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RURAL WATER SUPPLY PROJECT

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THE BENEFIT OF RURAL WATER PROJECTS:

An Impact Survey of Five Villages

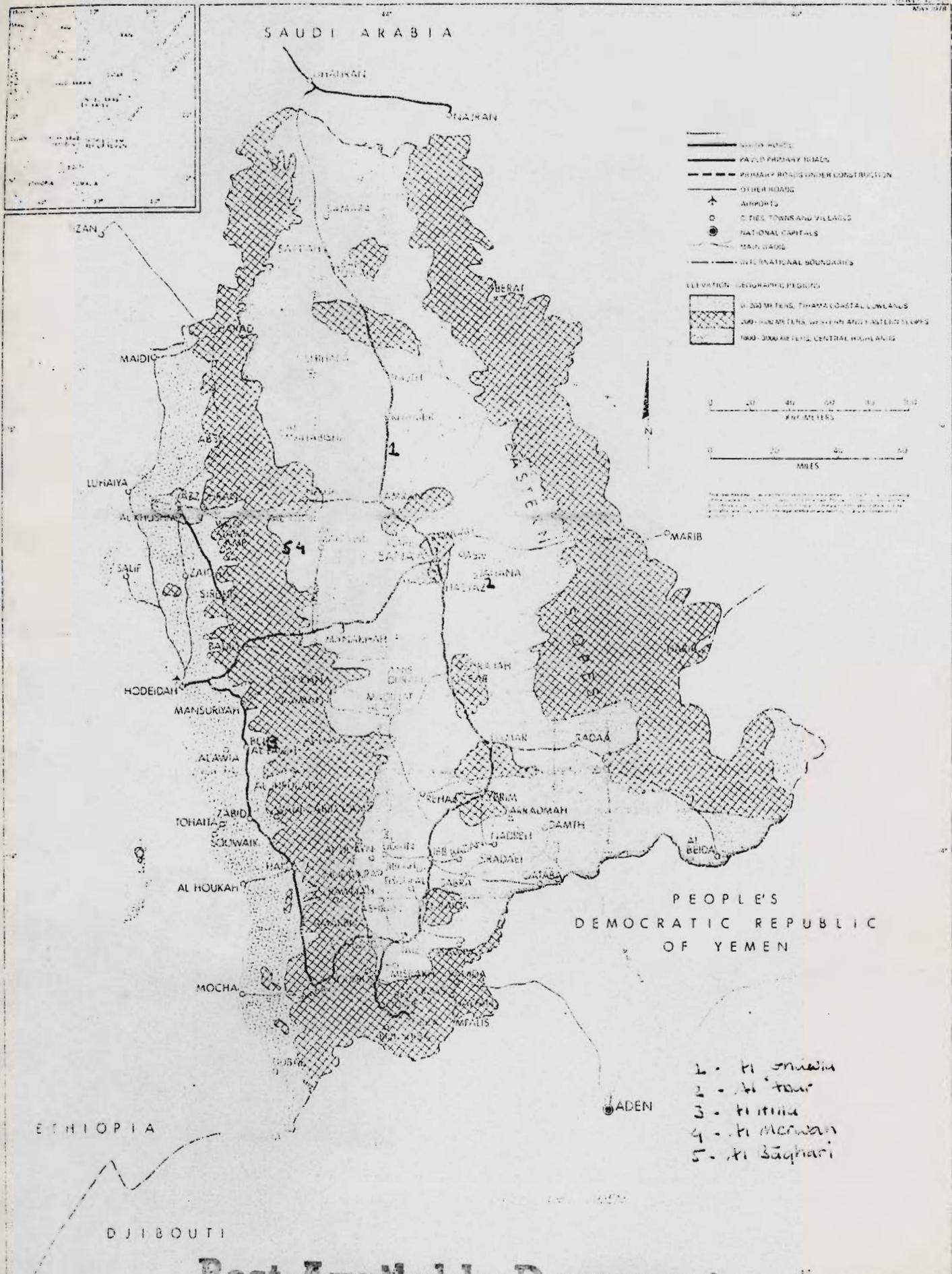
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# SAUDI ARABIA



- ROAD
- PAVED PRIMARY ROADS
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- ELEVATION - GEOGRAPHIC REGIONS
- 0-200 M FEET, THAMA COASTAL LOWLANDS
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  - 1000-3000 M FEET, CENTRAL HIGHLANDS



PEOPLE'S  
DEMOCRATIC REPUBLIC  
OF YEMEN

- 1 - Al Anadiah
- 2 - Al 'Awar
- 3 - Al 'Ithra
- 4 - Al Marwan
- 5 - Al Baqhari

Purpose and Scope of Study

1. This paper reports on an evaluation of 5 small water projects in diverse areas of rural Yemen. The evaluation concentrates on 3 related areas.

1. Drainage facilities and disposal of waste water
2. Sanitation facilities
3. The impact on health, water conservation and labor patterns as expressed by the women beneficiaries of the project and their reactions to the physical aspects of the project.

The sample includes 2 cistern projects, two well projects and one spring. One of the wells has been in place for many years and the most recent project is still under construction. The project beneficiaries reflect the whole range of Yemeni social strata, from Sada through to Akhdam. The sample by chance includes a village where the women did not carry water.

The villages were located in the following areas.

Rayda - Al-Ghuwla

Khawlan - Al-Abar

Bayt Al-Fuqih - Al-Hilla

Highland Mahweit - Al-Merwah

Foothills of Mahweit - Al-Bagari

(see attached map)

The evaluation was mostly domestic and relied on the women in the house for the gathering of data. My technique was simply of observing, listening and asking a few questions. I was familiar with all five areas studied and in three of the villages already had friends and acquaintances among the population.

I did not ask questions which attempted to ascertain attitudes towards future or imaginary situations. As much as possible I participated in the water carrying and water related tasks, as they were explained to me.

Because of the brief time and difficult logistics of the consultancy (six weeks field work in different parts of the country) no attempt was made to get other than a cursory impression of the village as a whole. The data presented is usually of a particular household although I try to point out when and where I feel this household and the women in it are acting in a particularly different way to the rest of the women in the village.

## 2. Domestic Water Use

### 2.1 Drinking

In all the villages studied "clear" water was the choice of water for drinking. The taste, odor, and degree of coolness were also important factors.

Water is most commonly drunk in its natural state in the afternoons if one is chewing qat or after particularly excessive physical exertion. When one is at home one drinks tea or gahwe.

Children tend to drink more water in its natural state than women.

### 2.2 Storage

The vessels in which the water was stored in the home (sheet metal barrels) were allowed to empty and then flushed with the small amount of water left in the bottom of the barrel. Water stored in the house is inevitably covered.

### 2.3 Washing Personal

Friday was the usual day for the women and children to wash "from the head down", i.e. including washing hair and, for the women at least, using soap.

In the Tihama standing under a bucket of cold water to "cool down" was practiced by many of the children in the compounds. The women said they too did this but, understandably, I never saw them.

While younger children are washed by their mothers, the older ones are generally told to wash only. Whether they do or they don't is "up to them", say their mothers.

### 2.4 Washing Clothes

Women in all the villages preferred to wash clothes in a location away from the public gaze and secluded from sun and wind. In all but one case this meant using a spot by her house or, in the case of Tihama villages, returning to a shaded part of the compound to wash.

In the only village in the survey where women went to the source to wash clothes rather than bring the water to them, they used a different well to the drinking well. The well they used for washing clothes was a walk of 15 minutes and was also used to irrigate land and the pump started early morning and late afternoon. Thus, these were the times women did their washing using a cement slab/pool, situated by the side of the well, and over which the water gushed before making its way to the fields.

Women with a lot of small children obviously washed clothes more often than those without. Women who "socialised" i.e. had a ritual procedure of washing, then sitting down to qat and mada with a clean dress on, also washed their clothes more often.

## 2.5 Watering Animals

Although the women preferred to water their animals with water that had not been used before in 2 of the 5 villages there was just not enough water for this to be possible. In these cases the cows, sheep, goats and chickens were given rinse water from the kitchen.

In only one village were the animals actually driven to the source to drink. In all the others the water was brought to them.

## 2.6 Water consumption by Household

It should be noted that the water consumption figures presented here include the adult men in the calculation as users of household water. It is true the men of the house take breakfast and lunch in the house and drink glasses of tea before and after these meals. They may also chew qat at their house and thus require cooled water. However much of the water is used by the main inhabitants of the house - the women and children. It is very difficult from a simple calculation of number of liters brought into the house divided by the number of persons to get a clear idea of who is using how much. Thus there follows a detailed description of one woman's use of water by volume for herself and her 4 children compiled from an observation period of 7 days.

Each morning upon getting up T. prepared a vacuum flask full of gahwe. When the gahwe had been prepared on the charcoal brazier in a small kettle she poured it into the flask and drank the two small glasses normally left in the kettle. 200 ml. She would then breakfast on lohoh and some rāib brought from a neighboring house. Whichever of her children were up would drink a glass of gahwe each from the flask (about 200 ml) after breakfast, as did she (100 ml). She would then make the first of her two trips to the

tank in the middle of town where she brought her first bucket of water and drank some from the top of it. She also drank some of this water on her return. (50 ml x4 = 200 ml) When she had completed her water carrying tasks she washed her face and hands in the foyer between rooms using about 500 ml water.

Through out the day the pan which was situated under the tap of the sheet metal tank was filled once or sometimes twice. (5 liters) This water had been used for rinsing cups and other cooking utensils (pans, knives, spoons) before and after use and washing her 2 small daughters when they got up. Some of the water in these operations was spilled onto the surrounding mud floor and the area was always wet and sometimes slippery (another 300 ml)

Then she began her cooking operations. Wheat flour was mixed with about 300 ml water and left to bubble and glutenise on the brazier. This mixture was later added to the ground grains before making lohoh to render the lohoh softer. The grains themselves were rinsed 2 or 3 times and picked over while soaking. (300 ml) This procedure was carried out by the door for more light and thus the water used for cleaning them thrown out the door. Finally the grains were left soaking in clear water. (300 ml) If there was meat for lunch this required rinsing water which was poured into the waste pan and then 500 ml to cook in.

The grinding stones in the kitchen were rinsed before grinding with about 750 ml water.

The next 2 hours was spent in the kitchen grinding the sorghum grains, mixing the resulting batter with the wheat flour mixture and making the lohoh.

Before lunch she rinsed her hands in a pan containing about 500 ml. Sometimes her children did, too.

During the morning the rest of the gahwe in the vacuum flask had either been drunk by T. and her children or offered to casual visitors. (about 700 ml left from breakfast).

Every two days she washes clothes and uses 2 buckets of water in this operation. Thus one day needs 20 litres.

After lunch a flask of tea is prepared (1 litre) and she drinks the two remaining glasses in the kettle (300 ml). Then she soaks the tobacco (about 150 ml) and changes the water in the meda'a (500 ml). She may have another cup of tea (100 ml) then wash her hands, face and feet in a further 500 ml of water before sitting down for the afternoon.

The two youngest daughters (2 and 3 years) are bottle fed and each day 2 vacuum flasks ( 2 litres) of boiled water are prepared with which to mix the dried milk. Some of this boiled water is used to rinse the bottles and teats prior to making up the feed. It should also be noted that it is the heat of the water as well as the boiling of it to remove germs which motivates T. to boil the water for the feeds.

In the afternoon she drank about 2 or 3 vacuum flask tops of cold water (about 350 ml) and at suppertime she and her family drank the rest of the flask of tea made at lunchtime. (1 litre left)

The spittoon was rinsed with the waste water sitting under the tap of the sheet metal barrel.

Total water used 36 litres.

Representative water consumption figures for the other villages were as follows:

#### 2.7 Change in Water Consumption Patterns

Bringing water closer to the village seems to have been one important factor in the trend towards women doing their washing closer to their homes.

Speaking to the older women in these villages it was apparent that when the only reliable source of water was a distant spring women took their washing to the source and washed there.

As a general rule, too, an increase in quantity of water is used in washing clothes, including children's and babies' clothes.

Apart from this, however, an increase in water consumption seemed to be dependent more on an individual awareness of the benefits of using more water on health than on the simple provision of more water. While many women took advantage of the extra water (e.g. in the cistern projects) others said they "fetched what the needed" and, as far as they were concerned, their needs had not changed. Related to this is the work load of any particular woman. If all one has to do is make lunch and keep the house clean then time can indeed be set aside for washing. However, women with heavy agricultural and livestock duties and women with dependent in-laws (rather than those sharing the work load) found it more difficult to take advantage of the extra water.

### 3. Waste Water Disposal

In most of the houses visited the kitchens (i.e. those fitted with traditional ovens, etc.) had, at least, a small hole at ground level through which water would run away. In areas where dung cakes were a major source of fuel the waste water ran from the kitchen to the pit where the dung cake mixture was soaking. In areas which did not rely on dung cakes for fuel the waste water from the kitchen either ran down the side of the house or down the side of a mountain.

However, not all women do all of their cooking in the traditional kitchen. More often the charcoal brazier and, sometimes, primus stove are located either in a different room or in the "foyer" area between the rooms.

The waste water from the cooking operations in this area is collected in a large bucket or pan and (if not offered to a cow) emptied periodically by throwing out into the street. In the Tihama regions, where living is all on one level and one is never very far from the drying powers of the sun, waste water tends to be disposed of as it is used, rather than collected into one large vessel and then disposed of.

Waste water from personal washings in a "hammam" runs down the side of the house. If no hammam is available ( and sometimes even though it is) women wash in a large tin tray and dispose of the water by transferring it to a bucket and then throwing it into the street. Small children are always washed in this large tin tray and the water disposed of the same way.

The soapy water from the large tin trays used for washing is simply made to run away by tipping up the tray on the ground upon which the tray has been sitting.

#### 4. Sanitation

##### 4.1 For Adults

##### The Traditional Yemeni Toilet

The care of the hammam is the responsibility of the women in the house though often she does not use it herself. In all the areas visited it was those women who prayed regularly who used the hammam for their absolutions prior to prayer. One woman actually prayed in the hammam (admittedly it was quite a large one). In many houses the washings and urinating facilities of the hammam were set quite apart from the facilities for excreta disposal, i.e. in completely different rooms. In some houses there were washing and urinating facilities but no where for excreta disposal. Most of the women when questioned were quite adamant that the excreta from their hammams or whatever fell to a place by the side of the house "away from the street". When the excreta was dry it was collected up and taken to the fields either by the family members themselves or paid workers.

In one of the hammams that I used regularly the floor, when wet, was a breeding ground for flies. Each morning as the sun poked into the hammam for a short distance by way of the hole for water to escape from, hundreds of fly maggots wriggled about in the sun and water. The woman of the house was not unduly worried by these (nor by the enormous spiders and cockroaches, though she did admit she was rather frightened by the spiders). No wonder she and her children never used the hammam.

Women have all sorts of things to say about hammams - some of which may influence how they are used. Hammams are a resting place of ginn and it is bad luck to talk in the hammam. Many women say the hole for excreta disposal is too big for their small children to use. The children look at the size of the hole, "get frightened" and jump down onto the main level of the hammam floor to defecate (the area normally reserved for liquid only).

In the Tihama villages visited both excreta disposal and urinating and washing facilities were situated in a secluded corner of the compound.

#### 4.2. For Children

Generally, if a toilet is available, children do not use it. They go outside the house to defecate, sometimes just outside the door. This is inevitably the place they play in, too, and since houses contain often many children then this is a primary way by which they re-infect themselves and others.

Their excreta undoubtedly dries in the sun but not before the flies have had a chance to sit all over it and they and other people may have walked it into the house. Children do not usually wear shoes and anyone familiar with children's habits will know how much a 2-3 year old will sit picking at his feet, sometimes even sucking at his toes. When children in this state eat with the family and do not wash their hands with soap and water beforehand, the potential for communication of diarrhea is obvious.

Babies obviously do not have nappies. When they defecate they do so into their trousers, (if they are wearing any) or if not onto a rag or even the mattress. After they have defecated, their mother pulls off the trousers (gingerly) and wraps up the excreta in it, rubbing the baby's bottom with the legs of the trousers as she goes. If she is sitting down the trousers or rag are thrown to a far corner of the room (presumably out of the way). She does not wash the baby's bottom or her hands after this and sees no reason why she should.

Urine is wiped up with a dirty rag or sometimes even with a special "urine towel". Urine soaked blankets from the night are put in the sun to dry but still, predictably retain a rather pungent smell.

Women who have a lot of children do not expect to be able to keep their house very clean and this is socially acknowledged if not condoned. While children are small the "best" furnishings are sometimes stored in a separate room. Children are universally said to "dirty" the house yet the extent of this dirt on their health is not realised.

#### 4.3 Sanitation and Animals

While food is always covered (though not always with a very clean cloth or basket) if animals share the downstairs living space then they provide another route by which excreta is walked into the house. Chickens jump up on things and walk over surfaces where eating takes place. While it is ideal to eat ones food from a straw worked basket ( which are very difficult to keep clean) , bits inevitably find their way onto the mat or linoleum and are not always discarded.

#### 4.4 Dung Cakes / Animal Manure

In 2 of the 5 villages production of dung cakes was an added household related chore for women. Pits for the soaking of animal manure are situated by the houses and often run off water from the hammam is collected in them. otherwise water from the source is used. The manure is mixed with old hay and the remains of sorghum stalks on which the animals have been feeding till it begins to ferment and then pounded by the women with their feet. The job is not considered dirty, just tiring. Then the mixture is formed into large disc like cakes and slapped into rocks or the walls of the house to dry. None of the mixture is wasted - the left over mixture not large enough to be made into a full size dung cake being formed into small hand size cakes.

The small cakes are used to start the fire in the tannur ( in the same way that cardboard boxes are used in Sana'a) and the large cakes to keep the fire going and make the tannur hot enough to bake khubz or maluj.

Human excreta is not used in the production of dung cakes.

In the villages where dung cakes were not made the animal excreta was collected in an open space by the side of the house (often where the animals were tied by day anyway) and mixed with the ashes from the charcoal brazier, tannur and other ovens. The mixture was periodically taken to the fields in a large straw bag by the women.

### 5. The Water Projects

#### 5.1 Female Reaction to Construction, Break down, maintenance

In all of the villages the construction of the project had been quite beyond the interest of the women. They had, of course, watched the cement bags come and go and noticed the various means by which the physical construction of the project took place - but they had accepted that it was taking place and that was that. They had not expected to

make any contribution except perhaps for providing lunches for visiting technicians.

Nor did they expect to play an active role in the solution of break-down problems or in the project's maintenance.

They were mostly then reluctant to criticise the finished project. Of all the projects the two cisterns were most warmly received because they undoubtedly provided more water. In the various random conversations to which I was party the project or water system was rarely discussed. The only time any passion was introduced into the subject was when " a piped water supply " was brought up. For many women this seemed the only arrangement worthy to call a "mashru" or "project".

However, they all had a lot to say on the "quality" of water the project gave in terms of taste, odor and degree of coolness. This along with the location very much seemed to influence how they used the project and was the way by which the women's feelings about the project became clear.

## 5.2 Drainage Facilities

In all of the projects except the 2 cistern projects the drainage facilities were poor. In the project still under construction it is the previous tank storing well water to which this comment refers.

It is also interesting to note that in Merwah, where wadi water was also available from a large tank for 2 YR a bucket the amount of water wasted was very small ( the attendant saw to that) and thus drainage was no problem.

At Al-Abar in Khuwlan the well was surrounded by little pools of stagnant water into which tin cans and other rubbish had been thrown. The pools provided a breeding ground for flying large wasps (hoorabee), but mosquitoes were said not to be a problem. None of the women saw any reason to remove the stagnant water even though the wasps can and did give nasty bites.

At Al-Hilla in Bayt Al-Faqih although the water from the taps of the storage tank quickly sank into the sand, the surface of the sand was covered with a green mold. The rough channel, structured only out of sand, to lead the water down into the adjacent fields did a very poor job. The taps dripped and the area around them was dirtied with donkey droppings.

At Al-Bagari one of the ten taps had been broken altogether (by a careless driver backing into it). It had been stopped up with a small towel but still obviously dripped as did most of the others. The result was two large pools of muddy water at two levels below the taps. The spring itself had been covered with a cement slab but the slab had been broken and thus the stagnant water under it exposed. The previous pool for animals to drink from (which they had never used) was still there and totally stagnant since by piping the water from the spring no fresh water ever ran into it.

It was acknowledged, at least in the areas of low altitude, that the rainy seasons brought an increase in the mosquito population. The standing water by the projects was not seen to lead to such a problem however.

The two cistern projects did not, of course, have a drainage problem since the spilled water ran down into the cistern again or else dried.

### 5.3 Use of Project Facilities

This obviously varied from project to project and the villages and projects will be described separately in the following sections. We will also look at how the project fits in with the other water sources in the area.

Al-Ghuwla

The cistern in this northern highland village was widened and deepened about 6 years ago. The new enlarged cistern was surrounded by a wire fence and animals forbidden from drinking there. Women were required to remove their shoes before descending the cement steps to the water. The new enlarged cistern seems to provide a year-round supply of water and is but a 5-10 minute walk from anyone of the houses in the village.

Before the project the primary source of water was spring down the mountain involving a 1-1½ hour journey there and back. This spring is now no longer used. The cistern although playing a large part in producing this change has to be considered along with the village-introduced large tin tanks, which can be found next to each house. These are filled by the men of the village from a well on the Amran plain. Those without cars may buy the water for about 5 YR a tank load.

It is obvious than that since the introduction of the new cistern and the tin tanks the amount of time the women spend on water carrying has lessened considerably. It is also true, though, that the women have abandoned the spring in favor of the cistern and well water. Because they wanted so much to save themselves the exertion of two trips up and down the mountain daily the women are content, even happy to use the cistern water. In most parts of highland Yemen cistern water is a second choice if other sources are available. The women in Al-Ghuwla, though, say that the cistern water is good enough, even for drinking. It is true that since the enlarging of the cistern the water is clearer, at least the water when the cistern is full. But water tests showed the cistern water to be polluted, as was the water stored in the tin tanks outside the houses.

The women strained the water through a thin veil before allowing it to fill up their large pans. The plants in the cistern they believed "cleared" the water. There were 3 other cisterns used by the village, as well as the two situated in the mosques. The water in these was used for washing clothes only.

Al-Abar - Khowlan

The well used for drinking water has been in place since "before the time of the Turks". It is a deep well its sides lined with cut stone and a mud wall supports the wooden beam and handles at ground level. In times of good rain the well is also used for irrigating the adjacent fields. Two or three years ago pump and pipes were fitted to the well to transport water to the nearby mosque on the same level as the well and also to a tank at a slightly higher level nearer the village. The first of these enterprises succeeded, the second did not. When the plan to pump water to the tank near the village did not succeed the women were not unduly worried. After all there was little difference in distance involved and, as many of the women said, "the well is better than a tank".

However, the houses which are furthest away from the well and that are also accessible by car have, in fact, set up their own small sheet metal tanks at the side of their houses. These are filled by car loads of water from various wells near the village.

Merwah

The second large cistern in the village of Merwah was first used in March, 1981. It was not yet then finished (and isn't still) but the rains came and the cistern filled up so women drew their water from it.

At the time of the visit the second cistern was empty but the first, smaller, one still contained water. As well as the two cisterns there is a truck which fills up once or sometimes twice a day from a nearby wadi and offers the water from a centrally located tank at 2 YR a 20 litres bucket.

At the moment the cistern is used mostly by energetic young girls and unmarried and older women. Women who have a source of income and many of them do ( this is a traditionally "muzayyen" village populated mostly with coffee shop and hotel owners, barbers, butchers and singers at weddings), use the centrally

located tank and prefer to pay for their water than walk to the cisterns (about  $\frac{3}{4}$  hour round trip). They say its too far. (Using the tank saves about 25 minutes per trip). The spring which was once a principal source of water is no longer used except by cars filling up jerry cans.

At the cistern the women automatically remove their shoes as they descend the cement steps to the water. The surface of the water is cleared with the bottom of their pan or bucket and then the inside rinsed with this clearer water. Even very small girls go to the cistern carrying smaller pans on their heads.

If both types of water are fetched(cistern and tank) the two are not mixed together in the house.

Cistern water is used for personal washing, washing clothes, washing grains and rinsing the grinding stones, mixing with flour to make dough for bread and wetting tobacco. The water from the tank is used for drinking first and for other purposes second.

#### Al-Bagari - Mahweit Foothills

There was a previous attempt, in the time of the last Imam to improve the large spring at Al-Bagari. The first project consisted of half bricking up the break in rock where the water appeared so that drinking water could be drawn by reaching down inside the stones, upstream from where people washed prior to praying. There was a pool built for the herds of goats, sheep, cows and oxen which came to drink at the pool but this was never used. The nimble goats knew very well which water tasted best and inevitably drew the less perceptive sheep and cows with them to the same spot that people drew water to drink from and washed in.

In January, 1981, project plans were agreed upon with the Khabt L.D.A. (Khabt is a lowland Nahiya in Mahweit Province) to separate the water used for drinking, washing and watering animals. Water tests had shown the water at the spring to be very polluted.

Thus a tank for storing drinking water, a pool for washing prior to prayer and a pool for storing animals drinking water were completed in March, 1981.

During the construction of the tank the womens attitudes were rather passive, as if the project had nothing to do with them. At the time one did not find this so surprising.

However, on a return visit in October, 1981 - 7 months after the project had been completed it was obvious, by the way the local people were using the project, that they were going out of their way to avoid using the tank. Instead they drew their water from the ever flowing pipe that ran into the pool for washing prior to prayer. The pipe, which had never been intended to be used to draw drinking water, is in a rather difficult position - there not being enough room underneath it to place a bucket or jerry can. Nevertheless, this is the water the local inhabitants of Al-Baghari want and they find ways to get around the position of the pipe. First a small Nido can is filled from the pipe and then this is poured, with the aid of a funnel, into the two jerry cans on the sides of the waiting donkey. They never use the tank and the taps attached to it although it is nearer for them. The tank is used solely by cars and trucks coming to fill up from the neighboring mountainous districts.

Of course the local inhabitants have their own, very good, reasons for not using the tank. The more curious have looked into the little port-hole at the top and noticed the layer of salt sitting in the bottom of the tank and the crystals of probably calcium and magnesium salts floating on the surface of the water. Al-Baghari water has a very distinctive taste and is said to be "healthy". Naturally the villagers have got used to this taste over the years. They mistook the calcium and magnesium crystals to be "dirt" and likened it to soap powder. The water in the tank was also much less cool than the water as it appeared out of the ground.

Nevertheless water tests showed the water coming out of the pipe at the washing pool to be unpolluted, as was the stored water in the tank. The animals drank from the new cement pool, which was some distance from the pipe and washing pool.

Unlike before, the water drawers drew their water directly from the pipe saying they didn't want water people had washed in. This is a significant improvement and probably has as much to do with the fact that the water in the pool is standing awater, or at least moves very slowly. Before the people had washed in the running water as it ran into the irrigation channels. The fact that the associated health campaign run by the LDA and the donor organization may have influenced this decision can also not be discounted. Like many users of running spring water the villagers at Al-Baghari believe that running water is clean water and can carry away any dirt that happens to get into it.

The cement washing place by the tank and taps was not used by the women. They said there were too many cars going backwards and for-wards all the time.

#### Al-Hilla

In Al-Hilla it is the men and children who fetch the water, at least nowadays. The older women used to carry water when they were younger (over their shoulders and on their hips) but about 15 years ago it somehow stopped being one of the "things women did."

Men and children use donkeys to collect water from the present smallish tank. If they don't use donkeys then large blue plastic barrels are filled and rolled to the houses. The usual paraphernalia of women's water fetching; buckets, large ghee tins, etc. are not in evidence in Al-Hilla.

### 6. Benefits

#### 6.1 Health

The two most common conditions to which lack of potable water may be related, in Yemen at least, are diarrhea and skin and eye infections. Predictably they are well known among rural women and thus questioning was limited to these two conditions rather than the vague term "health".

However, the relationship between both diarrhea and the water washed diseases and water was not necessarily very well understood. It is very difficult persuading women that perfectly clear water may be dirty. Also the understanding that excreta (even children's) is dangerous and that one can protect oneself from the communication of diarrhea from one person to another by washing ones hands often with soap and water was not understood. Moreover, the concept that washing with soap and water can prevent and cure skin and eye infections is not well acknowledged and sometimes even the reverse practice is encouraged. Providing potable water is indeed one step in diarrhea disease control. But that step alone is not sufficient. Even if diarrhea is water borne (and it has not been proved conclusively that it is always ) then improving water quality is indeed only one step along the path. While sanitation facilities (especially for children) remain as rudimentary ( and dangerous) as they are then the simple fecal-oral route remains the primary way by which diarrhea is transmitted, and while people do not see that children's excreta in the street is a hazard to their health then the cycle will go on and on. This is also true if women do not see it necessary to wash their hands and their children's after contact with excreta.

An increase in the quantity of water (quite apart from its quality) as in the cistern projects provides an excellent opportunity for the control of water washed diseases (scabies, impetigo, boils, eye infections). Yet the provision of water seems not be enough. One needs only to look to Sana'a where piped water is available to the majority of the population to see that all the water washed diseases persist, despite such access to water.

Most of the women (with a few exceptions) did believe "health" had improved over the last few years. However they did not relate this so much to water as to the influence of television and men (and women) going to Saudi Arabia and Sana'a and returning with new ideas.

## 6.2 Time Saving

It is often hoped that a saving in time previously used for water carrying activities will result in women participating " more productively " in the economy.

How many village women could be more productive than they are at the moment is difficult to envisage. Child rearing especially, although it may seem to involve a lot of staying in the house can be the most exhausting of all. Bringing up 5 children under 6 (not unusual) with a husband in Saudi Arabia or at least out of the house most of the day is an enormous task. Given the other tasks for which women are responsible it is only understandable that when time is saved or rather when ones work is lessened, most women do not actively go around trying to find something else "productive" to do. Their first thought is rest. Such thoughts of rest often transpose themselves into "communal rest" where a group of women sit down and relax together. Being able to indulge in leisure activities was traditionally the privileged of the elite in Yemeni society and understandably many women aspire to this.

Time saving then is a benefit in itself even if nothing more than sitting down is done with the time. Of course there is also the potential that a woman has more time to wash and feed her children, or spend more time with them if they are sick. If quality of life is seen by a woman as being related to relaxation then bringing water nearer to her home most certainly improves her quality of life.

## 7. Conclusions and Recommendations

In the improvement of water supplies the primary anticipated benefit is an attendant improvement in health. However, when making this assumption, two issues should be kept in mind:

1. From this and other experiences with water projects in rural Yemen, the physical improvement of the water supply system only may not have as great an impact on health as we expect. General sanitation and local concepts of sanitation play at least an equally important role.

2. Projects to improve water supply run the risk (as with all major environmental modifications) of increasing some disease problems.

Taking the latter point first, there is the risk that increased quantities of water may intensify the occurrence of Malaria and Bilharzia. These are already major public health problems in Yemen. Poor drainage, pools of standing water and dripping taps all present breeding grounds for the malarial mosquitoes if the project is at an altitude conducive to their survival. Otherwise flies and other insects benefit from inadequately maintained projects. However good the drainage plans are, though, it is ultimately the standard of maintenance by the village itself which will determine how good the drainage is, in practice.

Cisterns that are designed to hold year round supplies of water provide a perfect environment for the bilharzia snail. If the cistern never dries out then the snail population will not be wiped out as is the case of smaller traditional cisterns.

Washing places next to the project are not recommended. If the water is brought nearer to the village then women clearly prefer to do their washing by the side of the house. Individual wash places such as these provide a better chance for waste water to dry out quickly in the sun.

As to the former point the best combination of activities to make the anticipated benefit of improved health a reality appears to be:

1. Improved water supply, along with
2. Improved facilities for excreta disposal, and a
3. vigorous and sustained education campaign.

From the evidence of this report facilities for excreta disposal are urgently needed. Indeed, diarrhea and other excreta related infections can never be controlled without them. But much still needs to be achieved in the research and design of acceptable sanitation alternative for villagers. It is not easy from this report to draw wide generalizations on peoples' attitudes, thoughts and actions with regard to water or sanitation. More research needs to be done, and especially on sanitation alternatives.

However, the physical environment in which people live is clear and the application of health principles to this way of life is appropriate. People need toilets and more over the whole family needs to use them.

Education should be an integral part of a water project, whether or not one is considering tackling sanitation problems.

Villages need to know how to correctly use, operate and maintain the new facilities. (or at least where to get help if they need it) they need to know how important improvements in personal hygiene and excreta disposal are for their health. Finally, they need education concerning other measures which may be taken against bilharzia and malaria.

How TransCentury might accomplish these additional tasks is a different matter and a difficult one. Yet not to be aware of them is plainly not looking the overall problem squarely in the face. Undoubtedly the provision of a potable water supply is important, but it is not the complete answer to the water related health problems of most villagers in Yemen.

It is quite likely that these sanitation and education proposals will require collaborative arrangements with other branches of government. These may be the Sanitation Department of the Ministry of Municipalities and the Ministry of Health in the form of its Primary Health care plan. The latter should not be forgotten for the provision of support, advice and personnel in individual villages. At the central level passive support for its activities is recommended.