schemes.
The amount of labour days per head is average 0.65, what means that a family of 7 persons should work 5 days for the scheme.

3 SCHEME COMPONENTS

3.1 Sources

A summary of the watersources of the schemes is given in annex F. In general the schemes are based on new drilled boreholes between 70 and 350 meter deep, which are almost all paid by the government. Only 3 villages financed the drilling by themselves. The owner of the boreholes is in all cases the village(s) which are connected to the scheme. A few boreholes (6) are also used for irrigation purposes, while one borehole is only for irrigation. The use of scheme boreholes for irrigation was in the past more, but some villages reported big conflicts and stopped it.
Five schemes are based on springs which give often problems about waterrights. In most cases, the water of the springs is owned by several people and each of them has some hours per day or month water. The Islam prescribes that everybody is allowed to take water for personal use straight from a spring or well. There are no rules for piped systems and this gives often problems because it is not clear if this is still personal use.

The quantity of water in the boreholes is in general good. Only two schemes (Al Husul and Dafinah) have from the start a borehole with a limited amount of water. Pumptests carried out in 1982 showed already a yield which was not sufficient for a watersupply scheme.
Problems with a dropping watertable occur mainly in the areas around Rada'. Early this year Al Azan drilled on own costs a new borehole for the village scheme with a total depth of 297 meter.
From the systems based on springs only 1 is out of order because the yield of the spring decreased too much (Dhi Sabil). The other systems with springs are almost all working well after a start with problems about the waterrights.

The chemical quality of the water is in general good (see annex W). Four schemes have a bad water quality due to high contents of sulphate, iron, total hardness, chloride and sodium. Three of these schemes are located northeast of Rada' and one (Ar Rhawq) is abandoned because of the bad waterquality. Two other schemes are still used for all purposes because there are no alternatives. The fourth scheme (Al Haruj) has hot water with high contents of iron and fluoride. The people refuse to use this water for drinking, but have a good borehole for drinking nearby.
The problems with fluoride are limited and the concentration reaches only in 3 schemes values around 2.5 mg/l. Nitrate is nowhere a problem, only 3 schemes have water with concentrations around 50 mg NO_3/l.

3.2 Reservoirs.

Annex G gives a summary of all reservoirs built by the project. In phase I and II the project constructed only reinforced concrete reservoirs (32 ground and 3 elevated). The quality of the work depends strongly on the contractor but at least 13 of them are leaking or have bad quality of concrete works. Three others have been repaired

recently. The reservoirs constructed in the third phase are mainly made of masonry because it is cheaper and it is much easier for the people to supply materials and to participate in the construction. The difference in costs for SRWSD between a masonry and a reinforced concrete reservoir (50 m³) are approximately YR 80,000. Only the elevated reinforced concrete reservoirs are still built by contractors. The quality of the reservoirs of phase III is in general good and leakages were not established.

Almost all reservoirs built by contractors have no proper vent pipes with bends and flyscreens while the manhole lids are often not fixed well. These items are much better done in the reservoirs constructed with village participation. It strikes also that all reservoirs of phase III are locked in contrast with the ones of phase I which were all open.
Almost all reservoirs could be cleaned and everybody is aware of the need for cleaning. The average frequency of cleaning as told by the people is once per 2-3 months, but it should be doubted if this is realy happening or the wish to do so.

3.3. Pumping main and distribution system.

A summary is given in annex H.
Pumping mains:
In general there are no problems, except in some old schemes. Especially in Joar the pipes are not fixed properly to the steep rock and have been broken down several times. This is one of the main reasons that the scheme was out of order for more than 1.5 years. The pipes are repaired by welding but are still weak and leaking. Also in 3 schemes from phase I around Rada' (one contractor!) the quality of the pipe laying is below standards.
Straight connections from the pumping main to houses increase the chance of pollution of the water in the reservoir and can give reasonable pressure losses in the pumping line. In SRWSD schemes are straight connections to the pumping main exeptions.
The price of a 3" pipe made by a contractor is approximately YR 75 per meter higher than the same pipe made with village participation. The average length of a pumping main is 1000 meters, so this means a difference in costs of circa YR 75,000.
Distribution system:
When the location of the reservoir allows, all villages of phase I added a distribution system. The quality of the pipe laying is often bad, pipes are damaged and go through wastewater pools. The schemes of phase II included a limited distribution system with public taps for a group of houses. The different distances from the houses to the main distribution lines and the differences in costs to make houseconnections are one of the main reasons of problems in these schemes. In phase III the distribution systems are more extensive and reaches groups of at least 5 houses. The people are much more satisfied with these systems and the costs per capita for the distribution systems for 11 schemes made with village participation are even lower than the costs per capita for 10 comparable schemes made by contractor in phase II. The condition of the distribution systems of the phase II and III projects is in general good.

3.4 Public taps.

Annex I gives information about 501 public taps in 30 schemes.
In phase I, the schemes included 1 or 2 public fountains with 4, 6 or 8 taps on it. The choice of the amount of taps was not very well founded and with the present population this would mean an average of 147 people for 1 tap (minimum 61, maximum 750). In phase II the schemes included more public fountains scattered over the villages and average 54 people per tap. In phase III only 2 schemes in very small villages (100-200 inh.) have public taps straight connected to the reservoirs.

In the areas around Dhamar and Rada public taps are not successful. In almost all villages the people changed the system in a way that individual control of the access to water is possible and they have either houseconnections or big water storage tanks. The reasons for not using the public taps is the independance of the people, wastewater problems, fights between the women and misuse of water.

In the first two phases, the SRWSD constructed 18 schemes which have the possibility to make houseconnections and in 14 schemes the people did so. 1 scheme (Wastah) is special and still has public taps in the new village. In 3 other schemes (Joar, Jebal al Ma'al and Dhafar) the people have big water storage tanks (1-4 m*) because the operation of these schemes is not reliable and in the most favourable case the people have once per 1 to 4 weeks water. In these schemes it is more usefull to invest money in an extra or bigger tank which can also be used for water bought from cars than in a houseconnection. The water in these schemes is expensive (YR 20-54 per house per month) and the consumption is very low with an average of 12 liter per capita per day. The 'public taps' are only used to fill the private tanks and every village has his own rules for the division of the water. A good example is Thabaq were the villagers added extra taps so that every 6 houses have one tap. Once per month there is water and the ladies have to bring the water with buckets from the taps to the waterstorage tanks. These tanks should be located on 'own land' so people with land near the tap are in a privileged position.

In 5 villages of phase I the people still use the public taps because it is impossible or useless to make houseconnections. These schemes supply water for a flat rate of YR 2-5 per head per month. The consumption in 5 good schemes with public taps in the real sense (almost always water for everybody with shared costs) is average 21 liter per capita per day. These systems are still running but problems like not paying (up till 50% of the users) and no salary for the operator are common.

In the schemes with public taps the condition of the taps is in general acceptable. The drainage of wastewater is almost always bad, but problems occur only on places with a daily supply of water.
The condition of the public taps straight connected to a small reservoir is in general good and this seems to be an acceptable option for a watersupply system in small villages with up to 200 inhabitants.

3.5 Houseconnections.

The wish of every family is to have a houseconnection with a big storage tank and a continuous supply of water. In 24 of the 34 villages with an operational scheme, the people have houseconnections, in 6 schemes they are impossible while in 4 schemes houseconnections are not made because the scheme is not reliable. See annex J for more details.

In general everybody has to pay for his own connection, while in 40% of the schemes the construction of all connnections is done by an experienced pipe fitter. Only one scheme (Bashar) shared the costs of all houseconnections. In several new schemes a standard watermeter is prescribed. The costs of a houseconnection depend on the distance to the main distribution line, but are in the new schemes average YR 1000 without the tank. The costs of a 1 m^3 tank are approximately YR 1500.

The use of watermeters is one of the main conditions for operation and maintenance of the schemes in the long-term. Several problems with the schemes could have been avoided when watermeters were installed from the beginning. Other advantages of watermeters are that schemes with watermeters have almost continuous supply of water and that the waterconsumption is lower.
Only 1 scheme of phase I (Sirm al Banna) has installed watermeters a few months ago which are not used because 2 villagers are against it. In phase II the schemes with meters increased to 66%, while in phase III 89% of the schemes have meters.
In the new schemes the installation of watermeters was often used as a condition for the construction of sanitary facilities at the mosque or school. The SRWSD should continue with this strategy and insist on the installation of watermeters.
There are several types of watermeters available. The National Water and Sewerage Authority (NWSA) sells good meters, type Kent (UK) for YR 350 each. Italian meters type Bosco & Co (YR 250) are acceptable, while many Sisma meters (YR 200) are very bad.

The average consumption in 7 schemes without watermeters is 27 liter per capita per day, while the average in 11 schemes with meters is 22 liter per capita per day (for comparison: public taps 20 lcd).

Only in phase III the construction of the houseconnections was supported by the project by advices and a set of tools. The effects of this involvement are very clear and the quality of the houseconnections in many schemes is good to very good.

3.6 Cattle troughs.

The situation of the 18 cattle troughs is summarized in annex I. In phase I every scheme included a cattle trough which was planned near the reservoir. This location in the centre or even above the village is not very suitable because it will cause wastewater problems and it is more sound to put a cattle trough at a place were the cattle passes on the way back to the village. Several villages shifted the trough to a lower place (often near the borehole). Only 5 of the troughs are used for cattle, while 2 others are used for washing clothes and blankets.

4 Pumps and engines.

4.1. General

The visited schemes include 27 diesel pumps (23 vertical and 4 booster), 17 electric pumps (12 deepwell, 3 booster, 2 small) and 16 generators. None of the pumps, engines or generators is out of order. Only two schemes are not working due to problems with the size of the engine which are probably also a result of internal disagreement.
An overview of all project pumps is given in annex K.

In the schemes of phase I Sonidar Company from Sana'a installed 10 vertical pumps with diesel engines. The pumps for the schemes of phase II (diesel and electric) were almost all imported from van Heck Company in the Netherlands because of price differences with pumps available on the local market. One big disadvantage was that the time between ordering and installation of the pumps was sometimes almost two years due to long clearance procedures in the harbour of Hodeidah. Three schemes were extra delayed because the boreholes were not straight and the ordered vertical pumps with diesel engines had to be replaced by other submersible electric pumps with generators from The Netherlands. In phase III the project decided to buy the pumps on the local market because in schemes with village participation it is unacceptable to have a long time between completion of the civil works and the installation of the pumps.

4.2 Operation and maintenance.

The Caprari shaft driven vertical pumps with Adim diesel engines of phase I function quite well and there are no problems with the maintenance. The spareparts are available in Dhamar and Sana'a and repairs can be carried out by local engineers.

The vertical diesel pumps of Van Heck Company have often problems with the heads of the pumps and the SRWSD replaced already three of them. The diesel engines of these pumps are in general good, but it strikes that the only two villages with a certain type of engine (Al Hasoon and Bidashy) both refuse to accept the scheme because they have complaints about the engine (too saml1, very fast hot). Reports about testing the systems by the SRWSD are not available. Tests in Al Hasoon have been very short because the total amount of hours on the meter of the engine is only 4. These schemes should be inspected carefully by a team including an experienced mechanical engineer and a final report about the situation with conclusions and advices for decisions should be submitted to RWSD. In another village (Al Haruj) the engine was not installed well and the village improved the situation. The pump still leaks oil, possibly because the water in the borehole is hot.

The van Heck deepwell electric pumps function in general well. There are only problems with the spareparts of the Torpedo and Deutz generators. In 2 schemes the operators couldn't even get a simple fuse of the Torpedo generator and replaced it by a piece of silver foil. The schemes are only operational for 4 months and in future the problems

will increase. Problems with spareparts are not only occuring with the generators from the Netherlands but are also reported from the locally bought Ansaldo, Robin and Fiat generators.

Good tools for the maintenance of the Caprari and Van Heck systems of phase I and II were almost never given and the operators use often tools from cars or other engines. In phase III, the situation is somewhat better, but in general are the tools given with the engines not enough for proper maintance.

Big repairs were only necessary in some schemes of phase I and the schemes of Joar, Wathan and Al Haruj. Almost all repairs were done by local engineers and only in Wathan the people came to the project. Big repairs of the electric pumps and generators were not necessary yet but it can be expeced that it will give problems in the future. Training operators for this kind of repairs is however impossible.

4.3. Pumpoperators.

The tasks, responsiblities and salaries of the pumpoperator vary a lot. In some schemes the operator is only responsible for running the engine, while in other schemes he is also responsible for collecting money, repairing the pipes and dividing the water.
Annex L gives information about the pumpoperators.

The turnover in pumpoperators is rather low and 5 of the 10 schemes of phase I have still the first operator who started 4.5 years ago. The other schemes are still young but have also a low turn-over rate.

Before the start of the job, 17 of the 36 operators didn't have any technical experience, while the others had some experience with private pumps, cars or other engines. The operators in the mountain villages were in general less experienced from before the scheme than their colleagues from the plains.

The operators are in general dissatisfied with the training given at the time of pump installation and the follow-up by the project. Almost all mentioned that the instructions were limited to starting the engine and changing oil and filters.
In 1985 the SRWSD sent 3 pumpoperators to a Transcentury course in Sana'a. One is still on duty and his training course five years ago was remembered by several villagers. In November 1989, seven operators went to a 24 days training course in Sana'a organised by WHO/RWSD. All of them are very positive about this course and seem to be motivated to carry out their tasks in the best possible way. It stroke that the pumphouses and the pumps of these operators were all very clean.
For 13 other operators it would be good to have the same training course and 10 of them showed interest. Three others don't have the opportunity due to family circumstances or agricultural duties.
The training of the operators is enough to carry out the daily maintenance and to know what should not be done. It would be good when the mechanical engineer of the project gives some additional training focused on a specific type of pump.

There is a big difference in the salaries of the operators. In the schemes of phase I, 50% of the operators doesn't have a salary and the salaries of the others are not more than YR 1500 per month. The income of these operators can be calculated as YR 0-15 per hour work (pumping + going).
In phase II and III schemes, the salaries are much higher and in general between 1500 and 3000 YR per month. In a few schemes (Mangada and Bashar) the operator is a real entrepeneur who organises his company (the scheme) in the most optimal way. The people like it because the scheme is reliable and private investments in house-connections, toilets and kitchens are usefull.

The operator is in general a respected man in the village and only in few schemes people complain about the salaries of the operators. The most extreme cases occur in the composited schemes of Joar and Jebal al Ma'al. In these schemes the operators ask unfair salaries of YR 2500 and 3000 per month what can be recalculated as YR 69 and 81 per hour. Besides that, another 50% of the collected money is used for unclear reasons or disappears.
A reasonable salary of the operator seems to be YR 500 for 1-2 times weekly pumping, YR 1000 for 3-4 times pumping and YR 1500 for daily pumping. Other tasks like collecting money, repairing pipes and division of water should be paid additional. The maximum should be YR 3500 for an operator who is fulltime involved with the watersupply scheme in a village bigger than 1500 inhabitants.

4.4 Pumphouses.

All pumphouses are built according to standard designs of RWSD and in general the condition is good. Only the pumphouses in Al Mijhal (Joar project) are not well constructed. There is no concrete floor, the roofs are bad and one trapdoor has never been fixed.
In 12 pumphouses the roof leaks around the trapdoor. This causes often a big mass inside the pumphouse. The design should be changed or the construction should be more careful.

The situation inside the pumphouse is variable and depends strongly on the type of engine and the interest of the pumpoperator. The pumphouses of the old schemes are often dirty, while the trained operators have in general very neat pumphouses. In the older schemes the operators are in general less aware of the necessity of a clean pumphouse.

Problems with cooling water from the engines are limited. Most engines are air-cooled and the water from the others is often used for irrigation or washing clothes. Pools with wastewater around the pumphouses are only found in Wathan and Dafinah. The project should give advices and support for the use of the cooling water for a washing place for clothes.

5 Organisation.

5.1 General.

Villages with a sound organisation structure are in general able to take care about the daily running affairs of a watersupply scheme. Despite that, organisational problems are the main reason that SRWSD schemes are entire or partly out of order. In some cases the villages should be blamed, but more often the project who imposed big organisational tasks on villages who are not ready or able to handle them. Several problems could have been avoided when the structure and the interest of the villages were tested before the implementation of the schemes started. The best parameter for village interest is to ask a contribution which needs the effort of many villagers like the construction of an access road or the transport of stones. A contribution in cash is less suitable because money could be advanced by somebody who will claim it at the end from the people who want to use the scheme. Information about the organisational aspects of the schemes is gathered in annex M.

5.2 Responsibilities.

The initiative for the schemes is in general taken by influencial villagers who have to follow it sometimes for years in the Ministry. These people have often rather big expenditures for salary, transport, food and qat which should often be paid back by the villagers. Three schemes have problems about this. In Mithal the scheme is not working because the people have to pay YR 100,000 to the sjeich; in Dhafar 60 % is not connected because one village has to pay YR 50,000 to another village and in Joar the sjeich was forced to leave the village when his expenditures for the scheme became too big. The villages in phase I and II didn't pay any contribution to SRWSD, but the aquisition costs of these schemes are often higher than the contributions paid in the schemes of phase III.
A total of eight SRWSD schemes was constructed without a clear village initiative. Some of these schemes are in good condition while two others (Hanud and Al Hasoon) face people who are not interested.

Problems about ownership of the well or scheme are not found and almost all people consider the village(s) who are connected to a scheme as the owners. There is no difference in this between schemes built with contractors or village participation.

In general is the operator responsible for the scheme. His occupation is already discussed in chapter 4.3.

In 13 schemes are special cashiers which have only in 3 schemes a regular salary. In composite schemes with several villages the aqils collect the money from the villages and hand it over to the operator or the responsible person. In these schemes the money has to pass several hands which results in substantial higher costs of the water.

Five schemes in the bigger villages have a special committee with 4 to 27 members for financial control. The organisation, election and responsiblities of these committees differ from village to village and are described in detail in the villages of chapter 10.

5.3 Rules.

All villages have verbal rules for the use of the scheme. An example is that a man has to repair the pipes which are damaged by him or his family. Several schemes have additional written rules about the use of water for gardens, the place of the watermeters, penalties for destroying pipes by car, by accident or by purpose, etc etc. Some schemes have made a contract between the village and the operator with up to 50 rules. Such a contract presribes also the penalties which the operator can use in case people misuse the system. The most extreme case is Mangada where the operator made a contract with the village to give water for YR 20 per house per month during 10 years. As deposit he has put YR 150,000 on the village account, which will be transferred to the village at the end of the contract period or when the operator doesn't fullfill his duties.
Almost all schemes have rules about the use of the water for gardens. In most villages small gardens near the houses are allowed, while big gardens or irrigation of qat are forbidden. Only 2 or 3 villages have a complete ban on the use of water for any garden, but despite that it occurs.

5.4 Administration.

There is a big variation in the quality of the administration procedures, but almost all schemes with more than 300 inhabitants have at least a list or book for the registration of the paying.
The bigger schemes of phase II and III have almost all bills and three villages with more than 3000 inhabitants have even a special waterоffice where the bills should be paid. Bills are very usefull in the organisation of schemes with more than 500 inhabitants and the project should propagate the use of them.

5.5 Finances.

The financial affairs of the schemes are presented in annex O.
In most villages (23) the money is collected monthly, in 6 villages every three months, while 2 villages collect the money at the end of the Ramadhan.
The turnover of money in the schemes is rather small and table 3 shows that the earnings of 83% of the schemes are less than YR 5,000 per month. Two big schemes (Al Azan and Wathan) are real companies and earn both about YR 19,000 per month.

Annex O shows that of the 28 schemes:
- 14 schemes save no money;
- 4 schemes are spending more money than they earn (max YR 530). This means in general that the operator doesn't get his salary.
- 4 schemes are saving every month less than YR 1,000;
- 5 schemes are saving every month YR 1,000 - 4,000;

- 1 scheme saves every month YR 12,490.

Only the last 6 schemes (20%) save enough money to carry out the bigger repairs. Al Azan is a special case where the water price was increased recently from YR 7 to 15 because the village drilled a new borehole.

Earnings of the scheme per month	no of schemes
< 1,000 YR	9
1,000 - 5,000 YR	18
5,000 - 19,000 YR	4
> 19,000 YR	2

Table 3: earnings of 33 SRWSD watersupply schemes.

The big repairs of the 28 schemes are paid by collection (15 villages), from the box (9 villages), from the operator (2 special cases) or the government (2 villages) These last villages have both expensive schemes: Al Hajalah and Wathan.

The size of the schemes is also illustrated the amount of water delivered per month, see table 4.

Total amount delivered per month	no of schemes
< 200 m^3	10
200 - 600 m^3	14
600 - 1,800 m^3	5
> 1,800 m^3	2

Table 4: Total amount of water delivered per month in 31 SRWSD schemes.

5.6 Beneficiaries.

Annex M gives the percentages of people using the system and the percentage of the users paying.
In general is everybody in a village allowed to use the schemes. In a few schemes only a part of the population is connected because:
- the water is rather expensive due to big expenditures for diesel and other good watersources are available (Wathan);
- there is a much better private scheme (Joar);
- one whole village has problems (Dhafar, Al Mayfa'ah, Wastah);
- schemes are starting up (Ar Raba'ah, Adra'ah, Bani Zaydan);

In every village it is accepted that ladies who live alone (widows and divorced) don't pay for the water which means 5% of the houses. In most schemes it is also normal that a few of the poorest families don't pay. In the schemes with houseconnections is in general 90% of the people paying. In schemes with public taps the problems with not paying are bigger and the amount of not-payers increases sometimes up to 50 %. In schemes with meters the percentage of not-payers is lower than in the schemes with a flat rate system.

6. CONSUMERS.

6.1 Situation in the past.

An overview of the watersources of the villages before the schemes were constructed is given in annex O. Of the 43 villages, 22 had a reliable groundwatersource (spring, shallow well or borehole) within 15 minutes walking from the village, 7 other villages had such a source within 30 minutes walking while the last 14 villages didn't have a groundwatersource within a reasonable distance. These last group of villages were depending on cisterns, cars or sources far away (up till 2 hours walking from the village, one way). The cisterns are in general located near the villages but contain often only a part of the year water of an inferior quality. Water brought by cars is almost exclusively used for human consumption and costs average YR 100 per m^3.

6.2 Use of the watersupply scheme.

Most villages with a good watersupply scheme still use alternative sources. As presented in annex O, the use of the scheme is limited to certain activities. Related to this gives annex Q an overview of the sources which are at present used for the different domestic activities.

As expected, human consumption (drinking and personal hygiene) has priority and in almost all operational schemes the water is used for these activities. Two exceptions are schemes where the quality of the water is very bad (Al Garar and Al Haruj).

Sheep and goats are often watered during the day from watersources outside the village. Animals which stay near the houses get in general water from the scheme except in villages were the water is very scarce or expensive (YR 10-25 per m^3). In these villages animals drink water from the nearby cisterns. In almost all schemes the cows get also wastewater from the kitchens.

Only half of the villages (18) with a functioning scheme use the water for washing clothes. The reasons for using other sources are not enough water from the scheme (3 villages), water too expensive (6 villages) or wastewater problems near the houses (7 villages). Almost all these villages have a good alternative for washing (cistern, borehole) within 10-15 minutes walking from the village. The schemes are also used for washing clothes when there are no alternative sources within 15 minutes walking from the village or when the water of the scheme is paid on a flat rate basis. Watermeters are a good push to wash clothes outside the villages.

Washing big items like blankets and carpets is only in 7 villages done with water from the SRWSD scheme. Almost all these villages don't have a reasonable alternative, while in 1 scheme the water is free. In villages with expensive water and no alternatives, the washing of blankets is done in the rainy season.

The use of water from the schemes for gardens is in almost all villages limited to a few plants (often herbs) near the houses. Big 'scheme' gardens with trees were only seen in 4 villages. In most schemes the water is too scarce or expensive for watering gardens.

6.3 Waterconsumption.

The waterconsumption in each village has been estimated by:
- the number of pumphours related to the yield of the pump;
- the number of reservoirs filled by the operator;
- the readings of individual watermeters;
- the total readings from all meters;
- information from the women about the watertanks.

Not all methods could be applied in all schemes but for most villages the different methods gave comparable results. If the differences were too big, the values are not mentioned. Annex C gives the calculated waterconsumptions which are summarized in table 5.

Level	frequency	purposes	meters	no of schemes	consum.
PT	limited	only human	no	6	12 lcd
PT	always	all uses	no	5	20 lcd
HC	always	only human	yes	3	13 lcd
HC	always	all uses	yes	8	25 lcd
HC	always	all uses	no	7	27 lcd

PT = public tap. lcd = liter per capita per day.
HC = houseconnection.

Table 5: waterconsumption in the SRWSD watersupply schemes.

The estimated wateruse for human consumption only is 12 lcd. In the schemes which have less water, the people feel the shortage of water and complain. When the scheme is also used for cattle and washing clothes the consumption increases to 25-30 liter per capita per day. The amount of water used for only the cattle or the washing could not be calculated.

The relation between waterprice and waterconsumption is very clear: above YR 15 per m^3 the consumption drops fast to a level of 15 lcd.

In general the people can use as much water as they like and only in 4 villages (Al Husul, Dafinah, Jebal al Ma'al and Dhafar) the people complain about the water quantity.

6.4 Costs of the water.

There are several systems of paying:
- 8 schemes pay YR 3-10 per head per month;
- 6 schemes pay YR 20-60 per house per month;
- 9 schemes pay YR 5-20 per m^3;
- 3 schemes pay YR 10-50 per month + YR 8-25 per m^3

In annexes I and J the waterprices per head and per m^3 have been converted to each other with the use of the waterconsumption. For the price per house it has been assumed that every house has 7 inhabitants, except for villages where the exact number of houses or connections was available.
In a good system with public taps the expenditures for water are YR 20-30 per house per month. In an average system with houseconnections the bill is YR 35-50 per month while in some expensive schemes the people have to pay YR 60-110 per month per house.
In general is the price per head in the schemes with a very low waterconsumption acceptable, but the price per m^3 consumed rather high.

6.5 Waterstorage.

Annex Q gives an overview of the information about waterstorage.
Most families have a metal storage tank for water except very poor people who can not afford a tank. Families who don't need to store a lot of water (watersource nearby, family small) store the water in the plastic jerrycans which are also used for fetching the water.
The size of the metal tank varies a lot within a village and depends on the need for storage capacity which is determined by the frequency and reliability of the watersupply scheme. If water is often brought by car, the tank should be big (2 m^3), but when the water is fetched daily with jerrycans the tanks are usually smaller than 0.5 m^3. Another important factor for the size of the tanks is the financial capacity of the family. A tank of 0.5 m^3 is YR 900 while a tank of 1 m^3 costs YR 1500.
Large tanks are often situated outside the house whereas the smaller tanks are inside. If the tank is located outside, there are often small containers (100 liter) in the bathroom and/or kitchen for storage of water for direct use. Tanks which are located outside are in general more exposed to dust especially when the water is taken out from the top.
In villages were the women fetch water with donkeys from the public taps or alternative watersources, the tanks are filled with the jerrycans which are also used for the transport of the water. When a scheme with 'houseconnections' is operational the tanks are filled with hoses (older schemes) or taps above the tanks (more recent schemes). In some new schemes the people made closed systems with the taps straight to the distribution system. This is preferable because it reduces the chance of contamination.
In the older schemes the water is often scooped out from the top because there is no tap at the tank or the tap broke down. In the new schemes the water is more often taken out by a tap at the bottom of the tank.
In general the tanks are cleaned regularly. Only few tanks are dirty because they are never cleaned while the lids are left open. In a few schemes the water contains a lot of iron and salts and the tanks should be cleaned very often. Cleaning the tanks is rather difficult when there is no tap for complete emptying the tank.

AL MAYFA'AH, Dhamar Rada Project 3.

Mayfa'ah (550 inhabitants) is located just north of the asphalt road, 17 kilometers east of Dhamar. The driving time is 20 minutes. The village is rich and has a primary school for boys and girls. There is no health unit and the people go to Dhamar for health services.
The scheme is functioning. The men complain about the amount of water and talk about a new borehole. This seems to be not realistic, seen the waterconsumption of 35 liter per day per person.
Ad Daylami (165 inhabitants) on the other side of the asphalt road was connected in November 1985. This line was never used up till six months ago a new operator started to give this village some water.

Water: Before the scheme, the people used to take water from a private shallow well. The water was pumped through a pipe into a concrete reservoir close to the village, 10 minutes walking.
The scheme is used for drinking, washing of clothes and gardens. Almost every house has a homegarden with fruit trees, some of them have also potatoes and salad.
Washing of clothes and blankets is also done with the cooling water of at least 3 private pumps, 15 minutes walking.
The former pumpoperator used the water of the scheme for private irrigation. He owns a borehole near the project borehole and both boreholes were connected to the raiser main which was connected to the village reservoir and his qatfields on the other side of the village. Nowadays there is only irrigation of the homegardens.

Waterscheme: The dutch government drilled a borehole with a depth of 107 meter and an acceptable yield of 2.3 l/sec in 1981. A contractor constructed a reservoir (50 m^3), a pumphouse, a pumping main, a cattle trough and a public fountain. An extra line (360 m, 2") and a public fountain were made to Ad Daylami on the other side of the asphalt road. A vertical pump with diesel engine was installed in February 1985 and the scheme was completed in September 1985.
The village added a distribution system.

Contribution: distribution system.

Benefits: The contractor made two public fountains and a cattle trough which are all disconnected. The distance from the taps to the houses is maximum 400 meters.
The quality of the distribution system and the houseconnections is bad. There are many leakages which are repaired with pieces of rubber. All houses in Mayfa'ah made a houseconnection without watermeters. Ten houses which are located on higher places don't get enough water because all houses open the taps on the same time. These people get water by car or take the water from the houses of relatives.
The price of the water is YR 120-300 per house per 2 or 3 months. This depends on the size of the tank, the amount of the people and the size of the garden.
There is only water in the reservoir on friday and monday.
The estimated waterconsumption is 35 liter per capita per day. A lot of water is used for the gardens.

Use & reuse of water would be interesting. What do women think about quantity + opening hours

Organisation: The villagers asked for the scheme in Sana'a. The owner of the scheme is the village and there is an operator.

Operation and maintenance: The operator pumps every friday and monday 9 hours with an open distribution system. Total amount of pumping hours is 4850, this means an average of 23 hours per week during 53 months. Per week an estimated amount of 136 m^3 water is pumped to the village. The operator has some experience from other pumps and there is no need nor interest for training. The former operator misused the scheme and the present one took over because he wants to have the system operational. There is a mechanical engineer in the village who assists with the bigger repairs and maintenance.
The operator collects every 2-3 months YR 120-300 per house. He spents till the money is finished and collects again.
The operator collects an average of YR 7000 per three months.
The estimated monthly expenditures are YR 550 for diesel, YR 1500 for salary of the operator and YR 200 for oil. There are no savings. Repairs are paid from additional collections.
Some people are not paying, an exact number could not be given.
But do they use? How?

Inside the houses: Almost all houses have a metal tank in the yard. The tanks are filled with a hose. When the tank is full, the hose is put to the garden.
Containers with drinking water are filled with the taps at the bottom of the tanks and kept inside the house. Some houses have a tank on the roof which should be filled by cars because the pressure from the reservoir is not big enough. These houses have taps inside the bathrooms.

Sanitation: All houses have baladih toilets and the wastewater goes straight to the street. One house has flush toilets without any provision for the wastewater. Two houses have a soakaway pit.
The mosque has baladih toilets and a washing place. The school has no water nor toilets.
The village is dirty with a lot of garbage and wastewater, although there is a place near the reservoir, where a lot of garbage is accumulated.

Problems: Ad Daylami (165 inhabitants = 23% of the total) is not using the water.

7/136/20

550/20 1850.0/35

3500

7 SANITATION.

7.1 General

In most villages are the wastewater problems small because the waterconsumption is low and the small amounts of wastewater infiltrate or evaporate easily. Only few villages have wastewater pools inside. The problems with wastewater are also small because the houses are often built far from each other and every house has the possibility to dispose wastewater at the backside. Drainage of wastewater in the streets occurs only in a few big villages. See also annex Q.

All houses have a place for personal hygiene in the bathroom or a corner of the kitchen. The houses in villages on the plains have in general baladih toilets in contrast with the villages in the mountains west of Dhamar where the houses have often no toilets. Wastewater from the baladih toilets (urine mixed with flushwater) is in general drained at the backside of the houses. Pour-flush toilets with pits are only available in the villages around Rada and northeast of Dhamar. In villages without toilets the people go to places away from the village. Children stay in the village and stool of children is often found in the streets and yards.

In villages with a lot of cattle the streets are often full of dung. If the cattle lives in the house, dirt and dung is brought in easily and the houses get dirty very fast. In some villages the women make dungcakes for the oven from a mixture of dung and wastewater from the kitchen.

Water which has been used in the kitchen for washing dishes and vegetables is in general given to the cows or chickens. Water from washing clothes is in general very dirty and thrown away.

The problems in the villages with garbage are in general acceptable but shops have a dramatic increase of garbage in the villages as consequence.

7.2 Health education.

In the villages where health education has been given the women and often also the men are still very enthusiastic about it. The impacts are difficult to assess but in all villages it is clear that it has increased the knowledge and awareness of the women about hygiene, diseases and wastewater. In most villages the improvements are clearly noticeable and houses and village are in general cleaner than before.

One of the subjects of the health education meetings is the reuse of kitchen wastewater for small vegetable gardens. This has the aims to get rid of the wastewater and to improve the health of the people by consumption of vegetables. In four villages the women understood the message and use the wastewater for gardening.
Also the advice to throw wastewater at least a little distance away from the houses or to construct a few pipes to a garden has been followed up in at least five villages.

In three villages the health education sessions resulted in requests for public toilets for women and together with them the locations were selected. During the sessions appointments for cleaning and use were made. In general are these toilets very clean.

7.3 Sanitary facilities.

In phase II the project constructed 8 groups of dry toilets at schools, health units and prisons. The design of these units was poor and problems with the squatting plates and the covers occured. In general the toilets were not used. In phase III the SRWSD improved 4 of these dry toilets in Magrabit al Anab, but the people don't like them because it is impossible to clean themselves properly, although there is now water availble.
Dry toilet systems are not appreciated anymore in Yemen. In the past there were several dry baladih toilets at mosques and public places in the towns. Almost all of them are abandoned or in a very bad shape without maintenance.

In phase II the SRWSD made also a start with the construction of pour-flush toilets at 2 mosques and a school. The involvement of the project was limited to the construction of the building, while the village was supposed to contribute with the completion of the toilet systems and the pit. At present none of these systems is used. The two systems at the mosque have been replaced by new toilets, while the system at the school is converted to a classroom.

In phase III sanitation got more attention and in 8 villages with waterprojects the SRWSD constructed public toilets for men and women. The designs consist of a row of pour-flush toilets with taps inside and a metal water tank on the roof. When one row of toilets is used by male and femmale, a separation wall is added. In most cases the toilets were only constructed on condition that the village fulfilled something like the installation of watermeters. Only in few cases the village contributed in the construction costs by supply of materials and labour.

In total 7 schools with toilets were visited of which 3 are not used. From the others, 2 were clean, 1 was acceptable and 1 was dirty and damaged. The main problem with school toilets is the cleaning. The students are willing and able to clean, but the supply of materials and the scheduling should be organised by the teachers. Some toilets which were used in the past are now closed because the motivated teacher departed and the successor has no interest.
The health education given at the schools was very much appreciated but should be more directed to the teachers. It is impossible for the SRWSD staff to visit every year all schools with toilet facilities for giving health education to the new children.

The toilets of 8 mosques were visited. All of them are used and most of them are kept clean or acceptable clean. Only in one place, Wathan-mountain, the toilets were very dirty. The reason is that the people are too careful with the water. This village has an exceptional situation and provided the mosque also with a standard watermeter. The

water (YR 25/m³) iis paid from the income of the mosque. The amount of water used in the mosque (8 toilets and a washing place) is only 78 liter per day which is for sure not enough to keep the toilets clean. The responsibility for cleaning the mosque toilets is with the caretaker and in general there are no problems with the daily cleaning. Big cleaning with soap and a brush is not done and it would be good to stimulate bigger cleanings every 2-3 months.

Toilets at the health units are not often used because the units are in general far from the houses and the primary health care worker keeps them closed in order to prevent misuse. A good example of a pour-flush toilet inside the unit with a solar warm water system on the roof has more impact on the people.

In two villages the project constructed on request of the women public toilets, while in a third village the construction is not yet completed. These toilets are used and very well maintained but it is good to mention that these villages are special and that the acceptance of public toilets for women in an exeption for Yemen. In one of the villages, Bani Muwallad, The construction of the public toilets for women, resulted in a request for more toilets and after discussions with the villagers the project decided to start with a private latrine programme.

7.4 Private latrines.

As described above, Bani Muwallad requested for assistance with the construction of private toilets. The project made a proposal in which the costs would be shared. The project would contribute with materials like cement, squatting plates, pipes, tyles, doors and windows. The houseowner would be responsible for the construction of the toilet room, the excavation of the pit and the supply of the other building materials. The programme was very successful and 46 houseowners constructed a very nice bathroom in- or outside the house. More details of this activity are given in village description no 34 in chapter 10. This activity is very good and the SRWSD should put a lot of effort on the continuation of this initiative in other villages. It is true that it is rather time consuming, but it is also very effective in terms of health impact.

what about costs?

8 PROBLEMS IN SRWSD SCHEMES

This chapter gives a summary of the main problems faced in the SRWSD watersupply schemes. See for more details also annex R and the relevant village descriptions. Schemes which are not functioning are printed in *italic*.

8.1 Problems with the system.

The watersource gives in 9 schemes problems.
* Four villages don't have enough water in the borehole of spring:
  - Al Azan drilled on own costs a new borehole;
  - Al Husul and Dafinah are using the system;
  - *Dhi Sabil* doesn't use the scheme.
* Four villages have problems with the waterquality:
  - *Ar Rhawq* closed the scheme;
  - Jawf al Nukabah and Al Garrar use the scheme;
  - Al Haruj uses the scheme but not for drinking.
* One village (Magrabit al Anab) has problems about the water rights.

The civil works give in 5 schemes problems:
* Two villages (Joar and Sufara) have a bad pumping main;
* Two villages have bad reservoirs (Al Mihal and *Bidashy*)
* One village (*As Shaqqab*) has a poor distribution system.

The pumps and engines give problems in 7 schemes:
* Three vilages have problems with the size of the pump:
  - *Jarf Isbil* has been tested and approved;
  - *Bidashy* and *Al Hasoon* refuse to accept the engine;
* Three villages have general pumpproblems (Wathan, Joar, Al Haruj)
* One village has problems with the spareparts (Jebal al Ma'al)

8.2 Problems with the organisation.

Not paying is a problem in 3 schemes:
* Dafinah and Al Hajar have public taps and 50% doesn't pay;
* *Al Mashaa'hida* doesn't have watermeters.

Not using or connected is a problem in 7 schemes:
* Five schemes have one or more villages not connected: Al Mayfa'ah, Wastah, Dhafar, *Hanaka al Masud*, Magrabit al Anab.
* Two schemes have many people who can not afford the water from the scheme: Wathan and Jebal al Ma'al.

General problems are occuring in 8 schemes:
* Four schemes have not interested people: *Mawr*, *Hanud*, *Al Hasoon*, Wastah;
* Two schemes have internal conflicts: *Mithal* and *Shaqqab*;
* Two schemes are not well organised: Jebal al Ma'al and Joar.

9 CONCLUSIONS AND RECOMMENDATIONS

1. Of the 42 visited schemes 21 are working without problems, 11 have some problems while 10 are not operational at all. The schemes which are not functioning are all constructed in phase I and II.

2. Reasons that schemes are not operational are the pump (2 schemes), the watersource (2 villages) and the organisation (6 villages).

3. Almost all organisational problems in the schemes are caused by the fact that the people didn't participate or contribute. The SRWSD should not implement any watersupply or sanitation scheme without contribution. For certain activities the contribution can be low.

4. The civil works of the schemes are in a good condition. Only three schemes have problems with reservoirs and pumping mains and the SRWSD should try to solve these problems.

5. The pumps are in general good, except some pumpheads which should be replaced. The problems around the size of the pump and engines in three schemes should be studied and final decisions should be taken.

6. The 24 days training course for pumpoperators in Sana'a is a must. Additional training focused on a specific type of engine should be given by the mechanical engineer of the SRWSD.

7. The construction of waterschemes with village participation is cheaper and gives schemes which are better maintained.

8. The success of sanitary facilities at public places is variable, but will increase when the SRWSD asks for a small contribution.

9. The programme for construction of private latrines is very successful and should be stimulated as much as possible.

10. Health education is a very labour-intensive job but has a good effect on the way the scheme is used and maintained. SRWSD should develop a structure in order to cover more villages.

11. In the schemes which are functioning almost all people have access to the water and poor people are often not paying.

12. Watermeters and bills are major instruments in the organisation of the schemes and the SRWSD should use all means to push the villages to install watermeters and to introduce a good paying system.

13. The SRWSD should give more information and training about financial aspects of a watersupply schemes like the price of the water, the salary of the operator and a good system of bookkeeping.

14. The SRWSD should visit all schemes at least once a year in order to renew the training of the operator and to stimulate the people to maintain the scheme.

10 VILLAGES VISITED

This chapter contains a report of all schemes. Each report has the same structure:
- description of the village;
- water;
- waterscheme;
- contribution;
- health education;
- benefits;
- organisation;
- operation and maintenance;
- inside the houses;
- sanitation;
- problems.

The numbers of the villages are the same as used in the tables and annexes.

SAMA and SUFARA, Dhamar Rada Project 4.

These villages (550 and 300 inhabitants) are located 12 kilometers southeast of Dhamar, 25 minutes driving. There is a primary school in Sufara. The living standard in both villages is average and for health services the people go to Dhamar. Both villages are located on a 100 meter high basalt cliff which borders the Qa Shirah valley on the west side. In Sufara are 16 'earthquake houses' which are not used.
The waterscheme is operational without big problems for more than 4.5 years.

Water: In the past both villages took water from 45 meter deep hand-dug wells in the valley. Donkeys brought the water to the villages, 20 minutes walking. There were also cisterns, 10 minutes from the villages. The water from these cisterns is still used for the sheep. The waterscheme is used for drinking, washing of clothes and cattle. Washing of big items like blankets and carpets is done with the cooling water of the private boreholes around.

Waterscheme: The dutch government drilled a borehole with a very good yield (35 l/sec) and a depth of 152 meter in 1980. A contractor constructed 2 reservoirs (50 m^3), a pumphouse, 2 pumping mains, 2 cattle troughs and 3 public fountains. A vertical pump with diesel engine was installed in February 1985 and the scheme was completed in September 1985.
An improvement of the public fountains was carried out in December 1986

Contribution: Sama constructed 2 additional public fountains with 3 taps.

Benefits:
In Sama the project constructed 2 public fountains with 8 taps; the village added 3 taps. The distance to the house is maximum 1000 meters and some people come to fetch water with a donkey from the public tap. The condition of the fountains is in general bad and only 5 taps are working. Most taps are leaking and there is a lot of wastewater around. Most houses are too high for houseconnections: only 4 houses made a line with a tap to the yard. There are no watermeters.
The cattle trough of Sama, near the borehole, is disconnected.
The price of the water in Sama is YR 25 per person per year. There is almost always water in the reservoir.
The estimated waterconsumption is 20 liter per capita per day.

In Sufara the public fountain (4 taps) is still in good condition. The wastewater is drained away but the concrete slab under the taps is too small. The distance to the houses is maximum 300 meters.
It is not allowed to make houseconnections in Sufara.
The cattle trough near the reservoir is not used because children are playing with the water.
The price of the water in Sufara is YR 50 per person per year. There is almost always water in the reservoir.
The estimated waterconsumption is 21 liter per capita per day.

Organisation: Nobody took the initiative for the scheme. The scheme is owned by the two villages and there is one operator from Sama. In Sufara the money is collected by the aqil.
There is no relation between the two villages. The sjeich of Bait Al Dahr ordered the drilling of a borehole for both villages on the ground of Sama. In the beginning there were problems. They were settled by the project because drinking water should be given.

Operation and maintenance: The operator pumps every 4 days to Sama and every week to Sufara. The pumping time to each village is 5 hours. This means 59 pumping hours in one month.
Total amount of pumping hours is 3028, this means an average of 57 pumping hours per month during 53 months.
The operator has some experience with private pumps. He would like to have an additional training course, but has other responsiblities.
There were no big problems with the pump and engine, only once the belt broke down.
The operator collects yearly YR 10,550 in Sama. The aqil of Sufara collects every Ramadhan YR 14,500.
Every month both villages have to bring YR 500 for the operator, 100 liter diesel (YR 275) and 5 liter oil (YR 105). The diesel and oil bought by one village is used for pumping to that village. There should be money left (especially in Sufara), but the aqil said that it was not enough and that the people have to pay for repairs by collection.
The amount of people not paying in Sama is unknown; in Sufara 20 people (6%) are not paying.

Inside the houses:
Sama: The village and the houses are dirty, only some houses are clean. Water is mainly stored in jerry-cans, only few families have a tank. Only few families have a garden watered with clean water.
Sufara: The village is clean and the houses are either very clean or very dirty. Water is stored in tanks. Only few gardens which are watered with clean water from the scheme. The women want houseconnections.

Sanitation:
Sama: All houses have a baladih toilet. Urine and stool is going outside next to the houses. When the stool is dry it is used on the fields. There is a lot of waste in the village. Some people made drainage pipes for the wastewater. The wastewater problems are limited and mainly concentrated around the public taps.
Sufara: Only few houses have a baldih toilet with the drainage next to the house. Only small amounts of waste and wastewater in the village.

Problems: The pumping main to Sufara passes a place with loose rock, there are not enough supports and the pipe broke down several times.

SIRR AL BANNA, Dhamar Rada Project 5.

This small village (39 houses, 244 inhabitants) is situated at the eastern side of the Dhamar plain, 20 kilometers southeast of Dhamar. The village has a primary school and the living standard is medium. The people go to Dhamar for health services.
The waterscheme is functioning without big problems for almost 4.5 years.

Water: In the past water was taken from two cisterns 5 minutes walking from the village. Nowadays they are leaking and the water is not used anymore. When the cisterns were empty the water was taken from the neighbour village, at 45 minutes walking distance. The water from the scheme is used for drinking and washing of clothes, while big items like blankets and carpets are washed near agricultural wells.

Waterscheme: In 1981 the Netherlands government drilled a borehole with a depth of 200 meter and a very good yield of good water of 19 l/sec. A contractor constructed a reservoir (50 m^3), a pumphouse, a pumping main, a cattle trough and a public fountain with 4 taps. The place of the reservoir, public fountain and cattle trough was changed and the village contributed YR 8000 to the extra costs (in total YR 16000). The vertical pump with diesel engine was installed in February 1985 and the waterscheme was completed in September 1985.
The village added a distribution system with houseconnections.

Contribution: YR 8000 cash and distribution system.

Benefits: The first two years there were only public taps and it was not allowed to make houseconnections. These public taps gave big problems between the ladies and the village decided to change the system to houseconnections. One year ago problems about the waterconsumption resulted in the decision to install watermeters. Up till now 32 houses installed a watermeter (type: Bosco & co, Italy). Five houses with old ladies don't need a meter because they are not paying for the water. The two houses without a watermeter got a final time limit of 1 month, after that they will be disconnected.
The quality of the houseconnections is good. The villagers are not allowed to use water tanks. All houses have a tap near or inside the house.
The cattle trough is used, but dirty.
Although there are watermeters, the old system with paying per head persists. The price of the water is not clear. The men say YR 5 per capita per 3 months. The ladies say YR 5 or 10 per capita per month, YR 5 per cow and YR 5 for 20 sheep. YR 5 per head per three months and additional money for cows and sheep seems the most realistic.
There is almost always water in the reservoir.
The estimated waterconsumption is 45 liter per capita per day.

Organisation:
Nobody asked for the scheme and it was a surprise when the drilling for the village started. The owner of the scheme is the village and there are a pumpoperator and a cashier.

what does this mean?

Operation and maintenance: Every four days the operator pumps 5 hours with an open distribution system. Total amount of hours pumped is 1492, this means an average of 28 hour per month during 53 months.
The operator has learned the job from the former operator, who departed to Saudi Arabia. There is no interest for training.
The cashier collects every three months YR 1700. From this amount he spents YR 500 for diesel, YR 300 for oil and YR 150 for oil filter. The salary of the operator is YR 750 per three months. Five houses with ladies are not paying.
There is also a box with money for big repairs. The contributions to this box are from people returning from Saudi (YR 200) and from weddings: YR 4000 when the man is from Sirm al Banna and YR 5000 when the man is from another village. Nowadays the box contains YR 40 000.

who keeps it and how?

Inside the houses: The village is reasonable clean and the houses are clean. There are a lot of flies everywhere. The women were very eager to learn and kept asking all kind of questions about health and hygiene.
Some families have small gardens which are watered with clean water.

Sanitation: Most houses have a baladih toilet. The wastewater drainage is mostly at the backside of the houses.
The village is small and there are no wastewater pools inside the village. Near the mosque are old baladih toilets which are not used anymore.

Problems: Up till now there are no big problems. The village seems to be able to take care of the scheme.

How reliable is this info?

Them metered but not paying according to meter.

JARF ISBIL, Dhamar Rada Project 6.

This big village (1959 inhabitants) is located 20 kilometers east of Dhamar, 40 minutes driving. The village has primary and secondary (3) schools and the living standard is medium. There is no health unit and the people go to Dhamar for health services. The village is situated at the southwestern foot of the Jabal Isbil (an extinct volcano, 3190 meter). The government built 67 'earthquake houses' of which many are inhabited.
The waterscheme doesn't function because the pump is not strong enough to pump the water to the reservoir. Ladies bring water with donkeys from a reservoir near the scheme borehole to the village.

Water: In the past the people took water from the several waterholes excavated in the lava flows near the village, at 5 minutes walking distance. Some people without transport still use these holes for drinking water. Nowadays the water is taken with donkeys or cars from a village reservoir near the borehole of the drinking water scheme, 35 minutes walking. Washing of clothes and blankets is done with the water from boreholes (from the scheme and private). Washing is often done near the houses. It is forbidden to do this near to the reservoir.
In the winter water from the scheme borehole is sold for qat farming. The owner of the car pays YR 3 per m^3 for the water.

Waterscheme: In 1982 the Netherlands government drilled a borehole with a depth of 252 meter and a good yield of 6 l/sec. After the earthquake the village was in very big need for water and in 1983 the ministry of Public Works installed a pump while the village constructed a provisional pumphouse and reservoir near the borehole. These were demolished when the project started the construction of a new pumphouse, a reservoir (100 m^3), a pumping main, a cattle trough and 3 public fountains. On request of the villagers, the place of the reservoir was changed and the village contributed 50% to the extra costs (total YR 60 000). The project increased the capacity of the pump by adding 5 extra impellors in the period April till August 1986. The pump was not installed well and a second repair was necessary in November 1986. In february 1987 the villagers received the pump oficially. The scheme was only used for two days but the pump got too hot and the villagers stopped pumping.
The villagers complained to the Ministry. In March 1989 the project visited the village and the scheme was tested. The pump was not strong enough to pump the water to the reservoir. A proposal for the installation of an aditional boosterpump (200 meter head) was agreed upon by the Ministry. The village is now waiting for the installation.

Contribution: YR 30 000 cash and distribution lines.

Benefits: The public taps are not used. The village added extra taps and a distribution system to the main parts of the village. These were never used. There are no watermeters.
The village invested a lot of money (at least YR 100 000) and didn't get benefits from the scheme.
The cattle trough near the pumphouse is often used.

The price of the water is not clear. According to some people the water collected from the reservoir near the borehole is free. For a small truck drinking water (1.5 m^3) the people pay YR 60: 10 for the pumpoperator and 50 for the owner of the car.
The waterconsumption is difficult to estimate. The water is far away and the people are careful with the water. An estimate of the consumption of two families is 12 and 13 liter per capita per day.

Organisation: The initiative for the scheme was taken by 2 villagers who went to the ministry in Sana'a. The village is the owner and there is an operator. The money for diesel, oil and repairs is collected by the five aqils.

Operation and maintenance: The operator pumps twice a day 1.5 hours to the reservoir near the borehole.
Total amount of pumping hours is 3660, this means an average of 60 hours over a period of 60 months (72 months - 12 months out for repairs).
The operator has experience with private pumps and there is no need or interest for an additional training course.
The operator goes to the aqils when he needs money (every 4 months).
The expenditures are YR 2000 for diesel and YR 800 for oil. His salary is YR 1500 per month. There are no savings.
The operator says that all male adults pay for the water of their family.
For big repairs the village has to pay additional money:

Inside the houses: The houses are acceptable clean but the children looked dirty.
Water is stored in tanks next to the houses or in jery-cans. The tanks were not clean and some were not covered.
Only few houses have a garden for which water is brought by car.

Sanitation: Most houses have a baladih toilet and the wastewater is drained in the streets. There is a lot of waste and wastewater in this big village with the houses built close to each other.

Problems: The pump is too small to pump the water to the village reservoir. The village is waiting for the installation of an additional boosterpump. The scheme will not be operational with the installation of this booster pump only. The people are also not satisfied with the size of the reservoir and the lack of a good distribution system. This last point is reasonable because the village is big and the ideas about a good village watersupply scheme have been changed since the design was made in 1978. Public taps are not fit for such a big community.

AL HAJAR, Dhamar Rada Project 7.

This village has 894 inhabitants and is situated in the Dhamar plain at a distance 20 kilometers (40 minutes driving) northeast of Dhamar. The village has a primary school and the living standard is poor. There is no health unit and the people go to Dhamar for health services.
The village has problems with the neighbour villages southeast of them. People got killed and the village spent a lot of money for solving these problems.
The waterscheme is functioning without big problems for 4.5 years.

Water: In the past water was taken from a big cisterns 5 minutes walking north of the village. During the two times that the pump was broken, the women used this water without boiling. When this cistern was empty the women brought water from other villages, 2 hours walking. The waterscheme is used for all purposes. There are no private boreholes around.

Waterscheme: In 1982 the Netherlands government drilled a borehole with a depth of 240 meter and a very good yield of 15 l/sec. A contractor constructed a reservoir (50 m^3), a pumphouse, a pumping main, a cattle trough and a public fountain with 4 taps. The reservoir was built at a place lower than the houses. The vertical pump with diesel engine was installed in February 1985 and the scheme was completed in September 1985.
Transcentury organisation added some distribution lines to a mosque and the new built 'earthquake houses', but these pipes were never connected to the reservoir.

Contribution: no.

Benefits: There are 4 public taps which are all in good condition. The place around is dirty and one forth of the water is spilled. Water is transported in jerrycans or tubes by donkeys, wheelbarrows and on the head. Near the public fountain was no animal dung. At night the taps are closed in order to prevent spilling by children. The maximum distance to the houses is 700 meter.
The cattle trough near the pumphouse is sometimes used for the sheep.
The price of the water is YR 4/head/month (before last month YR 3).
Water brought by cars is YR 50 per m^3.
There is almost always water in the reservoir.
The estimated waterconsumption is 17 liter per capita per day.

Organisation:
Somebody from Husul asked for the scheme and the scheme is owned by the village. There is an operator without salary who is responsible for everything. The operator has a book and writes bills.

Operation and maintenance: The operator pumps every day 3 hours. Total amount of hours pumped is 3881, this means an average of 2.4 hours per day during 4.5 years.
The operator got a Transcentury training course in March 1985 and has knowledge about the pump.

are they using?

He collected last month YR 1800. From this amount he spents YR 1500 for diesel and YR 300 for oil. The operator has no salary.
444 people (50%) are not paying.
There is no money saved and extra money for repairs is gathered by additional collection.

Inside the houses: Some houses were acceptable clean while others were dirty. The water is stored in small tanks outside or inside the houses and is mainly scooped out from the top. Wastwater is throwm outside.
It is not allowed to wash near the taps so the washing is done near the houses or at some distance from the taps. Only few gardens were seen.

Sanitation: Fifty percent of the houses compose of a baladih toilet with the drainage next to the houses. Families without a toilet go to the wadi. There are oOnly small amounts of wastewater in the village, except the place around the tappoint. There are agricultural fields near the tappoint so it should be possible to make a good drainage to there.

Problems: Up till now there are no big problems. The village seems to be able to take care of the scheme.

AR RHAWQ, Dhamar Rada Project 8

This small village with 350 inhabitants is located 15 kilometers northeast of Rada'. Dhamar is 68 kilometers, 75 minutes driving. The village has no school nor health unit and the living standard is medium. The village overlooks a narrow valley which widens towards the northwest. There were problems with other vilages, but they seemed to be solved now.
The waterscheme is not functioning due to the very bad water quality.

Water: In 1977 there was only one shallow well with water from a depth of 17 meters. The water was brackish with an EC-value of 3500 uS. After the visit of the RIRDP field team the villagers started to dig more wells for irrigation. Early 1980 the production of these wells dropped considerably, due to overpumping. The water scheme is not working and people use free water from other sources like a cistern, a shallow well or borehole at varying distances from the village. According to the women, 3 boreholes give bad water, while two boreholes give good water. Washing is done with water from 2 shallow wells at 15 minutes walking from the villages. These wells give little salty water. Washing is also done with the cooling water of two pumps.
Some people buy drinking water from Rada for YR 100/m^3 (by car).

Waterscheme: In 1981 the Netherlands government drilled a borehole with a depth of 155 meter. A pumping test carried out in July 1981 showed a yield of 1.7 l/sec, mainly from layers deeper than 90 meters. A sample was tested in the WHO laboratory of the Ministry of Public Works and the results showed a bad quality of the water. See the table below. Despite this, the advive was that the water was fit for drinking and the contractor started with the construction of a reservoir (50 m^3), a pumphouse, a pumping main, a cattle trough and a public fountain with 4 taps. A vertical pump with diesel engine was installed and the scheme was completed in September 1985. The scheme was used for 2 years, but the quality of the water didn't improve and at present the scheme is not used anymore.
The villagers went to the Ministry of Electricity and Water and in September 1989 a water quality test was carried out. As shown in the table below, the quality of the water was still very bad and not good for human consumption. A report was made but there is no follow up yet. The villagers didn't complain more earlier because they had these problems with the neighbour villages.
The water which is left in the reservoir is brown and the taste is salty.

Contribution: The villagers constructed a distribution system with houseconnections.

Benefits: There were no benefits from the scheme. The public taps are changed to houseconnections without watermeters for all houses.
The cattle trough is directly connected to the raiser main and still in good condition.
The people spent money for the distribution system. It will be difficult for them to get external support because they have already a scheme although it is delivering brown stuff instead of drinking water.

The cattle does not want to drink the water from the scheme and after washing some people got an itchy rash. Nevertheless some people were using the water for these purposes. The people mainly complain about iron, salt and sulphur.
The price of the water was YR 5 per head per month. The people didn't want to pay because they were not satisfied with the water quality.

Organisation: The initiative for the scheme was taken in 1976 by the RIRDP who liked to improve the living conditions for this village. They made a report and the scheme came. The owner of the scheme is the village and the aqil is responsible for it.

Operation and maintenance: The scheme is not operational anymore. Total amount of pumping hours is 831. Filling the reservoir took 6 hours. The pump and the other parts of the scheme are still in good condition and can become operational as soon as a good water source is available.

Inside the houses: The village and the houses looked clean. The answers of questions differed considerably, making the reliability questionable. Clothes are washed next to the houses with the water of the shalllow wells. There are water tanks outside the houses and the water is taken out from the top. No gardens were seen in the village.

Sanitation: Generally there are no toilets and wastewater is drained next to the houses. The wastewater problems are small.

Problems: The very bad water quality, especially the high contents of salt and iron.

Waterquality in the borehole of Ar Rhawq.

Parameter	Unit	Sept 81	March 89	Sept 89	WHO-standards
EC	uS	3200	3340	3230	
pH	-	7.3	7.1	9.0	
Hardness ($CaCO_3$)	mg/l	**740**	**778**	**600**	100-500
Tot alkal. ($CaCO_3$)	mg/l	345	331	300	
Calcium	mg/l	164	176	128	75-200
Magnesium	mg/l	80	82	68	
Chloride	mg/l	**750**	**687**	**750**	200-400
Iron	mg/l	**0.2** (*)	0.1 (*)	**3.0**	0.1-0.3
Manganese (*)	mg/l	0.3 (*)	**0.7** (*)	**1.1**	0.1-0.5
Sulphate	mg/l	350	**440**	140	100-400
Nitrate	mg/l	0.9	0	1.1	10-20
Fluoride	mg/l	**1.8**	**2**	1.2	0.5-1.5
Hydrogen sulfide	mg/l	-	-	1.0	0-1
Sodium	mg/l	473	436	416	200-500
Potassium	mg/l		26		

In bold printed values are above WHO standards.
(*) : iron and manganese are oxidized and settle to the bottom of the tank or reservoir. The difference with the results of the water straight from the borehole is big.
Sept 1981: WHO laboratory of the Ministry of Public Works, pumptest.
March 1989: Rada Integrated Rural Development Project, reservoir.
Sept 1989: Ministry of Electricity and water, from pump.

what does it mean
How is it within the village

AL GARRAR, Dhamar Rada Project 9

This small village with 200 inhabitants is located 15 kilometers northeast of Rada'. The distance to Dhamar is 68 kilometers or 75 minutes driving. The village has no school and the children go to school in Wadi Matar. The village is located at a rock overlooking Wadi Matar to the east. The wealth of the village is medium.

Water: In the surroundings of the village is no shallow groundwater available. In 1977 the village didn't have own water sources and the water was collected from nearby villages like Wadi Matar and Khabran at a walking distance of 30 minutes. The quality of the water in the water scheme of Al Garrar is not good and most people still go to Khabran for drinking water or use rainwater when available. Water is also brought by car form Khabran for YR 50/m³.
The scheme is mainly used for cattle, washing of clothes and blankets and some drinking.

Waterscheme: In 1981 the Netherlands government drilled a borehole with a depth of 175 meter. A pump test carried out in in June 1981 showed a yield of 1.4 l/sec. A test of the water carried out in the WHO laboratory of the Ministry of Public Works showed a conductivity of 1750 uS and a high value for total alkalinity (420 mg/l), total hardness (660 mg/l), iron (0.2 mg/l), and manganese (0.3 mg/l). Chloride, sulphate and fluoride were high, but below the maximum permissible levels. The laboratory advised filtering and boiling of the water. This is done by some villagers. Others don't do as it means an increased use of firewood which has to be collected from far away.
The contractor constructed a reservoir (50 m³), a pumphouse and a pumping main. The public fountain with four taps was built near the reservoir. The cattle trough was made at a distance of 240 meters from the village, down near the road. A vertical pump with diesel engine was installed and the scheme was completed in September 1985.
The location of the reservoir is lower than the houses and house connections are not possible. During the construction the villagers asked the contractor to change the place of the reservoir, but he told them that expressing this wish to the dutch people would mean cancelling the project. The people mentioned that there was no understanding between the dutch project supervisor and the contractor because of the language.

Contribution: no.

Benefits: The quality of the water is bad and the contents of total hardness and iron re above WHO standards. The water in the reservoir is brown. There are no other watersources and the people have to use the water of the scheme. Some houses have drinking water from other villages or Rada'.
There are 4 public taps of which 3 are in acceptable condition. The place around the public fountain is dirty due to leakages and wastewater. The maximum distance from the houses to the tap is 200 meters. There are no houseconnections.
The price of the water is YR 5 per capita per month. There is almost always water in the reservoir and the estimated waterconsumption is 25 liter per capita per day. Everybody is allowed to use the scheme.

The cattle trough, far down in the wadi, is not used because the connection to the reservoir broke down. The place for the cattle trough was selected by the project, but the village agreed.
The people complain about the waterquality (salty and iron) and mention human stomach and kidney problems and black stones in the stomachs of slaughtered sheep.
In the past the water was also used for irrigation, but sharing the water gave big conflicts in the village. At present this irrigation is stopped completely.
The village asked for a reservoir on a higher place and a distribution system.

Organisation: Nobody asked for the scheme. The owner is the village and there is one operator who is responsible for the pump, the collection of the money and the repairs of the pipes. The operator doesn't have a salary. It is only allowed to use water for domestic purposes.
The RIRDP constructed also some waterschemes in nearby villages. One big scheme for all villages in Wadi Matar is not possible because Al Garrar is a different family.

Operation and maintenance: The operator pumps twice a week four hours. Total amount of pumping hours is 1088, this means an average of 22 hours per month during 49 months (53 months - 4 months broken down).
The engine broke down four times: once for a period of three months and three times for a period of two weeks. An engineer from the RIRDP came for repair but he spoiled the engine. Later on there were two engineers from Rada'. Their repair was also not successfull and finally the pump was repaired with assistance of an engineer from a nearby village (Goraishia).
The construction supervisor of the project came for a period of at least 1 year to give instructions like starting the engine and changing the oil. There was bad understanding due to the language. The operator is the first one and showed interest for an additional training.
The operator collects every month YR 800. From this amount he spents YR 550 for diesel and YR 200 for oil. There is no salary for the operator.
The amount of people not paying is 40 (20% of the total).
Repairs should be paid from the small saving of YR 50 per month.

Inside the houses: The houses did not look very clean neither did the children. There were several children with eye and skin infections. Clothes are washed near the houses. Storage of the water is in jerrycans or in tanks. If drinking water is fetched from other villages it is stored in jerry cans or small tanks.
Only one family has a garden which is according to the lady not as good any more since she irrigates with the water from the scheme.

Sanitation: The houses don't have any toilets, only a place for personal hygiene. Only wastewater from the kitchen is reused.
Little wastewater is seen except around the tappoint. Only small amounts of solid waste and garbage.

Problems: The quality of the water is bad.

JAUF AL MUKABAH, Dhamar Rada Project 10.

This very small village (13 houses, 100 inhabitants) is located 30 kilometers (1.5 hours driving) northeast of Rada'. Dhamar is 83 km or 2.5 hours driving. The village is poor and a mosque, a school and electricity are not available. The children attend schools in Baqarat or Jauf and have to stay there during the week. There is no health unit nearby, but the villagers expressed big interest for the course for female primary health care workers. The village lies at the side of a small wadi with mostly abandoned agricultural fields. In 1985 a part of the population (20 persons) left the village after killing one of the village leaders.

Water: Ten minutes from the village is a shallow well which was used for domestic purposes and for irrigation. The water in this well was tested by ILACO in 1981 and the results showed a high sulphate content. It was advised to use other water sources because the water in the well was not fit for drinking. The people followed this advice and abandoned the well.

Waterscheme: The dutch government drilled a borehole in 1981 with a depth of 162 meter. The main aquifer is a layer of grey weathered gneisses with pyrite at a depth of 23-30 meter. A pumping test carried out in August 1981 showed a yield of 16 l/sec. The water in this well was tested in the WHO laboratory of the ministry of Public Works. The results showed a high alkalinity (490 mg/l), a high hardness (740 mg/l), a high calcium (200 mg/l), a high iron (0.4 mg/l) and a high manganese content (0.5 mg/l). Also sulfate (438 mg/l) was above the WHO highest desirable level of 400 mg/l. Despite the bad water quality, the contractor got instruction to construct a reservoir (50 m^3), a pumphouse, a pumping main and a cattle trough. Public taps were never constructed. The project installed a vertical pump with diesel engine at a depth of only 24 meters in September 1987. Before there was another pump which was also used for irrigation. Nowadays there is no irrigation anymore.
The village added a distribution system made of the pipes of the old irrigation system. The quality of the distribution system is bad: many pipes are connected with plastic tubes and many leakages occur.

Contribution: The distribution system.

Benefits: The quality of the water is bad and the contents of iron, sulfate, manganese and total hardness are above WHO standards. Also the conductivity, total alkalinity, calcium, magnesium and potassium contents are very high. The water in the reservoir is brown and in private tanks is a floatting layer of white 'fatty' flocks. There are no other watersources and the people have to use the water of the scheme for all domestic purposes.
There are no houseconnections: the tanks near the houses are filled with plastic tubes temporarily fixed to the end of the distribution pipes.
Near the pumphouse are two metal tanks and especially in the dry season many ladies from other villages fetch water with donkeys from there.

Should be done ?

The cattle trough near the pumphouse is often used by big amounts of sheep and goats. The people complain about sheep diseases due to the bad water quality. This diseases generally occur in the spring time.
The water is free. Some people pay when they take a big amount of water by car straight from the borehole.
The estimated waterconsumption is 25 liter/capita/day.

Organisation: The initiative for the scheme was taken by the aqil, Saif Yahlan. The owner of the scheme is the village and there is an operator without a salary.

Operation and maintenance: According to the pumpoperator, he is pumping every three days three hours. Total amount of hours pumped is 320, this means an average of only 11 hours per month during 31 months. Long periods of pump breakdown are not reported.
The operator has some experience with pumps and there is no need for training.
The operator spents monthly YR 120 for diesel and YR 60 for oil. He doesn't have a salary because the villagers think that he gets a salary from the government. Besides that, many people are semi-nomads and stay often for only one or two months in the village.

Inside the houses: The houses were acceptable clean but everywhere were flies. According to the local people due to the rain. All houses composed of a small tank from which the water is scooped out from the top. In some tanks mosquito larves were seen which indicates a defiency in cleaning the watertanks. Clothes are washed near the houses or next to the reservoir. One family used water from a dirty tank for the cattle, washing clothes and some domestic use. Most houses had a small garden for which they use water from the scheme. One family collected drinking water from a cistern half an hour walking away. This because an old man doesn't accept the water from the scheme.

Sanitation: The houses don't have toilets. The village is small and there are no problems with wastewater.

Problems: The quality of the water is bad.

HANAKA AL MASUD, Dhamar Rada Project 11.

This big village (3000 inhabitants) is located 10 kilometers northwest of Rada, 50 minutes driving from Dhamar. The village is wealthy, has a primary school for boys and girls and a generator for electricity. The village is situated on the edge of a rocky plain with a wide valley south of it. The village has two waterschemes: a private waterscheme is used for the supply of domestic water and a project scheme is used for irrigation.

Water: The village was surveyed in 1980 and at that time the village collected water from 6 shallow wells. Nowadays these wells are all dry. The village made an own waterscheme because the construction of the promised governmental scheme was delayed several times till 1985. This village scheme costed YR 500 000 and consists of a borehole (125 m deep), a pumping main, an elevated reinforced concrete reservoir (30 m^3) and many distribution lines. The scheme is still operational but the condition is bad and the reservoir and the distribution lines are leaking at several places.
There are 5 private irrigation boreholes around and the ladies go there for washing blankets with the cooling water from the engines.

Waterscheme: In 1981 the dutch government drilled a borehole with a depth of 143 meter and a yield of good water of 5.5 l/sec. Despite the fact that there was already a village waterscheme with an elevated reservoir and distribution lines, the project constructed a ground reservoir (100 m^3) with public taps nearby. Other components of the scheme were a pumphouse, a pumping main and a cattle trough. The project installed a vertical pump with diesel engine and the scheme was completed in September 1985.

Contribution: nothing.

Benefits: Nowadays the project scheme is not operational and the water is only used for irrigation of fields with qat and alfalfa. A few years ago an employee of the RIRDP visited the scheme and reported that it was mainly used for domestic purposes. why?
The price of the water from the private scheme is only YR 2 per capita per month. The houses have every third day water.
The elevated reservoir is filled twice a day and the estimated consumption is 20 liter per capita per day.
The cattle trough near the pumphouse is not used.

Organisation: The aqil of the village asked for the project scheme and the scheme is now owned by the village. There is one operator who is responsible for for both schemes.

Operation and maintenance: Total amount of pumping hours of the project pump is 1179, this means an average of 0.7 hour per day. The pumpcapacity is 5.5 l/sec so the maximum daily abstraction is only 14 m^3 or 4 liter per capita. In the past the scheme was also used for domestic purposes so the use for irrigation is limited.
The operator has experience from Aden and private schemes and there is no need for additional training.

yes, but who is covering up for irrigation water?

The operator collects every month YR 4000 for both schemes. The expenditures are YR 3120 for diesel, YR 1210 for oil and YR 200 for filters. The operator doesn't have a salary. The expenditures are higher than the earnings.
The price of the water is too low and 1000 people (33%) are not paying. Altogether it is necessary that water is sold for irrigation purposes. For repairs the people have to pay additional money.

Inside the houses: The houses looked clean, but the village itself is dirty with some wastewater. Tanks are situated near the houses and are filled with the use of a hose, which is connected to the distribution pipes. The water is scooped out from the top of the tanks.

Sanitation: All houses have a toilet, most of the baladih type. The women are washing clothes near the houses and water is thrown outside, sometimes a little bit away from the houses.

Problems: - The reservoir is located on a low place and it is not possible to make houseconnections.
- The scheme is only used for irrigation.

MAWR, Dhamar Rada Project 12, Sanitation projects 3 and 42.

Mawr is a big village (3000 inhabitants) 10 kilometers southwest of Rada, 50 minutes driving from Dhamar. The village is wealthy and there are electricity (two systems) and telephone. There are a primary and secondary school (3 classes) and a health unit of the MCH clinic Rada'. The village consists of 5 subvillages which are located at both sides of a wadi.
The project built a reservoir and a pumphouse but the scheme was never completed. The reason is the lack of interest and cooperation of the villagers.

Water: In 1977 there were numerous shallow wells in the wadi banks. The water quality in these wells was fairly good with EC values of 600-700 uS. Later on many deepwells were drilled and the water table dropped very fast. Nowadays the shallow wells are dry and the people use water from irrigation deepwells for domestic purposes.
There are five private schemes and the owners of the wells sell the water per hour. The people have to pay an estimated price of YR 10 per m^3. There is always water available and well owners are eager to sell water for domestic use for YR 10-20 per tank of 1-2 m^3.

Waterscheme: The dutch government drilled a borehole with a depth of 100 meter in 1981. A pumptest carried out in August 1981 showed a yield of 10 l/sec from a fractured black and reddish brown basalt at a depth of 70 meters. The quality of the water was good.
The contractor constructed the pumphouse and the reservoir. According to the wish of the villagers the reservoir was shifted to another higher hill. Mawr promised to pay the extra costs (YR 130.000) to the ministry. Later on the village refused and the governor of Al Bayda interfered. The ministry stopped the contractor and the project was never completed. A dry well, an empty pumphouse and an empty reservoir are the remnants of a bad project identification procedure.
The internal problems between the different sub villages are too big and it seems to be impossible to construct a waterscheme for Mawr as a whole. Besides that the priority in terms of water scarcity and poverty is very low.

Contribution: nothing.
Benefits: none.
Organisation: none.
Operation and maintenance: none.

Inside the houses: There are gardens and qat fields next to almost all houses. The houses have a baladih or pour-flush toilet. Washing is done near the houses or/and boreholes.

Sanitation: The project constructed 4 pour-flush toilets at the mosque in April 1987. The quality of these toilets was not good and they were replaced by six new toilets in December 1989. These toilets are often used and the maintenance is good.

Problems: scheme not completed.

AL MIHAL, Dhamar Province Project 1.

This village (40 houses, 347 inhabitants) is located 25 kilometers southwest (50 minutes driving) from Dhamar and can be reached from the asphalt road Dhamar-Rada. The wealth of the village is medium and there is a primary school. For health services the people go to Dhamar. The village lies at the bottom of a rocky mountain overlooking the wadi to the east. The government built 39 new 'earthquake' houses of which 12 are inhabited.
The village has a waterscheme from which the borehole, the pump and the pumphouse are shared with the villages of the Joar project (DPP 2-9).

Water: The people used to take the water from 8 shallow wells around the village (10 minutes walking). The women still go there for washing clothes and blankets preferably with the cooling water of the irrigation pumps.

Waterscheme: The sjeich from Joar tried to get a waterscheme in his villages located on a plateau 300 meter above Al Mihal. On this plateau were no watersources and the sjeich made an agreement to drill two boreholes on land from Al Mihal: one borehole for the Joar villages and one borehole for Al Mihal. The government drilled two boreholes but Al Mihal refused access to the area for testing the boreholes. Negotiations started and pumptests were carried out in the spring of 1986. These tests showed that one of the boreholes was dry and new problems came up. The contractor completed already most of the civil works for the scheme for the Joar villages on top of the plateau while the source of the water was still unsure. Negotiations started again and in February 1987 the parties came to an agreement to use one borehole for both schemes.
In Al Mihal the contractor constructed a reinforced concrete reservoir (50 m^3), a pumping main, a pumphouse and 3 public fountains. The project completed the scheme with the installation of the pump in November 1987. An agreement for the construction of an extra distribution line to the new village was made. The amount of pipes in the contract was not big enough and the pipe ends now in the middle of the fields.
There were several problems with the pump and the scheme is now operational for approximately 1.5 years.

Contribution: the village added a distribution system.

Benefits: The public taps are almost all changed to houseconnections. Only two taps are still used, but locked. The keys are with ladies who can not afford a houseconnection.
Most houses made a houseconnection of a good quality. Five months ago watermeters were installed. Almost all houses are connected, except the 39 houses in the new village.
The price of the water is YR 5/m^3. There is almost always water in the reservoir of Al Mihal.
The consumption from the watermeters is 25 liter per capita per day.

Organisation: The initiative for the scheme was taken by the sjeich of Joar who needed a watersource for his scheme. The owners of the scheme are the people of the 9 villages. There is no comittee for controlling.

Operation and maintenance:
The systems for Al Mihal and Joar are independant: the operator in Al Mihal pumps every thursday to Joar but only when the representative of the Joar villages brings diesel and oil (YR 1500) and salary for the operator (YR 2200). When the diesel is finished, the operator stops pumping. See for more details also the description of the Joar system.

The operator says that he pumps once every 2 days seven hours to Al Mihal. Total amount of pumping hours is 901. Calculations are not possible because the scheme was often out of order.

The pumpoperator has some experience with pumps but has also interest for an additional training course.

The operator collects the money in Al Mihal every month. Last month he collected YR 950. The expenditures are YR 500 for diesel, YR 150 for oil and YR 300 for salary. The operator got some extra income from the crops he irrigates with the water of the scheme borehole.
There are no savings and the people have to pay additional money for spareparts etc.
Twelve houses (40%) are not paying

Inside the houses: not surveyed.

Sanitation: outside is not much wastewater visible.

Problems:
There were several problems with the deepwell pump:
- the pumphead was wrong installed and should be turned 180 degrees.
- the key of the engine was broken and after repair the battery was not recharged anymore.
- pumphead got too hot. The people went to the project and the technician promised to come. This never happened and the people went again to the project. The operator was told to buy a new pump head on the local market.

The quality of the reservoir is bad:
- foundation consists of loose sand,
- distribution line is fixed to the outlet for cleaning,
- no vent pipes / overflow pipe,
- quality of the roof is bad.

JOAR project, Dhamar Province Projects 2-9

This big project covers 8 villages situated 35 kilometers southeast of Dhamar, 70 minutes driving. The borehole of the scheme is in the wadi near Al Mijhal (DPP 1) from where the water is pumped to the plateau with the Joar villages, 300 meter higher. Total numbers of inhabitants is 1750 and the wealth is average. On a central place are a primary school and a health unit. The health unit is not used due to lack of staff. The borehole, the pump and the pumphouse are shared with Al Mijhal.
Only 6 villages with 1050 inhabitants (150 houses) use the scheme: Joar and Al Soma'a get water from another village scheme for a much lower price (20 instead of 50 YR per house per month).

Water:
The villages used to have several watersources:

Village	Source	Distance	Present use
Bait Mahras	cistern	30 min	sometimes washing
Bait Addumali	cistern	5 min	washing
Bait Al Ansi	cistern	15 min	washing
	spring	30 min	washing
Al Hamma	spring Azra'ah	3 hrs	no
Maswarah	cistern	1 hr	washing
	spring	2 hrs	no
Bait al Adwar	cistern	10 min	washing
Joar	spring	90 min	some drinking
Al Somaa	spring	90 min	some drinking

The amount of water from the scheme is limited and the water is mainly used for drinking and animals. Washing of clothes is done with water from the cisterns, 10-60 minutes walking away. Washing of big blankets is done with rainwater or the water from the cisterns.
The waterscheme was a long time out of order due to technical and organisational problems. The people used to go to the springs or bought water from cars for YR 100/m^3.

Waterscheme: The problem with the villages on the Joar plateau is the absence of good groundwater sources. Water was mainly taken from cisterns nearby the villages and springs far away. The prospectives for a successfull drilling on the plateau were low and the sjeich of Joar made an agrrement with Al Mijhal to drill two boreholes on their land: one borehole for the Joar villages and one for Al Mijhal. The government drilled two boreholes but Al Mijhal refused access to the area for testing the boreholes. They were afraid that their 7 private boreholes would dry up. Negotiations started and pumptests were carried out in the spring of 1986. These tests showed that one of the boreholes was dry and new problems came up. The contractor completed already most of the civil works while the source of the water was still unsure. Negotiations started again and in February 1987 the parties came to an agreement to use one borehole for both schemes. The project completed the schemes with the installation of the pumps in 1987.

The scheme consists of (see also the drawing below):
- a borehole, pump and engine and pumphouse (together with Al Mijhal);
- a reservoir (25 m^3) down + boosterpump and pumphouse;
- a reservoir (150 m^3) plateau;
- distribution line 1 to Bait Mahras and Bait Addumali;
- distribution line 2 to Bait Al Adwar, Joar, Al Somaa and Maswarah;
- distribution line 3 to a reservoir (25 m^3) + boosterpump and pumphouse for pumping to a reservoir (50 m^3) for Al Hamma and Bait Al Ansi.

Contribution: no

Benefits: Due to technical, organisational and financial problems the scheme was not operational for almost 1.5 years. The last four months there was every thursday or friday water and the people are satisfied. There are no watermeters and everybody tries to take the maximum amount of water from the scheme. The storage capacity near the houses is often very large (2-4 m^3).
The public taps are still used and every village has an own system:

Village	Houses	Taps	System
Bait Mahras	15	1	Two houses fill tanks with tube (7 m3
Bait Addumali	20	20	Every house own tap + tank + tubes
Bait Al Ansi	13	1	Tanks (1 m^3) with buckets
Al Hamma	52	9	Every 2 houses 1 tap, others have HC.
Maswarah	14	4	Extra taps made by the villagers
Bait Al Adwar	36	?	Extra taps near the houses.
Joar	60	2	15 houses take water without paying
Al Somaa	55	0	not using

In the connected villages all houses are allowed to use the water and there are no problems about the division of the water inside the villages.
Only in Al Hamma are houseconnections without watermeters. In Bait Al Adwar the village made extra pipes and taps closer to the houses. The price of the water is YR 50 per house per month. In Al Hamma and Bait Al Ansi the people have to pay an additional YR 10 per house per month for the boosterpump near Al Hamma. There is water once a week for circa 4 hours. The estimated waterconsumption is 17 liter per capita per day.

Organisation: The initiative for the scheme was taken by the sjeich of Joar. The procedure took a long time and the expenditures of the sjeich were rather high (YR 300,000). At the same time, some people from Joar/Al Somaa organised a private scheme on a good borehole drilled by the village. This scheme will be described below. Although the construction of a water supply scheme is a noble aim, it resulted in this case in a big internal conflict: people got killed and the sjeich had to leave his village.
Some villagers mention the sjeich as owner of the scheme, others see it as an ownership of the 9 villages together, while others mention the dutch government as the owner.

There are two operators: one in Al Mijhal and one in Al Hamma. Besides that some other people are involved in the collection and transfer of money to the operator in Al Mijhal.

Operation and maintenance: The systems for Al Mijhal and Joar are independant: the operator in Al Mijhal pumps every thursday to Joar but only when the Joar villages bring diesel, oil and salary. When the diesel is finished the operator stops pumping.
The cashier in the Joar villages collects every month YR 6700. From this amount he spents YR 1000 for diesel, YR 500 for oil and YR 2200 for salary of the operator. The savings (YR 3000) are put in the box of the waterscheme. The aqils in all villages are very well aware of the financial affairs of the scheme.
An additional amount (YR 600) is collected for the operation of the boosterpump for Al Hamma and Bait Al Ansi. From this amount YR 400 is spent for diesel and YR 200 for oil. The operator in Al Hamma doesn't have a salary. The operator in Al Hamma pumps every week 3 hours.
16 houses (11%) are not paying.

Inside the houses: In general the villages and the houses are clean. Water is stored in tanks outside the houses and also in additional containers like jerry cans and barrels. The tanks are filled with tubes or buckets and the water is taken out from the top.
Only few houses have a small garden which are watered with water from the cisterns.

Sanitation: Most houses have a baladih toilet with the drainage to the backside of the houses. There are no wastewater problems.

Problems:
- There are technical problems:
  * The deepwell pump in Al Mijhal becomes too hot (see report Al Mijhal, village 13).
  * Booster reservoir + pumphouse near Al Mijhal are not constructed well.
  * The raiser main from the wadi to the plateau is badly constructed: at many places the pipes have been broken and repaired. The operator of Al Hamma repaired the pipe 4 times in one month and collected YR 100-200 from every house.
- The organisation of such a big scheme is difficult. The villages are far from each other and there is no intensive contact between them. Many problems can be solved by the installation of watermeters so that every village can pay for its share in the consumption. The problem is the division between the villages. The villages are small and can organise the paying internally.

Private waterscheme Joar and Al Somaa.

Waterscheme: The construction of the governmental scheme took a long time and some villagers in Joar and Somaa took the initiative for the construction of a village scheme. Despite the bad prospectives to find water on the plateau, the villagers drilled 5 boreholes and found at the end good water. The expenditures for these boreholes were approximately 500,000 riyals. The scheme consists of a pumping main, a ground reservoir (15 m^3) and distribution lines with public taps.

Benefits: In Joar every 5 houses have a tap from which they fill the metal tanks near the houses.
The price of the water is YR 20 per house per month. There is only every other day water from 12 till 16 o'clock. According to the women there is enough water.
The estimated waterconsumption is only 11 liter per capita per day. The scheme is only used for drinking, while most of the washing is done near the cistern. Some families still depend on a spring, 1.5 hours walking from the village.

Operation and maintenance: The operator pumps every other day 2 hours. The operator collects every month YR 2300. His expenditures are YR 1200 for diesel, YR 600 for oil and YR 500 for salary. There are no savings and money for repairs is collected from the people. 10 of the 115 houses are not paying (9%).

Inside the houses: The houses and the village are not clean. Most families have a tank with a tap at the bottom. Some families cemented a small area under the tap.
In periods without water, the people take drinking water from the dirty cistern without boiling.

Sanitation: All houses have a baladih toilet with drainage of wastewater in the street next to the houses. Only small amount of wastewater. Wastewater from the clothes washing is used for making dungcakes.

JEBEL AL MA'AL Project, Dhamar Province Projects 10,11 and 12.

This project covers 3 villages 35 km (70 minutes) southeast of Dhamar:
- Jebel al Ma'al: 700 people, 84 houses, average wealth;
- Sirm al Abd: 350 people, 50 houses, very poor;
- Thabaq: 500 people, 74 houses, poor.

All three villages have a primary school for boys and girls. In Jebel al Ma'al is a health unit which is not yet operational.
The borehole with pump is in the wadi, 15 minutes driving from Jebel al Ma'al. The scheme is working.

Water: Jebel al Ma'al has a dam (a kind of big cistern) which collects rainwater and water from small springs, 15 minutes walking from the village. Water is brought by donkeys or by head. It is forbidden to wash or water animals near the dam and the ladies have to go barefoot from the village to the dam.
Sirm al Abd has a cistern deep down the rocks. The road is very steep and donkeys can not go there so the women have to carry the water. Going there takes 45 minutes up and down. It is not allowed to wash or water animals near the cistern and the women have to bring water up a few times per day.
Thabaq has a cistern with dirty water 20 minutes walking from the village. Water is brought to the village by donkeys or by head.
Washing of clothes is done with water from the cisterns. Only in Jebel al Ma'al some houses have enough water from the scheme to wash clothes. The water from the scheme is mainly used for drinking and cooking. The water is too expensive for gardens etc.
In some years the cisterns in Sirm al Abd and Thabaq fall dry and the people have to buy water from cars for YR 100 per m^3.

Waterscheme: The borehole is 160 meter deep, gives enough water and is only used for the scheme. In November 1985 the contractor started the construction of a pumphouse, two pumping mains and two reservoirs (50 m^3 for Jebel al Ma'al and 75 m^3 for Sirm al Abd + Thabaq). Each village got a distribution line with 2 public fountains. The project installed an electric deepwell pump with a 100 KVA generator and the scheme was completed in August 1986. The pumping main is very long (4503 meter).

Contribution: no.

Benefits: Every village has an own system.
Jebel al Ma'al: 8 of the 12 public taps are still in good condition. The metal storage tanks near the houses are filled with long rubber tubes connected to the public fountains. The village added some distribution lines and 54 of the 84 houses (64%) have now a tap near the house from which they can easily fill the tank with a hose. There are no watermeters.
Sirm al Abd: 2 public taps are still working. Every house has 1 or 2 tanks near the public fountain which are filled from the tap by a special hired man.
Thabaq: the village added 4 extra taps to the 8 of the project. Every six houses have a tap and from there the metal tanks are filled with buckets. There is not enough for filling all tanks and many problems arise. It is not allowed to put all tanks close to the public taps because of landownership. Some houses have to put the tanks further

away and they get less water than others who have land close to the tap. The taps are not realy public when they are on private land!
The price of the water is:
Jebel al Ma'al: YR 28 per house or YR 3.2 per person per month.
The price per m^3 can be calculated as YR 8.
Sirm al Abd: YR 3.6 per person or YR 25 per house per month.
Thabaq: YR 2.5 per person or YR 17 per house per month.
In Jebel al Ma'al is twice a month water, while Sirm al Abd and Thabaq have once per month water.
In Sirm al Abd the responsible man collects the money (YR 50 per house) and if he has enough, including his own profit, he goes to the operator in Jebel Al Ma'al.

The consumption from the scheme is very low:
Jebel al Ma'al: 13 liter per capita per day;
Sirm al Abd: 7 liter per capita per day;
Thabaq: 5 liter per capita per day.
Especially the people in Sirm al Abd and Thabaq mentioned that the amount of water is not enough and that they are too poor to buy more water. The reason for the small amount of water is not their poverty, but the cashiers and the operator.

Organisation: Jebel al Ma'al asked the president for a scheme in 1978. They got YR 150,000 and the village went to the LCCD with a request to contribute 40% for the drilling of a borehole. The LCCD agreed, the borehole was drilled and the project completed the scheme. The scheme is owned by the three villages and there is an operator with a salary of YR 3000 per month.
There is no relation between the villages and the idea to connect them to one scheme came from the project.

Operation and maintenance: The operator pumps 2 times a month. In total he pumps 16 hours to Jebel al Ma'al and 10 hours to Thabaq/Sirm al Abd. There are some problems with the filter of the generator and the maximum time of pumping is only 2.5 hours. The operator tried to buy the filter in Sana'a, but it is not available anymore.
The systems for the villages are independant:
Jebel al Ma'al: the operator collects YR 2250 from the village. His expenditures are YR 520 for diesel, YR 130 for oil and YR 1000 for salary. The savings are written in the book, but the operator collected an additional YR 250 from each village for a repair one month ago.
Sirm al Abd: the village has to bring 80 liter diesel (YR 260) and salary (YR 1000) for filling the reservoir once (maximum 75 m^3). The price of the water is minimum YR 17 per m^3. The operator fills the reservoir only when he gets the money and the diesel, what is not exactly every month the case.
Thabaq: see Sirm al Abd.
In the past Thabaq and Sirm al Abd used to have each half a reservoir, but this gave problems and now they buy each a reservoir for themself.
In Jebel al Ma'al 5 houses (6%) are not paying; the percentage of non payers in the other villages is not known.

Inside the houses:
In Jebel al Ma'al all houses have a tank near the house. The tanks have taps and a lot of tanks have a plastic or rubber cover under the lid to protect the water. Most houses have a kitchen on the roof with a small tank for drinking water. These tanks are filled with buckets and one house has a small pump.
In Sirm Al Abd all houses have a tank or container near the public tap. Water is taken out with buckets from the tap or the lid of the tank and brought to the kitchen. In the kitchen it is stored in a special container or in the 'transport bucket'.
In Thabaq the big watertanks are on 'own land'. Water is taken out with a tap and many tanks have a plastic cover under the lid to protect the water.

Sanitation: In Jebel al Ma'al and Thabaq almost all houses have a baladih toilet, in Sirm al Abd only half of the village. The liquid goes to the street. There are no soakaway pits.
Wastewater is also used for making dungcakes.

Problems: The operator and the cashiers make money out of the scheme.

The prices for the water given above are without the money that disappears here and there.

AL AZAN, Dhamar Province Project 13.

This wealthy, big village with 2331 inhabitants is located 1 kilometer south of the asphalt road Dhamar-Rada, 40 minutes (45 km) driving of Dhamar. There are primary and secondary schools, electricity and several shops. The village lies at the bottom of a hill with the wadi at the east side. This wadi is mainly used for the cultivation of qat. Al Azan is one of the main villages around Rada (capital of Al Arsh) and the RIRDP road to Sabah and Al Arsh passes.

Water: In 1981 there were a number of shallow wells and 6 private boreholes in the wadi east of the village. The water from these wells was mainly used for irrigation. Due to the heavy abstraction of groundwater for irrigation, the watertable around Al Azan drops very fast. The shallow wells are all dry, while all boreholes have been deepened, most of them several times.
Prior to the SRWSD scheme there was a private scheme and the women collected water from a tank in the centre of the village.
The SRWSD scheme is mainly used for drinking and personal hygiene. Clothes and blankets are washed with the cooling water of the pump engines.

Waterscheme: The dutch government drilled a borehole with a depth of 198 meter in 1981. The static waterlevel was 49 meter and the yield of the well was 9.6 l/sec. A second pumptest was carried out in 1985. The static waterlevel was dropped to 82 meter, while the yield was decreased to 3.4 l/sec.
The project constructed a groundreservoir (50 m^3), a pumphouse, a pumping main and a public washing place. The scheme was completed with the installation of the vertical pump with diesel engine in August 1986. The village got a distribution system from the RIRDP with a village contribution of 30 %.
In January 1990 the borehole was dry. Within a month the villagers started deepening the borehole, but didn't succeed. A new borehole (297 meter deep) was drilled ten meters from the old one, the pump was shifted and a new pumphouse was built. The old pumphouse is now used as office for Al Azan waterscheme. It is not clear yet how the costs for drilling this new borehole (YR 360,000) will be paid. The people have the aim to go to the RIRDP.

Contribution: YR 60,000 for the distribution system.

Benefits: There are no public fountains. Almost all houses made houseconnections with watermeters at their own cost. The quality of the houseconnections is good with taps going to the kitchen and/or the bathroom.
The price of the water is YR 15/m^3 and there is almost continuous supply of water.
The estimated waterconsumption is 30 liter per capita per day not including the water used for washing clothes.

Organisation: A villager who is member of the LCCD asked for the scheme. The owner of the scheme is the village which elected a committee with four members. The members are elected for unlimited time and doesn't have a salary. This committee made an agreement about the scheme and issued a list with rules.
There are an operator and a cashier. The operator has a monthly salary of YR 3000, the cashier doesn't have a salary.

Operation and maintenance: It is not clear how often the pumpoperator pumps. He says 11 hours per day, but that seems to be too much. The meter of the engine is not connected so the total amount of pumping hours is not known.
The operator has experience with pumps from private wells and there is no need for training.
The cashier collects the money every three months and gives special bills. In the period January - September 1989 he collected an average of YR 19,790 (1319 m^3) per month. From this amount he spent YR 3000 for diesel, YR 900 for oil, YR 400 for filters etc. and YR 3000 for salary of the operator. The savings per month were YR 12 490.
20 houses (10%) are not paying.

Inside the houses: Most house looked acceptable clean, but inside the village is a lot of waste. and wastewater.
Water is stored in tanks (0.5-2 m^3), mainly outside the houses. Most houses have a tap inside and the water in the tanks is only used during periods that the scheme is not operational.
Only few houses have a garden which is watered with clean water.

Sanitation: All houses have a baladih toilet or a flush toilet. The houses are built close to each other and there are big problems with wastewater. The infiltration capacity of the soil is low and the water flows down through the streets. On-site disposal is almost impossible and off-site disposal is technically and socially still very difficult.

Problems: The main problem is that the watertable drops very fast. The organisation of the watersystem is strong, the price of the water is high and the village has the financial capability to solve the problems around deepening the borehole by themselves. Deepening boreholes has a limit and studies from the RIRDP show that in the near future all groundwater in the area around Al Azan will be extracted.

AS SHAQQAB, Dhamar Province Project 14

The village with 1215 inhabitants lies 25 km (30 minutes driving) southeast of Dhamar at a hill at the eastern side of the Dhamar plain. The village has primary and secondary (3) schools and the living standard is medium. The people go to Dhamar for health services.
Activities for the construction of a watersupply scheme started in 1981 with the drilling of a borehole. The construction of the scheme faced many problems and was finally completed in July 1989.
The scheme is not functioning due to internal problems.

Water: In the past people took the water from a hand-dug well with the watertable at a depth of 53 meters. Nowadays they depend on 5 private boreholes located in the plain 2-3 km west of the village, 25 minutes walking. The ladies bring the water by donkey: some well owners give water free, while others charge YR 25 per month per house. Because of village problems, some people are not allowed or willing to use water from certain boreholes. Some houses have the water brought by car for YR 50/m³.
Clothes and blankets are washed near the private boreholes. Sometimes the people go 25 minutes by car to a good spring for washing big items like carpets.

Waterscheme: The Netherlands government drilled a borehole in 1981. The yield of this well was very low and the project was cancelled. In 1985 the LDA drilled a new borehole with a good yield of 5 l/sec. A proposal for a waterscheme was made. The SRWSD would finance a 50 m³ reservoir, a pump and dieselengine, a pumphouse, a pumping main and 3 public fountains. The contribution of the village would be the well and the distribution system to the public fountains. In August 1986 a new proposal was made and the whole scheme would be completed by the SRWSD. The construction of the civil works started in March 1987 and was completed in December 1987. The vertical pump with diesel engine from Holland could not be installed because the borehole was not straight. Another electric deepwell pump with generator was ordered from Holland and installed in July 1989. The scheme was handed over to the village in November 1989.
The quality of the small distribution lines is bad: the pipes (1") are everywhere above the ground and will be destroyed easily by cars etc. The villagers complain that the distribution system is too small.

Contribution: no.

Benefits: The scheme includes 18 public taps of which only 2 are in good condition. The others are taken away or demolished. There are no houseconnections yet. There are no benefits of the scheme.
The main drawback of the scheme is that it caused big internal problems in the village.
From the information of the women, the present waterconsumption can be calculated as 25 liter per capita per day.

Organisation: The initiative for the scheme was taken by Mr Abdul Assies Musaed Al Ansi. He pushed the scheme and managed to get extra distribution lines from the project. On of the main reasons for the problems is that the scheme was officially handed over to the three aqils of the village without involving this Mr Abdul Assies. At the moment nobody is responsible for the scheme and people started to demolish the pipes. We tried to get the keys of the pump and pumphouse, but they were not in the village.

Operation and maintenance: There is no pumpoperator and nobody is responsible for the scheme.

Inside the houses: Some houses looked dirty, while others were acceptable clean. There were a lot of flies all around.
Most houses have a tank outside the house and a small tank inside. Water is scooped out from the top. Only few houses have a tap inside. Washing of clothes is done near the houses and the boreholes.
No gardens were seen.
The women accepted the fact that the scheme is not working easily.

Sanitation: Most houses have a baladih toilet, some a pour-flush. The drainage of the wastewater is to a soakaway pit or down a cliff. Others drain next to the houses in the street.
The scheme is not working and the producuction of wastewater is still low. The houses in the old village are built close to each other and there will be big wastewater problems when the scheme becomes operational.

Problems: Big internal problems. The main reason is internal disagreement. Another reason is the long implemention time combined with a design which is not anymore according to the present ideas about the distribution system. A small distribution system with only public taps is not suitable anymore for big villages like As Shaqqab.
The quality of some distribution lines is below standards.

AL HAJALAH, Water Supply Project 3.

This village with 355 inhabitants (50 houses) is located at a distance 60 kilometers northeast of Dhamar (2.5 hours driving). The village lies at the northwestern edge of the plateau on which also Bani Fallah (IWP 11) is located. The village has a confict with a neighbour village (Bayt Abu Atif) for 24 years in which several people got killed. The primary school is housed in a tent and the people have a medium standard of life. For health services the people go to Zarajah and Bani Badda at 45 minutes driving. The scheme is working well for almost three years.
Due to lack of time the borehole and the pumphouse, 40 minutes driving down in the wadi, were not visited.

Water: In the past drinking water was taken from springs 2 hours walking from the village. Water was also brought by cars for YR 150 per m^3. Washing of clothes and blankets is done near the houses, but mainly near a cistern, 10 minutes walking from the village. There are no private boreholes around. The scheme is used for drinking and personal hygiene.

Waterscheme: The government drilled a borehole in the wadi, 240 meters below the village. The depth of the borehole is 170 meters and the yield is not known. According to information of the villagers the quantity and quality of the water are good.
The project started the construction of a pumping station with an electrical deepwellpump near the well (1996 m), a second pumping station with a diesel boosterpump and a 25 m^3 reservoir halfway the mountain (2155 m) and an elevated reservoir (40 m^3) in the village (2230 m). In the village the project constructed 3 public fountains with 10 taps. The scheme was completed in May 1987.

Contribution: The village added a distribution system.

Benefits: The public taps are all changed to houseconnections with watermeters (Bosco & Co, Italy). One of the villagers bought the materials and a pipefitter from Zarajah made the connections. The quality is good and the houses have a tap above the tank. The whole village is connected.
The price of the water is YR 20/m^3 and there is continuous supply.
The estimated waterconsumption is only 11 liter per head per day.

Organisation: The initiative for the scheme was taken by a villager who went to Sana'a. The owner of the scheme is the village and there is an operator who is responsible for everything. The salary of the operator is YR 1500 per month. There are general rules and it is not allowed to use water for gardens. There is only a list of people, no bills.

Operation and maintenance: Every 4 days the operator pumps 4 hours. Total amount of pumping hours is 800 (according to the operator). This means an average of 24 hours per month during 34 months.
The present operator took over from his predecessor 1.5 years ago. He learned the job from him and there is no need or interest for an additional training course.
The operator collects every month YR 3000. His expenditures are YR 600

for diesel, YR 120 for oil and YR 150 for filters etc. His salary is YR 1500 per month. There are no savings and the village will go to the government when they need money for repair.
Three houses (6%) are not paying.

Inside the houses: The houses and the village are acceptable clean. The water is stored in metal tanks, some a little away from the houses near the main distribution lines. The tanks are filled with taps and water is scooped out from the top. Water is also taken straight from the taps.
There are no gardens.

Sanitation: There are no toilets in the houses, only a place for personal hygiene. Wastewater is drained into the streets. The wateruse is very low and there are no wastewater problems in the village.

Problems: no big problems. The only complaint is that the one-way valve near the boosterpump is not good.

AL HARUJ, Water Supply Project 5.

The village (130 houses, 856 inhabitants) is located 25 kilometers east of Dhamar, 40 minutes driving. The village has a primary school for boys and girls and a health unit from Unicef. The wealth of the village is average and there is electricity in the evening hours. The houses are scattered in at least three groups. The government built about 50 'earthquake houses' of which only a few are inhabited.
The scheme is working since 10-2-1990. There are complains about the quality of the water and the power of the engine.
The water of the project scheme was tested and the quality is bad. The water is salty and contains too much fluoride. The people complain also about the bad taste and diesel oil in the water. The water in the reservoir is hot and has indeed a film of oil on the surface. It is possible that the high temperature in the well has a bad influence on the pump.

Water: Before the earthquake the village made a watersupply scheme consisting of a borehole and a groundreservoir in the middle of the village. Water was taken from the scheme by 10 public taps directly attached to the reservoir. After the earthquake the borehole was dry and the ministry was responsible to fill the reservoir daily with a truck from Dhamar.
Drinking water is taken for free from at least 2 private boreholes, 10 minutes walking from the village. Inside the village, 5 minutes walking, are a lot of nicely maintained, covered cisterns. The people who are not connected to the scheme use this water for all domestic purposes except drinking.
Only few people use the project scheme for drinking, most just for cleaning, washing, cattle and the production of dung cakes.

Waterscheme: The government drilled a borehole with a depth of 180 meter and a good yield of 9.9 l/sec. A contractor constructed a reservoir (50 m^3), a pumphouse, a pumping main and a distribution system with 6 public fountains (16 taps). The project installed a vertical pump with diesel engine and the scheme was handed over to the village on 3-7-1989.

Contribution: no.

Benefits: The public taps are all taken away. Some ladies take water illegally. The distance from the houses to the taps is maximum 250 meter. 41 houses (32%) made a houseconnection with a watermeter. The pipes are often leaking because the quality of pipe laying is bad and the pressure of the water is very high.
Many houses are not connected because the distribution system is far away and the people don't have the money for the houseconnection. Others don't want to spent money for bad water.
The price of the water is YR 5/m^3. There is always water in the reservoir.
The waterconsumption could not be estimated.

Organisation: The government organised the scheme for the village. The owner is the village and there is an operator who is responsible for all parts of the scheme. The village and the operator made a clear agreement about the scheme. There are several rules for the scheme. Examples are: illegal connections will be punished with YR 500 and the watermeters should be installed outside the houses.

Operation and maintenance: After installation, the pump was tested for 14 days. There were problems: the engine was not fixed straight to the pump and due to friction the concrete foundation broke. Besides that the pump leaked oil through the valves under the impellors. Despite the problems, the operator accepted the keys and signed the handing over letter. The village returned the keys to the LCCD and they promised to write a letter to the project, but they didn't. After 4 months waiting the village took the keys back and organised a repair by an engineer from Al Kharba. The engine was put in a straight line with the pump on a new concrete foundation. The costs of this repair (YR 15000, 10 days work) were shared by the connected villagers. There are still problems with the engine which gets too hot.
The operator pumps every day 6 hours.
The operator has some experience from other pumps, but showed interest for an additional training.
The financial affairs of the scheme are not organised yet. The salary of the operator will be YR 1500 per month and they will try to save 1000 YR per month.
It is expected that everybody will pay, because only reliable people are connected.

Inside the houses: Most taps are outside the house. Only few houses have a watertank on the roof and taps inside. The water is stored in jerry-cans (inside) or metal tanks (outside). Some houses store drinking water in plastic buckets with lids. Not all connected houses have a watertank.
The water is taken from the top of the tanks or poured out of the jerry-cans.
There are hardly any gardens, but the people want to try it with the water from the scheme.

Sanitation: The houses are built far from each other and there are no wastewater pools in the village. The village is clean and there is hardly any garbage.
Almost all houses have a baladih toilet, only a few richer people have bathrooms with taps. There are no soakaway pits.
The wastewater from the clothes washing is used for making dungcakes.

Problems: The engine gets too hot.
The quality of the water is bad.

WASTAH, Water Supply Project 6.

Wastah (900 inhabitants) is located in the Dhamar plain, 2 kilometers northwest of Ma'abar. The distance to Dhamar is 35 kilometer (35 minutes driving). There is no health unit and for health services the people can easily go to Ma'abar. Seven hunderd meters west of the old village is a new village with 71 'earthquake houses' of which only 18 houses are inhabited. The waterscheme is built for both villages but only the new village (126 inhabitants) is connected. This new village has also a primary school for boys and girls but the children of the old village are going to the school in Ma'abar because of internal problems.

Water: The village made a watersupply scheme 15 years ago. This scheme consists of a shallow well in the middle of the village, a pump with diesel engine, a groundreservoir (18 m^3) and a distribution system. The waterlevel in the shallow well drops and the well should be deepened every year. The water of the well was tested and is of a reasonable quality. The operator of the village scheme pumps every day two hours. The price of the water is YR 20 per head per 6 months.

Waterscheme: The government drilled a borehole with a depth of 72 meter and a good yield of 10.4 l/sec. A contractor constructed a pumphouse, a pumping main, an elevated reservoir (50 m^3) and a distribution system with 4 public fountains. Another pumping main was connected with the ground reservoir in the old village. An electric deepwell pump was installed by the project and the scheme was handed over to the village on 9-9-1989.

Contribution: no.

Benefits: The project constructed 8 public taps. The distance from the taps to the houses is maximum 150 meters. The general stuation is very bad: only 2 taps are working and there are big wastewater pools around. The discharge pipes for wastewater are blocked.
Only the house of the operator has a houseconnection without a watermeter. The price of the water is YR 50 per house per month. There is continuous supply.
The estimated waterconsumption is 13 liter per capita per day.

In the old village connections to the houses are made. Some have only a tap outside the house while others have a tank. There is only water for half an hour per day.
Most villagers in the old village want to be connected to the new scheme because the far away houses don't get enough water and the scheme is also often out of order for 1-2 months. The villagers have to pay additional mony for the repairs. The four owners of the old scheme are against this idea because they have some income from the scheme. The villagers have to change all together; changing on an individual basis to the new scheme is impossible.

Organisation: The village asked for the scheme in Sana'a. In a later stage the operator went to the project office and asked for assistance. The scheme is owned by the village and there is an operator.

Operation and maintenance: The pumpfrequency is once per month, 2.5 hours. The total amount of pumping hours is 10, this means an average of 2 hours per month.
The operator got instruction about the use of the pump, but shows interest for an additional training course.
The operator collects every month YR 350. The expenditures for diesel etc are not known. The scheme has already a negative balance because the operator spent YR 4500 for materials, diesel and transport. This means a debt of YR 900 per month. The operator asks YR 2000 from the old village as contribution for his expenditures.
The new village is mainly inhabited by seasonal workers of low class. These people (11 houses, 61%) don't pay for the water.

Inside the houses:
New village: some houses are clean, while others are dirty. In general the new village is clean. Water is collected and stored in jerry-cans. Many houses have a little garden which are watered with clean water.
In order to avoid wastewater in the vilage the ladies wash clothes near 3 private boreholes, 10 minutes walking away.
Old village: Few houses have a garden which are watered with clean water if available. If not the people use wastewater. There is a general lack of knowledge about health and hygiene. All families have cattle which are drinking from the village scheme.

Sanitation: All new houses have a pour-flush toilet but because of the bad smell they are not used. The soakaways are too small and the covers are very bad or not present. Two families enlarged the pits.
Around the public taps are big pools with wastewater.
At the school and the mosque in the new village are very dirty toilets.

In the old village almost all houses compose of a baladih toilet with the drainage next to the houses. The old village is very dirty with big pools filled with garbage and drainwater from the toliets. Flies were all around.

Problems: The old village is not connected. These people were not cooperative from the start of the project.

AL HASOON, Water Supply Project 7.

This village (1120 inhabitants) is located in the Dhamar plain, 1 km east of Ma'abar. The distance to Dhamar is 30 kilometer (30 minutes driving). The village has primary and secondary schools for boys and girls and a health unit. There are five sub-villages and the wealth is medium. The government added 3 groups of 'earthquake houses' , which are almost all empty.
The waterscheme doesn't function.

Water: Most houses are already connected to the watersupply system of Ma'abar town. The pressure of this system is very low and the people take water from taps situated 50 cm below street level in big holes excavated in the sand. The supply of water from this scheme is not enough and the people use also water from other sources.
Around the village (10 minutes walking) are many shallow wells and the water is brought to the village by car, donkey or wheel barrow. Washing of clothes and blankets is often done near the shallow wells. The borehole of the scheme is not used at all.

Waterscheme: The government drilled a borehole with a depth of 106 meter and a good yield of 9.2 l/sec. A contractor constructed a pumphouse, a pumping main, an elevated reservoir (50 m^3) and a distribution system with 8 public fountains. The scheme was completed with the installation of a vertical pump with diesel engine in January 1990. The village doesn't agree with the size of the engine and refuse to accept the scheme.

Contribution: no

Benefits: The project constructed 22 public taps which are all taken away. The distance from these taps to the houses is maximum 100 meters. There are no houseconnections nor watermeters.
Most houses are already connected to the water supply of Ma'abar but this scheme doesn't give enough water. The people invested YR 600 per house for a connection to this scheme; the price of the water is YR 30 per house per month. The project scheme has only public taps and this means in fact a step back in the development.

Organisation: Nobody asked for the borehole and it was a big surprise when the drilling rig came. The people of the village don't understand why the project made a new distribution system. The contractor made the scheme according to the design of the engineers from the Ministry.
The owner of the scheme is the village and there is an operator without a task.

Operation and maintenance: The operator has experience from private pumps but is not realy interested in the scheme. According to his information the reservoir was only half full after 6 hours pumping. This is not true because the total amount of pumping hours is only 4 and an inspection of the reservoir showed that it is almost completely full. The people told us that the contractor did so.

Inside the houses: Most of the houses and the villages are dirty.
Water is stored mainly in jerrycans and bowls, only few families have a tank.
Clothes are washed near the shallow wells or near the houses with water from the shallow wells.
There are no gardens.
The knowledge of the women about health and hygiene is minimal.

Sanitation: Most houses have baladih toilets with the drainage in the streets. There are some pits.

Problems: The people are not interested in the scheme and say that the engine is too small.

HAMUD, Water Supply Project 8.

This village is located 9 kilometers south of Dhamar, 2 kilometers east of the road to Taiz, 15 minutes driving from Dhamar. The village is rich and has 3 classes primary school. The village has 1326 inhabitants and there are 5 groups of houses. The government built several 'earthquake houses' which are almost all empty. There is no health unit but the people can easily go to Dhamar.
The project built a pumphouse, a reservoir and 7 public fountains but the scheme was never completed because the villagers were not interested.

Water: There are at least three private systems for the supply of water to concrete reservoirs inside the village. The people can take water from there for free. Some people made a houseconnection from the scheme and pay 100 YR per month.

Waterscheme: The government drilled a borehole with a depth of 134 meter and a resonable yield of 3.8 l/sec. The project constructed a pumphouse, a reservoir (100 instead of 50 m^3 as was designed!) and public fountains. The contractor didn't complete the work and the villagers were not interested in the scheme. The project decided to cancel the scheme and to stop all activities. A good decision because the villagers are not concerned at all.

Contribution: no.

Benefits: no, also no drawbacks for the people.

Organisation: none.

Operation and maintenance: none.

Inside the houses: The houses did not look clean. Water is taken from the private reservoirs and stored in small tanks or jerry-cans. Clothes are washed near the houses and the wastewater is thrown outside.
Only few gardens. The owner has to pay YR 50 per month for the water.

Sanitation: All houses have a baladih toilet with the drainage beside the houses. There was a lot of wastewater and the village was dirty.
There are two mosques with baladih toilets.

Problems: Scheme not completed and people not interested.

BIDASHY, Water Supply Project 9.

This village with 738 inhabitants is located at a high place at the eastern edge of the Dhamar plain. The distance to Dhamar is 17 kilometers, 40 minutes driving. The houses are built far from each other in at least seven sub-villages. The government added a new village with 96 'earthquake houses' at a distance of 600 meters from the old village. The village has a primary school for both boys and girls in a room made of corrugated iron sheets. A new school from the government is under construction. There is no health unit and the people go to Dhamar for health services. The living standard is average. Many man are working in Saudi-Arabia and these families are rich. The other families are generally poor.
The waterscheme is not working.

Water: The village had three shallow wells which were all dry after the earthquake. Nowadays the ladies take free water from small reservoirs near 3 private boreholes in the wadi, 20 minutes walking. Some families are not allowed to use this water and use rainwater and water from trucks (YR 25/m^3).

Waterscheme: The government drilled a borehole with a depth of 105 meter and a good yield of 5 l/sec. A contractor constructed a pumphouse, a pumping main, a ground reservoir (50 m^3) and a distribution system with 10 public fountains. The scheme was completed with the installation of a vertical pump with diesel engine in June 1989. The village doesn't agree with the size of the engine and refuse to accept the scheme. There are also other problems like leaking of the reservoir, a pumping main which is not fixed properly and a distribution system with too small pipes. Another problem is that at many places with road crossings, the pipes are not burried. The project told the village that these things will be repaired after signing the official handing-over letter. A strange procedure!

Contribution: no.

Benefits: The scheme is not working and the system starts to deteriorate. Several pipes are already broken. The contractor made public taps despite the fact that the villagers didn't want them. They had the intention to make houseconnections with watermeters.

Organisation: After the earthquake the villagers went to the governor to ask for assistance. After a long time waiting, the borehole was drilled. The people from the ministry made a survey in cooperation with the villagers but the construction was not done very well.

Operation and maintenance: There is no pumpoperator. Total amount of pumping hours is 10. Filling the reservoir takes 5.5 hours, which is according to the specifications of the pump. The people complain that the engine gets too hot.

Inside the houses: The houses and villages are clean. Few houses have a small tank with taps at the bottom which are kept very clean. Others store the water in jerry-cans.
Clothes are washed near the rainwater reservoirs.

Sanitation:
The houses are built far from each other, there is no water yet and there are no wastewater problems. All houses have a baladih toilet and the drainage is made far away from the houses down a cliff.

Problems: - problems with the pump;
- reservoir, distribution system and pumping main not well constructed.

BASHAR, Water Supply Project 10.

Bashar is located at the western foot of a mountain overlooking the Dhamar plain to the west. The distance to Dhamar is 17 kilometers, 40 minutes driving. The village is rich, has 720 inhabitants (118 houses) and a primary school for boys and girls. There is no health unit and the people go to Dhamar for health services.
The houses are scattered in seven groups. The government built 40 'earthquake houses' in a village 700 meters from the old settlement. All new houses are empty.
The waterscheme functions well since October 1989.

Water: There are several irrigation boreholes and shallow wells 10 minutes walking from the village. The village used to have a village watersupply scheme: a groundreservoir at a central place in the village which was filled free by the owner of a shallow well.
The private wells are still used for washing.

Waterscheme: the government drilled a borehole with a depth of 95 meter and a good yield of 8.9 l/sec. A contractor constructed a pumphouse, a pumping main, a ground reservoir (50 m^3) and a distribution system with 9 public fountains. The scheme was completed with the installation of an electric deepwell pump with generator. The scheme was handed over to the village on 17-10-1989.
The well of the scheme is also used for irrigation purposes.

Contribution: the villagers did excavation works for the pumping main.

Benefits: The public taps of the project (20) have all been changed to houseconnections. All houses have a houseconnection with a watermeter. The costs for the houseconnections (YR 70,000 total) are shared between all houses. This means an average of YR 593 per house.
The price of the water is YR 8 per m^3. Each house has to pay an additional YR 10 per house per month for the scheme box. There is continuous supply of water.
The calculated waterconsumption is 26 liter per capita per day.

Organisation: The sjeich and another villager were asking for the scheme. The scheme is now owned by the village and there are an operator and a cashier. The operator is responsible for the pump and the pipes.
There are strict rules for the use of the scheme. Destroying the pipes costs in general YR 1000, but YR 5000 when it is done on purpose.
The cashier has special bills and books.

Operation and maintenance: The operator pumps every day 2 hours. This means 240 hours per 4 months. The total amount of pumping hours is 357 so 117 hours are used for irrigation purposes.
The operator has experience with pumps from another company, but shows interest for an additional training course.
Last month YR 4560 was colllected for 570 m^3 water. The expenditures are YR 900 for diesel and YR 180 for oil. Salaries are YR 2500 for the operator and YR 500 for the cashier. The rest of the money is used for small repairs of the pipes.

An additional YR 1180 (YR 10 per house) is collected for big repairs.

Inside the houses: The houses and village looked clean. The water is adequate and the supply is daily for two hours. All houses have a tank with a tap above for filling. There are taps at the bottom of the tanks. Some clothes are washed near the houses and wastewater is thrown outside. Most families wash the clothes near the boreholes. There are many gardens watered with clean water from the scheme.

Sanitation: Most houses have a pour-flush toilet with a soakaway pit. No wastewater was seen in the village.

Problems: no

MANGADA, Water Supply Project 11.

This big village with 2713 inhabitants is located in the Dhamar plain, 12 kilometers north of Dhamar (25 minutes driving). The sub-villages are built on the bottom of big rocks on which the old villages used to be built. The village has primary and secindary (3) schools for boys and girls and the wealth is medium. The health unit is still housed in a tent, but a masonry building is under construction.
The water scheme functions very well for 9 months.

Water: Before the earthquake the village had a spring at 20 minutes walking from the village. Besides that there was a big cistern, 10 minutes walking from the village. One year after the earthquake the people paid YR 300 for the construction of a village waterscheme with a borehole and two reservoirs. The water from this scheme was also sold for irrigation purposes and this made the domestic water free. The surplus money was used for the construction of the mosque. The engine of the scheme was not maintained well and after four years the scheme broke down.
Some people are not connected to the scheme and they use water from one of the 14 private agricultural wells around.

Waterscheme: The government drilled a borehole with a depth of 96 meter and a reasonable yield of 3.2 l/sec. A contractor constructed a pumphouse, a pumping main, a reservoir (150 m^3) and a distribution system with 12 public fountains (46 taps). The project installed a vertical pump with diesel engine and the scheme was completed in December 1988.
It is not allowed to use the water from the scheme borehole for other purposes like growing of qat.

Contribution: no.

Benefits: The public taps of the project are all disconnected because they gave big fights between the women. Only straight to the reservoir are still two public taps for the poor people. The drainage around these taps is bad and there is a big wastewater pool around.
Most houses (315 of the 400, 79%) made a houseconnection without a watermeter. The price of the water is YR 20 per house per month. For gardens the people have to pay additional money (YR 15-25).
There is always water in the reservoir and every day one of the three distribution lines is open from the morning till the afternoon.
The estimated water consumption can not be estimated.

Organisation: Mangada got the waterscheme because it was on of the earthquake affected villages. The owner of the scheme is the village. The responsibility is handed over to the operator who put a deposit of YR 150.000 on the village account. The operator has the obligation to give water for YR 20 per house per month during 10 years.
This operator took over from the former operator who didn't take care about the pump and engine and who didn't give the same amount of water to all parts of the village. The present operator saw the bad things and felt responsible for the scheme. He added many distribution valves so he can control the different parts of the scheme easily.

The operator has a special wateroffice where the people can pay. There are special waterbills which are stamped after paying.

Operation and maintenance: According to the operator he pumps every day 6 hours. The total amount of pumping hours is 410 which means average 1 hour per day during a period of 14 months.
The operator has some experience with pumps but is very interested to have an additional training course.
The operator collects per month YR 6300 from the houses and some additional money for the gardens. His expenditures are YR 1485 for diesel and YR 285 for oil. His income can be calculated as YR 3280 per month (YR 4530 - 1250 for the savings). The savings of the scheme are YR 150,000 per 10 years, this means YR 1250 per month.
Some houses are not able to pay for the water.

Inside the houses: The village and houses looked clean. Water is stored in tanks inside the houses, The tanks are filled with the use of taps and water is scooped out from the top or with a tap. Clothes are washed near the houses. Some houses have a garden watered with clean water from the scheme.

Sanitation: The houses are built close to each other and at several places are problems with wastewater. Several houses have a flush toilet with a drainage pipe to the wadi far away from the village.

Problems: not yet.

AR RABA'AH, Water Supply Project 12.

This village (899 inhabitants, 118 houses) is located 20 kilometers (35 minutes driving) southwest of Dhamar. The village is wealthy and has a primary school. The scheme includes two villages: Ar Raba'ah (85 houses) and Al Hoden (33 houses). There is no health unit and the people go to Dhamar for health services. There are 60 earthquake houses of which approximately 20 are inhabited. The houses of the village are built far from each other on a place a little bit higher in the plain. The scheme was completed in april 1989, but became operational on 20-2-1990.

Water: In the past the ladies brought water with donkeys from two shallow wells, 400 meter from the village (15 minutes walking). The ladies still go there for washing clothes and blankets.

Waterscheme: The government drilled a borehole with a depth of 74 meter and a reasonable yield of good water of 2.9 l/sec. A contractor constructed a ground reservoir (50 m^3), a pumphouse, a pumping main, and a distribution system with public fountains. The scheme was completed with the installation of the pump in May 1989.
The houses are scattered and the distance from some houses to the distribution system is rather big. The differences in costs of the houseconnections gave internal problems. Two months ago these problems were solved in Al Hoden and the village got water from the scheme. Last week also the people of Ar Raba'ah came to an agreement to share the costs of the houseconnections which will be YR 7000 per house.

Contribution: no.

Benefits: The project constructed 6 public fountains with 14 taps. Only 4 of them are still good. All houses in Al Hoden and 10 houses in Ar Raba'ah (12%) made an own connection to the scheme. This means in many cases not more than a tap straight to the distribution line. There are no watermeters because of the costs.
The price of the water is YR 5 per capita per month.
The consumption of water can not be calculated.

Organisation: The two aqils from Ar raba'ah and Al Hodeh asked for the scheme. The owner is the government and the aqils are responsible.

Operation and maintenance:
The pump frequency is once every 3 days for 2 hours. The total amount of pumping hours is 36.
The operator of the scheme got instruction about the use of the pump for only 1 hour. He doesn't have any experience with pumps and an additional training is necessary.
The people from Al Hoden paid last month YR 1000. The people from Ar Raba'ah has to pay YR 3000 per month.
The salary of the operator is YR 1500 per month.
The financial affairs are not organised yet.

Inside the houses: The village and the houses look clean except for the toilets. Water from the scheme is adequate and stored in tanks inside

the houses. The tanks are filled by jerrycan or by hose from the tap near the distribution line. Clothes are washed near the houses. There are a few gardens and they are watered with clean water.

Sanitation: Most house have a baladih toilet, some houses only for urine. The drainage is outside next to the houses. No wastewater was seen during the visit.

Problems: internal problems in the village.

AL MITHAL, Water Supply Project 13.

The wealthy village with 1744 inhabitants, lies 17 kilometers northeast of Dhamar at the bottom of a mountain overlooking the Dhamar plain to the west. Dhamar is 40 minutes driving. The village has a primary and secondary school for both boys and girls. There are electricity and telephone. There is no health unit and for medical treatment the people travel to Dhamar. West of the old village is a new village with 'earthquake houses'. Almost all new houses are empty.
The waterscheme is not functioning due to internal problems.

Water: Near the village are two old shallow wells. These wells have a limited yield and the water is used for drinking in only 5 families. Most ladies bring free drinking water with a donkey from one of the 6 private boreholes at a distance of 2-3 km west of the village. Three cars bring water to the village for YR 80/m^3.
Clothes and blankets are washed near the shallow wells and boreholes and also near the houses. The borehole of the scheme is not used for other purposes.

Waterscheme: The government drilled a well with a total depth of 270 meter, a reasonable yield of 2.5 l/sec and water with a good quality. A contractor constructed a reservoir (100 m^3), a pumphouse, a pumping main and a distribution system with public fountains. The scheme was completed with the installation of an electric pump with generator. The village rejected this pump and wanted to have an heavier one. The project took their pump back and the Ministry of Electricity and Water installed an heavier one.

Contribution: no.

Benefits: The scheme did never function. The reason for this is that the villagers refuse to pay YR 100.000 to the sjeich who spent this money for guarding the project pump (15.000), spareparts for the pump (35.000) and public relation work (50.000). According to the information of the sjeich 90% of the people agree with his claims. However, up till now nobody paid and the waterscheme seems to be one of the items in a bigger game.
The public fountains are all disconnected and a lot of houses made already houseconnections. Some people constructed a completely closed system with a tank on the roof, others constructed a tap near or inside the house. Several families didn't complete the houseconnection. The public fountains are closed because they expect that it will be dirty places. There are no watermeters installed. The average price of a houseconnection is YR 2500 with a water tank.
The price of the water is not known yet.

Organisation: The initiative for the scheme was taken by the sjeich who went to the ministry in 1983. Some people in the village also said that he is the owner of the scheme.

Operation and maintenance: The operator got a training course in Sana'a and has some experiene with private pumps.
The total amount of pumping hours is 8 and filling the reservoir takes 3 hours.

It is not clear yet how the operation of the scheme will be organised. They hope that they will save YR 4000 per month for big repairs.

Inside the house: In general the houses looked clean. Almost all houses have a big steel watertank with a tap at the bottom.
No vegetable gardens were seen, only a few trees that don't need watering anymore. Some women mentioned that they have no health facilities in the village and people are dying on the way to the hospital in Dhamar.

Sanitation: Almost all houses have either a baladih or pour-flush toilet. Some houses have a pit. Wastewater is thrown in the toilet or in the street.
At present the wastewater problems are small, but they will be bigger when the water scheme becomes operational. The houses are built close together and there is money enough to invest in wastewater producing items like flush toilets, bathrooms and washing machines.
There are no toilets at the school.

Problems: Big internal problems.

ADRA'AH, Water Supply Project 14.

This big village (300 houses, 3095 inhabitants) is located 5 kilometers south of the road Dhamar-Rada near Sannaban. The distance to Dhamar is 25 kilometrs, 40 minutes driving. The village is wealthy and has primary and seconcary schools and a health unit. Besides Adra'ah are five subvillages: Abalah, Ar Rakh, Al Kharabah, Ar Rukbah and Ad Dayyah. There are 125 'earthquake houses' of which approximately 25 are inhabited. The main village lies at the bottom of a steep rock at the junction of two wadi's.

Water: In the eastern wadi is a spring with a good yield (1.5 l/sec) at a distance of 200 meter of the village. The villagers constructed a reservoir (15 m^3) with 5 taps. Many ladies are washing clothes near this reservoir and there are very dirty wastewater pools around. More upstream in the wadi, 10 minutes from the village, is a dam and the ladies go there for the washing of clothes and blankets. The people mentioned another spring (without reservoir) and a dam in the western wadi. Private boreholes near the village give salty water which is used for washing and drinking.
Some villages of the Joar project (DPP2-9) mentioned the springs of Adra'ah as alternative watersource when their waterscheme was not working. The distance to these villages is 3-4 hours walking.

Waterscheme: The village drilled a borehole with a depth of 110 m. A pump test carried out in 1986 showed a good yield. In February 1988 the project wanted to install the pump but the steel well cap was removed. The well was filled up with stones to a depth of 53 meter and there was no water anymore. In October 1988 the village repaired the well to a depth of 103 m. For this the almost completed pumphouse was destroyed. A second pumptest carried out in March 1989 indicated a good yield of 8.6 l/sec. The vertical pump with diesel engine was installed by the project in July 1989.
In October 1987 a contractor started the construction of a reinforced concrete reservoir (150 m^3), a pumphouse and 10 public fountains. This contractor didn't complete the job and another contractor took over in August 1989. He completed the reservoir, reconstructed the pumphouse and laid the pipes. The scheme was completed and handed over in January 1990.

Contribution: Drilling the well (YR 250.000).

Benefits: The public fountains were never connected to the scheme. The villagers don't want them because they will create dirty places like the place around the existing reservoir. They started to make houseconnections with standard watermeters (type: Bosco & Co, Italy). There is a special administrator who arranges the houseconnections. After 1 month, 45 houses (15%) are connected to the scheme and every day, 1 or 2 new connections are made. The average costs of a houseconnection are YR 1600 per house (YR 700 pipes (30 m), YR 200 watermeter, YR 700 watertank). The quality of the houseconnections is very good. People who can not afford a houseconnection are not allowed to use the scheme.

These families continue to collect the water from the springs by donkeys. Mainly the houses close to the distribution system made a houseconnection. The people in the houses further away think that the government is responsible for the extra pipes needed.
The price of water is YR 6/m^3 and there is almost continuous supply.
The estimated waterconsumption is 25 liter/capita/day.

Organisation: The initiative for the scheme was taken by one of the villagers who went to the LCCD. The owner of the scheme is the village which elected a water committee of 15 persons for a period of 2 years. Five of them are responsible for the administration and they are controlled every six months by the other 10 members of the committee. The pump operator and the administrator will be the only members with a salary. This committee issued 30 rules for the use of the water scheme. Examples are that it is not allowed to make houseconnections without permission of the administrator and that it is allowed to use the water for small gardens near the houses.
There will be a special water office in one of the new built houses.

Operation and maintenance: The operator pumps every day 2 hours and keeps the reservoir always filled with water. Filling the reservoir takes 7 hours. Total amount of pumphours is 50.
The pumpoperator got a training course (24 days) in Sana'a and has a good idea about the maintenance of the pump.
The administrator gives special bills at the end of the month. This month he collected YR 1000. According to his information only 2 of the 45 connected houses can not pay for the water. Their houseconnections are paid by others.
The scheme is working only for one month and the water committee has still to decide upon the salaries for the operator and administrator.
So far all connected houses paid YR 100 for diesel and oil.
Repairs of the scheme should be paid from the savings.

Inside the houses: The houses and streets are clean. Many houses made a closed system including a metal watertank. Some houses have a garden which is watered with water from the spring.

Sanitation: Some houses have a poyr-flush toilet with drainage pipes to outside the village. Most houses in the village are scattered and the wastewater problems are not so big. Some houses made soakaway pits.

Problems: The scheme is working good.

DHI SABIL, Dhamar Health Project 43.

The village with 496 inhabitants is located 15 kilometer southwest of Hammam Ali, 1.5 hours driving from Dhamar (55 km). There is a primary school for girls and boys and a health unit with a male and female primary health care worker. The living standard is average, but it struck that there were several handicapped people in the village. The village lies at the northside of a mountain ridge overlooking the wadi of Hammam Ali.
The waterscheme is not functioning because the spring gives only a very small amount of water.

Water: Ten minutes walking east of the village are two springs 50 meters from each other. Twenty years ago the springs were big and the water reached the wadi 500 meter down. The springs belong to people from another village and in the beginning they refused the water to be pumped up to the village reservoir.
The most western spring provided the water for the waterscheme, but according to the information of the villagers the yield of this spring depends strongly on the rains. It is normal that this spring is almost dry for 3-4 months a year. In March 1990 the yield was estimated to be 2 l/minute only. The spring is inside a cave (with a door) where the water comes out of a crack in the rock. Nowadays the women take the water from inside the cave, but at the time the scheme was operational the door of the cave was locked and the water could not be reached.
The other spring gives a more constant yield of some liters per minute. The water is collected in an underground, covered bassin with only a small opening (40 * 30 cm) for keeping the water clean. Water can be taken from there with a small container, but a jerrycan or bucket can not enter this bassin. The excess water, if any, goes to some fields with alfalfa. Children spent a lot of time with filling the jerrycans with the small containers.
Despite the scarcity of water, fights and conflicts were not reported.
There is no water available for irrigation.
When the yield of the springs is realy low (3-4 times a year) the women go to the wadi for collecting water and washing clothes (2 hours walking). Water is also brought by car for YR 200/m^3.

Waterscheme: The construction of the scheme started in September 1987. The project improved the situation around the spring and constructed a concrete cistern for storage of water nearby. A boosterpump was installed to pump the water from this cistern to the masonry village reservoir (6 m^3). The scheme was completed in December 1987. An additional line to the health unit was made in February 1988.

Contribution: no contributions.

Benefits: The scheme was working for more than one year. Six months ago some pipes broke down in a period with heavy rains. The yield of the spring was very low and the villagers felt it not worth to repair the pipes. Like before they fetch water straight from the springs. At the moment there are no benefits from the scheme.
When the scheme was operational the water use increased and fights near the taps occured.

The project constructed 7 public taps straight to the reservoir. Four of them are still in good condition. Nobody made a houseconnection. The price of the water was YR 10 per house.
The present waterconsumption can be estimated as 12 l/capita/day, not including washing of clothes.

Organisation: The initiative for the scheme was taken by the primary health care worker. At present the village is the owner and there is still an operator who never got a salary.

Operation and maintenance: The scheme is out of order and the information is not clear anymore.

Inside the houses: The houses looked acceptable clean. Water is stored in small containers without a tap or in jerry cans.
Washing of the clothes is done a little distance away from the spring.
There are no gardens in the village.
The women didn't know a lot about health and hygiene. The female primary health care worker finished her training 6 months ago but she only works in the unit.

Sanitation: Most houses have a place for washing and urine. Some houses constructed pipes for drainage of wastewater. Wastewater was not seen in the village.
There are many cows and a lot of cow dung in the village.

Problems: The low yield of the spring. The problem of the waterrights seemed to be solved now.

DHAFAR and AL GALEH, Rural Water Projects 6 and 7.

Dhafar is a small poor village (50 houses, 275 inhabitants) located 12 kilometers southeast of Yarim. Dhamar is 1 hour, 42 kilometers. In the past Dhafar was very important as capital of an old kingdom. The village is located at the top of a mountain overlooking the plain around Yarim. There is a primary school, but for health services the people have to go to Yarim or Kitab, 25 minutes driving.
Al Galeh is located at the bottom of the same mountain, is wealthier and has 55 houses with 400 inhabitants.
There is no special relation between the villages and Al Galeh asked for a connection when the construction of the scheme started. The connection was made but Al Galeh didn't get water because Dhafar asked YR 50 000 as a contribution to the acquisition costs of the scheme (food, qat etc.). This resulted in internal problems in Al Galeh because the village got only a 1.5 " line with 1 public fountain (2 taps) for 55 houses. The objections of Al Galeh are understandable because the village has to spent a lot of money for a proper distribution system. The people of Al Galeh paid already Y 25 000 to their aqil for this, but they don't want to pay more.

Water: Around Dhafar are many cisterns at a distance 10 minutes walking from the village. Nowadays they are used for washing clothes and blankets, for cattle and cleaning. The water of the scheme is mainly used for drinking and personal hygiene.

Waterscheme: The government drilled a borehole with a depth of 250 meter a good yield of 4.4 l/sec and water of good quality. A contractor constructed a reservoir (25 m^3), a pumphouse, a pumping main and a distribution system with public fountains. The scheme was completed with the installation of an deepwell pump with a 57 KVA generator in May 1989. The scheme was handed over to the village in January 1990.

Contribution: no.

Benefits: The project made 6 public fountains with 24 taps of which 13 (54%) are still functioning. The construction of the taps is not nice and the provisions for the drainage of wastewater are not sufficient. There are dirty pools with wastewater under and around them. The maximum distance from the houses to the taps is 200 meters.
Houseconnections are not made because the people don't have money . One person started and made a pipe from a public tap to halfway his house.
The price of the water is YR 20 per house per month and there is only twice a month supply.
Five houses (10%) are not able to pay for the water.
The estimated waterconsumption is 12 liter per capita per day.

Organisation: The initiative for the scheme was taken by the chairman of the council for antiquities who went to the ministry of electricity and water. The owner of the scheme is the village and the operator is responsible for the whole scheme.

Operation and maintenance: The operator pumps every 2 weeks 6 hours with an open distribution system. The total amount of pumping hours is 135, what means 12 hours per month for a period of 11 months.
The operator has some experience with diesel cars and got an additional training course in Sana'a. The pumphouse is very clean.
The operator collects every month YR 900. The expenditures are YR 275 for diesel, YR 100 for oil, YR 25 for filters and YR 500 for salary. There are no savings.
Money for big repairs will be collected from the villagers.

Inside the houses: The houses looked reasonably clean. Every two weeks the water is brought with hoses to the tanks. Water is scoped out from the top of the tank or with a tap. Some families have only a small tank because they can not afford a bigger one. For all families, especially the ones with a small tank, the supply is not adequate and they still fetch water from the cisterns for the cattle and cleaning. All women want houseconnections so they will not spill so much water and subsequently have enough water in the village. For making dungcakes they use wastewater and water from a cistern near the mosque.
There was only one garden which belongs to the sjeich and which is watered with a truck.

Sanitation: Only few houses compose of a toilet and most people go to places outside the village. There was no wastewater near the houses, only the spilling near the taps is evident.

Problems:
Al Galeh is not connected.
The organisation of the scheme is very weak and it can be expected that the scheme will not be sustainable for a long time.

Since dec '89

SHARAFAH, Rural Water Project 9.

Sharafah (596 inhabitants, 68 houses) is located 25 kilometers south of Dhamar, 2 kilometers from the asphalt road Dhamar-Yarim. The driving time to Dhamar is 25 minutes. The village is rich and there is a primary school. For health services the people go to Dhamar or Yarim. The village lies at the top of a small mountain with a steep canyon south of it. The scheme functions for 1 week.

Water: Around the village, 15 minutes walking, are three private boreholes. These are mainly used for irrigation but the owners constructed also some pipes to the village. The tanks near the houses were filled with plastic hoses for YR 100 per m³. Some people brought free water with donkeys straight from the borehole. Almost all people use the project scheme for all domestic purposes except washing of blankets which is mostly done at the private boreholes.

Waterscheme: The government drilled a borehole with a total depth of >72 meter and a yield of 5.8 l/sec. The project started the construction of a watersupply scheme with village participation in August 1989. The project supplied the vertical pump with diesel engine, the pipes and steel & cement for the masonry reservoir (50 m³) and the pumphouse. The scheme was completed in December 1989 and handed over to the village in February 1990.

Contribution: Labour, local materials, transport, housing. The participation of the villagers was average and there were some minor problems. The villagers themselves have a positive feeling about the participation and it was not too heavy for them. According to their information all people participated or hired labourers from the village.

Health education: Two months after the construction of the scheme started, health education meetings with the women were organized. At the beginning the interest was rather low, but later on the women became very enthousiatic. Subjects discussed were the importance of clean drinking water, diarrhoea (ORS), worms, flies and wastewater. During our visit, the women made several remarks about the health education and they want to make adaptations according to the given advices. It is still too early to see any real improvement.

Benefits: There are no public taps. Almost all houses (94%) made a houseconnection with Italian watermeters. Four houses are not connected due to personal circumstances. Every houseowner paid for his own houseconnection (circa YR 1000 without tank), but the construction was mainly done by one of the villagers. The quality of the houseconnections is very good and many houses have a closed system with a tap at the bottom of the watertank (2 m³) and sometimes taps inside the house. One house has even a shower.
The price of the water is not yet known. There is almost always water in the reservoir.
The waterconsumption can not be calculated but is estimated as 15 liter per capita per day from former water use.

Organisation: Somebody from the village who lives in Sana'a took the initiative for the scheme. The owner is the village and there is an operator with a salary of YR 500 per month.

Operation and maintenance: The operator pumps every four days 3 hours. Total amount of pumping hours is 16 (9-3-1990).
The operator has some experience with private engines and there is no need or interest for an additional training course. The project sent a mechanical engineer to give the operator some training.
The expenditures for diesel, oil etc are not known yet.

Inside the houses: Some houses looked clean while others were dirty. The water is stored in tanks outside the houses. All tanks have a tap and few families made taps inside the house.

Sanitation: There is a lot of waste, shit and dung inside the village. Most houses have a baladih toilet. Wastewater is generally drained next to the houses, but some houseowners made a drainage pipe from the bathroom to the garden or a place away from the houses. There are no soakaway pits.
Clothes are mainly washed near the houses and the wastewater is thrown in the streets. Wastewater is also used for making dungcakes.

Problems: no

BAYT AS SHAMY, Rural Water Project 10.

This small village with 300 inhabitants is located 27 kilometers south of Dhamar, 2 kilometers from the asphalt road Dhamar-Yarim. The driving time to Dhamar is 30 minutes. The village is poor, there is no school and the people go to Yarim for health services. The village is situated at the bottom of a big rock. There is little agriculture but the people have a lot of sheep. Families who left the village for Yarim because of the lack of water return now. The scheme functions just for 5 days. The information from men and women about the scheme is not univocal.

Water: Three hunderd meter from the village (10 minutes walking) is a contaminated spring which is still used for cattle. Another spring at 2 km from the village (30 minutes) is used for washing blankets. The water of the scheme is used for all domestic purposes.

Waterscheme: The village drilled a borehole with a total depth of 140 meter and a yield of 6.25 l/sec. Three other boreholes were dry and the village spent in total YR 245,000. The project started the construction of a watersupply scheme with village participation in June 1989. The project supplied the vertical pump with diesel engine, the pipes and steel and cement for the masonry reservoir (25 m^3) and the pumphouse. The scheme was completed in December 1989 and handed over to the village in February 1990.

Contribution: Borehole, labour, local materials and housing. The village participation was very good and the villagers themselves have a positive idea about the fact that they worked together for the scheme.

Health education: During the construction of the scheme the village was visited 12 times. Discussions with the women about diarrhoea, ORS, hygiene, wastewater, food intake after recovery, worms, bottle milk and houseconnections were attended by a group of 25 women. In general the women were enthusiastic and attentive.
During our visit, the women know about the topics discussed in the meetings, but don't practice it much.

Benefits: There are no public taps. All houses made houseconnections with watermeters, type Bosco & co, Italy. The houseconnections are made on an individual basis and the quality is good.
The villagers constructed a cattle trough near the reservoir. This trough is used, but too big and the sheep are standing inside for drinking the water in one of the corners.
The price of the water is YR 10 per m^3. The people paid YR 20 per house for buying the first diesel and oil. There is almost always water in the reservoir and the distribution system is every day open for 2 hours. The ladies say that there is only once a week water.
The waterconsumption can not be calculated yet.

Organisation: The mandub lobbied in the ministry in Sana'a for a watersupply scheme. The owner of the scheme is the village and there is an operator. His salary is not fixed yet.
There are no bills and only general rules for the use of the scheme.

Operation and maintenance: The operator pumps every other day 3.5 hours. Total amount of pumping hours is only 8 (4-3-1990).
The operator has some experience with private engines and got an additional training course in Sana'a.
The expenditures for diesel, oil etc are not known yet.
Four poor families are not paying for the water.
The operator complained that the head of the pump becomes too hot.

Inside the houses: Most houses are clean, while some others are dirty. Water is stored in tanks next to the houses and in additional jerry cans. The tanks have taps at the bottom. A lot of water is spilled because the taps are leaking and the children play with the taps.
Clothes are washed near the houses.
Many houses have a garden which are watered with the water from the scheme.

Sanitation: Most houses have a baladih toilet with the drainage of wastewater in the streets next to the houses. Approximately 10 houses haven't a toilet.
The project constructed 2 toilets at the mosque and 1 public toilet for women on a central place in the village. They are not used because the soakaways are not completed. The village would contribute to the construction by the excavation of the soakaways while the project would make the reinforced concrete covers. The project neglected to make a good contract with the villagers. They choose the most easy way of excavation and brought a big shovel instead of the necessary digging by hand. The result is two big holes 8 m long, 2 m wide and 3 m deep. The construction of the covers is now very expensive and more difficult because it will be necessary to make an extra lining of concrete blocks.

Problems: The people complain that the pumphead becomes too hot.

[illegible] Dhamar & Rada, [illegible]

AS ZUVAB, Rural Water Project 11.

105 hhs

This rich village (840 inhabitants) is located 12 kilometers northwest of Rada', 1 hour driving from Dhamar (65 km). The village has a primary and secondary (3) school for boys and girls. A health unit is under construction and female health workers are in training in Rada'. The village lies at the northern edge of the big Rada' plain near the end of the old lava flows from Jabal Isbil. The SRWSD waterscheme functions just for two months.

Water: In the past water was stored in waterholes excavated in the lava flows 10 minutes north of the village. Up till some years ago the village had a waterscheme, but the borehole dried up and the water became very sandy. The water was only used for washing the clothes and water the animals. Water for human consumption was collected from 3 private boreholes with good yields, 15 minutes walking from the village.

Waterscheme: Twelve years ago the village got YR 120 000 from the government for a watersupply scheme. The village drilled a borehole, installed a diesel pump and constructed a small reservoir beside it. The borehole was near to the village (10 minutes walking) and the ladies went there to fetch water with donkeys. The waterlevel in the borehole dropped and a try to deepen it failed. The village drilled another borehole nearby but there was not enough water. The villagers decided to go back to the first borehole and with 6 hours a day careful pumping it was possible to get enough water. The amount of water in the borehole decreased further and the government drilled a new borehole on the other side of the road.
The Ministry supplied a vertical pump with diesel engine and temporarily (10 months) the water was pumped to a small metal tank. In September 1989 the project started the construction of the other parts of the scheme with village participation. The project supplied the pipes and steel and cement for the pumphouse. The elevated reinforced concrete reservoir ($50\ m^3$) was constructed by a contractor. The scheme was completed in January 1990. The official handing over to the village was in March 1990.

Contribution: Labour, local materials, transport, housing and some galvanized steel pipes (22 pieces of 2"). The cooperation of the village was in general good. Only at the end there were some minor problems. The village saved money from the old water scheme and was able to hire the labourers from Rada.

Health education: This village had been one of the concentration villages of the women section of the RIRDP. When the construction of the water supply scheme started the Dhamar project took over. The village has been visited 7 times together with the two future female primary health care workers. Discussions were held about worms, diarrhoea (ORS), hygiene, food intake after recovery and wastewater.
The interest of the women was good, but due to strict family rules it was not possible to gather them all in one house.

Benefits: The old scheme had public taps fixed to the reservoir. The people paid YR 5 per head per month and YR 2 per sheep per year. After

Where did they keep it ?

12 years the savings of this scheme were YR 70 000. This money was used to pay the contribution for the new scheme and to pay the running costs of the SRWSD scheme so far. There is still YR 10 000 left.
The new scheme doesn't have public taps and all houses (105) made a houseconnection. Several families did not install a watermeter yet.
The houseconnections are made on an individual basis. Far away houses get support from the village box, but the watermeter and 1 or 2 pipes are always for the houseowner.
The price of the water is not yet decided. There is almost always water
The estimated waterconsumption is 30 liter per capita per day.

Organisation: One of the villagers took the initiative for the scheme. The scheme is owned by the village and the operator is responsible for the pump and the pumping main. His salary is YR 800 per month. The scheme is controlled by a committee with the representatives of the seven families as members. One of them is the cashier. There is a complicated registration system with all kinds of bills and papers. The responsible person for filling is mentioned between brackets.

1. a yearly record per house (operator);
2. a monthly waterbill to the houseowner (cashier);
3. a monthly receipt to the houseowner (cashier);
4. a yearly record per house (cashier);
5. a monthly record with the persons who paid (cashier);
6. paymentorders from the scheme committee to the cashier for buying diesel etc, should be signed by all seven members!;
7. a cash book with earnings and expenditures of the scheme (cashier);
8. a receipt when somebody buys water straight from the well (cashier); example: contractor of the road has to pay YR 25 for a big truck.
9. special tickets with fines for people who harm the scheme (cashier);
10. official paper for letters concerning the scheme.

Operation and maintenance: The operator pumps every day 2 hours. Filling the reservoir takes 4 hours. Total amount of pumping hours is 456, this means 1.5 hours per day during 10 months.
The operator has followed the training course in Sana'a.
The operator mentioned that he used to pump more often when the old system with public taps was used. The reason is that more water was wasted during filling and transport of the water.
The cashier is responsible for the collection of the money, but up till now there is no money collected. Diesel etc is bought from the village box. The monthly expenditures are YR 480 for diesel, YR 115 for oil, YR 100 for filters etc. and YR 800 for salary.

Inside the houses: The houses are all clean. Some houses have a tank for the storage of water while others have only a tap inside the house. Clothes are washed near the houses and the wastewater is thrown outside. Only few houses have a garden which is watered with clean water.

Sanitation: Only few houses have a toilet but all houses do have a place for personal hygiene. The wastewater problems in the village are limited. The village is acceptable clean.
Outside the village is a special place for burning garbage.

Problems: no.

Since August '88

BANI MUWALLAD, Integrated Water Project 2, Sanitation Projects 22,23,24 27, 28, 39.

Bani Muwallad is a very cooperative village with 600 inhabitants at a distance 45 kilometers west of Dhamar (2 hours driving). The village has a primary and secondary (3 years) school and a health unit. The wealth of the village is medium. The village is located at the top of a mountain.
After the construction of the watersupply scheme, the health education continued and the project started with a sanitation programme. First of all the project constructed toilets at the mosques, the school and the health unit. There came also a request for public toilets for women and after a thorough study the project constructed two of them. The need for toilets was big but the distance acceptable for public women toilets was small. The necessary amount of public toilets for women was rather big and during the discussions with the villagers it became clear that the villagers were willing to contribute for private toilets. The project was also interested because it was a good chance to gain experience with a private latrine programme in a very cooperative village. A proposal was made in which the houseowner would be responsible for the excavation of the pit and the construction of the toilet rooms, while the project would support with materials. See below for more details. This programme became very popular and nowadays almost all houses have a very nice toilet in- or outside the house.

Water: The village owns a spring in a small wadi, 2.5 kilometers, 40 minutes walking north from the village. The villagers constructed a spring cover and a filter and the yield of the spring is 0.3 l/sec. In periods with enough water, the water of the spring is also sold for irrigation. The money is used for the waterscheme. Eight years ago the villagers made a gravity line from the spring to the village and the women collected the water from two places with public taps. These very dirty places are now away because the villagers committed themselves to clean the places after completion of the water scheme.
There is another spring, 10 minutes walking from the village and this one is still used for washing clothes and blankets. This spring is contaminated and not suitable for drinking water.
The water of the scheme is used for all domestic purposes.

Waterscheme: For a long period the village was included in programmes for watersupply schemes of Oxfam and Transcentury. This resulted in financial support by Oxfam, which was not able to give technical support. The SRWSD got involved and in March 1988 the project started the construction of the waterscheme with village participation. The scheme consists of the existing gravity line (1") from the spring to a reservoir near the village (25 m^3, 1909 m). Attached to this reservoir is a boosterpump which pumps the water to a village reservoir on a high location (25 m^3, 1980 m). A distribution system brings the water to the village. The project supplied pipes, the pump, cement and steel. A part of the materials was financed by Oxfam. The scheme was completed in August 1988 after five months work.

Health education: The village was visited 8 times for health education sessions with the women. The number of women attending the discussions was 12-25, depending on the amount of work in the fields. One lady from the village was made responsible for the organisation of the meetings and she was very good in translating the messages to a level understood by the village women. During the sessions subjects like causes and transmission of diseases, diarrhoea, bilharzia and eye and skin infections were discussed. Later on sanitation related topics like use and reuse of water and the dangers of faeces were mentioned. This resulted in a request for toilets. The construction of the toilets was accompanied by sessions about the proper use of the toilets. After 6 and 12 months two evaluation visits have been made.
The health education sessions were very much appreciated by both men and women and a group of six women was almost always present.
There was no female primary health careworker in the village but it was no problem that the male primary health care worker attended the meetings with the women. In the near future this problem will be solved because the lady who organized the sessions in the village is nowadays on a training for female primary health care workers. She is respected very much in the village and she can play an important role in the follow-up of the project activities.

Contribution: Labour, local materials, transport, housing. From the preparation onwards the population has been very much involved. During the implementation the participation has been excellent. The villagers themselves think that their participation is good because the work is for their own benefit and it makes them feel responsible for the scheme. They started also other activities like improvement of the school and the health unit.

Benefits: There are no public taps and 70 houses (97%) made a house-connection with aw atermeter. The quality of the houseconnections is good and almost all houses have a closed system to avoid contamination. Up till now the water has been free. The reading of the water meter was taken only once, two months ago. The price of the water will be YR 5/m³. The estimated waterconsumption is 22 liter per capita per day.
A benefit for the women is that they are not suffering anymore from pains in the shoulders from carrying water on the head.

Organisation: The mandub, Abdul Latief, took the initiative for the scheme. The village is the owner and an elected villager together with the operator are responsible for the scheme.
There is a rule that the water of the scheme is only for drinking.

Operation and maintenance: Every 2 days the operator pumps 2.5 hours. The operator has experience with pumps from South-Yemen and there is no need for additional training.
There is no money collected, but the operator spends every month YR 600 for diesel, YR 110 for oil and YR 20 for grease and filters. A small amount of this money became available from selling water for irrigation purposes. This year there was enough rain and no water was sold. Up till now the running costs are paid by a few persons who seem to have made a special arrangement with the village in order to pay off old debts.
Only 2 houses (3%) are not connected: the old lady takes water from the toilets for women. Nobody is paying for the water.

what do you mean: gardens watered with "clean" water

Inside the houses: The houses and the vilage looked fairly clean which is a big difference with the last visit one year ago. Several families constructed a garden which are mainly watered with clean water. Sometimes wastewater is used for growing trees. In general there was no wastewater in the vilage.

Sanitation: The project constructed toilets at several places:
- 5 toilets at the school - 1 for teachers: squatting plate damaged;
  - 3 for boys: 1 blocked, 2 acceptable;
  - 1 for girls: dirty.

  The guard of the school is responsible for the weekly cleaning of the toilets by the students. He felt embarrassed when we complained about the dirty toilets. There is no money for brushes and soap.
  The plastering of the walls get loose at the bottom of the walls.
- 2 public toilets for ladies: used, clean, water available.
  One lady is responsible for regular cleaning.
- 4 toilets at the mosque: used, clean, water available.
- 2 toilets at the mosque: used, clean, water available.
- 2 toilets at the mosque: used, clean, water available.

  The toilets at the mosques are cleaned by anyone who passes.

Construction of private toilets:

The construction of public toilets resulted in a request for the construction of private toilets. The project made a proposal for a pilot scheme for the construction of pour-flush toilets with a soakaway. A houseowner could choose if he wants a toilet in- or outside the house.
For each toilet the project would supply the following materials:
- squatting plate;
- 1 m^2 tyles;
- 1 piece of plywood for shettering (roof and soakaway);
- 15 bags of cement (5 bags if the toilet is inside);
- steel for the top slab of the soakaway and toilet roof;
- window and door;
- tap, valve, shower head with fittings;
- 6 m galvanized steel pipe 0.5";
- paint for inside;
- PVC pipe, 4" as much as needed.

The houseowner would be responsible for:
- the excavation of the soakaway (1.5 * 1.5 * 3 meter);
- the supply of the other materials;
- the construction of the toilet and the top slab of the soakaway.

very, very much compared to other projects/countries

The response to this proposal was very good and 46 houses constructed a very nice toiletroom. Due to circumstances (money, family problems) seven houses couldn't participate and they want to be included now.
All toilets are constructed by a contractor from the village who works for the villagers at a daily rate. Part of the work was done by himself and he employed people from the village for building, pipe fitting and pipe laying. The quality of the work is very good and in many cases the toilets are nicely adapted to the given space and circumstances.

The average costs of a toilet room outside are approximately YR 20 000. The toilets are not all completed and the SRWSD expenditures are not known yet. The excavation of the soakaways was sometimes difficult because on many places the underground consists of hardrock. The costs of the soakaway are between YR 4000 and YR 8000, with an average of YR 5000. Some houses made a the soakaway deeper than 3 meters, but most of the not. Some families made the soakaway together.
The places for the soakaways were selected by the villagers. When possible, the soakaways were made on own land, but the villagers were cooperative with giving the land to others.
Only few houses connected also the kitchen to the soakaway.

Problems: no.

Do emptying problems will
shall in the future?

AL MASHAA'HIDA, Integrated Water Project 3, Sanitation projects 25 & 26

Al Mashaa'hida is an uzlat with seven small villages 5 kilometers north of Hamman Ali. Dhamar is 45 kilometers or 1.5 hour driving. Total number of inhabitants is 1025. The villages have a primary school and a health unit. Some villages have electricity and the wealth is average. The villages are located at a high plateau almost completely surrounded by deep wadi's.
In March 1990 the scheme was not functioning for two weeks due to problems about paying.

Water: There is no shallow water on the plateau and in the past the women and children brought water with donkeys from springs in the wadi's. Such a trip took four hours. Every 4 or 5 days a watercar brought water for cleaning purposes for YR 150 per m^3. One village used water from a big cistern 5 minutes from the village.
The water of the scheme is used for all domestic purposes. It is forbidden to use the water for gardens.

Waterscheme: The ministry of Public Works drilled a borehole with a depth of 290 meter and a yield of good water of 4.7 l/sec. The first part of the scheme was constructed without village participation. A contractor constructed a pumphouse, a pumping main and a reinforced concrete reservoir (100 m^3) in the end of 1987. The second part, a distribution system, was constructed with village participation. The project installed an electrical deepwell pump with a 65 KVA generator and the scheme became operational on 16/11/1988.

Health education: The implementation of this scheme was accompanied by a very intensive health education programmme. Four village were visited for 3 to 7 consecutive weeks while the education in the other villages was given by the local birth attendant. Involvement of a nurse and midwife of the health centre in Hammam Ali was less successful and they only joined once. After 6 months (21 sessions) the scheme was operational and all main topics about health were covered. In each village the start was always a little bit difficult, but the other weeks groups of 10-20 very enthousiastic women attended. Especially demonstrations of handwashing and walks through the villages with jokes about unhealthy things and practices were very useful.
After completion of the scheme the village was choosen for a try out for the cooperation between the Dhamar Rural Health Project/Health Office Dhamar and the SRWSD. From October till February health education was given according to a scheme with assistance of all levels of HOD/DHRP. In March 1990 the project evaluated the effects of this health education. The results are difficult to assess and differ considerably between the villages. One main result is that the 3 primary health care workers are motivated and capable to give advices about hygiene and health. It is a fact that the villages were much cleaner and the people were more aware about the hygiene problems. The people made pipes for the discharge of wastewater and despite the water project, the amount of the wastewater in the villages is less than before. Some houses started the construction of toilets.

Contribution: Labour, housing, food, transport. The participation of the villagers was satisfactory.

Benefits: There are no public fountains and all houses (200) made good houseconnections without watermeters.
The price of the water is YR 10/head/month. Each village has one day of the week water in order to prevent spoiling of water. This is not always enough, but then water is taken from other villagers or even other villages. Sharing water seems to be easy.
The estimated waterconsumption is 28 liter per capita per day.
One main benefit is that the women have more time for the family and housekeeping. The women feel better, have less headache and started to make gardens and baskets. The children have time to go to school and have less diarrhoea. In general the women are very pleased with the scheme.

Organisation: One of the villagers (Mohammed Mohammed Al Jabri) went for years to the ministry in Sana'a for a water supply scheme. Although he lives in Sana'a, he is now mentioned as the general manager of the scheme. The owner of the scheme is the village and there are an operator and a cashier. There is a committee for financial control with 27 members: the general manager, the operator, the cashier and 24 heads of family. There is a document with scheme rules. An example is that somebody who breaks a pipe has to pay YR 5000 and a cow.

Operation and maintenance: The scheme started well, but is at the moment in a critical position. The main reason is that the lack of watermeters gives problems between the villages which will result in a complete breakdown of the scheme.
From the start seven families (70 persons) refused to pay for the water because they say that they didn't get a new 'earthquake house'. This problem was not solved and from January 1990 on all people refused to pay. There was some money saved and the operator could continue pumping up till 10th of March. After that day he didn't do anything anymore.
The only solution for these problems is installation of watermeters and a strict application of the paying rules.
The operator pumped every day 4 hours. Total amount of hours pumped is 1827 and this means an average of 3.8 hours a day. Filling the reservoir takes 12 hours.
The operator got a training course (24 days) in Sana'a and has a good idea about the maintenance of the pump. The pumphouse is kept very clean.
The cashier collected every month approximately YR 9500. The expenditures are YR 2000 for diesel, YR 300 for oil, YR 200 for filters etc. The salary of the operator is YR 3000, the cashier gets YR 700. Each month there should be a saving of YR 3300. Most of this money is used for keeping the system the last months running.
The amount of people who were not paying was 70 (7%).

Inside the houses: Due to lack of time not all villages were visited. There are big differences between them and especially in Al Harajim the village and children were very dirty.
The houses have two tanks: one for drinking water and another one for cattle and washing. Prior to refilling the drinking water tank it is emptied in the other tank and cleaned. In some houses the drinking water tank is placed on the roof with taps in the kitchen or bathroom. Washing of clothes is done near the houses. Several families have a small garden which are mainly watered with the wastewater from washing clothes. It is forbidden to use water from the scheme for gardens.

nevertheless it is done. This gives problems because everybody pays the same amount of money and gardenowners use considerably more water.

Sanitation: The villages are small and there are no big wastewater problems. Some houses have special provisions for safe disposal of the wastewater. Several other people have plans to construct so.
Most houses have a toilet for washing and urine only. For defaecating the people go outside.
The project constructed 3 toilets, 2 soakaways and 4 public taps at the school. The toilets are used and are kept acceptable clean. From the four public taps, 3 are taken away. The last one is used.
The project made also 2 toilets at the other side of the road near the health unit. They were locked and it seems that they are occasionaly used.

Problems: financial problems because there are no watermeters.

NB. System was working again during our visit in May 1990

WATHAN, Integrated Water Project 4, Sanitation Projects 29,30,31,32.

Wathan is an uzlat with several small villages at a distance 50 kilometers (2.5 hours) west of Dhamar. The estimated total population is 3297. Wathan-mountain has 332 houses (5 villages) and is located 600 meters above the wadi's around. The main villages besides Wathan are Al Mishraq and Al Lakhama. The wealth is average.
Wathan-wadi has 139 houses and is located 100 meters above Wadi Hurdah. The two main villages in Wathan-wadi are As Salfah and Suq al Ithnayn. Wathan-wadi has many poor families.
The two wells of the water scheme are located in Wadi Hurdah.
There are primary and secondary schools and a health unit. In Wathan-mountain are telephone and electricity.
There are many new 'earthquake houses' built by the Netherlands government. Most of them are used.

Water: In the past people from Wathan-mountain took drinking water from a shallow well, 1 hour walking (400 meter down). There are also cisterns in the villages and this water is still used for washing clothes and blankets. Water was also brought by car for YR 120/m^3.
People who can not afford a houseconnection (34%) still depend on the shallow well or take water from neighbours.
In Wathan-wadi 86% of the families can not pay for the water from the scheme and still use the water from a spring which is carried through pipes to the middle of the village.
The water of the scheme is expensive and mainly used for drinking, cooking and personal hygiene.
Water of borehole 1 is also sold for drinking and irrigation (YR 10/car). Borehole 2 gives water with a 'soapy' taste and for this reason it is mainly used for irrigation.

Waterscheme: In 1981 the governor of Dhamar made a request to the president of the YAR for a watersupply scheme for Wathan. In the same year, a Yemeni mission studied the area and made a proposal to drill a borehole near the old shallow well. A Dutch team visited the area in 1984 and proposed to dig a well in Wadi Al Jawr. This land is owned by another uzlat and digging this well would have resulted in big conflicts. In 1985 the SRWSD received a request from the Dhamar Aided Selfhelp Reconstruction Project (DASR) for a water supply scheme for Wathan. The problem was that there were no good watersources available. Despite this, March 1987 an agreement for the construction of a scheme was made between the village, SRWSD and the DASR-project. The village and the DASR-project would be responsible for the supply of a good watersource and the construction of pumphouses, reservoirs, public fountains and distribution lines. SRWSD would be responsible for testing the wells, installation of the pumps and construction of the pumping main. Mid 1987 two boreholes were drilled in the wadi southeast of the village. A pumptest carried out on one of the wells in August 1987 showed a good yield of 6 l/sec. It was the purpose to test the other well also but this was impossible because the village installed already a pump. The scheme is based on both wells with deepwell pumps in the wadi. The water is first pumped to a reservoir (20 m^3) near one of the wells from where the water is pumped with a booster pump to a reservoir (60 m^3) halfway the mountain. A second boosterpump pumps the water to the village reservoir (100 m^3) on top of the mountain. The

reservoir halfway is also used for the supply of water to Wathan-wadi. In September 1987 the construction of the raiser main started. With the installation of the pumps in December 1988, the SRWSD-part of the scheme was in fact completed. The villagers built the reservoirs and pumphouses but there was no money available anymore for the construction of a distribution system. The village requested the SRWSD again for assistance and the SRWSD agreed to complete the scheme with village participation. The scheme became operational in April 1989.

Health educattion: The village was visited twice, but a follow-up was not given anymore.

Contribution: The villagers constructed the pumphouses and reservoirs. They also provide labour, transport and housing for the work at the distribution system. The participation of the people in Wathan-mountain has been excellent. The work in Wathan-wadi was often delayed because there were not enough labourers available.

Benefits: There are no public taps and the people made houseconnections with standard watermeters (Kent) supplied by the sjeich. The sjeich bought 450 watermeters from the NWSA for YR 250 each. People have to pay a guarantee of YR 750, so a meter costs YR 1000. The price of a houseconnection varies with the distance to the main distribution line but is average YR 3000 per house, including a tank. The quality of the houseconnections is good.
The price of the water is YR 25 per m^3 with an additional YR 10 per house per month per house for maintainance and quarantee. There is almost continuous supply of water.
In Wathan-mountain 220 houses (66%) made a houseconnection. In Wathan-wadi only 19 (14%). Total percentage of connected houses is 51%. Due to the price of a connection and the additional YR 10 per house per month, some houses share a connection, so the amount of people using the scheme is higher.
The estimated waterconsumption is 15 l/cap/day.
In Wathan-mountain all women mentioned the fact that they are not so tired anymore. Nevertheless they have little time to rest because they have to work in the fields, look after the children, cattle etc.

Organisation: The sjeich took the initiative for the scheme and his requests were strongly supported by the DASR-project. The owner of the scheme is the Uzlat Wathan, while the responsibility is with the sjeich. He employes two pumpoperators and a cashier. The financial affairs are controlled every 6 months by a committee of 5 elected village representatives. These people are also the representatives of the Uzlat Wathan in the LCCD of Magreb Ans. There are rules: it is not allowed to grow qat with water from the scheme; small gardens and building are allowed.

Operation and maintenance: There are two boreholes in the wadi:
On borehole 1 the village installed a vertical pump with diesel engine. Water from this well is also sold to cars. The total amount of pumping hours of this pump is 2591 what means an average of 2.5 hours per day during 32 months.
On borehole 2 the project installed an electric deepwellpump with a 89 KVA generator. This generator is also for the boosterpump and is only started when it is necessary to start the boosterpump. Total amount of

running hours of the generator is 870 what means an average of 3 hours per day during ten months.
The boosterstation halfway was not visited and the total amount of pumphours is not known. The top reservoir is filled in 6 hours. The consumption in the village is 25 m³ per day so this means maximum 2 hours pumping per day. When Wathan-mountain needs water, the people shout to the operators down to start pumping.
The operator down didn't get any training and don't have experience with pumps. He showed interest for an additional training course. This operator lives near the pumphouse and his salary is given in kind (water for irrigation). The need for a training for the operator in Wathan-middle is not known. His salary is YR 2500 per month.
The cashier is responsible for reading the meters and collecting the money bimonthly. His salary is YR 2000 per month. The cashier collects approximately YR 19000 per month for 714 m³ water and he hands the money over to the sjeich. The expenditures of the scheme are:

- 4800 liter diesel (24 barrels)	= YR 11 000
- 85 liter oil (17 gallons)	= YR 1 700
- salary operator down	in kind
- salary operator middle	= YR 2 500
- salary cashier/ meterreader	= YR 2 000
Total	= YR 17 200

There are no savings. When the village has big repairs they will ask the government for additional money.
From the 239 connections, 231 people (97%) pay. Some houses near the house of the sjeich don't have a watermeter.

Inside the houses: In both villages the houses did not look clean.
Wathan-wadi: Most houses without a houseconnection have small tanks inside where the water is scooped out from the top. Some houses don't have a tank and use jerry cans for storing the water from the spring. The few houseconnections that are present are made well with a closed system. These families have bigger tanks (0.5-1 m³). Washing of clothes is done near the houses.
Wathan-mountain: Almost all families have tanks which are mainly situated outside. The water is carried with jerrycans inside the houses and is stored in a small tank in the kitchen and/or bathroom. Some closed systems exist or are under construction. Washing is often done near the houses and near the cisterns.

Sanitation:
In Wathan-wadi only few houses have a toilet and wastewater goes to the street.
In Wathan-mountain many houses don't have a toilet. The wastewater goes to soakaway pits, is thrown down from a high cliff of drains into the street.
The project constructed toilets at four places:
- 8 toilets and 8 taps at the mosque in Wathan-mountain:
  * closed, only open at praying times?, no water in soakaways.
  * very dirty, because there is no water.
  * cleaning is the responsibility of the mosque guard.
  * watermeter: 35 m³ used in total (washing and toilets); water paid from income of the mosque (zakhah).

- 4 toilets at the school in Wathan-mountain (370 boys, 100 girls):
  * 1 for girls, 3 for boys.
  * always closed, never used.
  * boys go to the toilets in the main mosque.
- 4 toilets at the school in Wathan-wadi: 1 for teachers: used, clean.
  3 for boys: 1 used, clean.
  no girls at the school.
  * The students are responsible for the weekly cleaning.
  * Teachers gave some education about the use of the toilets.
- 4 toilets at the mosque in Wathan-wadi:
  * closed, only open at prayer times. Reason: children would destroy the toilets. Another reason could be that it is not allowed to take free water from there.
  * acceptable clean.

Problems: The price of the houseconnections and the water is high and many houses, especially in Wathan-wadi can not afford it.

HA'ANAH, Integrated Water Project 5B, Sanitation Project 36.

This very small village (90 inhabitants) is located 45 kilometers west of Dhamar (2 hours driving). A school and health unit are in Bani Muwallad, 20 minutes walking. The wealth of the village is medium. The village is located at the other side of the small valley which borders Bani Muwallad and Al Saifer.

Water: The villagers own a spring with a yield of 10 liter per minute, 10 minutes walking down from the village. The entrance to the spring is locked and it is not possible to take water straight from the spring. Irrigation is only allowed when there is enough water. There are no other watersources. Animals are watered near the houses.

Waterscheme: In September 1988 the project started the construction of the scheme with village participation. The project supplied the pipes, a small boosterpump and cement and steel for the masonry reservoir (15 m^3). The construction was completed in December 1988. In a later stage the project assisted in the construction of a good pumphouse. In March 1989 the boosterpump was out of order because of carelessness of the villagers and the project installed a new one.

Health education: The village was visited 5 times for health education. The sessions were visited by 10 women, including a traditional birth attendant who also joined several sessions in Bani Muwallad. Topics discussed were the causes and transmission routes of illnesses, the danger of waste and wastewater and the need for toilets. This resulted in a request for toilets and after thorough discussions it was decided to built 2 public toilets: 1 for men and 1 for women. At the time the toilets were nearly completed a follow-up visit was paid in order to stress the importance of cleaning the toilets. As described below the results are very good and the toilets are in an excellent condition.

Contribution: Labour, local materials, transport and housing. The village participation was good and the villagers have a positive idea about the fact that they participated in the construction of their own waterscheme.

Benefits: There are four public taps fixed straight to the reservoir. They are all in good condition and the wastewater is drained to the cistern near the mosque. The distance from the houses to the public taps is maximum 100 meters. There are no houseconnections. The villagers tried to use the place under the taps as a cattle trough, but the cattle made the place around the taps realy dirty.
People have to pay according to the daily use of the water: the price of a daily use of 20 liter is YR 5 per month. So daily 100 liters is YR 25 p.m. In general a house pays 20-50 YR per house per month. The price of the water can be recalculated as YR 8/m^3. There is always water in the reservoir.
The estimated waterconsumption is 17 liter per capita per day.

Organisation: The operator asked for the scheme. The village is the owner and the operator is responsible for everything.

Operation and maintenance: The operator pumps every day 1.5 hours. Total amount of pumping hours is not known.
The operator got a short instruction when the pump was installed. The pump is very small and there is no need for additional training.
Per three months the operator collects YR 900. His monthly expenditures are YR 180 for diesel and YR 50 for oil. His salary should be YR 300 but up till now he didn't receive anything. Everybody is allowed to use the water, 2 families (17%) don't pay.

Inside the houses: The houses looked acceptable clean but there were many flies around. Although the village is still dirty the situation has much improved since the last visit one year ago.
Most women keep the water in jerrycans in which they collect the water and have no special storage tanks inside the houses.

Sanitation: There are no toilets in the houses and prior to the public toilets most people went to a place at the backside of the houses.
The project constructed two public toilets. The one for the men is situated in the mosque yard; the one for the women is near the reservoir. The toilets are used and kept very clean. Every group is responsible for cleaning the own toilet and in every toilet there is a brush and wiper from the project for cleaning. The women toilet is also used for taking a shower and the washing of clothes. Some women don't use the toilets they said it was too far whereas they have to go to the reservoir anyway too collect the water. These women want another toilet at the other side of the village.

Problems: no.

The villagers asked for houseconnections. This is not possible because the reservoir is on a low place. During the preconstruction talks the project suggested an higher location of the reservoir, but this place was rejected by the villagers.

500 2.000 14
500
2000

AL SAIFER, Integrated Water Project 5A.

This small village (315 inhabitants) is located 45 kilometers west of Dhamar (2 hours driving). A school and health unit are in Bani Muwallad, 10 minutes walking. The wealth of the village is medium.

Water: There is a spring 15 minutes walking north from the village. The spring is owned by most of the villagers and the water is also used for irrigation. Although the spring is open, the situation is acceptable. In the dry season the spring is sometimes dry and the people take water from Bani Muwallad. The scheme is used for all domestic purposes.

Waterscheme: In September 1988 the project started the construction of the waterscheme with village participation. The project supplied the pipes and cement and steel for the masonry reservoir (20 m^3). The reservoir is filled by gravity so a pump is not necessary. The construction of the scheme was completed in December 1988.

Health education: Before the construction of the water scheme the village was visited 4 times. The request for health education came from the men in imitation of the sessions in nearby Bani Muwallad because in the dry season the women use the water from BM. The sessions were attended by 6-10 very interested women and subjects like causes and transmission of illnesses, hygiene and reuse of wastewater were discussed. It was during these sessions that the women requested for a water scheme, simultaneous with the men.

Contribution: Labour, local materials, transport, housing. The village has a positive idea about the fact that they participated.

Benefits: There are no public taps and all houses made houseconnections without watermeters. The houseconnections we saw were good but it was not enough to get a general impression.
The pipe from the spring to the reservoir has an automatic closing valve and there is always water in the reservoir. There are 3 groups of houses and every day the distribution line to each group is open for 15 minutes. The reason for this is to avoid waste of water by children.
The water is free, but there is a proposal to collect YR 5 per house per month. The estimated consumption is 16 liter per head per day.

Organisation: The mandub took the initiative for the scheme. The village is the owner and the mandub is responsible for everything.

Operation and maintenance: money for repairs is collected.

Inside the houses: Due to lack of time only two houses were visited. These houses looked reasonable clean. There is enough water the whole year through now. Water is stored in tanks outside and scooped out from the top. Washing of clothes is done near the houses.

Sanitation: The people asked for private toilets like Bani Muwallad. The project refused because in the dry season the yield of the spring is too small.

Problems: not anymore. In the past problems about the waterrights.

AL MIQDARAH, Integrated Water Project 7, Sanitation Projects 33 & 34.

This small village (28 houses, 280 inhabitants) is located 10 kilometers north-east of Yarim and can be reached from the asphalt road Dhamar-Yarim. The distance to Dhamar is 35 kilometers, 45 minutes driving. The village has a primary school for boys (78) and a girl. Many villagers are working in Saudi Arabia and the village is wealthy. The village lies at a big rock overlooking a wadi to the north. For health services the people go to Yarim or Mars.

Water: In the past most of the water came from a spring, half an hour walking north-west of the village. Nowadays the ladies go there for washing blankets and carpets. Sometimes the people got also water from private boreholes in the wadi, 30 minutes north of the village. Some families bought drinking water from watercars for YR 110/m³.
The waterscheme is now the only source for drinking water and the people use the scheme also for washing of clothes.

Waterscheme: The village drilled a borehole with a total depth of 120 meter and a yield of 5 l/sec. The costs of the well were YR 105.000. The project started the construction of the scheme with village participation in December 1988. The project supplied steel and cement for the masonry reservoir (25 m³), the pipes and the submersible electric pump and 40 KVA generator. The pumphouse was built by a contractor. Another steel reservoir (4 m³) is located above the old village.
On request of the women the project made an extra tap with metal storage tank for watering cattle near the pumphouse. This facility is well maintained and used.
The scheme was handed over to the village in April 1989.

Contributions: Borehole, labour, local materials, food and housing. The participation of the villagers was excellent. However the people were not skilled labourers and it took some time to train them to construct a water project. The villagers themselves have a good feeling about the village participation and after completion of the waterproject the people continued with an improvement of the mosque.

Health education: During all phases of the scheme implementation health education has been given to the women and schoolchildren. In total 12 meetings with the women and 4 at the school. Subjects discussed were ilnesses, washing of hands, ORS and diarrhoea. Also subjects more directly related to the waterproject like watertanks, toilets, houseconnections and watermeters were discussed. The interest and cooperation of the women was very good.
As a result of the health education visits, ARA started with promoting forestry nurseries and Risabah development project started with a programmme for home-gardens. The programme of ARA continued, while Risabah stopped due to internal problems.

Benefits: There are no public fountains. All houses (28) made houseconnections with big metal water storage tanks (2 m³) at their own costs. 25 houses have installed the prescribed standard watermeter (type: Kent, YR 300). The other houses don't need a meter because it is accepted that they are not able to pay for the water. The quality of

the houseconnections is very good.
The price of the water is YR 50 per house per month with an additional YR 10 per m^3 used. There is almost continuous supply of water.
The estimated waterconsumption is 20 liter per capita per day.

Organisation: One of the villagers went several years to the ministry in Sana'a for a water supply scheme. The owner of the scheme is the village which appointed an operator and administrator. Both don't have a salary. The operator is responsible for the whole scheme. Many villagers are involved in the financial control of the scheme. There is a registration book and the cashier has special bills.

Operation and maintenance: Every week the operator pumps 2-2.5 hours. Pumping takes place preferably on Saturday. Filling the reservoir takes 2 hours. Total amount of hours pumped is 134. This means 3 hours per week during 10 months.
The pumpoperator doesn't have any experience with other pumps. He doesn't have interest in a training course because he is illiterate and will depart soon to Saudi Arabia. Before there was a candidate for a training course for pump care takers in Sana'a, but the candidate didn't show up. The villagers have already a new pumpoperator in mind.
The administrator is responsible for the collection of the money every one or two months. Three of the 28 houses are not able to pay the water. The total amount of money collected is YR 2500/month. The expenditures per month are only YR 140 for diesel and YR 130 for oil. The operator doesn't have a salary and the savings are big.

Inside the houses: The houses look clean and in the village is only a small amount of waste present. Water is stored in metal tanks (2 m^3) and water is taken out with a tap. Few families don't have a tank and store the water in jerry-cans. Clothes are washed near the houses and the wastewater is used for making dung cakes.
Few gardens are present which are watered with clean water from the scheme.

Sanitation: Most houses have a baladih toilet with the drainage next to the houses. There are no wastewater pools inside the village. Domestic wastewater is often brought to the backside of the houses.
The project constructed 4 toilets, a soakaway and a washing place with 8 taps at the mosque. The toilets are used and are kept acceptable clean. The main problem is that the people don't use enough water for flushing.
The project made 4 toilets at the school. At the moment they are not used at all because the teachers expects problems with cleaning. In the past there was another teacher who asked for the toilets and he organised the cleaning in a proper way.

Problems: There are no problems. The scheme functions very nice and the operation and maintenance go smoothly.

MAGRABIT AL ANAB, Integrated Water Project 8, San. Projects 16,17,21.

Magrabit al Anab consists of 10 small villages 25 kilometers north of Medinat as Sharq, 4 hours driving from Dhamar (115 km). The villages are scattered at the bottom part of a steep mountain overlooking the wadi to the north. On a central place between the villages are a primary school and a health unit. The road to the villages is bad and in general the people are poor. Total number of inhabitants is 1130.
In March 1990 most systems were functioning.

Water: There are five springs. The water is used for both irrigation and domestic purposes. The distance from the villages to the springs is in general 15 to 20 minutes walking. The yields of the springs are 0.5-2.6 l/sec.

Waterscheme: The project started with the construction of 7 small masonry reservoirs (6 and 15 m^3) with public taps by contractors in 1986 and 1987. The local population was supposed to participate in the projects by the supply and construction of the pipes from the springs to the reservoirs. A good estimate of these village costs was never made but based on the price level of 1988 the villagers have to pay YR 267,347 or 65% of the total construction costs. It is clear that the people were not able or ready to pay such a contribution. Another problem is that the springs are often not owned by the villagers.
After an internal evaluation the project decided to complete the systems as an integrated water project. The project supplied the pipes and a small pump. The village contributed labour, local materials, transport and housing. This way of participation was more successful and the schemes were completed in March 1989.

Contribution: labour, local materials, transport, food and housing. The partcipation was in general good, except one village (Warkah) which didn't cooperate at all.

Health education: During the construction of the project 6 health education lessons has been given to women from the villages which were gathered in a course for local birth attendants. The female primary health care worker of the villages has also a good understanding about hygiene and the level of the sessions was rather high. Most villages were visited to stress the importance of the sessions and to stimulate the local birth attendants to continue health education in their villages.

Benefits: On several places the project constructed reservoirs and metal tanks with public taps, maximum 200 meters from the houses.
The five springs will be discussed separately:

1. Ain al Mizan: villages: Mahal al Dehni (100 inhabitants)
   Al Matar (40 inhabitants)

   The spring is owned by other people and the villagers don't have any right on the water. There are two masonry reservoirs (6 m^3) and a metal tank (Al Matar). The system functions and there is always water. The water is free.

2. Ain al Halfat:
   The spring is owned by 150 people. Every owner has the water from the spring for certain hours and when he likes he fills a reservoir. People who have no share in the spring can buy the water from a springowner for YR 10/m³. There are two masonry reservoirs (15 m³) and three metal tanks. The reservoir near the school is filled by gravity. From there it is pumped with a small pump to the reservoir in Bait Al Hutair.
   The villages connected to this spring are:
   - Akmat Gazi (100 inhabitants, health unit): functioning.
   - Bait al Hutair (200 inhabitants): functioning.
     This village is higher than the spring and the water is pumped up from the reservoir near the school. Price of the water is YR 10/m³.
   - Ahthyl (80 inhabitants), not functioning anymore. There are problems with the owners of the spring.
3. Ain al Kariel?:
   This spring is owned by the villagers. The system is not working because the pipe broke down two months ago. The men are soldiers and they are not in the village to repair the system. There are no masonry reservoirs, only 4 metal tanks. The villages are:
   - Juluba (250 inhabitants),
   - Bayt Muhani: (60 inhabitants).
4. Ain al Qud: villages: As Surm (150 inhabitants)
   Al Qud (100 inhabitants)
   The spring is owned everyday by another family who is responsible to fill the two masonry reservoirs (15 m³). There is always water. One reservoir has 3 taps and the water is free.
5. Ain al Warkh: village: Al Warkh (50 inhabitants)
   This village was not visited. According to information from the office, this village was not cooperative and the scheme was never completed. Near the spring is a masonry reservoir (6 m³).

Organisation: The initiative for the schemes was taken by one of the villagers. The users of the springs are often not the owners and this makes the organisation of the schemes very weak. Despite that 690 people (61%) are using the facilities of the schemes.

Operation and maintenance: The waterrights are the most important factor. Only one village (Bait Al Hutair) depends on a small pump. The operator of this pump pumps 4 times a week 3 hours. He collects every month 10 or 20 YR from each house, in total YR 200. This money is all spent for diesel and oil. He doesn't have a salary. The price of the water in this village is YR 10/m³. Money for repairing the systems is collected from the people involved.

Inside the houses and sanitation:
- Mahal al Dehni and Al Matar: Most houses are clean although the villages itself are dirty. The water is stored mainly in the open jars in which the women fetch the water. There are no gardens.
- Akmat Gazi and Bait al Hutair: The houses are clean. Most families have a tank which they fill with a hose from the main line (one connection point in each village). Only families that can't afford a tank don't use the scheme and collect the water straight from the spring. Clothes are washed near the spring. A few houses have a garden.

- Al Qud: water is brought in buckets and jerry cans to the village which is located above the reservoir. Clothes are washed near the houses and the wastewater is thrown in the streets. The village was not visited due to lack of time.
- Juluba: This system is not working. The women collect now water from the spring, 20 minutes walking. The clothes are also washed there. The village looked clean.

Sanitation:
- Mahal al Dehni and Al Matar: Only few houses have a toilet, but they have all a place for personal hygiene. Wastewater is drained away from the village with plastic pipes. There was no wastewater inside the village.
- Akmat Gazi and Bait al Hutair: Most houses have a toilet for urine and personal hygiene. Wastewater is drained outside the village with pipes. In the village was a lot of animal dung and flies were everywhere.

In February 1987 the project constructed dry toilets at the school(3) and the health unit(2). The quality of the building was below standards and in September 1988 all toilets were improved. The system is still dry but the people don't like the toilets because it is impossible to clean themselves properly, although the toilets are now connected to the waterscheme.
The toilets at the school are not used. One is used for washing clothes while in the others the taps are broken down. The villagers have the wish to change them to a pour-flush system because there is now water in the village.

Problems: The organisation of the systems is weak.

BANI FALLAH, Integrated Water Project 11, Sanitation Project 38.

Bani Fallah consists of two villages (Al Mishwar and Mahallah) at a distance 55 kilometers (2,5 hours driving) northeast of Dhamar. The village has a primary school for girls (6) and boys (67) and the living standard is medium. Total number of inhabitants is 600. The villages are located on the highest places of a plateau surrounded by steep wadis. The people go to Bani Badda for health services. The waterscheme is functioning well for 8 months.

Water: The situation of the village was very bad. The people used to take water from cisterns at a walking distance 5 minutes from the village. In the dry season (6 months) the cisterns were empty and the ladies have to go to Bayt Abu Atif or Bani Badda. There are seven boreholes and a spring in Bani Badda and going there takes 2 hours one way.
The scheme is used for drinking and washing of clothes and blankets. The cisterns are only used for drinking of cattle. There are no gardens.

Waterscheme: The government drilled a borehole with a depth of 343 meter and a yield of 3.8 l/sec. In March 1989 the project started the construction of the waterscheme with village participation. The project supplied pipes, pump, cement and steel. The scheme consist of a borehole, an electric pump with 60 KVA generator, a pumping main, a round masonry reservoir (50 m^3) and a distribution system. The construction time was only four months and the scheme was handed over to the village in July 1989.

Contribution: Labour, local materials, food and housing. The participation and cooperation of the villagers was one of the outstanding ones. The main reason was that the village was in a big need of water. Every person paid cash YR 260 without the houseconnection.

Health education: Both villages were weekly visited 8 times. Only a small group of ladies was attending the meetings, mainly because the health educator didn't push the ladies in a way they are used to.

Benefits: All houses (55) made houseconnections with watermeters, type Bosco & co, Italy. The houseconnections are made on an individual basis. The quality of the houseconnections is good. Everybody is connected and paying.
The distribution lines to both villages are always open and both villages get the same level of service.
The price of the water is since this month YR 20/m^3 (before YR 15) and there is always water in the reservoir.
The estimated waterconsumption is only 10 liter per capita per day.

Organisation: The initiative for the scheme was taken by a villager who went to the ministry in Sana'a. The owner is the village and there is an operator who is responsible for the whole scheme. The operator has a salary of YR 2000 per month and he keeps records in a book. There are some general rules.

Operation and maintenance: Two times a week the operator pumps three hours. Total amount of pumping hours is 161 what means an average of 5 hours per week during eight months.
The operator got short instructions when the pump was installed. He was supposed to attend a training course of 3 weeks in Sana'a but he didn't show up. He is still very much interested in such a course. There were no problems with the pump sofar.
The operator collected last month YR 2700. The expenditures are YR 600 for diesel, YR 250 for oil, YR 100 for filter etc and YR 2000 for salary. Due to the rather high salary of the operator and the low consumption of the water ,the amount of money collected is low and the price of the water had to be increased from YR 15 to YR 20 per m^3.
The total consumption over the last six months was 977 m^3.

Inside the houses: The houses and village are not very clean. The women are all very pleased with the scheme.
All houses have a tank outside with a tap over it. Most tanks have a tap to take the water out. Washing of clothes is done at a little distance to avoid the wastewater next to the houses as a result of the health education sessions. There are no gardens.

Sanitation: The wastewater problems are small because the houses are far from each other and the consumption of water is very low.
Only few houses have a toilet, but all houses have a place for personal hygiene.
The project constructed 3 toilets (1 for teachers, 1 for boys and 1 for girls) and a soakaway at the school. The toilets were locked and not used. The project gave instruction how to use the toilets, but the people are still afraid that they will get dirty because of misuse by the children. The project constructed also three taps outside which are used.

Problems: no.

BANI ZAYDAN, Integrated Water Project 12, Sanitation Project 40.

This village (800 inhabitants, 80 houses) is located 57 kilometers (2.5 hours driving) northeast of Dhamar. The village has a primary school for boys (100) and girls (5) and the living standard is medium to poor. The village consists of seven groups of houses which are all located at small hills at both sides of the main wadi. There are four main families. The people go to Bani Badda for health services.
The waterscheme is functioning for 2 months.

Water: In the past water was taken from a shallow well at least 20 minutes walking from the village. This place is still used for drinking and washing of clothes. In one (poor) village water from a cistern is used for washing clothes, for the cattle and the garden. The water from the scheme is used for drinking and washing clothes, while big items like carpets and blankets are washed with water from the shallow well and small dams in the wadi. In general the clothes are washed near the house.

Waterscheme: The government drilled a well with a depth of 213 meter and a yield of 4.5 l/sec. The project started the construction of a water supply scheme with village participation in May 1989. The project supplied the pipes, the pump, steel and cement. The scheme consists of a borehole with submersible electric pump and 40 KVA generator, a pumphouse, a pumping main, a round masonry reservoir (50 m^3) and a distribution system. The scheme was handed over in January 1990.

Contribution: Labour, local materials, food and housing.
The village participation was not good and the work stopped a few times.

Health education: During the work one village has been visited for 5 consecutive weeks with a girl from Zarajah. Her father didn't allow her to go anymore and due to the lack of another person and the workload of the health educator, the health education visits were stopped. At first the women were not interested, but after the second visit about 8 women attended the sessions about hygiene, diarrhoea, waterstorage, wateruse, waterreuse and wastewater.

Benefits: 50 houses (63%) have a houseconnection with a watermeter. The operator (also mandub) fixes the pipes and the watermeters, while the pipes are bought individually. New connections are made daily. Thirty houses are not connected yet because they don't have the money for the watermeter and a tank for the storage of water. Seven houses (9%) with poor people will be connected without watermeters and will not pay.
The quality of the houseconnections is fair. Some 'houseconnections' are very small (50 cm pipe, watermeter and tap) due to a lack of money. People who can not afford a meter are not allowed to use the scheme. The operator has a special tap without a watermeter near his house which gives water for the mosque, his fields and others. How much is not known.
The price of the water is YR 10/m^3 and there is almost always water in the reservoir. There is a circulation system so that each village has every 2 or 3 days water. Families with only a small tank have to collect additional water from other sources.

The estimated waterconsumption is 30 liter per capita per day.

Organisation: The initiative for the scheme was taken by the sjeich who asked at least three years for a borehole in Sana'a. The owner of the scheme is the village and the mandub is the operator who is responsible for the pump and the pipes. The salary of the operator is YR 2000 per month. There are no special rules for the use of the water. The operator has a list with people and doesn't give bills.

Operation and maintenance: The operator pumps every other day 2 hours. Filling the reservoir takes 2.5 hours. Total amount of pumping hours is 110.
The operator got a training course (24 days) in Sana'a and there is no need for additional training.
The operator collects every month YR 3500. He spents YR 675 for diesel, YR 500 for oil, YR 150 for filters etc and YR 2000 for salary. The savings are not known yet.

Inside the houses: Most houses are clean and the villages looked reasonable clean. The metal tanks are filled with a tap above the tank or a hose in case of a very small 'houseconnection'. The water is taken out with a tap or from the top. All houses have a separate tank or stone bottle for the storage of drinking water.
Several houses made a small garden with wastewater or water from the cistern. Two women made these gardens in respons to the health education sessions.

Sanitation: The houses are scattered and the problems with wastewater are small. Most houses have a bathroom for washing only. Few houses have a toilet. Wastewater is drained next to the houses or with a pipe a small distance away.
The project constructed 4 toilets (3 for boys and 1 for girls) and a soakaway at the school. The toilets are used but not very clean. The teachers admitted that they are responsible for the cleaning and that the project gave instruction about the use of the toilets. The teachers complained that there were no taps outside and that the boys make the toilets dirty when they want to drink water after playing football. The lid of the soakaway was also away and the general interest seems to be low.

Problems: The main problem is that only 63% of the houses is connected and that there are connections without watermeters.

ANNEXES

Contents:

What recording system used?

Annex A

WATERSUPPLY SCHEMES SRWSD PROJECT DHAMAR

nr	Pr.code	Project name	Official name	District	Province	Coordinates North	Coordinates East
1	DRP 01	Al Husul	Al Husul	Ans	Dhamar	16128	4475
2	DRP 02	Dafinah	Dafinah	Ans	Dhamar	16052	4249
3	DRP 03	Al Mayfa'ah	Al Mayfa'ah	Ans	Dhamar	15990	4515
4	DRP 04	Sama/Sufara	Samah/Sufarah	Ans	Dhamar	16015	4440
5	DRP 05	Sirm al Banna	Sirm al Banna	Ans	Dhamar	15932	4451
6	DRP 06	Jarf Isbil	Hayd Isbil	Ans	Dhamar	16093	4622
7	DRP 07	Al Hajar	Al Hajar	Ans	Dhamar	16148	4545
8	DRP 08	Ar Rhawq	Ar Rawq	Qaifah	Al Bayda	16044	4916
9	DRP 09	Al Garrar	Al Qarar	Qaifah	Al Bayda	16040	4890
10	DRP 10	Jawf al Nukabah	Jawf an Nuqaba	Qaifah	Al Bayda	16152	4962
11	DRP 11	Hanaka al Masud	Hanakat Ahl Masud	Qaifah	Al Bayda	15985	4778
12	DRP 12	Mawr	Mawir	Al Arsh	Al Bayda	15885	4720
13	DPP 01	Al Mihal	Al Mijhal	Ans	Dhamar	15939	4521
14	DPP 06	Joar	Jaw'ar	Ans	Dhamar	15866	4507
15	DPP 10	Jebal al Ma'al	Jabal al Mal	Ans	Dhamar	15873	4460
16	DPP 13	Al Azan	Azzan	Al Arsh	Al Bayda	15920	4738
17	DPP 14	As Shaqqab	Ash Shaqb	Ans	Dhamar	15880	4436
	TIP 01	Al Hajjaylah		Bajil	Hodeidah		
	TIP 02	Mahal as Sadr		Qanawis	Hodeidah		
	TIP 03	Dyer al Harad		Qanawis	Hodeidah		
18	WSP 03	Al Hajalah	Al Hijlah	Al Hada	Dhamar	16425	4483
19	WSP 05	Al Haruj	Al Haruj	Ans	Dhamar	16030	4585
20	WSP 06	Wastah	Wasitah	Al Hada	Dhamar	16385	4228
21	WSP 07	Al Hasoon	Al Hasoon	Al Hada	Dhamar	16361	4245
22	WSP 08	Hanud	Hanid	Ans	Dhamar	16014	4398
23	WSP 09	Bidashy	Baddash	Al Hada	Dhamar	16214	4384
24	WSP 10	Bashar	Bishar	Al Hada	Dhamar	16201	4449
25	WSP 11	Mangada	Manqadhah	Ans	Dhamar	16178	4348
26	WSP 12	Ar Raba'ah	Ar Rab'ah	Ans	Dhamar	16001	4223
27	WSP 13	Al Mithal	Al Mithal	Al Hada	Dhamar	16177	4483
28	WSP 14	Adra'ah	Azra'ah	Ans	Dhamar	15918	4565
	WSP 18	As Sudah		Amran	Sana'a		
29	IHP 43	Dhi Sabil	Dhi Sabil	Dawran	Dhamar	16175	4013
30	RWP 06	Dhafar		As Saddah	Ibb		
31	RWP 09	Sharafa	Ash Sharafah	Ans	Dhamar	15877	4328
32	RWP 10	Bayt as Shamy	Bayt ash Shamy	Yarim	Ibb	15858	4387
33	RWP 11	As Zuwab	Az Zuwab	Qaifah	Al Bayda	16028	4809
	RWP 31	Asabeh			Taiz		
34	IWP 02	Bani Muwallad	Bani Muwallad	Maghreb Ans	Dhamar	16001	4054
35	IWP 03	Al Mashaa'hida	Al Mashahidhah	Dawran	Dhamar	16230	4070
36	IWP 04	Wathan	Wathan	Maghreb Ans	Dhamar	15973	4010
37	IWP 05	Al Saifer	Al Saifer	Maghreb Ans	Dhamar	16001	4060
38	IWP 06	Na'amah	Na'amah	Maghreb Ans	Dhamar	16005	4062
39	IWP 07	Al Miqdahah	Al Miqdahah	Yarim	Ibb	15830	4412
40	IWP 08	Magrabit al Anab	Jul'ubah	Jabal as Sharq	Dhamar	16364	3868
41	IWP 11	Bani Fallah	Al Mishwar	Al Hada	Dhamar	16398	4508
42	IWP 12	Bani Zaydan	Bani Zaydan	Al Hada	Dhamar	16370	4555

VILLAGES IN GENERAL

		Village Name	No. of villages	Inhabi-tants	Schools prim.	Schools sec(*)	Health unit	Wealth	Dhamar km	Dhamar time(#)
Phase I	1	Al Husul	1	784	*	3	no	rich	17	30
	2	Dafinah	1	977	*	-	no	rich	12	15
	3	Al Mayfa'ah	1	550	*	-	no	rich	17	20
	4	Sama/Sufara	2	850	*	-	no	medium	12	25
	5	Sirm al Banna	1	244	*	-	no	medium	22	30
	6	Jarf Isbil	1	1959	*	3	no	medium	20	40
	7	Al Hajar	1	894	*	-	no	medium	20	40
	8	Ar Rhawq	1	350	-	-	no	medium	68	75
	9	Al Garrar	1	200	-	-	no	medium	68	75
	10	Jawf al Nukabah	1	100	-	-	no	poor	83	135
	11	Hanaka al Masud	1	3000	*	-	no	rich	50	50
	12	Mawr	1	3000	*	3	yes	rich	50	50
Phase II	13	Al Mihal	1	347	*	-	no	medium	25	50
	14	Joar	8	1750	*	3	yes	medium	35	70
	15	Jebal al Ma'al	3	1550	*	-	yes	poor	35	70
	16	Al Azan	1	2331	*	3	no	rich	45	40
	17	As Shaqqab	1	1215	*	3	no	medium	25	30
	18	Al Hajalah	1	355	*	-	no	medium	60	150
	19	Al Haruj	1	856	*	-	yes	medium	25	40
	20	Wastah	1	900	*	-	no	medium	35	35
	21	Al Hasoon	1	1120	*	6	yes	medium	30	30
	22	Hanud	1	1326	*	-	no	rich	9	15
	23	Bidashy	1	738	*	-	no	medium	17	40
	24	Bashar	1	720	*	-	no	rich	17	40
	25	Mangada	1	2713	*	-	yes	medium	12	25
	26	Ar Raba'ah	2	899	*	-	no	rich	20	35
	27	Al Mithal	1	1744	*	6	no	rich	17	40
	28	Adra'ah	1	3095	*	6	yes	rich	25	40
	29	Dhi Sabil	1	496	*	-	yes	medium	55	90
	30	Dhafar	1	675	*	-	no	poor	42	60
Phase III	31	Sharafa	1	596	*	-	no	rich	25	25
	32	Bayt as Shamy	1	300	-	-	no	poor	27	30
	33	As Zuwab	1	840	*	3	no	rich	65	60
	34	Bani Muwallad	1	600	*	3	yes	medium	45	120
	35	Al Mashaa'hida	7	1025	*	-	yes	medium	45	90
	36	Wathan mountain	5	2324	*	6	yes	medium	50	150
		Wathan wadi	2	973	*	-	no	poor	50	150
	37	Al Saifer	1	315	-	-	no	medium	45	120
	38	Na'amah	1	90	-	-	no	poor	45	120
	39	Al Miqdahah	1	280	*	-	no	rich	35	45
	40	Magrabit al Anab	10	1130	*	-	yes	poor	115	240
	41	Bani Fallah	2	600	*	-	no	medium	55	150
	42	Bani Zaydan	1	800	*	-	no	medium	57	150
		TOTAL		45611						

(*) 3 = 3 years secondary school
6 = 6 years secondary school
(#) driving time by car in minutes

7 poor villages
What about natural soc. econ structure ?

any idea about area coverage + what type of villages not yet ?

SUMMARY OF THE SRWSD WATER SUPPLY SCHEMES

		Village Name	COSTS (YR) total	per head	Functio-ning	Problems (*)	Inhabitants of villages with good schemes	problem schemes	bad schemes(#)	Consumption (lcd)	Price of water (YR)
Phase I	1	Al Husul	300,737	384	yes	some	784	-	-	22	3/head/m
	2	Dafinah	272,815	279	yes	yes	-	977	-	12	3/head/m
	3	Al Mayfa'ah	272,082	495	yes	some	550	-	-	35	(50/house/m)
	4	Sama/Sufara	540,676	636	yes	no	850	-	-	21	3/head/m
	5	Sirm al Banna	270,612	1,109	yes	no	244	-	-	45	3/head/m
	6	Jarf Isbil	476,504	243	no	-	-	-	1959	-	-
	7	Al Hajar	233,305	261	yes	no	894	-	-	17	4/head/m
	8	Ar Rhawq	269,847	791	no	-	-	-	350	-	-
	9	Al Garrar	210,936	1,055	yes	yes	-	200	-	25	5/head/m
	10	Jawf al Nukabah	185,844	1,858	yes	yes	-	100	-	25	free
	11	Hanaka al Masud	271,711	91	no	-	-	-	3000	-	-
	12	Mawr	151,812	51	no	-	-	-	3000	-	-
Phase II	14	Al Mihal/Joar	2,522,626	1,203	yes	yes	347	1750	-	21	54/house/m
	15	Jebal al Ma'al	1,108,848	715	yes	yes	700	850	-	10	28/house/m
	16	Al Azan	615,500	264	yes	no	2331	-	-	30	15/m3
	17	As Shaqqab	762,785	628	no	-	-	-	1215	-	-
	18	Al Hajalah	1,177,515	3,317	yes	no	355	-	-	15	20/m3
	19	Al Haruj	727,687	850	yes	yes	-	856	-	?	5/m3
	20	Wastah	718,948	799	yes	yes	126	-	774	13	50/house/m
	21	Al Hasoon	638,706	749	no	-	-	-	1120	-	-
	22	Hanud	186,002	140	no	-	-	-	1326	-	-
	23	Bidashy	832,956	1,129	no	-	-	-	738	-	-
	24	Bashar	832,980	1,157	yes	no	720	-	-	26	10+8/m3
	25	Mangada	793,917	293	yes	no	2713	-	-	?	20/house/m
	26	Ar Raba'ah	809,947	901	yes	no	899	-	-	?	5/head/m
	27	Al Mithal	1,154,702	662	no	-	-	-	1744	-	-
	28	Adra'ah	1,466,710	474	yes	no	3095	-	-	25	6/m3
	29	Dhi Sabil	130,011	262	no	-	-	-	496	-	-
	30	Dhafar	824,998	1,222	yes	yes	275	-	400	12	20/house/m
Phase III	31	Sharafa	611,124	1,025	yes	no	596	-	-	?	?
	32	Bayt as Shamy	544,831	1,816	yes	no	300	-	-	?	10/m3
	33	As Zuwab	744,331	886	yes	no	840	-	-	30	?
	34	Bani Muwallad	502,398	837	yes	no	600	-	-	22	5/m3
	35	Al Mashaa'hida	1,108,808	1,082	yes	yes	-	1025	-	28	10/head/m
	36	Wathan	2,085,760	633	yes	no	3297	-	-	15	10+25/m3
	37	Al Saifer/Na'amah	253,129	625	yes	no	405	-	-	17	8/m3
	39	Al Miqdahah	641,711	2,292	yes	no	280	-	-	20	50+10/m3
	40	Magrabit al Anab	601,743	533	yes	yes	690	440	-	?	free
	41	Bani Fallah	953,233	1,589	yes	no	600	-	-	10	20/m3
	42	Bani Zaydan	1,022,035	1,278	yes	no	800	-	-	23	10/m3
		TOTAL	YR 28,030,823				22741	6198	16122		

lcd = liter per capita per day
(*) problems only in the schemes that are functioning.
(#) means not functioning.

SUMMARY OF THE SRWSD WATER SUPPLY SCHEMES CONT'D

	Village Name	Condition scheme	Made by (&)	INVOLVEMENT Con. ($)	HE	IMPROVEMENTS Additions (*)	Suggestions from the village	Possible for SRWSD
Phase I	1 Al Husul	good	con.	no	no	D	new borehole	no
	2 Dafinah	problems	con.	no	no	no	new borehole	no
	3 Al Mayfa'ah	good	con.	little	no	D + H	-	-
	4 Sama/Sufara	good	con.	no	no	1 line	houseconnections	no
	5 Sirm al Banna	good	con.	little	no	D + H	no	no
	6 Jarf Isbil	bad	con.	some	no	D	new pump + dist.	yes
	7 Al Hajar	good	con.	no	no	D	reservoir higher	no
	8 Ar Rhawq	bad	con.	no	no	D + H	new borehole	no
	9 Al Garrar	fair	con.	no	no	no	new borehole	no
	10 Jawf al Nukabah	fair	con.	no	no	D	new borehole	no
	11 Hanaka al Masud	bad	con.	no	no	no	elevated reservoir	not urgent
	12 Mawr	bad	con.	no	no	no	no sollution	no
Phase II	14 Al Mihal/Joar	fair	con.	no	no	some lines	good pump + pipes	yes
	15 Jebal al Ma'al	fair	con.	little	no	some taps	distribution	no
	16 Al Azan	good	con.	some	no	D + H	good system	no
	17 As Shaqqab	bad	con.	no	no	no	no	no
	18 Al Hajalah	good	con.	no	no	D + H	good system	no
	19 Al Haruj	fair	con.	no	no	H	good engine	some ($)
	20 Wastah	fair	con.	no	no	no	watermeters	no
	21 Al Hasoon	bad	con.	no	no	no	good engine	difficult
	22 Hanud	bad	con.	no	no	no	no	no
	23 Bidashy	bad	con.	no	no	no	good engine	some ($)
	24 Bashar	good	con.	no	no	H	good system	no
	25 Mangada	good	con.	no	no	H	good system	no
	26 Ar Raba'ah	good	con.	no	no	H	good system	no
	27 Al Mithal	bad	con.	no	no	no	good system	no
	28 Adra'ah	good	con./vil.	little	no	H	more pipes	no
	29 Dhi Sabil	bad	con.	no	no	no	new borehole	no
	30 Dhafar	fair	con/	no	no	no	houseconnections	some ($)
Phase III	31 Sharafa	good	village	yes	yes	H	good system	no
	32 Bayt as Shamy	good	village	yes	yes	H	good system	no
	33 As Zuwab	good	vil./con	yes	yes	H	good system	no
	34 Bani Muwallad	good	village	yes	yes	H	good system	no
	35 Al Mashaa'hida	fair	con./vil.	some	yes	H	good system	no
	36 Wathan	good	village	yes	some	H	good system	no
	37 Al Saifer/Na'amah	good	village	yes	yes	H	good system	no
	39 Al Miqdahah	good	vil./con.	yes	yes	H	good system	no
	40 Magrabit al Anab	fair	village	yes	yes	no	good system	no
	41 Bani Fallah	good	village	yes	yes	H	good system	no
	42 Bani Zaydan	good	village	yes	yes	H	good system	no

*) D = distribution system.
H = houseconnections.

&) con. = contractor.
vil. = village (participation).

$) Con. = contribution from the village, cash, kind or labour.
little is less than 5 % of the total costs.
some is 5-10 % of the total costs.
yes = more than 10 % of the total costs.
HE = health education given to the village.

$) should be studied in more detail by project staff.

COSTS OF THE SCHEME, OFFICE OVERHEAD NOT INCLUDED

Village Name		COSTS (YR) total	per head	PIPES YR	%	CIVIL WORKS YR	%	PUMPS YR	%	TAPS/TROUGHS YR	%	PROJECT COSTS *) YR	%	CONTRIBUTIONS YR	%
1 Al Husul		300,737	384	55,720	19%	160,156	53%	69,720	23%	15,141	5%	0	0%	0	0%
2 Dafinah		272,815	279	29,880	11%	114,852	42%	66,062	24%	62,021	23%	0	0%	0	0%
3 Al Mayfa'ah		272,082	495	72,130	27%	119,014	44%	60,339	22%	12,889	5%	0	0%	7,710	3%
4 Sama/Sufara		540,676	636	259,640	48%	191,070	35%	66,239	12%	23,727	4%	0	0%	0	0%
5 Sirm al Banna		270,612	1,109	81,750	30%	109,158	40%	61,519	23%	10,185	4%	0	0%	8,000	3%
6 Jarf Isbil	(&)	476,504	243	129,080	27%	157,704	33%	146,078	31%	13,642	3%	0	0%	30,000	6%
7 Al Hajar		233,305	261	7,740	3%	119,332	51%	87,774	38%	8,459	4%	0	0%	0	0%
8 Ar Rhawq		269,847	791	81,775	30%	113,366	42%	63,997	24%	10,709	4%	0	0%	0	0%
9 Al Garrar		210,936	1,055	25,685	12%	114,852	54%	59,690	28%	10,709	5%	0	0%	0	0%
10 Jawf al Nukabah		185,844	1,858	18,720	10%	110,722	60%	47,803	26%	8,599	5%	0	0%	0	0%
11 Hanaka al Masud		271,711	91	45,910	17%	156,582	58%	58,510	22%	10,709	4%	0	0%	0	0%
12 Mawr		151,812	51	0	0%	146,662	97%	0	0%	5,150	3%	0	0%	0	0%
14 Al Mihal/Joar		2,522,626	1,203	1,256,186	50%	639,341	25%	561,599	22%	65,500	3%	0	0%	0	0%
15 Jebal al Ma'al		1,108,848	715	579,833	52%	189,015	17%	311,200	28%	16,800	2%	0	0%	12,000	1%
16 Al Azan	(&)	615,500	264	278,000	45%	137,200	22%	135,300	22%	20,000	3%	0	0%	45,000	7%
17 As Shaqqab		762,785	628	359,054	47%	172,235	23%	208,696	27%	22,800	3%	0	0%	0	0%
18 Al Hajalah		1,177,515	3,317	344,470	29%	308,045	26%	510,000	43%	15,000	1%	0	0%	0	0%
19 Al Haruj		727,687	850	316,187	43%	182,500	25%	209,000	29%	20,000	3%	0	0%	0	0%
20 Wastah		718,948	799	236,085	33%	296,950	41%	173,913	24%	12,000	2%	0	0%	0	0%
21 Al Hasoon		838,706	749	266,950	32%	309,454	37%	235,302	28%	27,000	3%	0	0%	0	0%
22 Hanud		186,002	140	0	0%	163,602	88%	0	0%	22,400	12%	0	0%	0	0%
23 Bidashy		832,956	1,129	455,239	55%	182,500	22%	165,217	20%	30,000	4%	0	0%	0	0%
24 Bashar		832,980	1,157	464,080	56%	146,900	18%	192,000	23%	30,000	4%	0	0%	0	0%
25 Mangada		793,917	293	324,000	41%	263,308	33%	182,609	23%	24,000	3%	0	0%	0	0%
26 Ar Raba'ah		809,947	901	363,460	45%	235,983	29%	191,304	24%	19,000	2%	0	0%	0	0%
27 Al Mithal	(&)	1,154,702	662	536,978	47%	328,500	28%	252,174	22%	37,050	3%	0	0%	0	0%
28 Adra'ah		1,466,710	474	886,645	60%	317,662	22%	200,000	14%	30,400	2%	0	0%	32,000	2%
29 Dhi Sabil		130,011	262	18,511	14%	59,000	45%	52,500	40%	0	0%	0	0%	0	0%
30 Dhafar		824,999	1,222	394,869	48%	147,000	18%	239,130	29%	44,000	5%	0	0%	0	0%
31 Sharafa		611,124	1,025	182,088	30%	80,369	13%	204,348	33%	0	0%	25,319	4%	119,000	19%
32 Bayt as Shamy		544,831	1,816	142,828	26%	77,357	14%	177,650	33%	0	0%	39,276	7%	107,720	20%
33 As Zuwab		744,331	886	154,506	21%	160,550	22%	303,500	41%	0	0%	20,075	3%	105,700	14%

COSTS OF THE SCHEME. OFFICE OVERHEAD NOT INCLUDED

Village Name	COSTS (YR) total	per head	PIPES YR	%	CIVIL WORKS YR	%	PUMPS YR	%	TAPS/TROUGHS YR	%	PROJECT COSTS *) YR	%	CONTRIBUTIONS YR	%
34 Bani Muwallad	502,399	837	85,063	17%	44,795	9%	74,400	15%	0	0%	86,900	17%	211,240	42%
35 Al Mashaa'hida	1,108,809	1,082	458,063	41%	262,000	24%	260,845	24%	0	0%	57,100	5%	71,000	6%
36 Wathan	2,085,760	633	705,954	34%	135,000	6%	729,816	35%	0	0%	86,690	4%	428,300	21%
37 Al Saifer/Na'amah	253,129	625	88,108	35%	19,738	8%	25,550	10%	0	0%	41,633	16%	78,100	31%
39 Al Miqdahah	641,711	2,292	67,172	10%	82,325	13%	361,160	56%	0	0%	37,054	6%	94,000	15%
40 Magrabit al Anab	601,743	533	267,347	44%	172,342	29%	24,750	4%	4,000	1%	58,654	10%	74,650	12%
41 Bani Fallah	953,233	1,589	200,100	21%	33,857	4%	518,410	54%	0	0%	61,441	6%	139,425	15%
42 Bani Zaydan	1,022,035	1,276	400,434	39%	26,150	3%	379,000	37%	0	0%	60,251	6%	156,200	15%

*) Salary technicians, transport materials.

started phase II

HE costs ??

no, is overhead.

50% is overhead of total costs.

33% of total costs is overhead.

So you need an additional 50% on your investment costs

Annex D

CONTRIBUTIONS AND COSTS

Village Name	COSTS (YR) total	per head	CONTRIBUTION A	B	C	COMPONENTS OF THE CONTRIBUTION (YR) cash	mate-rials	trans-port	food	labour	LABOUR D	E
Al Husul	300,737	384	-	-	-	-	-	-	-	-	-	-
2 Dafinah	272,815	279	-	-	-	-	-	-	-	-	-	-
3 Al Mayfa'ah	272,082	495	7,710	3%	-	-	-	-	-	7,710	-	-
Sama/Sufara	540,676	636	-	-	-	-	-	-	-	-	-	-
Sirm al Banna	270,612	1,109	8,000	3%	33	8,000	-	-	-	-	-	-
6 Jerf Isbil (&)	476,504	243	30,000	6%	15	30,000	-	-	-	-	-	-
Al Hajar	233,305	261	-	-	-	-	-	-	-	-	-	-
Ar Rhawq	269,847	791	-	-	-	-	-	-	-	-	-	-
9 Al Garrar	210,936	1,055	-	-	-	-	-	-	-	-	-	-
10 Jawf al Nukabah	185,844	1,858	-	-	-	-	-	-	-	-	-	-
Hanaka al Masud	271,711	91	-	-	-	-	-	-	-	-	-	-
Mawr	151,812	51	-	-	-	-	-	-	-	-	-	-
14 Al Mihal/Joar	2,522,626	1,203	-	-	-	-	-	-	-	-	-	-
Jebal al Ma'al	1,108,848	715	12,000	1%	7	-	-	-	-	12,000	-	-
Al Azan (&)	615,500	264	45,000	7%	19	15,000	-	-	-	30,000	-	-
17 As Shaqqab	762,785	628	-	-	-	-	-	-	-	-	-	-
Al Hajalah	1,177,515	3,317	-	-	-	-	-	-	-	-	-	-
Al Haruj	727,687	850	-	-	-	-	-	-	-	-	-	-
20 Wastah	718,948	799	-	-	-	-	-	-	-	-	-	-
21 Al Hasoon	838,706	749	-	-	-	-	-	-	-	-	-	-
Hanud	186,002	140	-	-	-	-	-	-	-	-	-	-
Bidashy	832,956	1,129	-	-	-	-	-	-	-	-	-	-
24 Bashar	832,980	1,157	-	-	-	-	-	-	-	-	-	-
Mangada	793,917	293	-	-	-	-	-	-	-	-	-	-
Ar Raba'ah	809,947	901	-	-	-	-	-	-	-	-	-	-
27 Al Mithal (&)	1,154,702	662	-	-	-	-	-	-	-	-	-	-
Adra'ah	1,466,710	474	32,000 *	2%	10	-	2,000	-	27,000	3,000	30	0.01
Dhi Sabil	130,011	262	-	-	-	-	-	-	-	-	-	-
30 Dhafar	824,999	1,222	-	-	-	-	-	-	-	-	-	-
31 Sharafa	611,124	1,025	119,000	19%	200	-	45,000	14,000	20,000	40,000	320	0.54
Bayt as Shamy	544,831	1,816	107,720 *	20%	359	-	23,350	2,000	24,750	57,620	380	1.27
As Zuwab	744,331	886	105,700	14%	126	-	43,000	4,000	21,500	37,200	372	0.44
34 Bani Muwallad	502,398	837	211,240	42%	352	-	101,140	20,000	24,000	66,100	565	0.95
Al Mashaa'hida	1,108,808	1,082	71,000	6%	69	-	2,000	22,000	22,500	24,500	245	0.24
Fathan	2,085,760	633	428,300	21%	130	-	100,000	78,000	30,500	219,800	?	-
37 Al Saifer/Na'amah	253,129	625	78,100	31%	193	-	16,400	10,000	15,500	36,200	311	0.77
Al Miqdahah	641,711	2,292	94,000 *	15%	336	-	15,600	-	19,500	58,900	-	-
Magrabit al Anab	601,743	533	74,650	12%	66	-	8,300	2,500	26,850	37,000	335	0.30
Bani Fallah	953,233	1,589	139,425	15%	232	-	33,850	28,500	15,900	61,175	514	0.86
42 Bani Zaydan	1,022,035	1,278	156,200	15%	208	-	54,200	6,000	22,000	74,000	360	0.45

= total value of contribution in YR
B = contribution as percentage of total costs
C = contribution in YR per head
D = total nr. of labour days
E = nr of labour days per head
* = additional contribution with bore holes or pipes
& = including other donations like pumps from ministry and distribution systems from RIRDP

WATERSOURCES

	Village Name	Type	Depth meter	Owner	Paid by	Yield l/sec	Quantity	Quality (*)	Situ-ation	Irriga-tion	Pump-depth m
1	Al Husul	Borehole	90	Village	Holland	0.9	not enough	v.good	clean	no	69
2	Dafinah	Borehole	138	Village	Holland	< 0.9	little	good	muddy	no	105
3	Al Mayfa'ah	Borehole	107	Village	Holland	2.3	good	good	fair	no more	96
4	Sama/Sufara	Borehole	152	2 Villages	Holland	35	good	v.good	dirty	no	96
5	Sirm al Banna	Borehole	200	Village	Holland	19	good	v.good	dirty	no	99
6	Jarf Isbil	Borehole	252	Village	Holland	6	good	good	dirty	yes	?
7	Al Hajar	Borehole	240	Village	Holland	> 15	good	good	fair	no	189
8	Ar Rhawq	Borehole	155	Village	Holland	1.7	good	v.bad	clean	no	99
9	Al Garrar	Borehole	175	Village	Holland	1.4	enough	bad	dirty	no more	90
10	Jawf al Nukabah	Borehole	162	Village	Holland	16	good	bad	clean	no	30
11	Hanaka al Masud	Borehole	143	Village	Holland	5.5	good	fair	dirty	only	90
12	Mawr	Borehole	100	Village	Holland	dry	-	-	-	-	-
13	Al Mihal + Joar	Borehole	98	10 Villages	LDA	10	good	good	clean	yes	60
15	Jebal al Ma'al	Borehole	160	3 Villages	Government	?	good	v.good	clean	no	80
16	Al Azan	Borehole	198	Village	Holland	dry	-	-	-	-	-
		Borehole	297	Village	Village	?	good	good	clean	no	240
17	As Shaqqab	Borehole	300	Village	LDA	5	good	good	?	no	90
18	Al Hajalah	Borehole	170	Village	Government	?	good	fair	?	no	150
19	Al Haruj	Borehole	180	Village	Government	9.9	good	bad	clean	no	110
20	Wastah	Borehole	72	Village	Government	10.4	good	good	clean	no	65
21	Al Hasoon	Borehole	106	Village	Government	9.2	good	good	clean	no	75
22	Hanud	Borehole	134	Village	Government	3.8	-	-	-	-	
23	Bidashy	Borehole	105	Village	Government	5	good	good	clean	no	80
24	Bashar	Borehole	95	Village	Government	8.9	good	good	fair	yes	60
25	Mangada	Borehole	96	Village	Government	3.2	good	v.good	clean	no	50
26	Ar Raba'ah	Borehole	74	Village	Government	2.9	good	good	clean	no	65
27	Al Mithal	Borehole	270	Village	Government	2.5	good	good	clean	no	?
28	Adra'ah	Borehole	103	Village	Village	8.6	good	good	clean	no	75
29	Dhi Sabil	Spring	-	Others	-	0.05	bad	fair	fair	no	-
30	Dhafar	Borehole	250	Village	Government	4.4	good	v.good	clean	no	225
31	Sharafa	Borehole	72	Village	Government	5.8	good	good	clean	no	60
32	Bayt as Shamy	Borehole	140	Village	Village	6.3	good	good	clean	no	
33	As Zuwab	Borehole	130	Village	Government	5.5	good	fair	clean	no	
34	Bani Muwallad	Spring	-	Village	-	0.3	good	good	clean	yes	-
35	Al Mashaa'hida	Borehole	290	Village	Government	4.7	good	fair	clean	no	210
36	Wathan	Borehole	235	Village	Government	3.2	good	soapy	dirty	yes	220
		Borehole	225	Village	Government	3.8	good	good	dirty	yes	-
37	Al Saifer	Spring	-	Village	-	0.2	enough	good	clean	yes	-
38	Na'amah	Spring	-	Village	-	0.2	enough	fair	clean	some	0
39	Al Miqdahah	Borehole	120	Village	Village	5	good	v.good	clean	no	100
40	Magrabit al Anab	4 Springs	-	1/2 Village	-	0.8-1.6	good	good	clean	yes	-
41	Bani Fallah	Borehole	343	Village	Government	3.8	good	good	clean	no	270
42	Bani Zaydan	Borehole	213	Village	Government	4.5	good	good	clean	no	102

(*) as examined by the SRWSD laboratory

RESERVOIRS

	Village Name	Capacity *) A	B	Material	Type @)	Costs YR	Cleaning possible	freq #)	Cover	Lid	Lock	Vent pipes pres.	bends	screen	Condition building	inside
1	Al Husul	100	128	RC	ground,middle	124,626	yes	12	yes	yes	no	yes	no	no	good	clean
2	Dafinah	50	51	RC	ground,low	79,322	yes	12	yes	yes	no	yes	no	no	good	clean
3	Al Mayfa'ah	50	91	RC	ground,middle	83,484	yes	?	yes	yes	no	yes	no	no	fair	clean
4	Sama	50	91	RC	ground,middle	77,770	yes	3	yes	yes	no	yes	no	no	good	clean
4	Sufara	50	167	RC	ground,low	77,770	yes	12	yes	yes	no	yes	no	no	good	clean
5	Sirm al Banna	50	205	RC	ground,high	73,628	yes	6	yes	yes	no	yes	no	no	good	clean,
6	Jarf Isbil	100	51	RC	ground,high	122,174	yes	-	yes	yes	no	yes	no	no	leaking?	empty
7	Al Hajar	50	56	RC	ground,low	83,802	yes	9	yes	yes	no	yes	no	no	good	clean,hot water
8	Ar Rhawq	50	143	RC	ground,high	75,484	yes	-	yes	yes	no	no	-	-	fair	empty
9	Al Garrar	50	250	RC	ground,low	76,970	yes	12	yes	no	-	yes	no	no	fair	turbid water
10	Jawf al Nukabah	50	500	RC	ground,high	72,840	yes	18	yes	yes	no	yes	no	no	bad	turbid water
11	Hanaka al Masud	100	33	RC	ground,middle	118,700	yes	-	yes	no	-	no	-	-	fair	empty
12	Mawr	100	33	RC	ground,high	108,780	yes	-	yes	no	-	no	-	-	fair	empty
13	Al Mihal	50	144	RC	ground,high	86,700	yes	6	bad	yes	yes	no	-	-	bad	clean
		25	-	RC	ground,booster	56,793	yes	0	bad	no	-	no	-	-	bad	fair
14	Joar	150	86	RC	ground,high	135,530	yes	1	yes	yes	no	no	-	-	good	clean
		25	-	RC	ground,booster	56,793	yes	6	yes	yes	yes	no	-	-	good	clean
		50	108	RC	ground,high	86,700	yes	6	yes	yes	yes	no	-	-	good	clean
15	Jebal al Ma'al	75	107	RC	ground,high	80,810	yes	6	yes	yes	yes	yes	no	no	good	clean
		50	59	RC	ground,high	59,795	yes	6	yes	yes	yes	yes	no	no	good	clean
16	Al Azan	50	21	RC	ground,high	107,200	yes	12	yes	yes	yes	yes	yes	yes	good	clean
17	As Shaqqab	50	41	RC	ground,high	108,347	yes	-	yes	yes	yes	yes	no	no	good	empty
18	Al Hajalah	25	-	RC	ground,booster	49,470	yes	4	yes	yes	no	yes	no	no	good	clean
		40	85	RC	elevated, 9 m	155,675	yes	4	yes	yes	no	yes	no	no	good	clean
19	Al Haruj	50	58	RC	ground,high	107,500	yes	0	yes	yes	yes	yes	no	no	good	hot water,oil
20	Wastah	50	33	RC	elevated, 12 m	251,950	yes	12	yes	yes	yes	yes	yes	yes	good	clean
21	Al Hasoon	50	45	RC	elevated, 12 m	237,454	no	-	yes	yes	no	yes	no	no	good	empty
22	Hanud	100	75	RC	ground,high	125,352	yes	-	bad	no	-	no	-	-	leaking?	empty
23	Bidashy	50	68	RC	ground,high	107,500	yes	-	bad	yes	yes	yes	no	no	leaking	empty
24	Bashar	50	69	RC	ground,high	101,900	no	0	bad	yes	yes	no	-	-	leaking	clean
25	Mangada	150	55	RC	ground,high	199,828	yes	0	yes	yes	yes	yes	yes	yes	good	clean
26	Ar Raba'ah	50	61	RC	ground,high	160,983	yes	12	yes	yes	yes	yes	no	no	good	clean

DISTRIBUTION SYSTEM

	Village Name	Made by	Total length meter	Costs in YR Total	per cap	per m	general condition	Leakages	Damaged pipes	pipes in wastewater
1	Al Husul	Village	whole	-	-	-	fair	no	no	no
2	Dafinah	no	-	-	-	-	-	-	-	-
3	Al Mayfa'ah	village	whole	-	-	-	bad	yes	yes	yes
4	Sama/Sufara	village	1 line	-	-	-	good	no	no	no
5	Sirm al Banna	village	whole	-	-	-	good	no	no	no
6	Jarf Isbil	village	partly *	-	-	-	no water	?	yes	yes
7	Al Hajar	NTF	partly *	-	-	-	not used	?	yes	no
8	Ar Rhawq	village	whole	-	-	-	no water	?	no	no
9	Al Garrar	no	-	-	-	-	-	-	-	-
10	Jawf al Nukabah	village	whole	-	-	-	bad	yes	no	no
11	Hanaka al Masud	village	whole	-	-	-	very bad	yes	yes	yes
14	Al Mihal/Joar	SRWSD	13157	634,311	302	48	good	no	no	no
15	Jebal al Ma'al	SRWSD	4303	146,503	95	34	good	no	no	no
16	Al Azan	RIRDP	whole	?	?	?	good	some	some	yes
17	As Shaqqab	SRWSD	2300	188,821	155	82	bad	yes	yes	no
18	Al Hajalah	village	whole	-	-	-	good	no	no	no
19	Al Haruj	SRWSD	2427	183,280	214	75	good	some	no	no
20	Wastah	SRWSD	899	62,750	42	70	buried	no	no	no
21	Al Hasoon	SRWSD	1944	185,050	165	95	buried	?	no	no
23	Bidashy	SRWSD	4260	277,089	375	65	fair	some	yes	no
24	Bashar	SRWSD	3262	204,720	284	62	good	no	no	no
25	Mangada	SRWSD	2802	205,140	76	73	good	no	no	yes
26	Ar Raba'ah	SRWSD	2251	243,520	295	108	good	no	no	no
27	Al Mithal	SRWSD	3591	298,659	171	83	good	?	?	no
28	Adra'ah	SRWSD	7776	698,750	226	90	good	no	no	yes
29	Dhi Sabil	no	-	-	-	-	-	-	-	-
30	Dhafar	SRWSD	3006	285,070	422	95	good	no	no	no
31	Sharafa	SRWSD	1968	113,588	190	58	good	no	1	no
32	Bayt as Shamy	SRWSD	1056	44,428	148	42	good	no	no	no
33	As Zuwab	SRWSD	1680	93,306	111	55	good	no	no	no
34	Bani Muwallad	SRWSD	1821	67,303	112	37	good	no	no	no
35	Al Mashaa'hida	SRWSD	7105	309,693	302	44	good	no	no	no
36	Wathan	SRWSD	11834	460,977	140	40	good	no	no	no
37	Al Saifer	SRWSD	1471	60,906	194	41	good	no	no	no
38	Na'amah	no	-	-	-	-	-	-	-	-
39	Al Miqdahah	SRWSD	1560	54,212	194	35	good	no	no	no
40	Magrabit al Anab	SRWSD	9603	267,347	237	28	fair	yes	yes	no
41	Bani Fallah	SRWSD	3324	174,450	291	52	good	no	no	no
42	Bani Zaydan	SRWSD	6846	296,034	370	43	good	1	1	no

* partly means that only a part of the village has a distribution system.

Annex I

CATTLE TROUGHS

	Village Name	Constructed	Total costs YR	Used	Situation
1	Al Husul	1	6.350	no	only used for washing
2	Dafinah	1	5.390	no	removed
3	Al Mayfa'ah	1	6.030	no	disconnected
4	Sama	1	6.360	no	disconnected
	Sufara	1	6.360	no	disconnected
5	Sirm al Banna	1	5.990	yes	good
6	Jarf Isbil	1	5.950	yes	good
7	Al Hajar	1	5.590	yes	good
8	Ar Rhawq	1	6.030	no	scheme not working
9	Al Garrar	1	6.030	no	pipe broken
10	Jawf al Nukabah	1	6.030	yes	often used
11	Hanaka al Masud	1	6.030	no	not used
12	Mawr	1	5.150	no	never connected
32	Bayt as Shamy	1	300	yes	too big, sheep go inside
40	Magrabit al Anab	4	4.000	no	all disconnected

PUBLIC TAPS

	Village Name	Con-struc ted	Costs YR	Inhab per tap	Functioning no	Functioning %	Maximum Distance houses m	Real water price YR/mth	calculated price per house/ month	head/ month	m3	Freq.*)	Con sump. lcd	Changed to housecon	Situation	Remarks
1	Al Husul	10	8,791	78	1	10	800	free	-	-	-	-	-	yes	fair	1 tap for mosque
2	Dafinah	(24)	(56.631)	(41)	7	29	800	3/head	21	3	6	4 days	12	no	dirty	
3	Al Mayfa'ah	6	6,859	89	0	0	-	-	-	-	-	-	-	yes	not used	
4	Sana	8	7,338	69	5	45	1000	2/head	15	2	3	always	20	no	bad	
4	Sufara	4	3,669	75	3	75	300	4/head	29	4	6	always	21	no	good	
5	Sirm al Banna	4	4,195	61	0	0	-	-	-	-	-	-	-	yes	not used	
6	Jarf Isbil	12	7,692	163	0	0	-	-	-	-	-	-	-	-	not used	
7	Al Hajar	4	2,869	224	4	100	700	4/head	28	4	8	always	17	no	good	
8	Ar Rhawq	4	4,679	88	0	0	-	-	-	-	-	-	-	yes	no water	
9	Al Garrar	4	4,679	50	3	75	200	5/head	35	5	7	always	25	no	acceptable	
10	Hanaka al Masud	4	4,679	750	0	0	-	-	-	-	-	-	-	yes	no water	
13	Al Mihal	8	7,706	43	2	25	-	free	-	-	-	-	-	yes	locked	1 tap for ladies
14	Joar	60	57,794	29	47	78	100	54/house	54	8	15	7 days	17	no	good	
15	Jebal al Ma'al	12	7,200	58	8	66	200	28/house	28	3	8	14 days	13	no	good	
	Sirm al Abd/Thabaq	16	9,600	53	10	63	100	25/house	25	4	17	28 days	6	no	good	
16	Al Azan	12	20,000	194	0	0	-	-	-	-	-	-	-	-	demolished	
17	As Shaqqab	18	22,800	68	2	11	-	-	-	-	-	-	-	-	no water	
18	Al Hajalah	10	15,000	36	0	0	-	-	-	-	-	-	-	yes	not used	
19	Al Haruj	16	20,000	54	0	0	-	-	-	-	-	-	-	yes	not used	
20	Wastah	8	12,000	62	2	25	150	50/house	50	7	18	always	13	no	very dirty	
21	Al Hasoon	22	27,000	51	0	0	-	-	-	-	-	-	-	-	no water	
22	Hanud	28	22,400	47	0	0	-	-	-	-	-	-	-	-	not completed	
23	Bidashy	20	30,000	37	0	0	-	-	-	-	-	-	-	-	no water	
24	Bashar	20	30,000	36	0	0	-	-	-	-	-	-	-	yes	not used	
25	Mangada	46	24,000	50	2	4	-	free	-	-	-	-	-	yes	dirty	2 taps for poor
26	Ar Raba'ah	14	19,000	64	4	29	200	5/head	35	5	?	always	?	yes	acceptable	
27	Al Mithal	38	37,050	46	0	0	-	-	-	-	-	-	-	yes	no water	
28	Adra'ah	32	30,400	97	0	0	-	-	-	-	-	-	-	yes	not used	
29	Dhi Sabil	7	reservoir	71	4	57	-	-	-	-	-	-	-	no	no water	
30	Dhafar	24	44,000	28	20	83	200	20/house	20	4	10	14 days	12	no	dirty	
38	Na'amah	4	reservoir	23	4	100	100	8 /m3	30	4	8	always	17	no	very good	
40	Magrabit al Anab	?	reservoir	?	?	?	200	free	free	free	free	always	?	no	good	

*) 4 days means every 4 days water available
lcd = liter per capita per day

Annex I

HOUSECONNECTIONS

	Village Name	Present	Water-meters	Quality connections	Real price YR	Calculated price (YR)per House/m	Head/m	m3	Freq.*)	Consump. lcd
1	Al Husul	yes	no	fair	3/head/m	21	3	5	4 days	22
2	Dafinah	no	-	-	-	-	-	-	-	-
3	Al Mayfa'ah	(yes)	no	bad	50/house/m	50	4	4	3 days	35
4	Sama/Sufara	yes	no	-	-	-	-	-	-	-
5	Sirm al Banna (#)	yes	Bosco	good	3/head/m	17	3	5	always	45
6	Jarf Isbil	no	-	-	-	-	-	-	-	-
7	Al Hajar	no	-	-	-	-	-	-	-	-
8	Ar Rhawq	yes	no	good	-	-	-	-	-	-
9	Al Garrar	no	-	-	-	-	-	-	-	-
10	Jawf al Nukabah	yes	no	bad	free	free	free	free	always	25
11	Hanaka al Hasud	yes	no	bad	2/head/m	14	2	3	3 days	20
13	Al Mihal	yes	Sisma	fair	5/m3	34	4	5	always	25
14	Joar	no	-	-	-	-	-	-	-	-
15	Jebal al Ma'al	no	-	-	-	-	-	-	-	-
16	Al Azan	yes	yes	good	15/m3	107	14	15	always	30
17	As Shaqqab	no	-	-	-	-	-	-	-	-
18	Al Hajalah	yes	Bosco	good	20/m3	64	9	20	always	15
19	Al Haruj	yes	yes	good	5/m3	?	?	5	always	?
20	Wastah	no	-	-	-	-	-	-	-	-
21	Al Hasoon	no	-	-	-	-	-	-	-	-
23	Bidashy	no	-	-	-	-	-	-	-	-
24	Bashar	yes	yes	good	10+8/m3	49	8	10	always	26
25	Mangada	yes	no	good	20/house/m	20	3	?	3 days	?
26	Ar Raba'ah	yes	no	fair	5/head/m	35	5	?	always	?
27	Al Mithal	yes	no	good	-	-	-	-	-	-
28	Adra'ah	yes	Bosco	very good	6/m3	46	5	6	always	25
29	Dhi Sabil	no	-	-	-	-	-	-	-	-
30	Dhafar	no	-	-	-	-	-	-	-	-
31	Sharafah	yes	Bosco	very good	?	?	?	?	always	?
32	Bayt as Shamy	yes	Bosco	good	10/m3	?	?	10	?	?
33	As Zuwab	yes	Bosco	very good	?	?	?	?	always	30
34	Bani Muwallad	yes	Sisma	very good	(5/m3)	(27)	(3)	(5)	always	22
35	Al Mashaa'hida	yes	no	good	10/head/m	70	10	12	7 days	28
36	Wathan	yes	Kent	good	10+25/m3	82	12	27	always	15
37	Al Saifer	yes	(no)	good	free	free	free	free	always	16
38	Na'amah	no	-	-	-	-	-	-	-	-
39	Al Miqdahah	yes	Kent	very good	50+10/m3	100	10	20	always	20
40	Magrabit al Anab	no	-	-	-	-	-	-	-	-
41	Bani Fallah	yes	Bosco	good	20/m3	65	6	20	always	10
42	Bani Zaydan	yes	Bosco	fair	10/m3	70	7	10	3 days	23

Values between brackets are special cases, see village descriptions.
(*) 4 days means every 4 days water
(#) watermeters installed but not used
lcd : liters per capita per day

Annex K

PUMP & ENGINE

	Village Name	General	Head meter	Cap. l/s	Pump Brand	Type	Imp.	Engine Brand	Type	HP
1	Al Husul	Vertical diesel	115	2.1	Caprari	P6L 3-20/10	10	Adim	1052 LP	28
2	Dafinah	Vertical diesel	124	0.8	Caprari	P6L 3-20/10	10	Adim	1052 LP	28
3	Al Mayfa'ah	Vertical diesel	83	2.1	Caprari	P6L 3-20/8	8	Adim	1052 LP	27
4	Sama/Sufara	Vertical diesel	167	4.2	Caprari	P6L 3-20/15	15	Adim	1052 LP	33
5	Sirm al Banna	Vertical diesel	> 82	2.8	Caprari	P6L 3-20/8	8	Adim	1052 LP	28
6	Jarf Isbil	Vertical diesel	> 256	6.2	Porcelli	PV 80M	25	MWM	D226-6	85
7	Al Hajar	Vertical diesel	195	1.4	Caprari	P6L 3-20/13	13	Adim	1052 LP	31
8	Ar Rhawq	Vertical diesel	119	1.4	Caprari	P6L 3-20/10	10	Adim	1052 LP	28
9	Al Garrar	Vertical diesel	101	1.4	Caprari	P6L 3-20/8	8	Adim	1052 LP	29
10	Jawf al Nukabah	Vertical diesel	35	2.8	Caprari	P6L 3-20/3	3	Adim	1052 LP	29
11	Hanaka al Masud	Vertical diesel	69	5.5	Caprari	P6C 3-20/6	6	Adim	1052 LP	27
12	Mawr	-	-	-	-	-	-	-	-	-
13	Al Mihal	Vertical diesel	101	6.9	Van Heck	LDW 6119 VN3	?	Hatz	3M40H	26
14	Joar	Booster electric	310	8.0	Van Heck	4504	10	-	-	-
		Booster diesel	60	4.0	Van Heck	ZW-NE6*18	?	Hatz	Z790	12
15	Jebal al Ma'al	Deepwell electric	350	?	?	?	?	-	-	-
16	Al Azan	Vertical diesel	300?	5.6	Caprari	P6C 3-20/20	20	VM	1054 P	50
17	As Shaqqab	Deepwell electric	238	4.1	Van Heck	DW6-36/330	36	-	-	-
18	Al Hajalah	Deepwell electric		3.0	Pleuger	55 HP	?	-	-	-
		Booster diesel		3.0	Ebara	50 MS 5 E	5	Yanmar	TS 250	19
19	Al Haruj	Vertical diesel	170	3.2	Van Heck	LDW6-28/330	28	VM	67A	?
20	Wastah	Deepwell electric	97	4.1	Van Heck	DW6-16/330	16	-	-	-
21	Al Hasoon	Vertical diesel	110	2.8	Van Heck	LDW6 20/230	20	VM	DM 862-1	?
22	Hanud	-	-	-	-	-	-	-	-	-
23	Bidashy	Vertical diesel	160	2.8	Van Heck	LDW6-28/230	28	VM	DM 862-1	?
24	Bashar	Deepwell electric	215	2.8	Van Heck	DW6 40/230	40	-	-	
25	Mangada	Vertical diesel	100	6.3	Van Heck	LDW6-10/700	10	VM	67A	?
26	Ar Raba'ah	Vertical diesel	65	3.5	Van Heck	LDW6-34/230	34	VM	67A	?
27	Al Mithal	Deepwell electric	311	9.3	?	?	?	-	-	-
28	Dhi Sabil	Booster diesel	50	5.0	Ebara	50 MSL 4 E	3	Yanmar	TS 130	13
28	Adra'ah	Vertical diesel	200	5.7	Van Heck	LDW6 19/700	19	VM	Sun 3105	65
29	Dhafar	Deepwell electric	316	2.2	Van Heck	DW6 40/230	40	-	-	-
30	Sharafa	Vertical diesel			Van Heck	LDW6 32/330	32	VM	Sun 3105	55
31	Bayt as Shamy	Vertical diesel	220		Van Heck	LDW6 28/330	28	VM	Sun 2105	32
32	As Zuwab	Vertical diesel			Caprari	R16/3L/20	?	VM	Sun 1054	?
33	Bani Muwallad	Booster electric	100	2.5	Grundfos	KMER 132 S2	16?	Robin	PY 80-2	16 generator
34	Al Mashaa'hida	Deepwell electric	320	3.1	Van Heck	DW6 43/330	43	-	-	-
35	Wathan	Vertical diesel	?	?	Caprari	R26/3L/24	24	Daim.Benz	OM 314	50
		Deepwell electric	250	3.0	Van Heck	DW6 40/230	40	-	-	-
		Booster electric	315	3.0	Hitz	4503	14	-	-	-
		Booster diesel	400	?	Caprari	APB 80D/14	14	VM	Sun 6105	120
37	Al Saifer	-	-	-	-	-	-	-	-	-
38	Na'amah	Small electric	50	0.2	Audoli&Bertola	1.5 HP	-	-	-	-
39	Al Miqdahah	deepwell electric	215	6.6	VPM Wiehl	KD6B/24	24	-	-	-
40	Magrabit al Anab	small electric	50	0.2	Audoli&Bertola	1.5 HP	-	-	-	-
41	Bani Fallah	deepwell electric	320	2.5	VPM Wiehl	KD6B/36	36	-	-	-
42	Bani Zaydan	deepwell electric	180	4.5	GFB	SD6B/24	24	-	-	-

Imp. = nr of impellors

PUMP & ENGINE

	Village Name	Generator Brand	Type	KVA	Problems
1	Al Husul	-	-	-	no
2	Dafinah	-	-	-	some big repairs
3	Al Mayfa'ah	-	-	-	no
4	Sama/Sufara	-	-	-	no
5	Sirm al Banna	-	-	-	no
6	Jarf Isbil	-	-	-	too small
7	Al Hajar	-	-	-	no
8	Ar Rhawq	-	-	-	no
9	Al Garrar	-	-	-	no
10	Jawf al Nukabah	-	-	-	no
11	Hanaka al Masud	-	-	-	no
12	Mawr	-	-	-	-
13	Al Mihal	-	-	-	pumphead not good
14	Joar	Deutz	F6L 912	65	not any more, solved by themselves
		-	-	-	no
15	Jebal al Ma'al	Ansaldo	M2B 250 SB4	100	pump becomes too hot,spareparts
16	Al Azan	-	-	-	no
17	As Shaqqab	Torpedo	F4L912 LSA 42M3	32	-
18	Al Hajalah	MWM	?	?	no
		-	-	-	no return valve installed
19	Al Haruj	-	-	-	pump leaks oil
20	Wastah	Torpedo	F3L912 LSA 410M0	-	spare parts
21	Al Hasoon	-	-	-	engine becomes too hot, pumphead replaced
22	Hanud	-	-	-	-
23	Bidashy	-	-	-	engine becomes too hot
24	Bashar	Torpedo	F4L912 LSA 42M3	32	spareparts
25	Mangada	-	-	-	no
26	Ar Raba'ah	-	-	-	no
27	Al Mithal	Lister	BRF 280	117	no
28	Dhi Sabil	-	-	-	no
28	Adra'ah	-	-	-	no
29	Dhafar	Deutz	F4L912	57	no
30	Sharafa	-	-	-	pumphead replaced by project
31	Bayt as Shamy	-	-	-	head becomes too hot
32	As Zuwab	-	-	-	no
33	Bani Muwallad	-	-	-	fuel injection
34	Al Mashaa'hida	Deutz	F6L 912	65	no
35	Wathan	-	-	-	no
		Deutz	F6L 413FR	89	not any more
		-	-	-	no
		-	-	-	not any more
37	Al Saifer	-	-	-	-
36	Na'amah	Yanmar	YDG 3000E	4	not any more
39	Al Miqdahah	Fiat	8041	40	no
40	Magrabit al Anab	Mitsubishi	MDG-35	4	no
41	Bani Fallah	Fiat	8061	60	no
42	Bani Zaydan	Fiat	8041	40	no

Annex L

PUMP & ENGINE 2

	Village Name	Name operator	Period $) A	B	Experience from	1	Training #) 2	3	Main-tenance	Salary (YR) per month
1	Al Husul	Moh. Saleh Asies	54	0	Saudi	no	no	-	yes	(500)
2	Dafinah	?	24	10	pumps	no	no	-	yes	500
3	Al Mayfa'ah	Saleh Ali Saleh	6	1	pumps	no	no	-	yes	1500
4	Sama/ Sufara	Ahmed Ali Jaafer	5	1	some	no	yes	no	yes	1000
5	Sirm al Banna	Saleh Musaed Nasser	36	1	no	ex-oper.	no	-	yes	250
6	Jarf Isbil	Saad Mohammed Yahya	24	?	pumps	no	no	-	yes	1500
7	Al Hajar	Ahmed ibn Ahmed Saleh	53	0	no	Trans.	no	-	yes	0
8	Ar Rhawq	-	-	1		-	-	-	-	-
9	Al Garrar	Ahmed M.Ahmed Al Musadi	53	0	no	some	yes	yes	yes	0
10	Jawf al Nukabah	Moh. Ahmed Naqieb	31	0	pumps	no	no	-	yes	0
11	Hanaka al Masud	Rasjed Musjad Al Musjadi	53	0	pumps	no	no	-	yes	in kind
12	Mawr	-	-	-	-	-	-	-	-	-
13	Al Mihal	Ahmed Ali Ahmed Ad Daglami	27	0	pumps	1 hour	yes	yes	yes	300
14	Joar	operator from Al Mihal	-	-	-	-	-	-	-	2200
		Mohammed Ali Nasser	27	0	no	no	yes	yes	some	0
15	Jebal al Ma'al	Ali Ahmed Yahya	41	0	no	no	yes	yes	yes	3000
16	Al Azan	Ali Izi Ahmed Abdul Qadr	12	1	pump	no	no	-	yes	3000
17	As Shaggab	-	-	-	-	-	-	-	-	-
18	Al Hajalah	Nasser Saleh Abu Asied	15	1	no	ex-oper.	no	-	yes	1500
19	Al Haruj	Saleh M.Asaid	1	1	pumps	no	yes	yes	weak	1500
20	Wastah	Abdullah Ahmed Kassim	4	0	no	small	yes	yes	some	0
21	Al Hasoon	Saleh M.Hussein	2	0	pumps	no	yes	-	-	-
22	Hanud	-	-	-	-	-	-	-	-	-
23	Bidashy	-	-	-	-	-	-	-	-	-
24	Bashar	Ahmed Ali Al Magjari	4	0	company	small	no	-	good	2500
25	Mangada	M. Ali Hussein Ar Raym	9	1	some	no	yes	yes	good	3280
26	Ar Rabe'ah	M.Gaid Ahmed Darham	1	0	no	small	yes	yes	weak	1500
27	Al Mithal	Ahmed M. Hussein	3	0	some	24 days	no	-	-	-
28	Adra'ah	Abdurabi Ahmed Said	2	0	no	24 days	no	-	yes	?
29	Dhi Sabil	Ali Ahmed Ferhan	24	0	no	no	no	-	-	-
30	Dhafar	Ali Saleh Mohammed	11	0	cars	24 days	no	-	yes	500
31	Sharafa	Ahmed Musaed Addalie	1	0	pumps	small	no	-	enough	500
32	Bayt as Shamy	Mohammed Ali Ahmed	1	0	pumps	24 days	no	-	enough	-
33	As Zuwab	Abdul Khawieh Dheifallah	10	0	pumps	24 days	no	-	enough	800
34	Bani Muwallad	Hassan Gaid Ali Muwallad	19	0	Aden	some	no	-	yes	?
35	Al Mashaa'hida	Moh. Moh. Ahmed Mahsoon	16	0	no	24 days	no	-	enough	3000
36	Wathan	Mahdi Qubani	5	2	no	no	yes	yes	engineers	in kind
		M.Ahmed Keihlan	10	0	?	?	?	?	?	2500
37	Al Saifer	-	-	-	-	-	-	-	-	-
38	Na'amah	Nasser Yahya Ali	14	0	no	small	no	-	yes	(300)
39	Al Miqdahah	Yahya Nasser	10	0	no	small	yes	no	yes	0
40	Magrabit al Anab	?	12	0	no	good	no	-	yes	0
41	Bani Fallah	Ahmed Saleh	8	0	no	no	yes	yes	enough	2000
42	Bani Zaydan	M. Scheia Nasser	2	0	no	24 days	no	-	yes	2000

#) 1 = training given
2 = training needed
3 = training possible (family circumstances, agricultural duties)

Values between brackets are special cases, see village descriptions

$) A = number of months of duty of the present operator
B = number of operators before the present one

PUMP & ENGINE 2 CONT'D

	Village Name	Workload operator (hrs/mnth) pump	travel	total	Pumping *) 1	2	3	4	Project tools	Spare-parts	Cooling water	Situation pumphouse building	inside
1	Al Husul	180	20	200	1522	?	30	6	no	Sonidar	no	roof leaks	clean
2	Dafinah	90	45	135	4039	88	30	3	some	Sonidar	bad	roof leaks	fair
3	Al Mayfa'ah	81	6	87	4850	92	9	9	no	Dhamar	outside	roof leaks	fair
4	Sama/ Sufara	55	11	66	3028	57	7 4	5 5	few	Sonidar	bad	roof leaks	dirty
5	Sirm al Banna	35	7	42	1492	28	7	5	some	Sonidar	no	good	dirty
6	Jarf Isbil	90	60	150	3660	60	30	3	no	Dhamar	no	roof leaks	dirty
7	Al Hajar	90	10	100	3881	73	30	3	no	Sonidar	no	roof leaks	fair
8	Ar Rhawq	-	-	-	831	-	0	0	-	-	no	good	not used
9	Al Garrar	32	8	40	1088	22	8	4	some	Sana'a	field	good	dirty
10	Jawf al Nukabah	30	5	35	320	11	10	3	some	Rada'	outside	fair	fair
11	Hanaka al Masud	-	-		1179	22	-	-	no	Sonidar	outside	fair	dirty
12	Mawr	-	-		-	-	-	-	-	-	-	-	-
13	Al Mihal	-	-		901	?	-	-	no	difficult	no	no door	dirty
14	Joar	32	4	36	360	?	4	8	no	difficult	no	very bad	clean
		12	2	14	?	?	4	3	some	difficult	no	good	clean
15	Jebal al Ma'al	26	11	37	?	?	2	13	yes	difficult	no	roof bad	clean
16	Al Azan	330	30	360	?	?	30	11	no	Sana'a	no	good	clean
17	As Shaqqab	-	-	-	?	-	-	-	-	-	-	-	-
18	Al Hajalah	56	21	77	700	24	7	4	no	Sana'a	no	?	?
					?	?	7	4	no	Sana'a	tank	roof leaks	clean
19	Al Haruj	?	?	?	?	?	?	?	no	Sana'a	outside	good	clean
20	Wastah	2	1	3	10	2.5	1	2	no	difficult	no	roof leaks	clean
21	Al Hasoon	-	-	-	4	-	-	-	no	-	-	roof leaks	not used
22	Hanud	-	-	-	-	-	-	-	-	-	-	-	-
23	Bidashy	-	-	-	10	-	-	-	no	-	no	fair	not used
24	Bashar	60	30	90	357	89	30	2	no	difficult	no	roof leaks	clean
25	Mangada	?	?	?	410	29	?	?	no	Sonidar	no	good	clean
26	Ar Raba'ah	20	8	28	36	-	10	2	yes	project	no	roof leaks	clean
27	Al Mithal	-	-	-	8	-	-	-	-	-	-	good	clean
28	Adra'ah	60	20	80	50	-	30	2	some	Sonidar	no	good	clean
29	Dhi Sabil	45	20	65	?	?	30	1.5	yes	-	no	no pumphouse	dust
30	Dhafar	12	2	14	135	12	2	6	some	difficult	no	good	clean
31	Sharafa	21	7	28	16	-	7	3	no	-	no	roof leaks	clean
32	Bayt as Shamy	45	15	60	8	-	15	3	some	Sana'a	no	fair	clean
33	As Zuwab	60	20	80	456	46	30	2	no	Rada'	trees	good	clean
34	Bani Muwallad	37	10	47	?	?	15	2.5	some	Dhamar	no	good	clean
35	Al Mashaa'hida	120	30	150	1827	114	30	4	no	Sana'a	no	good	very clean
36	Wathan	240	10	250	2591	81	30	8	no	Sana'a	bad	fair	dirty
		180	30	210	899	87	30	6	some	project	bad	fair	clean
37	Al Saifer	-	-	-	-	-	-	-	?	project	?	?	?
38	Na'amah	45	10	55	?	?	30	1.5	yes	Dhamar	no	good	very clean
39	Al Miqdahah	6	3	11	134	12	4	2	yes	Sana'a	no	good	very clean
40	Magrabit al Anab	54	6	60	?	?	18	3	yes	Dhamar	no	good	clean
41	Bani Fallah	24	8	32	161	20	8	3	some	-	no	good	clean
42	Bani Zaydan	30	15	45	110	?	15	2	some	Dhamar	no	good	clean

*) 1 = total hours on the meter of the pump
2 = no of hours per month as calculated from 1
3 = days per month pumping according to the information of the operator
4 = hours per day pumping according to the information of the operator

Annex M

ORGANISATIONAL ASPECTS OF WATER SUPPLY SCHEMES

	Village Name	ORGANISATION Initiative	Owner	Responsible	PERSONNEL Oper.	Cash.	Com.	REGISTRATION system	bills	RULES
1	Al Husul	villager	village	operator	1	-	-	list	no	normal
2	Dafinah	sjeich	village	operator	1	-	-	no	no	normal
3	Al Mayfa'ah	villager	village	operator	1	-	-	list	no	normal
4	Sama	government	2 villages	operator	1	1	-	list	no	some
	Sufara	-	-	-	-	-	-	-	-	-
5	Sirm al Banna	government	village	oper. + cash.	1	1	-	list	no	some
6	Jarf Isbil	2 villagers	village	operator	1	5	-	no	no	some
7	Al Hajar	villager	village	operator	1	-	-	list	yes	normal
8	Ar Rhawq	RIRDP	village	aqil	-	-	-	-	-	-
9	Al Garrar	government	village	operator	1	-	-	no	no	normal
10	Jawf al Nukabah	aqil	village	operator	1	-	-	no	no	normal
11	Hanaka al Masud	aqil	village	operator	1	-	-	list	no	no
12	Mawr	village	village	-	-	-	-	-	-	-
13	Al Mihal	sjeich Joar	9 villages	operator	1	-	-	list	no	no
14	Joar	sjeich Joar	difficult	difficult	1	some	-	?	no	no
15	Jebal al Ma'al	villager	3 villages	operator	1	2	-	no	no	no
16	Al Azan	villager	village	cashier	1	1	4	office	yes	special
17	As Shaqqab	villager	nobody	nobody	-	-	-	-	-	-
18	Al Hajalah	villager	village	operator	1	-	-	list	no	normal
19	Al Haruj	government	village	operator	1	-	-	list	no	several
20	Wastah	villager	village	operator	1	-	-	no	no	some
21	Al Hasoon	government	village	operator	1	-	-	-	-	no
22	Hanud	government	village	nobody	-	-	-	-	-	-
23	Bidashy	villagers	?	?	-	-	-	-	-	-
24	Bashar	sjeich	village	operator	1	1	-	book	yes	several
25	Mangada	government	village	operator	1	-	-	office	yes	several
26	Ar Raba'ah	2 aqils	government	2 aqils	1	-	-	list	no	normal
27	Al Mithal	sjeich	sjeich	nobody	1	-	-	no	-	-
28	Adra'ah	villager	village	operator/cashier	1	1	15	office	yes	several
29	Dhi Sabil	PHC-worker	village	operator	1	-	-	-	-	no
30	Dhafar	outsider	village	operator	1	-	-	list	no	no
31	Sharafa	villager	village	operator	1	-	-	-	-	no
32	Bayt as Shamy	villager	village	operator	1	-	-	-	-	normal
33	As Zuwab	villager	village	committee	1	1	7	books	yes	special
34	Bani Muwallad	villager	village	mandub	1	1	-	not yet	no	normal
35	Al Mashaa'hida	villager	village	committee	1	1	27	book	?	special
36	Wathan	sjeich	villages	sjeich	2	1	5	book	yes	special
37	Al Saifer	villager	village	mandub	1	-	-	-	-	normal
38	Na'amah	villager	village	operator	1	-	-	list	no	some
39	Al Miqdahah	villager	village	operator	1	1	-	book	yes	some
40	Magrabit al Anab	villager	villages	villagers	1	-	-	no	no	no
41	Bani Fallah	villager	village	operator	1	-	-	list	no	some
42	Bani Zaydan	sjeich	village	operator	1	-	-	list	no	no

oper = operator
cash = cashier
com = committee (numbers of members)

ORGANISATIONAL ASPECTS OF WATER SUPPLY SCHEMES CONT'D

	Village Name	Operational (month)	FINANCES YR/mth in	out	savings	SERVICE level	freq(*)	Total delivered (m3)	SCHEME USER A (%)	B (%)
1	Al Husul	53	1,200	1,590	(-390)	HC	4 days	518	100	51
2	Dafinah	53	1,200	1,200	0	PT	4 days	351	?	41
3	Al Mayfa'ah	53	2,300	2,300	0	HC	3 days	578	77	90
4	Sama	53	?	880	0	PT	always	330	100	94
	Sufara	53	1,150	880	0	PT	always	180	100	97
5	Sirm al Banna	53	566	566	755	HC	always	315	100	98
6	Jarf Isbil	72	?	4,300	0	BH	always	?	100	?
7	Al Hajar	53	1,800	1,800	0	PT	always	450	100	50
8	Ar Rhawq	-	-	-	-	-	-	-	-	-
9	Al Garrar	53	800	750	50	PT	always	200	100	80
10	Jawf al Nukabah	31	0	180	(-180)	HC	always	75	100	10
11	Hanaka al Masud	70	4,000	4,530	(-530)	HC	always	1800	100	66
12	Mawr	-	-	-	-	-	-	-	-	-
13	Al Mihal	27	950	950	0	HC	always	234	90	67
14	Joar	4	7,300	4,300	3000	PT	7 days	535	60	89
15	Jebal al Ma'al	41	4,770	4,770	0	PT	14 days	420	100	90
16	Al Azan	24	19,790	7,300	12,490	HC	always	1845	88	90
17	As Shaqqab	-	-	-	-	-	-	-	-	-
18	Al Hajalah	34	3,000	3,000	0	HC	always	160	100	94
19	Al Haruj	1	?	?	-	HC	always	-	32	?
20	Wastah	4	350	?	-	PT	always	50	14	39
21	Al Hasoon	-	-	-	-	-	-	-	-	-
22	Hanud	-	-	-	-	-	-	-	-	-
23	Bidashy	-	-	-	-	-	-	-	-	-
24	Bashar	4	5,740	4,560	1,180	HC	always	470	100	100
25	Mangada	14	6,300	5,050	1,250	HC	3 days	?	79	?
26	Ar Raba'ah	1	?	?	-	HC	always	?	36	?
27	Al Mithal	-	-	-	-	-	-	-	-	-
28	Adra'ah	2	1,000	?	-	HC	always	348	15	96
29	Dhi Sabil	-	-	-	-	-	-	-	-	-
30	Dhafar	11	900	900	0	PT	14 days	95	41	90
31	Sharafa	1	?	?	-	HC	always	-	94	?
32	Bayt as Shamy	1	?	?	-	HC	always	-	100	90
33	As Zuwab	120	?	?	-	HC	always	750	100	?
34	Bani Muwallad	19	(730)	730	0	HC	always	375	97	(100)
35	Al Mashaa'hida	16	9,500	6,150	3,350	HC	7 days	855	100	93
36	Wathan	10	19,000	19,000	0	HC	always	740	51	97
37	Al Saifer	14	0	0	0	HC	always	150	100	-
38	Na'amah	14	300	530	(-230)	PT	always	36	100	83
39	Al Miqdahah	10	2,500	270	2,230	HC	always	125	100	89
40	Magrabit al Anab	12	200	200	0	PT	on request	?	61	100
41	Beni Fallah	8	3,600	2,950	650	HC	always	180	100	100
42	Bani Zaydan	2	3,500	3,325	175	HC	3 days	350	63	100

(*) : A = % of people using the system
B = % of the users that pay for the water
(*) : 4 days means every 4 days water
BH = taps near bore hole (public taps in village not connected
HC = houseconnections
PT = public taps
Values between brackets are special cases, see village descriptions

klopt dit met vergelijk info?

FINANCES

	Village Name	Expenditures in YR per month: Diesel	Oil	Others	operator	cashier	Collected YR/month	Savings YR/month	Freq.*)	Big repairs paid from	Calculated water price per m3 (YR): total	for diesel	for salary	for savings
1	Al Husul	900	190	-	(500)	-	1,200	(-390)	12	collection	5	4	1	0
2	Dafinah	550	100	50	500	-	1,200	0	12	collection	8	5	3	0
3	Al Mayfa'ah	550	200	50	1,500	-	2,300	0	4	collection	4	1	3	0
4	Sama	275	105	-	500	0	?	0	1	collection	3	2	1	0
	Sufara	275	105	270	500	-	1,150	0	1	collection	6	2	4	0
5	Sirm al Banna	166	100	50	250	0	566	#755	4	box	5	3	2	0
6	Jarf Isbil	2,000	800	-	1,500	0	?	0	4	collection	?	?	?	0
7	Al Hajar	1,500	300	-	0	-	1,800	0	12	collection	8	8	0	0
9	Al Garrar	550	200	-	0	-	800	50	12	box	7	6	0	1
10	Jawf al Nukabah	120	60	-	0	-	0	(-180)	-	operator	-	-	-	-
11	Hanaka al Masud	3.120	1.210	200	0	-	4,000	(-530)	12	collection	3	3	0	0
13	Al Mihal	500	150	-	300	-	950	0	12	collection	5	3	2	0
14	Joar	1,400	700	-	2,200	0	7,300	3,000	12	box	15	4	5	6
15	Jebal al Ma'al	1,040	130	600	3,000	0	4,770	0	12	collection	8	2	6	0
	Sirm al Abd/Thabaq	-	-	-	-	0	-	-	-	-	17	4	13	0
16	Al Azan	3,000	900	400	3,000	0	19,790	12,490	4	box	15	4	2	9
18	Al Hajalah	1,200	240	60	1,500	-	3,000	0	12	government	20	10	10	0
19	Al Haruj	-	-	-	1,500	-	-	-	12	collection	5	-	-	-
20	Wastah	?	?	?	-	-	350	-	12	?	-	-	-	-
24	Bashar	900	180	480	2,500	500	5,740	1,180	12	box	10	3	5	2
25	Mangada	1,485	285	-	3.280	-	6,300	1,250	4	operator	-	-	-	-
26	Ar Raba'ah	-	-	-	1,500	0	-	-	12	?	-	-	-	-
28	Adra'ah	-	-	-	-	-	1,000	-	12	box	-	-	-	-
30	Dhafar	275	100	25	500	-	900	0	12	collection	10	4	6	0
31	Sharafah	-	-	-	500	-	-	-	12	box	-	-	-	-
32	Bayt as Shany	-	-	-	-	-	-	-	12	-	10	-	-	-
33	Az Zuwab	480	115	100	800	0	0	?	12	box	-	-	-	-
34	Bani Muwallad	600	110	20	0	0	(730)	0	-	collection	-	-	-	-
35	Al Mashaa'bida	2,000	250	200	3,000	700	9,500	3,350	12	box	12	3	5	4
36	Wathan	11,000	1,700	1,800	2,500	2,000	19,000	0	12	government	27	18	9	0
37	Al Saifer	0	0	-	-	-	-	0	0	collection	0	0	0	0
38	Na'amah	180	50	-	(300)	-	300	(-230)	4	collection	8	6	(8)	0

FINANCES

	Village Name	Expenditures in YR per month: Diesel	Oil	Others	operator	cashier	Collected YR/month	Savings YR/month	Freq.*)	Big repairs paid from	Calculated water price per m3 (YR: total	for diesel	for salary	for savings
39	Al Miqdahah	140	130	-	0	0	2,500	2,230	12	box	20	2	0	18
40	Magrabit al Anab	150	50	-	0	-	200	0	6	collection	0	0	0	0
41	Bani Fallah	600	250	100	2,000	-	3,600	650	12	box	20	5	11	4
42	Bani Zaydan	675	500	150	2,000	-	3,500	175	12	box	10	4	5	1

*) no of times collected per year
$ from collection at weddings and travels
Values between brackets are special cases, see village descriptions

Annex O

WATERSOURCES BEFORE THE SCHEME WAS CONSTRUCTED

Village Name	Source 1	time (*)	Source 2	time (*)	by car YR/m3
1 Al Husul	boreholes	15 min.	-	-	-
2 Dafinah	shallow well	5 min.	spring	30 min.	-
3 Al Mayfa'ah	shallow well	10 min.	-	-	-
4 Sama/Sufara	shallow well	20 min	cistern	10 min	-
5 Sirm al Banna	cisterns	5 min	other village	45 min	-
6 Jarf Isbil	rainwaterholes	5 min	-	-	40
7 Al Hajar	cistern	5 min	other villages	2 hrs	50
8 Ar Rhawq	shallow well	15 min	-	-	100
9 Al Garrar	other villages	30 min	-	-	50
10 Jawf al Nukabah	shallow well	10 min	-	-	-
11 Hanaka al Masud	village scheme	1 min	-	-	-
12 Mawr	shallow wells	10 min	-	-	-
13 Al Mihal	shallow wells	10 min	-	-	-
14 Joar	springs	30 min-3hrs	cisterns	5 min-1 hr	100
15 Jebal al Ma'al	cisterns	15-45 min	-	-	100
16 Al Azan	shallow wells	10 min	-	-	-
17 As Shaqqab	boreholes	25 min	spring (by car)	25 min	50
18 Al Hajalah	spring	2 hrs	cistern	10 min	150
19 Al Haruj	cisterns	5 min	boreholes	10 min	-
20 Wastah new	village scheme	20 min	boreholes	10 min	-
21 Al Hasoon	Ma'abar scheme	5 min	shallow wells	10 min	-
22 Hanud	private schemes	5 min	-	-	-
23 Bidashy	boreholes	20 min	rain water	-	-
24 Bashar	shallow well	10 min	-	-	-
25 Mangada	spring	20 min	cistern	10 min	-
26 Ar Raba'ah	shallow wells	15 min	-	-	-
27 Al Mithal	shallow wells	10 min	boreholes	20 min	80
28 Adra'ah	spring	5 min	dam	10 min	-
29 Dhi Sabil	2 springs	10 min	wadi	2 hrs	200
30 Dhafar	cisterns	10 min	-	-	-
31 Sharafa	boreholes	15 min	-	-	100
32 Bayt as Shamy	spring	10 min	spring	30 min	-
33 As Zuwab	village scheme	10 min	-	-	-
34 Bani Muwallad	village scheme	5 min	-	-	-
35 Al Mashaa'hida	spring	2 hrs	cistern	5 min	150
36 Wathan mountain	shallow well	1 hr	cisterns	5 min	
Wathan wadi	spring	5 min	-	-	120
37 Al Saifer	spring	15 min	-	-	-
38 Na'amah	spring	10 min	-	-	-
39 Al Miqdahah	spring	30 min	borehole	30 min	110
40 Magrabit al Anab	springs	20 min	-	-	-
41 Bani Fallah	boreholes	2 hrs	cistern	5 min	-
42 Bani Zaydan	shallow well	20 min	cistern	5 min	-

(*) : walking time in minutes, one way only

Where is personal & domestic hygiene ?

USE OF SRWSD WATER SCHEME FOR:

	Village Name	Human consump.	Watering animals	Washing clothes	Washing blankets	Used for gardens	Alternative source for drinking water	Time(*)
1	Al Husul	+	+	-	-	few	boreholes	15 min
2	Dafinah	+	-	-	-	-	boreholes	10 min
3	Al Mayfa'ah	+	+	+	-	many	boreholes	15 min
4	Sama/Sufara	+	+	+	-	few	boreholes	20 min
5	Sirm al Banna	+	+	+	-	few	borehole	15 min
6	Jarf Isbil	+	+	+	+	-	boreholes	35 min
7	Al Hajar	+	+	+	+	few	other villages	2 hrs
8	Ar Rhawq	-	-	-	-	-	shallow wells	15 min
9	Al Garrar	3/4	+	+	+	1	other villages	30 min
10	Jawf al Nukabah	+	+	+	+	few	cistern	30 min
11	Hanaka al Masud	-	-	-	-	-	village scheme	1 min
12	Mawr	-	-	-	-	-	private schemes	house
13	Al Mihal	+	+	-	-	-	shallow well	10 min
14	Joar	+	+	-	-	-	spring	3 hrs
15	Jebal al Ma'al	+	-	-	-	-	cisterns	15-45 min
16	Al Azan	+	+	-	-	few	boreholes	10 min
17	As Shaqqab	-	-	-	-	-	boreholes	25 min
18	Al Hajalah	+	-	-	-	forbidden	spring	2 hrs
19	Al Haruj	-	+	+	-	few	boreholes	10 min
20	Wastah new	+	-	-	-	few	boreholes	10 min
21	Al Hasoon	-	-	-	-	-	Ma'abar scheme	5 min
22	Hanud	-	-	-	-	-	private schemes	5 min
23	Bidashy	-	-	-	-	-	boreholes	20 min
24	Bashar	+	+	-	-	many	boreholes	10 min
25	Mangada	+	+	+	-	many	borehole	10 min
26	Ar Raba'ah	+	+	+	-	few	shallow wells	15 min
27	Al Mithal	-	-	-	-	-	boreholes	20 min
28	Adra'ah	+	+	-	-	-	spring	5 min
29	Dhi Sabil	-	-	-	-	-	springs	10 min
30	Dhafar	+	-	-	-	-	cisterns	10 min
31	Sharafa	+	+	+	-	few	boreholes	15 min
32	Bayt as Shamy	+	-	+	-	few	spring	10 min
33	As Zuwab	+	+	+	-	few	borehole	15 min
34	Bani Muwallad	+	+	-	-	many	spring	10 min
35	Al Mashaa'hida	+	+	+	+	few	spring	2 hrs
36	Wathan mountain	+	-	-	-	-	shallow well	1 hour
	Wathan wadi	1/5	-	-	-	-	spring	5 min
37	Al Saifer	+	+	+	+	-	other spring	30 min
38	Na'amah	+	+	+	+	-	other village	30 min
39	Al Miqdahah	+	+	+	-	few	spring	30 min
40	Magrabit al Anab	1/2	-	-	-	-	spring	20 min
41	Bani Fallah	+	-	-	-	-	borehole	2 hrs
42	Bani Zaydan	+	+	+	-	-	shallow well	20 min

(*) = walking distance in minutes, one way only

WATERSOURCES USED NOWADAYS

	Village Name	Drinking	time (*)	Watering cattle	time (*)	Washing clothes	time (*)	Washing blankets	time (*)	Gardens	Water used
1	Al Husul	scheme	house	scheme	house	boreholes	15 min	boreholes	15 min	few	car/wastewater
2	Dafinah	scheme	5 min	boreholes	10 min	boreholes	10 min	boreholes	10 min	no	-
		boreholes	10 min								
3	Al Mayfa'ah	scheme	house	scheme	house	scheme+bh's	15 min	boreholes	15 min	many	scheme
4	Sana	scheme	10 min	scheme	10 min	scheme	10 min	boreholes	20 min	few	scheme
	Sufara	scheme	5 min	scheme	5 min	scheme	5 min	boreholes	20 min	few	scheme
5	Sirm al Banna	scheme	house	scheme	house	scheme	house	borehole	15 min	few	scheme
6	Jarf Isbil	scheme	35 min	scheme	35 min	scheme	35 min	scheme	35 min	few	car
7	Al Hajar	scheme	5-15 min	scheme	5-15 min	scheme	5-15 min	scheme	5-15 min	few	scheme
8	Ar Rhawq	shallow well	15 min	shallow well	15 min	shallow well	15 min	shallow well	15 min	no	-
9	Al Garrar	scheme	5 min	scheme	5 min	scheme	5 min	scheme	5 min	no	scheme
		other villages	30 min								-
10	Jawf al Nukabah	scheme	1 min	scheme	1 min	scheme	1 min	scheme	10 min	few	scheme
11	Hanaka al Masud	village scheme	1 min	vill. scheme	1 min	vill. scheme	1 min	boreholes	10 min	few	village scheme
12	Mawr	priv. schemes	house	priv. schemes	house	priv. schemes	house	priv. schemes	house	most	priv. schems
13	Al Mihal	scheme	house	scheme	house	shallow wells	10 min	shallow wells	10 min	no	-
14	Joar SRWSD	scheme	5 min	scheme	5 min	cist/spring	10-30 min	rainwater		no	-
	Joar private	priv. scheme	house	cistern	10 min	cistern	10 min	cistern	10 min	no	-
15	Jebal al Ma'al	scheme	5 min	cistern	15-45 min	cistern	15-45 min	cistern	15-45 min	no	-
16	Al Azan	scheme	house	scheme	house	borehole/sch	10 min	boreholes	10 min	few	scheme
17	As Shaqqab	boreholes	25 min	boreholes	25 min	boreholes	25 min	boreholes	25 min	no	-
18	Al Hajalah	scheme	house	cistern	10 min	cistern	10 min	cistern	10 min	not allowed	-
19	Al Haruj	boreholes	10 min	scheme	house	scheme	house	scheme	house	few	scheme
20	Wastah	scheme	5 min	no	-	boreholes	10 min	boreholes	10 min	few	scheme
21	Al Hasoon	Ma'abar scheme	5 min	Ma'abar scheme	5 min	shallow wells	10 min	shallow wells	10 min	no	-
22	Hanud	priv. schemes	5 min	priv. schemes	5 min	priv. schemes	5 min	priv. schemes	5 min	some	priv. schemes
23	Bidashy	boreholes	20 min	boreholes	20 min	boreholes	20 min	rainwater		few	boreholes
24	Bashar	scheme	house	scheme	house	boreholes	10 min	boreholes	10 min	many	scheme
25	Mangada	scheme	house	scheme	house	scheme	house	borehole	10 min	many	scheme
26	Ar Raba'ah	scheme	5 min	scheme	5 min	scheme	5 min	shallow wells	15 min	no	-
27	Al Mithal	b.holes, car	20 min	boreholes	20 min	boreholes	20 min	boreholes	20 min	no	-
28	Adra'ah	scheme	house	scheme	house	spring	5 min	dam	10 min	few	spring

WATERSOURCES USED NOWADAYS

	Village Name	Drinking	time (*)	Watering cattle	time (*)	Washing clothes	time (*)	Washing blankets	time (*)	Gardens	Water used
29	Dhi Sabil	springs	10 min	springs	10 min	springs	10 min	springs	10 min	no	-
30	Dhafar	scheme	5 min	cisterns	10 min	cisterns	10 min	cisterns	10 min	one	car
31	Sharafa	scheme	house	scheme	house	scheme	house	boreholes	15 min	few	wastewater/sch.
32	Bayt as Shany	scheme	house	spring	10 min	scheme	house	spring	30 min	few	scheme
33	As Zuwab	scheme	house	scheme	house	scheme	house	boreholes	15 min	few	scheme
34	Bani Muwallad	scheme	house	scheme	house	spring	10 min	spring	10 min	many	scheme
35	Al Mashaa'hida	scheme	house	scheme	house	scheme	house	scheme	house	few	wastewater/sch.
36	Wathan mountain	scheme	house	cistern	5 min	cistern	5 min	cistern	5 min	no	-
	Wathan wadi	spring	5 min	spring	5 min	spring	5 min	spring	5 min	no	-
37	Al Saifer	scheme	house	scheme	house	scheme	house	scheme	house	no	-
38	Na'amah	scheme	3 min	scheme	3 min	scheme	3 min	scheme	3 min	few	wastewater
39	Al Miqdahah	scheme	house	scheme	house	scheme	house	spring	30 min	few	scheme
40	Magrabit al Anab	spring/scheme	5-20 min	spring/scheme	5-20 min	spring	20 min	spring	20 min	no	-
41	Bani Fallah	scheme	house	cistern	5 min	cistern	5 min	cistern	5 min	no	-
42	Bani Zaydan	scheme	house	scheme	house	scheme	house	shallow well	20 min	few	wastewater

(*) = walking time in minutes, one way only

Annex Q

STORAGE OF WATER

	Village Name	Supply (*)	Storage	Jerry-cans	Size metal tanks m3	Filling with	Fetching through	Situa-tion
1	Al Husul	4	yes	no	1-2	tap	lid	clean
2	Dafinah	4	yes	yes	< 0.5	jerrycan	lid	fair
3	Al Mayfa'ah	3	yes	few	1-2	hose	tap	clean
4	Sama	always	yes	most	few	-	-	fair
	Sufara	always	yes	no	yes	jerrycan	lid	dirty
5	Sirm al Banna	always	no	no	no	-	-	-
6	Jarf Isbil	always	yes	yes	0.5-2	jerrycan	lid	dirty
7	Al Hajar	always	yes	few	0.5-1	jerrycan	lid	fair
8	Ar Rhawq	no	yes	no	0.5-2	jerrycan	lid	clean
9	Al Garrar	always	yes	some	0.5-1	jerrycan	lid	dirty
10	Jawf al Nukabah	always	yes	no	0.3-1	hose	lid	dirty
11	Hanaka al Masud	3	yes	no	0.5-1	hose	lid	?
12	Mawr	always	yes	no	1-2	tap/closed fitting	tap	clean
14	Joar SRWSD	7	yes	some	2-4	hose,bucket	tap/lid	clean
	Joar private	2	yes	no	yes	hose	tap	clean
15	Jebal al Ma'al	14	yes	yes	?	hose,bucket	tap/lid	clean
16	Al Azan	always	yes	no	0.5-2	tap/hose	tap	clean
17	As Shaqqab	no	yes	no	0.5-2	jerrycan	tap	clean
18	Al Hajalah	always	yes	no	1-2	tap	lid	clean
19	Al Haruj	always	yes	yes	0.5-2	tap	lid	clean
20	Wastah old	daily	yes	no	0.5-1	tap	?	clean
	Wastah new	always	yes	yes	no	-	-	-
21	Al Hasoon	always	yes	yes	few	jerrycan	-	-
22	Hanud	always	yes	yes	< 0.5	jerrycan	lid	clean
23	Bidashy	no	yes	yes	< 0.5	jerrycan	tap	clean
24	Bashar	daily	yes	no	0.5-1	tap	tap	clean
25	Mangada	always	yes	no	1-2	tap	tap/lid	clean
26	Ar Raba'ah	?	yes	no	1-2	jc/hose		
27	Al Mithal	no	yes	no	1-2	jerrycan	tap	clean
28	Adra'ah	always	yes	no	1-2	closed fitting	tap	clean
29	Dhi Sabil	always	yes	yes	< 0.5	jerrycan	lid	fair
30	Dhafar	14	yes	no	1-2	hose	lid	fair
31	Sharafa	always	yes	no	1-2	closed fitting	tap	fair
32	Bayt as Shamy	2	yes	yes	1-2	tap	tap	leaking
33	As Zuwab	always	yes	no	1-2	tap	tap	clean
34	Bani Muwallad	2	yes	no	1-2	closed fitting	tap	clean
35	Al Mashaa'hida	7	yes	no	0.5-2	tap	tap	clean
36	Wathan mountain	always	yes	no	1-2	tap,closed fitting	tap	clean
	Wathan wadi	always	yes	yes	0.5-1	jc, closed fitting	lid/tap	fair
37	Al Saifer	always	yes	no	0.5-1	tap	lid	fair
38	Na'amah	always	yes	yes	no	-	-	-
39	Al Miqdahah	always	yes	few	2	tap	tap	clean
40	Magrabit al Anab	always	yes	yes	0.5-2	hose	lid/tap	fair
41	Bani Fallah	always	yes	no	0.5-1	tap	lid	fair
42	Bani Zaydan	3	yes	yes	0.5-2	tap/hose	lid/tap	fair

(*) 4 means every 4 days water available

jc = jerry can

closed fitting means a system with taps straight to the distribution system

SANITATION

	Village Name	General situation houses	village	Toilets Baladih	Pour-flush	Wastewater drainage($)	to gardens	Pits available
1	Al Husul	very clean	clean	most	?	pipes	yes	no
2	Dafinah	acceptable	dirty	most	?	street	-	no
3	Al Mayfa'ah	clean	dirty	all	few	street	-	2
4	Sama	dirty	dirty	all	?	outside	-	no
	Sufara	variable	clean	few	?	outside	-	no
5	Sirm al Banna	clean	acceptable	most	?	outside	-	no
6	Jarf Isbil	acceptable	dirty	most	?	street	-	no
7	Al Hajar	variable	acceptable	few	?	outside	-	no
8	Ar Rhawq	clean	clean	no	no	outside	-	no
9	Al Garrar	dirty	acceptable	no	no	outside	-	no
10	Jawf al Nukabah	acceptable	clean	no	no	outside	-	no
11	Hanaka al Masud	clean	dirty	most	few	street	-	few
12	Mawr	clean	clean	few	few	outside	-	few
14	Joar SRWSD	clean	clean	most	?	outside	-	no
	Joar private	acceptable	acceptable	all	no	outside	-	no
15	Jebal al Ma'al	acceptable	acceptable	most	no	outside	-	no
16	Al Azan	clean	dirty	most	few	street	-	yes
17	As Shaqqab	variable	variable	most	few	outside	-	few
18	Al Hajalah	acceptable	acceptable	no	no	street	-	no
19	Al Haruj	acceptable	clean	most	no	outside (*)	-	no
20	Wastah new	acceptable	clean	-	all	pits	-	yes
	Wastah old	acceptable	dirty	most	?	street	few	no
21	Al Hasoon	dirty	dirty	most	?	street	-	few
22	Hanud	dirty	dirty	most	?	outside	-	no
23	Bidashy	clean	clean	most	few	pipes	-	nw.houses
24	Bashar	clean	clean	few	most	pits	-	yes
25	Mangada	clean	acceptable	many	few	pipes	-	no
26	Ar Raba'ah	clean	clean	most	?	outside	-	no
27	Al Mithal	clean	acceptable	most	few	street (*)	-	few
28	Adra'ah	clean	acceptable	many	few	pipes	-	few
29	Dhi Sabil	acceptable	dirty	no	no	pipes	-	no
30	Dhafar	acceptable	clean	few	one	outside (*)	-	one
31	Sharafa	acceptable	acceptable	most	?	outside	yes	no
32	Bayt as Shamy	clean	acceptable	most	?	street	-	no
33	As Zuwab	acceptable	acceptable	few	few	street	-	yes
34	Bani Muwallad	clean	clean	no	most	pits	-	yes
35	Al Mashaa'hida	variable	variable	no	few	outside	yes	few
36	Wathan	acceptable	acceptable	few	few	outside	-	few
37	Al Saifer	acceptable	acceptable	no	no	outside	-	no
38	Na'amah	acceptable	acceptable	no	2 public	otside/pit	yes	2
39	Al Miqdahah	clean	clean	most	?	outside (*)	-	no
40	Magrabit al Anab	acceptable	acceptable	few	no	outside	-	few
41	Bani Fallah	acceptable	acceptable	few	?	outside	-	no
42	Bani Zaydan	clean	acceptable	few	?	outside	yes	no

(*) = also used for making dungcakes

($) = outside means in a way not disturbing (at the backside of houses etc.)
street means causing problems inside the village

Annex R

PROBLEMS WITH THE SRWSD WATER SUPPLY SCHEMES

	Village	SCHEME WORKING	PROBLEMS WITH THE SYSTEM Source	Civil	Pumps	Kind of problem
1	Al Husul	yes	yes	no	no	Not enough water.
2	Dafinah	yes	yes	no	no	Not enough water.
3	Al Mayfa'ah	yes	no	no	no	-
4	Sama/Sufara	yes	no	yes	no	Pumping main to Sufara.
5	Sirn al Banna	yes	no	no	no	-
6	Jarf Isbil	no	no	yes	yes	Pump not good, reservoir leaking?
7	Al Hajar	yes	no	no	no	-
8	Ar Rhawg	no	yes	-	-	Waterquality too bad, system abandoned.
9	Al Garrar	yes	yes	no	no	Waterquality bad.
10	Jawf al Nukabah	yes	yes	no	no	Waterquality bad.
11	Hanaka al Masud	no	no	no	no	-
12	Mawr	no	-	-	-	People not cooperative.
13	Al Mihal	yes	no	yes	yes	Reservoir bad. pump too hot.
14	Joer	yes	no	yes	yes	Pumping main not good, pump too hot.
15	Jebal al Ma'al	yes	no	no	yes	Spareparts pump.
16	Al Aram	yes	yes	no	no	Borehole dry, solved by the village.
17	As Shaqqab	no	-	yes	-	Distribution system bad.
18	Al Hajalah	yes	no	no	no	-
19	Al Haruj	yes	yes	no	yes	Waterquality bad, pump leaks oil.
20	Wastah	yes	no	no	no	
21	Al Hasoon	no	-	-	yes	Pump not accepted.
22	Hamud	no	-	-	-	People not interested.
23	Hidaehy	no	-	yes	yes	Pump not accepted. reservoir not good.
24	Haskar	yes	no	no	no	-
25	Mangada	yes	no	no	no	-
26	Ar Raba'ah	yes	no	no	no	-
27	Al Mithal	no	-	-	-	
28	Adra'ah	yes	no	no	no	-
29	Bir Sabil	no	yes	-	-	Not enough water in spring.
30	Dhafar	yes	no	no	no	-
31	Sharafa	yes	no	no	no	-
32	Bayt as Shamy	yes	no	no	no	-
33	As Zuwab	yes	no	no	no	-
34	Bani Muwallad	yes	no	no	no	-
35	Al Mashaa'hida	yes	no	no	no	-
36	Warhan	yes	no	no	yes	Problems with the pumps.
37	Al Saifer	yes	no	no	n/a	-
38	Na'amah	yes	no	no	no	-
39	Al Miqdahah	yes	no	no	no	-
40	Magrabit al Anab	yes	yes	no	no	Problems about waterrights.
41	Bani Fallah	yes	no	no	no	-
42	Bani Zaydan	yes	no	no	no	-

n.a = not applicable

PROBLEMS WITH THE SRWSD WATER SUPPLY SCHEMES

Village	PROBLEMS WITH THE ORGANISATION			
	General	Paying	Users(*)	Kind of problem
1 Al Husul	no	no	no	-
2 Dafinah	no	yes	no	60 % not paying.
3 Al Mayfa'ah	yes	no	no	Operator was bad, Ad Daylami not connected
4 Sama/Sufara	no	no	no	-
5 Sirm al Banna	no	no	no	-
6 Jarf Isbil	-	-	-	-
7 Al Hajar	no	yes	no	50 % not paying.
8 Ar Rhawq	-	-	-	-
9 Al Garrar	no	no	no	-
10 Jawf al Nukabah	no	no	no	-
11 Hanaka al Masud	-	-	yes	System not used for drinking, only for irrigation.
12 Mawr	yes	-	-	People not cooperative.
13 Al Mihal	no	no	no	-
14 Joar	yes	no	yes	System too complicated, two villages not connected.
15 Jebal al Ma'al	yes	no	no	Money disappears, water too expensive, once a month.
16 Al Azan	no	no	no	-
17 As Shaqqab	yes	-	-	Big internal problems.
18 Al Hajalah	no	no	no	-
19 Al Haruj	no	no	no	-
20 Wastah	yes	no	86 %	Old village not connected.
21 Al Hasoon	yes	-	-	Village not interested.
22 Hanud	yes	-	-	Village not interested.
23 Bidashy	no	-	-	-
24 Beshar	no	no	no	-
25 Mangada	no	no	no	-
26 Ar Raba'ah	no	no	no	-
27 Al Mithal	yes	-	-	Internal problems.
28 Adra'ah	no	no	no	-
29 Dhi Sabil	no	-	-	-
30 Dhafar	yes	no	59 %	1 village not connected.
31 Sharafa	no	no	no	-
32 Bayt as Shamy	no	no	no	-
33 As Zuwab	no	no	no	-
34 Bani Muwallad	no	no	no	-
35 Al Mashaa'hida	no	yes	no	Problems with paying because no watermeters.
36 Wathan	no	no	48 %	System too expensive.
37 Al Saifer	no	no	no	-
38 Na'amah	no	no	no	-
39 Al Migdahah	no	no	no	-
40 Magrabit al Anab	yes	no	no	Problems waterrights.
41 Bani Fallah	no	no	no	-
42 Bani Zaydan	no	no	no	-

*) percentage of people with no access to the scheme.

ACTIVITIES FOR WATERSUPPLY OF HEALTH CENTRES/UNITS of Health Office Dhamar (HOD) Information from project documents and staff

VILLAGE NAME	REGIO	WATER SOURCE	SRWSD PROJECT CODE	WORKS	START	DURATION MONTHS	YR	SITUATION
Hamman Ali HC	HA	spring	DHP 01	Improve watersupply	Aug 85	9	64,741	good
	HA	spring	IWP 01	Reconstruction spring catchment	Jun 88	4	155,848	
Medinat as Sharq HC	MAS	SW	DHP 02	Improve water & sewer system	Aug 85	13	14,420	
Medinat as Sharq HC			DHP 05	Deepen existing well	Apr 86	7	228,701	pump broke down
At Tallabi HC		?	DHP 03	Improve watersupply	Nov 85	2	21,500	included in big watersupply scheme
Al Masnaa HU	HA	spring	DHP 28	Supply line + storage tank	Mar 87	10	11,916	never completed
Bani Badda HC	Hadda	SW	DHP 31	Connection to existing system	Sep 86	3	34,717	problems with watersource
	Hadda	BH	IWP 01	Connection to new borehole	Jun 88	2	12.000	
Jab Jab HU	HA	spring	DHP 41	2 Reservoirs + supply line	Jun 87	6	12,365	not visited
Bani Fadl HU	BFM	spring	DHP 46	Reservoir + pipes + pumps	Feb 87	5	42.435	pump broke down, problems waterrights
Al Juma HC	Juma	BH	DHP 49	Connection to existing pump	Oct 87	2	18.900	not visited
Health Centres (3)		-	DHP 29	Improve water & sewer system	Jul 86	6	22,620	
Al Mashahida HU	HA	BH	DHP 42	Extended to whole village				good
Dhi Sabil HU	HA	spring	DHP 43	Extended to whole village				spring dry
Magrabit al Anab HU	Juma	spring	DHP 44	Extended to whole village				good
Bani Asaad HU	Juma	BH	DHP 45					not visited
Bait al Taybi HU	Ans	?	IWP 10	Connection to existing system	Dec 88	2	31,508	good
Mariyah HU	Ans	?	IWP 14	Connection to existing system	Jun 89	1	7,911	good
Jabel 'Amal HU	TAL	?	IWP 17	Connection to existing system	Oct 89	1	6,572	good
Bani Qawz HU	HA	?	IWP 21	Connection to existing system	Nov 89	1	5,520	good
Al Malha HU	HA	?	IWP 23	Connection to existing system	Dec 89	1	1,930	good

HC = Health Centre
HU = Health Unit
BH = Borehole
SW = Shallow Well

HA = Hamman Ali
MAS = Medinat as Sharq
BFM = Bani Fadl Middle
TAL = At Tallabi

Annex S

VILLAGES WITH SMALL WATERSUPPLIES : DHP (Dhamar Health Projects) Information from project documents and staff.

VILLAGE				SRWSD PROJECT						PARTICIPATION VILLAGE		operational	
NAME	REGIO	POPUL	WATER SOURCE	CODE	WORKS	START	END	DURATION MONTHS	COSTS YR	ITEM	VALUE (YR)	per 31-12-1987	REMARKS
Al Harf	BFM	250	spring	DHP 04	res 12 m3	Jan 86	Feb 86	2	21,500	no	0	no	
Al Masahi	BFM	40	spring	DHP 10	res 6 m3	Sep 86	Feb 87	6	16,200	no	0	no	problems waterrights
Mautab	BFM	360	spring	DHP 12	res 12 m3 + CT	Dec 86	Jul 87	8	28,040	no	0	no	problems waterrights
Kouraba	BFM	250	spring	DHP 13	res 15 m3	Sep 86	Feb 87	6	26,100	hs. connect.	12,000	yes	
Ain al Haraba	BFM	2120	spring	DHP 14	res 6 m3 + conn.	Jul 86	Aug 86	2	14,500	no	0	no	
Dolman	BFM	75	spring	DHP 16	res 12 m3 + CT	Mar 86	Apr 86	2	21,500	pipes	36,000	yes	
Al Awali	BFM	250	spring	DHP 17	res 12 m3 + CT	Mar 86	Apr 86	2	21,500	tube	400	no	
Qarana	BFM	60	spring	DHP 18	res 12 m3 + CT	Mar 86	Apr 87	2	21,500	no	0	no	Jun 87: H.U. connected
Geraa	BFM	40	spring	DHP 20	res 6 m3 + CT	Dec 86	Feb 87	3	10,700	pipes	4,000	no	
As Shauqaba	BFM	20	spring	DHP 32	res 12 m3 + conn.	Oct 86	Nov 86	2	30,000	pipes	35,000	yes	
Al Haisa	BFM	28	spring	DHP 33	res 6 m3 + CT	Oct 86	Feb 87	2	17,200	no	0	no	
Al Habal	BFM	28	roof	DHP 34	res 6 m3	Oct 86	Mar 87	6	15,500	no	0	no	supply from roof to tank
Bait Taher	BFM	25	spring	DHP 35	res 6 m3	Dec 86	Feb 87	3	21,200	tube	3,000	yes	
Al Bakr	BFM	42	spring	DHP 36	res 6 m3	Feb 87	Apr 87	3	15,500	tube	1,500	no	well dry
As Saffal	BFM	42	spring	DHP 37	res 6 m3	Feb 87	Apr 87	3	15,500	tube	400	yes	
Ain al Mizan	MEA	140	spring	DHP 06	res 6 m3 + CT	May 86	Oct 86	6	37,500	pipes	3,000	yes	
Ain al Halfat	MEA	100	spring	DHP 07	res 15 m3 + CT	Feb 86	Apr 86	3	25,000	no	0	no	
Ain al Qud	MEA	200	spring	DHP 08	res 15 m3	Feb 86	Apr 86	3	25,000	no	0	no	
Ain al Hifair	MEA	100	spring	DHP 09	res 15 m3	Apr 86	Jun 86	3	25,000	pipes	3,000	yes	supply line bad
Al Nauba	MEA	50	spring	DHP 19	res 15 m3 + CT	Jan 86	Mar 86	2	25,000	no	0	no	
Al Warkha	MEA	50	spring	DHP 24	res 6 m3 + CT	May 86	Aug 86	4	12,500	no	0	no	
Bait al Gazi	MEA	100	spring	DHP 26	res 6 m3 + conn.	Jul 86	Dec 87	18	57,300	no	0	yes	Dec 87: H.U. connected
Gibli B.Gusheib	Juma		spring	DHP 21	res 12 m3	Jan 86	Apr 86	4	21,500	pipes	2,000	yes	bad maintenance
Al Jebar	Juma		spring	DHP 22	res 12 m3	Jan 86	Apr 86	4	21,500	no	0	no	
Al Juma	Juma		spring	DHP 30	res 6 m3	Sep 86	Oct 86	2	13,550	pipes	400	yes	prison
Al Jeleba	MEA	310	spring	DHP 23	supply line	Apr 86	May 87	14	13,120	no	0	no	
Al Maugha	MEA	80	spring	DHP 25	supply line	May 86	May 87	13	24,260	52 storage tanks	6,000	yes	
Ad Dhorrah	MAS		well	DHP 11	well improvemt.	Apr 87	Jun 87	3	25,100				

BFM = Bani Fadl Middle
BFH = Bani Fadl High
MEA = Magrabit al Anab
MAS = Medinat as Sharq
CT = Cattle trough

Annex T

SANITATION PROJECTS SAP

VILLAGE NUMBER	CODE	NAME VILLAGE	TOILETS TYPE	TOILETS TOTAL	COSTS YR	COMPLETED	REMARKS
		SCHOOLS					
-	SAP 07	Sannaban	-	10	190,000	Jul 87	used as classroom
-	SAP 12	Bani Fadl	dry	3	47,961	Jun 87	not visited
-	SAP 14	Bani Asaad	dry	3	52,500	Dec 86	not visited
40	SAP 16	Magrabat al Anab	dry	3	34,100	Feb 87	-
		Improvement	-	-	27,600	Sep 88	not used
34	SAP 22	Bani Muwallad	PF	5	111,050	Jul 88	dirty
35	SAP 25	Al Mashaa'hida	PF	3	65,000	Sep 88	clean
36	SAP 29	Wathan low	PF	4	106,000	Dec 88	clean
36	SAP 30	Wathan high	PF	4	100,000	Dec 88	never used
39	SAP 33	Al Miqdaha	PF	4	80,000	Mar 89	not used
-	SAP 35	Baradoon	PF	7	180,000	Jun 89	not visited
41	SAP 38	Bani Fallah	PF	3	80,000	Oct 89	not used
42	SAP 40	Bani Zaydan		?	?	Nov 89	acceptable
		MOSQUES					
1	SAP 02	Al Husul	PF	1	32,423	Nov 86	acceptable
12	SAP 03	Mawr	-	4	78,800	Apr 87	-
-	SAP 42	Mawr phase 2	PF	6	72,000	Dec 88	clean
-	SAP 04	Sannaban	-	8	210,000	Jul 87	demolished
	SAP 06	Faraza	PF	4	78,500	Aug 87	acceptable
34	SAP 24	Bani Muwallad	PF	4	102,608	Nov 88	clean
34	SAP 27	Bani M. women M.	PF	2	40,000	Nov 88	clean
36	SAP 31	Wathan high	PF	8	231,000	Dec 88	very dirty
36	SAP 32	Wathan low	PF	4	104,000	Dec 88	acceptable
39	SAP 34	Al Miqdaha	PF	4	110,000	Sep 89	acceptable
-	SAP 37	Marar al Sud	PF	2	31,255	Sep 89	not visited
-	SAP 41	Mushraq	PF	4?	94,400	Jan 90	not visited
32	SAP 43	Bayt as Shamy	PF	2	?	-	not completed
		HEALTH CENTRES					
-	SAP 01	Medinat as Sharq	-	-	20,000	Jan 87	not visited
-	SAP 13	Bani Fadl	dry	2	37,611	Jan 87	not visited
-	SAP 15	Bani Asaad	dry	2	39,650	Nov 86	not visited
40	SAP 17	Magr. al Anab	dry	2	28,500	Feb 87	acceptable
-		improvement	-				
-	SAP 20	At Tallabi	-	-	3,398	Dec 87	not visited
34	SAP 23	Bani Muwallad	PF	2	50,420	Jul 88	clean
35	SAP 26	Al Mashaa'hida	PF	2	40,000	Sep 88	not used
		OTHERS					
-	SAP 10	Al Juma	dry	1	25,350	Nov 86	not visited
-	SAP 11	Al Juma	dry	1	14,450	Nov 86	not visited
34	SAP 28	Bani Muwallad women	PF	2	40,000	Nov 88	clean
38	SAP 36	Al Nama'ah public	PF	2	32,000	Jul 89	very clean
32	SAP 43	Bayt as Shamy women	PF	1	?	-	not completed

CHEMICAL ANALYSES OF WATERSAMPLES

Code	Village name	Wahyat	Source type	Sampling date	Analysis date	El.cond. micro S	pH	Tot.hard mg/lCaCO3	Tot.alkal. mg/l CaCO3	Calcium mg/l Ca++	Magnesium mg/l Mg++	Sodium mg/l Na+	Potassium mg/l K+	Manganese mg/l Mn++	Iron (T) mg/l Fe++	Sulphate mg/l SO4--	Nitrate mg/l NO3-	Phosphate mg/l PO4---	Fluoride mg/l F-	Chloride mg/l Cl-
drp01	Al Husul	Ans	BH	900305	900306	414	6.9	132	124	44	5	19	3.4	0	0.03	22	15	0.8	1.2	13
	very good water																			
drp02	Dafinah	Ans	BH	900228	900304	582	7.8	171	154	48	13	44	3.5	0	0.04	32	27	0.6	0.4	44
	good water																			
drp03	Al Mayfa'ah	Ans	BH	900220	900224	359	7.8	137	128	46	5	60	5.7	0	0.03	18	15	0.3	0	82
	very good water																			
drp04	Sama/Sufara	Ans	BH	900225	900226	350	7.9	130	128	39	8	15	3.9	0	0.04	17	7	0.5	1.1	12
	very good water																			
drp05	Sirm al Banna	Ans	BH	900307	900308	374	8.1	122	126	38	7	26	4.1	0	0.04	25	7	0.6	0.5	19
	very good water																			
drp06	Jarf Isbil	Ans	BH	900311	900312	654	7.8	230	233	53	24	35	10.5	0	0.04	28	15	0.5	1.0	32
	good water, very hard																			
drp07	Al Hajar	Ans	BH	900311	900312	484	7.9	145	101	52	4	30	4.8	0	0.05	33	49	0.6	0.4	29
	good water, nitrate needs attention																			
drp08	Ar Rhawq	Qaifah	BH	810710	810722	3200	7.3	740	345	164	80	473	-	0.3	0.2	350	1	-	1.8	750
	Ar Rhawq	Qaifah	BH	890306	890318	3340	7.1	778	331	176	82	436	26	0.7	0.08	440	0	0.1	2.0	687
	very bad water, very salty, conductivity, hardness, manganese, iron, chloride, fluoride too high																			
drp09	Al Garrar	Qaifah	BH	810628	810726	1750	6.8	660	420	124	85	-	-	0.3	0.2	350	2	-	1.5	230
	Al Garrar	Qaifah	BH	900319	900322	1763	7.4	579	349	126	64	136	21	0.2	4.3	310	0	0.1	0.9	168
	bad water, salty, hardness, manganese, iron too high																			
drp10	Jawf al Mukabah	Qaifah	Shallow well	861216	861217	1764	7.2	740	325	104	68	133	11	0.1	0.1	600	0	0.5	1.3	60
	Jawf al Mukabah	Qaifah	BH	810817	810817	2000	6.8	740	490	201	58	-	-	0.5	0.4	300	1	-	-	70
	Jawf al Mukabah	Qaifah	BH	810820	810830	-	7.3	684	433	200	45	106	17	0.1	0.2	438	0	-	0.7	68
	Jawf al Mukabah	Qaifah	BH	900319	900320	1828	6.7	820	513	222	65	113	18	0.5	7.1	475	0	0.4	0.8	60
	Jawf al Mukabah	Qaifah	House 1	900319	900321	1720	8.1	804	515	211	68	134	19	0.2	0.09	500	0	0.7	0.8	60
	Jawf al Mukabah	Qaifah	House 2	900319	900321	1659	7.8	743	462	182	70	150	17.5	0.1	0.27	512	0	0.7	0.9	70
	bad water, salty, iron, manganese too high																			
drp11	Hanaka al Masud	Qaifah	BH project	810622	810726	1200	7.5	400	300	104	34	-	-	0.2	0.1	100	5	-	1.3	240
	Hanaka al Masud	Qaifah	BH project	861028	861029	1353	6.9	450	280	136	27	114	4.4	0	0.09	60	4	0	1.3	250
	Hanaka al Masud	Qaifah	BH	880402	880404	922	8.1	263	235	69	22	69	5.2	0	0.02	26	11	0.1	1.6	105
	Hanaka al Masud	Qaifah	BH	900317	900322	918	7.9	268	216	66	25	63	9.6	0	0.02	32	11	0.8	0.7	113
	good water from private scheme, acceptable from project scheme																			
drp12	Mawr	Al Areb	BH private	880321	880323	774	8.4	238	205	61	21	73	1.7	0	0.07	85	18	0.9	0.4	65
	good water																			
dpp06	Joar	Ans	BH	900226	900227	380	7.7	163	125	56	6	-	2.1	0	0.03	15	10	0.6	0.2	10
	Joar Scheme priv.	Ans	BH	900226	900227	430	8.1	193	142	47	18	1	1.5	0	0.03	25	15	0.9	0.5	12
	good water																			

CHEMICAL ANALYSES OF WATERSAMPLES

Code	Village name	Wahyat	Source type	Sampling date	Analysis date	El.cond. micro S	pH	Tot.hard mg/lCaCO3	Tot.alkal. mg/l CaCO3	Calcium mg/l Ca++	Magnesium mg/l Mg++	Sodium mg/l Na+	Potassium mg/l K+	Manganese mg/l Mn++	Iron (T) mg/l Fe++	Sulphate mg/l SO4--	Nitrate mg/l NO3-	Phosphate mg/l PO4---	Fluoride mg/l F-	Chloride mg/l Cl-
dpp10	Jebal al Ma'al very good water	Ans	BH	900224	900226	320	7.4	139	132	47	6	13	2.4	0	0.1	16	9	1.1	0.3	10
dpp13	Al Azan	Al Arsh	BH old	810606	810726	1000	7.7	150	230	40	12	209	-	0.2	0.1	170	1	-	0.6	140
	Al Azan	Al Arsh	BH old	880625	880702	897	8.3	104	168	22	12	155	2.0	0	0.18	140	1	0.7	0.7	91
	Al Azan good water	Al Arsh	BH project	900318	900322	868	8.2	92	176	20	10	157	2.3	0	0.13	140	0	0.7	0.8	82
wsp03	Al Hajalah acceptable water, fluoride needs attention	Al Hadda	BH	900312	900313	490	7.7	107	170	28	9	75	3.3	0.1	0.08	56	0	0.3	2.6	33
wsp05	Al Haruj bad water, salty, iron, fluoride too high	Ans	BH	900220	900222	2120	7.9	356	450	86	34	304	12	0	2.19	44	0	0.1	2.4	383
wsp06	Wastah new	Al Hadda	BH	900221	900224	426	7.8	150	192	35	15	42	3.1	0	0.02	25	14	1.1	0.3	12
	Wastah old good water	Al Hadda	Shallow well	900221	900225	490	8.2	146	136	44	9	177	1.4	0	0.03	40	15	0.8	0.5	243
wsp10	Bashar good water	Al Hadda	BH	900222	900225	448	7.9	164	140	50	9	23	2.3	0	0.01	32	16	1.1	0.7	21
wsp11	Mangada very good water	Ans	BH	900222	900225	373	8.2	95	138	27	7	38	4.6	0	0	22	5	0.6	0.3	14
wsp12	Ar Kaba'ah good water	Ans	BH	900228	900303	407	7.7	137	149	47	5	26	4.9	0.1	0.07	15	16	0.7	0.4	15
wsp13	Al Mithal good water	Al Hadda	BH	900305	900306	477	8.6	11	129	3	1	99	11.5	0	0.05	48	0	0.6	0.5	44
wsp14	Acra'ah	Ans	BH	900303	900304	447	7.9	140	133	40	10	33	1.4	0	0.06	35	12	0.7	0.6	24
	Acra'ah good water	Ans	Spring	900303	900304	364	7.8	162	152	51	9	12	1.7	0	0.03	19	5	0.6	0.3	10
dhp01	Hammam Ali good water, very hard	Dawran	Spring	900321	900322	1039	7.3	312	315	91	21	101	5.9	0	0.05	110	17	0.6	0.5	66
rwp06	Dhafar very good water		BH	900310	900311	334	8.1	117	148	37	6	25	2.6	0	0.03	13	1	0.5	0.3	9
rwp09	Sharafa good water	Ans	BH	900310	900311	353	8.1	124	112	34	9	10	11.5	0	0.13	17	6	1.3	0.2	16
rwp10	Bayt as Shamy good water	Yarim	BH	900304	900305	805	8.8	27	392	2	5	182	3.8	0	0.02	21	0	0.5	0.4	11
rwp11	As Zuwab	Qaifah	BH village	850101	850108	1500	7.4	405	410	100	38	116	5	0.2	0.1	146	1	0.0	0.8	65
	As Zuwab acceptable water from project sheme, fluoride needs attention	Qaifah	BH	900317	900322	921	7.7	230	210	55	23	82	13	0	0.01	41	12	0.6	2.5	116

CHEMICAL ANALYSES OF WATERSAMPLES

Code	Village name	Mahyat	Source type	Sampling date	Analysis date	El.cond. micro S	pH	Tot.hard mg/lCaCO3	Tot.alkal. mg/l CaCO3	Calcium mg/l Ca++	Magnesium mg/l Mg++	Sodium mg/l Na+	Potassium mg/l K+	Manganese mg/l Mn++	Iron (T) mg/l Fe++	Sulphate mg/l SO4--	Nitrate mg/l NO3-	Phosphate mg/l PO4---	Fluoride mg/l F-	Chloride mg/l Cl-
dhp43	Dhi Sabil	Dawran	Spring 1	900321	900322	739	7.8	264	192	84	13	37	5.2	0	0.03	46	51	0.6	0.7	50
	Dhi Sabil	Dawran	Spring 2	900321	900322	760	7.9	221	190	62	4	56	6	0	0.01	45	74	1.0	0.7	39
	acceptable water, nitrate needs attention																			
iwp02	Bani Muwallad	Maghreb Ans	Spring	900314	900315	598	8.0	245	236	75	14	21	2.7	0	0.03	21	0	1.0	0.3	26
	good water																			
iwp03	Mashaa'hida	Dawran	BH	900321	900322	1064	7.9	405	418	97	39	63	6	0.3	0.01	56	0	0.5	2.6	53
	acceptable water, very hard																			
iwp04	Wathan	Maghreb Ans	BH 1	900306	900308	800	7.5	276	281	63	29	55	1.3	0.1	0.09	41	34	0.5	0.4	33
	Wathan	Maghreb Ans	BH 2	900306	900308	551	6.8	15	83	2	2	99	0.6	0	0.04	64	3	0.5	0.6	56
	good water in BH2, BH1 very hard																			
iwp05a	Al Saifer	Maghreb Ans	Spring	900314	900315	543	8.1	211	211	63	13	27	1.9	0.1	0.03	24	0	0.7	0.4	26
	good water																			
iwp05b	Na'amah	Maghreb Ans	Spring	900314	900315	950	7.8	336	135	99	22	44	5	0.1	0.02	65	58	0.7	0.4	134
	acceptable water, nitrate needs attention																			
iwp07	Al Miqdahah	Yarim	BH	900304	900305	379	7.6	171	166	53	9	5	1.7	0	0.06	7	2	0.8	0.3	6
	very good water																			
iwp08	Magrabit al Anab	Jabal as Sharq	Ain al Mizan	900313	900314	443	8.2	170	159	54	9	18	3	0.1	0.03	18	8	0.4	0.5	20
	Magrabit al Anab	Jabal as Sharq	Ain al Halfat	900313	900314	413	8.0	150	146	49	7	22	3.4	0	0.03	16	10	0.6	0.7	22
	Magrabit al Anab	Jabal as Sharq	Ain al Qud	900313	900314	527	8.1	165	205	52	9	49	3	0	0.02	25	0	0.4	1.3	32
	good water																			
iwp11	Bani Faliah	Al Hadda	BH	900312	900313	701	7.8	263	210	72	20	42	3.1	0	0.03	61	16	0.6	0.4	50
	good water																			
iwp12	Bani Zaydan	Al Hadda	BH	900312	900313	782	7.6	245	236	66	18	66	5.1	0	0.05	70	6	0.6	1.3	58
	good water																			

Annex X

SUPPORT RURAL WATER SUPPLY DEPARTMENT DHAMAR.
Questionaire for village water supply schemes.
February 1990.

Village: Date:

General:
1. No of inhabitants:
2. Schools:
3. Health services:
4. Distance to Dhamar (km and hours):
5. Wealth of the village:
6. Is the scheme functioning:
7. Price of the water:

Watersources:
1. Type: 2. Depth:
3. Paid by:
4. Ownership:
5. Quantity:
6. Quality:
7. Used for other purposes:
8. Situation around the source:
9. Problems:
10. Sources in the past:
11. Use of this source:
12. Present sources for drinking:
13. Washing of clothes:
14. Washing of blankets:
15. Watering cattle:
16. Watering gardens:

Reservoir:
1. Material, size:
2. Cover / lid / lock / vent pipes / bends / screens.
3. Situation from inside.
4. Cleaning, frequency.
5. General condition: good / fair / bad.

Pumping main:
1. Size:
2. Straight connections:
3. Leakages:
4. Quality of pipe laying:

Distribution system:
1. How big:
2. Leakages:
3. Damaged pipes:
4. Pipes through wastewater pools:
5. Watermeters:
6. Houseconnections:
7. Waterstorage tanks:

Public taps:
1. Number of taps, condition:

2. Drainage wastewater:
3. General situation:
4. Distance to the houses:

Cattle trough:
1. Condition:

Pump, pumphouse, pumpoperator:
1. Type of pump:

2. Total hours:

3. Pumpoperator:
4. How long:
5. How often pumping:
6. Salary:

7. Experience from:
8. Training given:
9. What kind of maintenance:
10. Spareparts from where:
11. Need for training:
12. Project tools:
13. Cooling water:
14. Money collected:
15. Diesel:
16. Oil:
17. Filters:
18. Money saved:
19. Big repairs paid from:

Sanitation:
1. Wastewater pools:
2. Fits:
3. Garbage:

Organisation:
1. Initiative
2. Owner of the scheme:
3. Resonsibility:
4. Participation:
5. Waterbills:
6. Book, list:
7. Many people (ladies) not paying:
8. Everybody connected:
9. Rules for gardens:

Problems:
10. Type of problems:

11. Where going with a problem:
12. Suggestions for improvement:

Toilet facilities:
1. Number:
2. Used:
3. Situation:
4. Problems:

1. Number:
2. Used:
3. Situation:
4. Problems:

Remarks:

Annex X

In-house survey:	1	2	3	4	5	6
1. Drinking water						
2. Source in the past						
3. Still used						
4. Washing clothes						
5. Washing blankets						
6. Cattle						
7. Garden						
8. Enough water						
9. Good water						
10. Price of water						
11. Waterstorage						
12. How filled						
13. How water taken						
14. Watermeter:						
15. Everybody connected:						
16. Toilet:						
17. Wastewater toilet:						
18. Wastewater kitchen:						
19. General impression:						
20. Outside:						
21. Problems:						

22: Remarks: