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WATER AND SANITATION  
FOR HEALTH PROJECT

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# THE EFFECT OF DROUGHT CONDITIONS UPON VILLAGE WATER SUPPLY AND PUBLIC HEALTH IN MAURITANIA

## WASH FIELD REPORT NO. 112

### APRIL 1984

The WASH Project is managed  
by Camp Dresser & McKee  
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At Chapel Hill

Prepared for:  
The Office of Foreign Disaster Assistance (OFDA)  
U.S. Agency for International Development  
Order of Technical Direction No. 172

April 18, 1984

Mr. Donald Miller  
USAID Mission  
Nouakchott, Mauritania

Dear Mr. Miller,

On behalf of the WASH Project I am pleased to provide you with five (5) copies of a report on "The Effects of Drought Conditions upon Village Water Supply and Public Health in Mauritania".

This is the final report by Ralph Preble and is based on his trip to Mauritania from December 1st through 21st, 1983.

This assistance is the result of a request by the Office of Disaster Relief, U.S. Agency for International Development on November 28, 1983. The work was undertaken by the WASH Project on November 28, 1983 by means of Order of Technical Direction No. 172, authorized by the USAID Office of Health in Washington, D.C.

If you have any questions or comments regarding the findings or recommendations contained in this report we will be happy to discuss them.

Sincerely,



Dennis B. Warner  
Director  
WASH Project

cc: Mr. Victor W.R. Wehman, Jr.  
S&T/H/WS

DBW:tg

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Prepared by  
Ralph E. Preble, P.E.

January 1984

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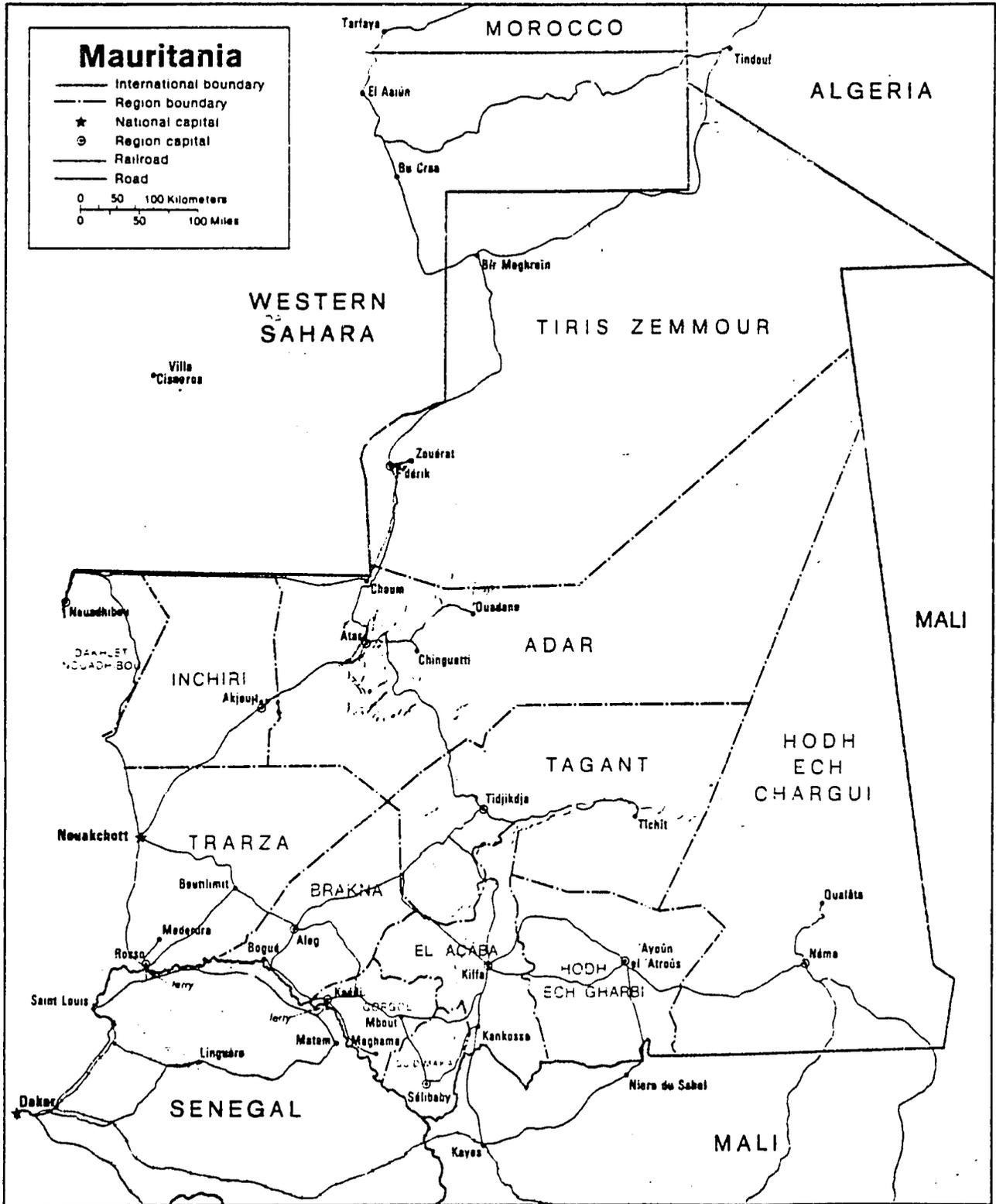
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The cooperation and assistance extended by all of the AID/Mauritania staff was also appreciated, especially the help and advice provided by Peter Benedict, Mission Director, Richard Goldman, Assistant Director, Christopher Brown, Project Development Officer (and WASH team control officer), Betsy Brown, Public Health Advisor, Michael Kerst, Food for Peace Officer, and Karen Woodbury, Health Officer.



## Chapter 1

### INTRODUCTION

#### 1.1 Overview

The population of Mauritania is almost evenly divided between traditionally pastoral nomads in the north and the farmers of the Senegal River basin in the south. The persistence and severity of the current drought has virtually eliminated productivity in both these areas. At present, the very existence of a great majority of the population is fully dependent upon foreign assistance. USAID/Mauritania has assumed a lead role in the planning and implementation of relief shipments of food. It is now anticipated that prompt action in this area by the U.S. and other donor countries will be adequate to avert a national famine in 1984.

The growing crisis of village and community water supply shortage has only recently been recognized. At present the critical needs are not fully known and methods of addressing them are yet to be determined. Under the present (December 1983) severe drought conditions many traditional water sources and wells are dry that withstood previous droughts. Lowered water levels are reported in many more sources which will also become useless if subnormal rainfall (similar to that of 1983) were to persist for another year. Because of the almost universal inadequate supplies of water (of crisis proportions in some communities and general failure of supplies in others) USAID/Mauritania proposed to use PL 480 funds of up to 90 million UM (or approximately US \$2 million) to alleviate current widespread hardship and suffering and to avert the potentially catastrophic consequences of a continuing drought.

#### 1.2 Scope of Work

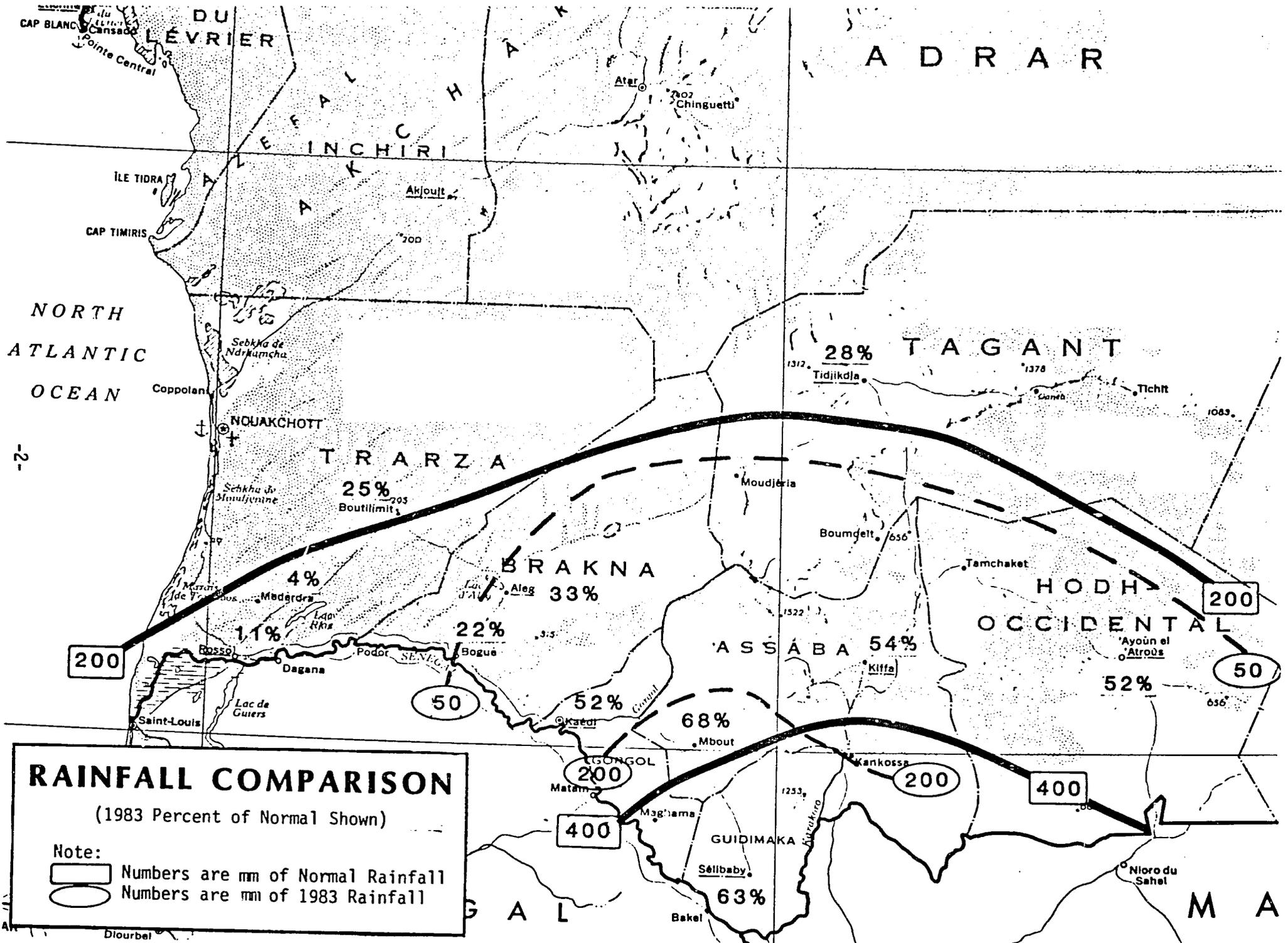
A three-man WASH team arrived in Nouakchott 1 December 1983 in response to a request from USAID/Mauritania for OFDA assistance. The team was asked to identify short-term emergency water supply needs and targets of opportunity in respect to long-term water supply improvements.

Specifics pertaining to the team's Scope of Work were detailed in a Water and Sanitation for Health (WASH) Order of Technical Direction (OTD) Number 172.

#### 1.3 Team Activities

Initially Christopher and Elizabeth Brown were the principal USAID/Mauritania contacts and accompanied the Team on field trips to the Tagant Region and through the Brakna and Trarza Regions. Following their departure for the U.S. on December 15, Richard Goldman, acting USAID Director, in Peter Benedict's absence, became the team's contact for assistance.

The USAID/Mauritania briefing of the team, upon their arrival, indicated a principal interest in the status of existing village wells and the needs of the villagers in respect to water supply. Observations relative to sanitation practices were also of interest but were not specifically thought of as an



emergency concern. The team's observations and brief research showed that while many problems do exist none of the problems appear new or unique but have been exacerbated by the severity of the current drought.

#### 1.4 General Situation

The severity of the current drought has affected the whole country and a large number of village wells of the open dug type have become dry or nearly so. No grass was seen throughout the area visited by the team. It was also observed that even the drought resistant acacia trees had been affected, with many dead and/or dying specimens in evidence. The nature and extent of the drought is evidenced in the accompanying photographs. As mentioned above, USAID/Mauritania, in response to the current drought emergency, proposes to use up to 90 million UM in PL 480 funds for the improvement of village and community water supplies in an effort to avert catastrophe.

#### 1.5 Problems

The major problem with water supplies, as noted above, is the lowering of ground water levels to the point where the drawing of water is impossible or nearly so. Groundwater levels have generally declined a meter or more in Brakna and southern Trarza and it has been reported that some Saharian locations have experienced declines of over four meters. In some areas where wells have dried up, the villagers are perceiving them as totally useless and filling them in. In the northern Saharian regions, including Adrar where a German group is presently engaged in an extensive groundwater program and the Government of the Islamic Republic of Mauritania (GIRM) is also engaged in well drilling, there is little or no recharge to the groundwater reservoir and a large proportion of the new wells are unsuccessful in finding a subsurface that will yield water. Review of prior groundwater studies and reports provide a much more encouraging picture of groundwater throughout much of the former acacia savanna where rainfall does provide groundwater recharge and where groundwater is, with few exceptions, available when wells of adequate depth are provided. Problems of water quality, especially high concentrations of salt in the water, do affect use in the western part of this zone including certain areas along the east-west highway and groundwater use should be thoughtfully managed throughout all areas.

Not only are the water supply problems potentially catastrophic from natural causes but the government's ability to cope with them appears to be seriously hampered by institutional problems. Various observers of the situation note that the GIRM budget for water supply activities only covers salaries and supplies and equipment maintenance are not adequately funded. In fact the government well digging brigades equipment is, by observation, totally non-functional. This is unfortunate as the personnel in the field appeared competent and experienced in their work which they are continuing without the benefit of mechanized equipment at the present time.

While a general GIRM disaster plan was prepared, specific plans for improving village water supplies from the Directorate of Water were not available during the Team's stay in Mauritania.

## 1.6 Current Foreign Donor Water Supply Activities

In addition to the AID/Mauritania proposal to utilize up to 90 million UM of PL 480 funds for water supply purposes, other donors are funding on-going water supply improvement programs, and UNDP has budgeted for a million dollar emergency water assistance fund. UNDP and GIRM have decided to use the UNDP emergency fund for various types of well construction equipment. A second separately funded UNDP proposal is to provide a mechanic/trainer to repair and maintain the 26 diesel-electric powered pumps UNDP financed under the 36 Drilled Well Program and an agronomist to provide training in utilizing the well water. The UNDP/Resident Director indicated both programs were funded and only awaited UNDP/GIRM agreement on specific details. It is understood that the UNDP Resident Director had expressed an interest in the possible use of the UNDP emergency water assistance funds to procure U.S. excess property. While this suggestion was not directly rejected by USAID/Mauritania, the wisdom of such action was questioned on the basis that used equipment would create more problems than it would solve.

Actual current foreign donor financed water supply activities includes:

- o Saudi financed: exploratory drilling and water supply development in Tagant and Adrar with GTZ a German group
- o Saudi financed: water treatment plant for Rosso
- o Fonds European Development (FED) financed: urban water supply improvements in Selibaby, Aloun and Atar  
  
an "elevage dan le Sud-Est" Project involving some livestock water development

## 1.7 Recommendations-Village Water Supplies

### 1.7.1 General

As has been described previously, the basic village water supply problem is not an absence of groundwater but one of the inadequacy of wells and facilities to utilize it.

The greatest needs at the moment are (1) the deepening of the hand-dug wells in the southern part of the country in the farming area adjacent to the Senegal river and in communities throughout much of the former acacia savanna and (2) mechanical pumps to supply drinking water to displaced person squatter camps along the east-west highway (principally between Aleg and Boutilimit).

To develop a quick response to these needs, the government, PVOs, and private enterprise should be joined in a coordinated emergency water-supply program. While USAID/Mauritania has PL 480 funds to implement a program, it does not possess the capability to develop program details and coordinate and monitor

implementation. Neither does it possess the U.S. dollar funds to engage personnel capable of doing so. The provision of funds to provide such people is the area where OFDA assistance is most urgently needed.

### 1.7.2 Basic Details of Emergency Program

As previously noted the use of PVOs and the private sector in addition to governmental efforts are necessary to obtain a quick response to the current water supply emergency. In addition, the Peace Corps could and has expressed a willingness (through their Mauritanian Assistant Director) to be involved with an initial screening of measurements of village well depths and depth of water. CARE is currently considering an emergency program within six months and have expressed an interest in being a part of any water supply program. The Mauritanian Red Crescent has been carrying out a program to institute a village handpump program and has also indicated an interest in participation in any water supply program.

Specific program details and coordination of the various identities noted above will necessarily await knowledgeable personnel to work directly in an emergency water supply program. Some basic details of possible actions include, but are not limited to, the following:

- o Agreements on geographical or some other division of responsibilities between all identities expected to be involved and/or specific interests and capabilities of PVOs.
- o Assessment of which villages have problems and the extent of the water supply problems related to impromptu squatter settlements of drought-displaced persons.
- o Identification of private sector operations and individuals in the private sector with abilities in well construction and/or deepening.
- o Establishment specific program elements involving villagers participation (including money and work) on their own behalf.
- o Contractual relations.
- o Governmental relationships.
- o Technical requirements of well construction and improvement and pump installation where such are incorporated into the program.

The public health aspects of water supply are felt to be of intermediate and not of urgent concern except for improving drinking water quality at rural health centers to circumvent a potential source of spreading disease. In any event, a public health program is expected to get under way early in 1984 through a previously funded program.

## Chapter 2

### REPORT ON FIELD TRIPS

#### 2.1 Background

After being briefed by USAID/Mauritania the team conducted a series of field visits. In preparation for a field trip the following meetings were held with:

- Dr. Lo Boide, Director of National Center of Hygiene
- Assane Diop, GIRM Director of Planning
- Sidi El Moctar, Chief of Infrastructure Service and Acting Director of Hydraulique

#### 2.2 General Aspects of the Team's Field Trip

The team accompanied by C. Brown, USAID, B. Brown, USAID, Ahmed Salem, USAID, Dam Van Hoang, advisor to Director of Planning, Amadou Boucoum, geotechnical engineer of Hydraulique, Steve Hilbert and Jill Hilbert of the Catholic Relief Services left Nouakchott 5 December 1983 to visit certain of the drought affected areas.

The team's field trips extended as far inland as Tidjikja in Tagant and also covered a section of the Senegal River valley area between Boghe and Rosso in the Brakna and Trarza regions. Many existing deep wells and hand dug open wells were inspected and sanitary conditions noted. The problems of adequacy of water supply and operation and maintenance of deep well pumps were discussed with the district prefects, regional governors, and responsible villagers. Also, discussions were held with the chiefs of the well digging brigades of the Department of Hydraulics, and their workshops and equipment were inspected.

#### 2.3 Observations Between Nouakchott and Aleg

The team observed a large number of existing deep wells and large diameter hand dug open wells throughout the areas visited. Although the water table is receding, due to lack of recharge in recent years, substantial yields of reportedly potable water can generally be found at most locations along the road between Idini (where 18 wells supply water for the Nouakchott water system) and Aleg at depths of some 40 to 60 meters. Reportedly shallow ground water is available within the dry lake bottom at Aleg at a depth of only a few meters.

Two machine drilled deep wells, constructed and equipped with diesel generator powered pumps under a UN "36 well" program were visited on the way to Aleg but both were found to be inoperative. Wells of similar construction were installed to provide water supplies for road construction in recent years. These road construction wells were generally installed in batteries of two or four with individual wells separated by approximately 100 meters. At some locations one of these wells would have a generator and pump left in place by prior agreement between GIRM and the road construction company. Other wells in

a battery would remain but be capped. It is reported that there are some locations at which single wells, not constructed in batteries, are capped without any form of pumping equipment.

Most of the machine drilled deep wells are eight inches in diameter with a maximum depth of about 125 meters. Most of the drilled wells along the east-west highway are reported to yield some 12,000 liters to 60,000 liters per hour. The water from these wells is not uniformly satisfactory. At some locations residual salt water from a time when the ocean covered the land is encountered or drawn into a well by pumping. Probably more than half of the installations observed were not operational due to an apparent inability to provide any form of maintenance.

At Tiniang, 10 km east of Boutilimit, one of the wells of the UNDP financed 36 Transit Well Program was visited. This is an eight inch diameter well 130 meters deep. Mohammed Sabin, Chief of the local cooperative, reported that the well was intended for gardens and animals during the rainy season. There is no garden this year as the pump's generator had been inoperative for five months. In past years as many as 1,000 people and their animals would pass through the area during the three-to-four month rainy season. Due to the drought only a few animals and people have passed through the area this year. Some 500 families live within a 12 km radius of the well (about 3,000 people excluding the population of Boutilimit). At present, they are supplied with water from six hand dug open wells. The open well of Tiniang was dug 60 meters deep by a GIRM team. The population of the area and a rich man contributed 10 million UM\* to help pay for the well. Because of the depth to water the cooperative provides donkey teams to lift water to the ground level. Members of the cooperative pay 200 UM per month for one inner tube (1 truck tire tube) of water per day.

#### 2.4 Abandonment of Side Field Trip to Mal (Brakna Region)

Originally a visit to Mal to the southeast of Aleg had been planned. This visit was to view a depression called the Lake at Mal that in prior years had been frequented by many of the nomadic people in their travels from one pasturage to another. This plan was revised and the side trip to Mal abandoned after talking with the Governor of Brakna Region in Aleg.

The Governor reported that the water in the Lake at Mal had, through evaporation and lack of rainfall, become so mineral concentrated and polluted that animals drinking from it sickened and died. As a consequence all people traveling through this part of the Brakna Region were now avoiding the Mal area.

#### 2.5 Brief Descriptions of Selected Site Visits

To provide as much coverage as possible the team divided at Aleg. John Topik, in company with Christopher Brown and others, proceeded to Tidjikja, Capital of the Adrar region, while Ralph Preble and Nguyen Sy Tin, with Betsy Brown

\* UM 54 = US \$1.00



Flood plain cropland 10 to 12 km northwest of  
BOGUE remained unflooded and unplanted in 1983.  
6 Dec 1983



Former swamp, a 12 month water source, 30 to 40 km  
east of ROSSO, now dry in 1983. 7 Dec 1983

and others circled through Boghe (Brakna Region) and along the Senegal River to Rosso (Traraza Region) before returning to Nouakchott.

While all visits during the field trip were felt to be of significant interest, some events and information appeared to be of sufficient importance to recount. Specifically:

- The presence of a Red Crescent-installed, foot operated French pump in Makta Lajar (Brakna Region).
- Interviews with Hydraulique Directorate well digging brigade chiefs.
- The visit to Mudjeria, including the meeting with the Prefect who said that the original inhabitants had been unable to cope with the drought. Also, of interest was the discussion with Hydraulique's well drilling crew who were constructing a well at Mudjeria.
- Details pertaining to the availability and use of water in Tidjikja from a 120 meter deep test well and the interview, at this Regional Capital town of some 12,500 people, with the Governor of the Tagent Region.
- Descriptions of visits at selected villages:
  - . Reguba nomadic people - well digging in progress
  - . Toudery semi-nomadic people - well digging discontinued
  - . Dar El Barka sedentary people - well digging planned

#### 2.5.1 French Foot Operated Pump at MAKTA LAJAR

In Makta Lajar the Team member (John Topik), who had gone on the northern trip after the team split up at Aleg, met with a resident Peace Corps volunteer. The volunteer accompanied the group to a well that the Mauritanian Red Crescent had equipped with a French foot operated pump. Discussions with local villagers indicated that the well was probably no deeper than 10 meters as this was the depth for a number of nearby open dug wells (constructed in sand). The villagers reported that the pump was installed nearly three years ago and that it had failed three times but in each instance had been promptly repaired by Red Crescent people. At the time of the visit the foot pedal appeared loose and water was escaping. The villagers also said that water production was lower than it had been.

#### 2.5.2 Interviews with Hydraulique Directorate Well Digging Brigade Chiefs

The WASH team met with the chiefs of the Brakna Well Digging Brigade in Aleg and the Targant Brigade in Tidjikdja and inspected their equipment and workshops.

There are digging brigades in nine regions of the country. A brigade may consist of either two or three digging teams. Each team consists of 10 men: one well foreman, one assistant foreman, one compressor technician, one driver, five laborers, and one watchman.

The brigades build only open, large diameter (1.80m) wells up to 75 meters deep. They also deepen, repair, and clean existing village wells. While the brigades are part of the Direction Hydraulique. The regional Governors and District Prefects seem to direct where they shall work.

With simple hand tools, a team can dig one meter in three to four days in sandy soil. With an air compressor, jackhammers and dynamite a brigade can penetrate six meters per month of rock. All wells constructed by the brigade are lined with concrete rings. Concrete rings with steel reinforcement are fabricated by the brigade at the well site within steel forms. The casting is done in pits excavated so the top of the steel form is approximately at ground level. After the concrete is placed in the form, the pit is backfilled for curing the "pipe like" rings. These one meter deep rings, after curing, are dug up and successively added, one on top of the other, as the well is dug.

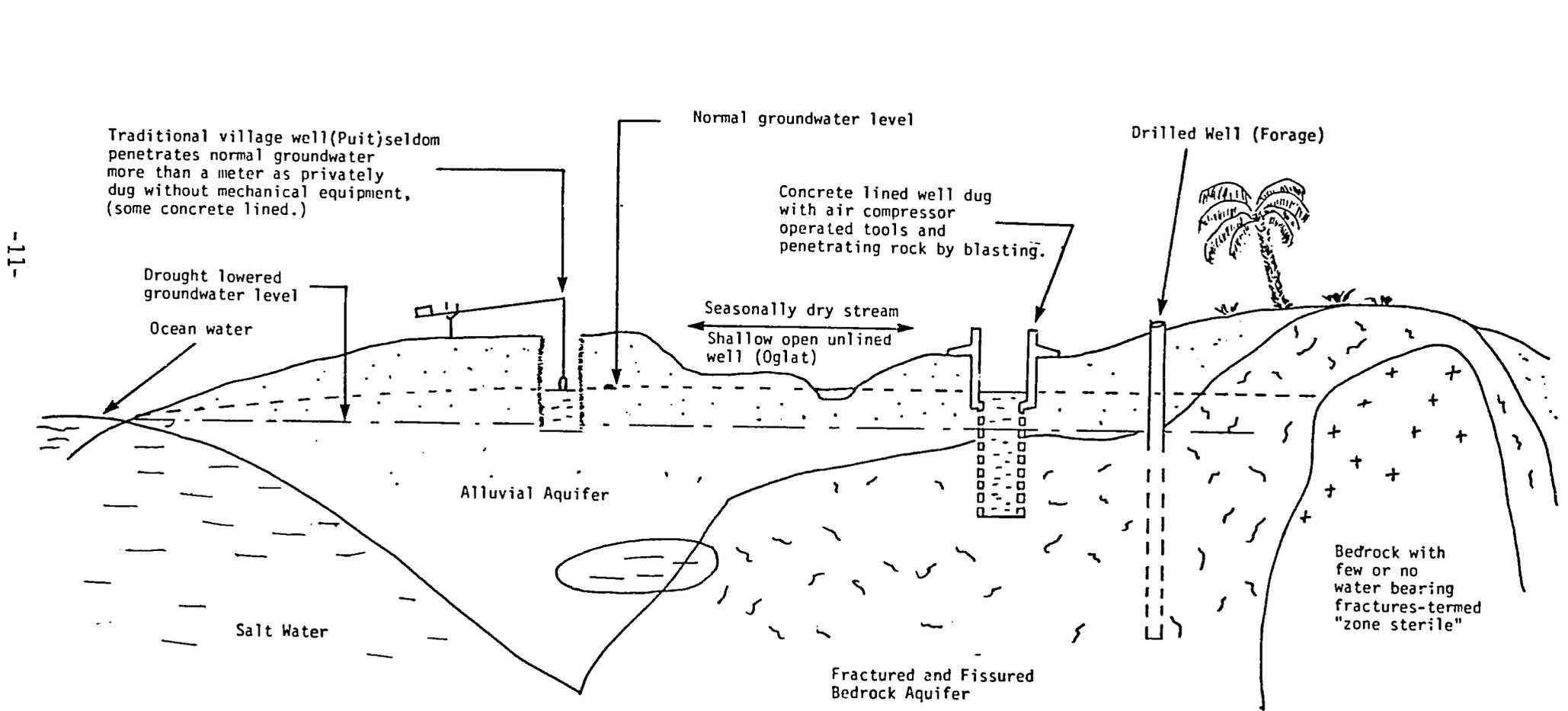
This method of well construction is commonly referred to as the caisson method and is the method of construction below groundwater level. Well construction in the dry section above groundwater may also utilize this method of construction. But, the more common method appears to be casting the concrete in place with one meter long removable forms. Once the digging has reached groundwater a smaller diameter perforated concrete ring, fabricated outside of the well, is slipped inside the partially completed well. Digging then proceeds into the aquifer using the caisson method described above. Due to the presence of water in this lower portion of the well further deepening of the well is terminated when digging reaches 1 to 1.5 meters below the water level (see Figure 1).

The above described open dug well construction methods are used by both private contractors and GIRM brigades. In the past, when the brigade's compressors and mechanical equipment were functioning, they constructed a more drought resistant well by penetrating the ground water to greater depths. This was accomplished by using one air operated dewatering pump run by the brigades compressor that lowered the water level in the well. By such means, wells could be completed with a four or five meter water depth. Relatively hard clay layers are reported to have been present at many of the well sites. When the brigade's compressor was in working order an air operated digging spade was used to facilitate the penetration of such a hard layer.

Brigade equipment included Landrovers, 4 x 4 trucks, air compressors, jackhammers, air driven spades, compressed air pumps, winches, hand tools, and dynamite. Practically all of the mechanical equipment of the brigades visited was not operational and was beyond repair. During the visits with the Aleg and Tidjika Brigade chiefs detailed lists of their equipment and materials needs were given to the team. These lists are appended. The list prepared by the Tidjika chief included prices that he had obtained from 1979 catalogues.

The digging brigade's lists differ somewhat from a Hydraulique Directorate request to USAID/Mauritania for assistance in the procurement of well digging equipment and materials. This request was divided into two parts, one for the digging brigades and one for drilling equipment. These lists are also

Figure 1. GENERALIZED MAURITANIAN WELL TYPES



appended. Discussions with the Hydraulique Directorate indicated that acquisition of such equipment could only be accomplished through UNDP or funding from some other foreign donor as it was impossible to get a foreign exchange component approved in their regular budget. However, action had been taken whereby AID PL 480 funds might be applied to the purchase of equipment and application had been made to the Central Bank to exchange 20 million UM of PL 480 funds for equivalent foreign exchange. The Director appeared confident that this could be done.

### 2.5.3 Visit to Mudjeria

The Prefect in Mudjeria indicated that most of the original permanent residents had moved out of town due to a shortage of water. The five dug wells that were 10 meters deep were currently providing the townspeople with water were extremely low and at only three of these wells was it possible to draw any water at all. While the majority of the permanent residents had gone, their place had been taken (during the last year or so) by persons that normally followed a nomadic existence. As a consequence, the town's total population had remained at about the same level of some 500 families and approximately 3,000 people. Fewer nomadic families were expected to pass through the town than was common in prior years but the prefect estimated that some 200 to 300 families might do so. An extended discussion of the drought situation centered around the dying date palms and the inability of the former townspeople to continue to raise garden crops. The current inhabitants depend almost exclusively upon GIRM food distribution for their food. No cattle remain in the area, and it is almost impossible to see how the few goats and camels observed find enough vegetation to survive.

In Mudjeria a visit was made to the site (about one kilometer from the town) where a GIRM Hydraulique team, with an Ingersoll-Rand drilling rig, was drilling a new well. A Mr. Brahim, who is working for his Ph.D. at the Universite Hydraulique at Grenoble, was in charge of the rig and the well installation. Mr. Brahim appears to be extremely well qualified for the work he is doing. He explained that he had selected the site, at the foot of a 1,500 foot high escarpment, in hopes of drilling into a visible fault. He noted that the drilling was penetrating both sandstone and dolomite with the drilling advancing at a rate of 40 to 50 meters in hard rock and some 60 to 70 meters in soft rock during a seven hour working day.

### 2.5.4 Visit to Tidjikja Capital City of the Tagant Region

The current population of Tidjikja is approximately 12,500. Like Mudjeria many of the town's former residents had moved and their places taken by others who had previously followed a nomadic existence or had moved in from oases where the date palms had died and water had dried up because of the drought. The discussion with Ahmedon O'Sidi, Governor of the Tagant Regions, centered on the water supply problems of Tidjikja.

The major problem is that the population does not have an adequate quantity of water. There is only one deep drilled well. This well is of small diameter and was originally installed as a test well. For fear that the pump will break down, it is not operated over five hours per day and produces only about 5,000



Well and diesel generator driven electrical submersible pump at ALEG-BOUHCHICHA which due to a mechanical problem has not operated in two years, 5 Dec 1983.



Government well digging team yard at ALEG gives evidence of mechanical problems for which budget or expertise are not available, 6 Dec 1983.

liters per day. This is shared between the people and the hospital. (It was noted that the 60 bed hospital alone could use this amount and if the WHO recommended 20 liters per capita was applied to the overall population some 250,000 liters per day would be needed.) It is expected that the well drilling rig, newly engaged at Mudjeria, will be moved to Tidjika to drill a second deep well. This would provide an adequate supply since the original test well now in use yielded two cubic meters an hour from a 12m deep zone, 15 cubic meters per hour from a 70m deep zone and 32 cubic meters per hour from a 95m deep zone. However, even if the well is installed no one knows where a pump will come from.

At present the people obtain much of their water from several open dug wells that were originally installed privately. There is a great demand to deepen those dug wells but they are unlined and subject to collapse. The government teams refuse to have anything to do with them for this reason. New lined wells are not being installed as the government digging teams have no operational equipment or supplies.

The major concern, at present, is replacement and spare parts for the present diesel-generator that powers their one well pump. It was noted that diarrhea was a major health problem but it seemed like this was considered to be of secondary importance to the problem of an unreliable water supply.

An interview with the government well digging brigade at Tidjika was presented in a prior section.

#### 2.5.5 Visit to a village of former nomadic people at Reguba, Department Boghe, Region Brakna

This community has a population of 630. The team was met by the Chief of the village. It was reported that all of their livestock were dead. To provide some income the people of the village are now making charcoal and selling it.

At the time of this visit the villagers had engaged a well digger who was in the process of digging a well. The village had been near a swampy area where shallow excavations had provided the village with water in past years. During the present drought and the drying out of the swamp, such excavations became dry and new ones failed to encounter enough water to meet the villages' very basic needs. This community was not financially able to meet the estimated new well cost quoted by a local well digger and a delegation was empowered to cross the border into Senegal and negotiate for the needed well.

In Senegal the villagers hired a well driller for a flat rate of 20,000 UM (two thirds of the price quoted by a local Mauritanian digger) with an estimated depth of 20 to 28 meters. The well digger provides all equipment (casing mold, tools, etc.), and actual digging labor. The community furnishes all materials (sand, gravel, cement, steel reinforcing bars, etc.) The villagers also provide all above ground labor and provide all food to the well digger and his assistant. The digging process and the working schedule is kept a secret. Nobody knows when the well is to be finished.



Public Health Problems discussed with  
Health Center personnel at BOGUE, 6 Dec 1983.



Former grasslands and acacia savannah  
between ALEG and BOGUE. 6 Dec 1983.

The people of this village do not construct latrines. The villagers acknowledged that diarrhea was a problem but said that their main health problems were malnutrition and arthritis.

#### 2.5.6 Visit to Toudery, Department of Boghe, Region Brakna

The village of Toudery has a population of only 160 at present. The population is a semi-nomadic people who formerly supported themselves by cattle raising. The villagers report that all of their cattle are now dead, most of the young men have gone to seek other work, and only the women, children, and old people are left. Diarrhea is a major health problem and the villagers reported that three children had died of diarrhea within the three or four months.

Their major problem was cited as lack of water. Water supplies, available in past years, were now dry. A government well-digging team had started to dig a well for the village about a year ago. The well was never completed as bedrock was encountered before reaching groundwater. While it has been normal practice to extend dug wells into the bedrock (adequate village supplies are generally available from the rock fractures), the digging team abandoned the partially completed well as no equipment or dynamite was available for them to continue work. The village now resorts to carrying water from a source eight kilometers away. This had been accomplished with donkeys but now all the donkeys have died and the transport of water imposes unbearable hardship.

#### 2.5.7 Visit to Dar El Barka (A Village of Sedentary People)

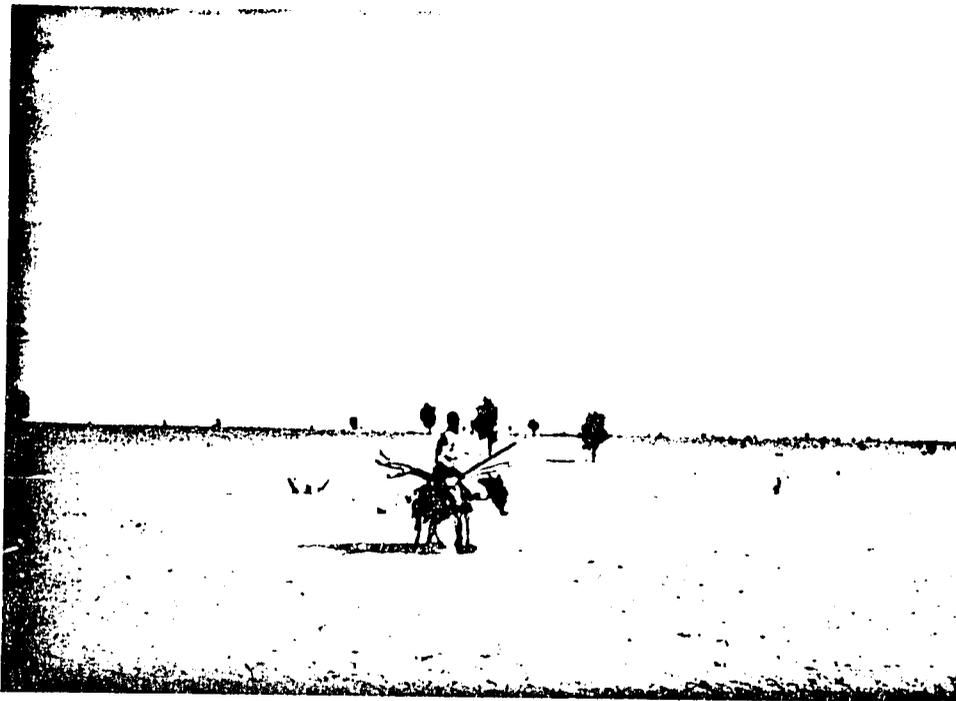
The team was welcomed at Dar El Barka by Mr. Sall Mamadou Diète, chief of the village, and Miss Krysten Mourhead, a Peace Corps Volunteer and health educator. Dar El Barka village, situated 60 kilometers to the west of Boghe, is located along a Senegal River tributary and has a population of about 800.

Usually the water of the Senegal River is at a level that there is water in the tributary all year. In past years the tributary was used to irrigate rice and other crops. This year the long drought has almost dried up the tributary water and no irrigation is possible.

At the present time, the village water resource consists of one hand-dug well almost completely dried up and 14 shallow hand dug watering holes (2 to 10m deep) in the depression left by the retreating tributary. An increase in intestinal diseases (diarrhea, dysentery) was recorded during November 1983.

To improve the Dar El Barka water situation, Miss Krysten Mourhead has requested a budget of 76,200 UM from Peace Corps funds, to install a new well and to deepen and repair the existing well. To this amount the villages can afford to add 20,000 UM and would provide all labor except for the actual well digging for a total of UM 96,200.

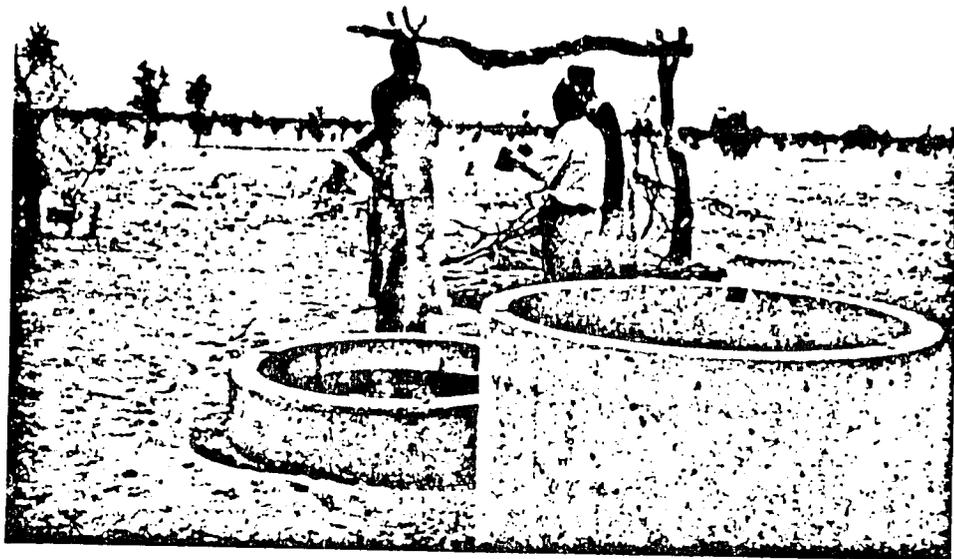
It is anticipated that the new well will be 10-12 meters deep. A detailed accounting of labor and material are:



Relocation of the population has been in progress for some years and at an increased pace during the last three years. Often a single family member goes to NOUAKCHOTT to seek work and the remaining family group moves later. 6 Dec 1983



Former herders and nomads utilize former road construction well and ground storage tank for irrigation of nearby garden plots and for 500 family village, 1.2 km away as shallow well at village BAREL BARKA is salty. 5 Dec 1983



Dug well at TOUDERY, 18 km north of BOGUE, left unfinished nearly a year ago when rock was encountered and government workers' stock of dynamite was exhausted.



Drawing water at a 60 meter depth from a hand dug well at TINIAN about 12 km east of BOUTILIMIT, 5 Dec 1983.

Services - well driller 30,000 UM

Materials

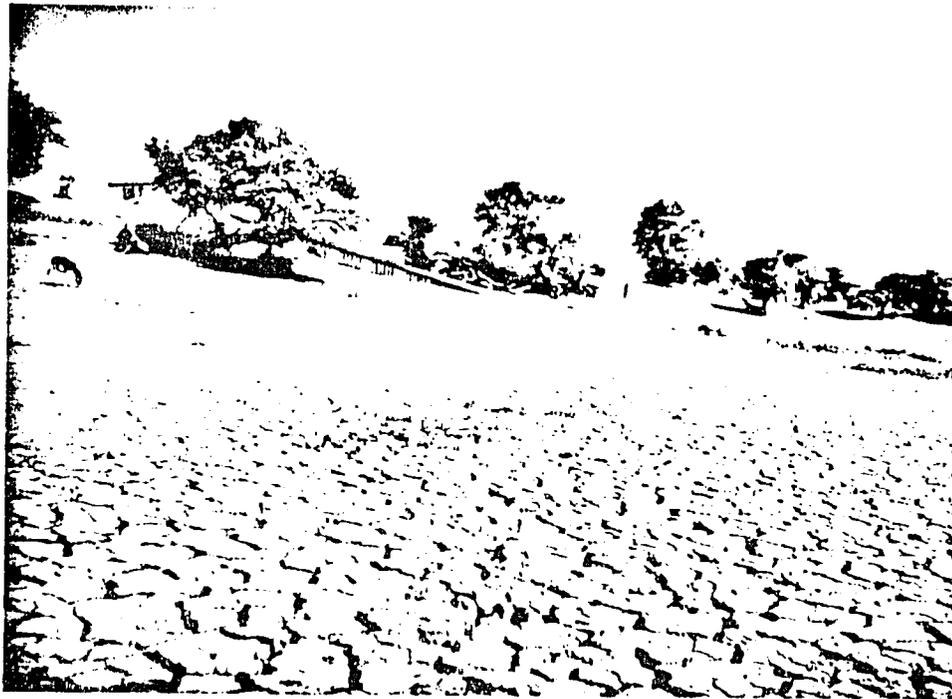
50 bags of cement 450 UM/bag	22,500
2 1/2 steel reinforcing rods	15,000
1 pulley for new well	3,000
20 meters of rope for new well	2,000
2 new buckets	600
material transport (Nouakchott to Dar El Barka)	5,000

Without contingencies - TOTAL 78,100 UM

It was unclear if the 5,600 UM charge for deepening the original well was in the above price, but it is assumed that would be an additional cost. If so it appears as if 12,500 UM was proposed as a contingency as such a figure would be necessary to add up to the above total of 96,200 UM.



The Senegal River at BOGUE, 6 Dec 1983.



Former river bed at DAR EL BARKA, 7 Dec 1983.  
Note intake pipeline which had served to  
irrigate extensive rice field in prior years.

## Chapter 3

### REVIEWS OF VARIOUS DOCUMENTS AND BACKGROUND MATERIAL

#### 3.1 General

After returning from the field trip the WASH team reviewed various documents and background material in order to better understand the hydrogeology of Mauritania, the various means by which groundwater might be exploited (current methods, alternate well construction, and utilization of pumps) and what practical measures might be taken to combat water-related diseases.

#### 3.2 Review of AID/Mauritania WASH Team Briefing Documents

The briefing documents given the WASH team by AID/Mauritania (copies of which are in the appendices of this report) included an exchange of correspondence between Peter Benedict, USAID Mission Director in Mauritania, and the Commissioner for Food Security of GIRM. This correspondence implies that the Commissioner understands that the 90 million UM well drilling program is exclusively a GIRM operation. USAID Director Benedict when asked (in a letter from the Commissioner dated 8 November 83) to make an advance of 20 million UM carefully avoided any commitments. His reply, dated 22 November 1983, did say that the Commissioner's request would be considered if he presented a detailed proposal which met USAID's criteria. As of 18 December 1983 USAID/Mauritania had not received a reply to the USAID Director's letter.

This review and continuing discussion with USAID/Mauritania personnel indicated that consideration of relief activities pertaining to drought related water supply problems need not be restricted to the three regions which were to receive food relief.

#### 3.3 Review of December 1982 UNDP Report

This report, entitled Project DP/UN/MAU-77-002/1, Planification de l'Utilisation des Eaux, Republique Islamique de Mauritanie, Conclusions et Recommendations du Project, contains condensed data on the hydrology of the country (climatic, meteorological data; boundaries, depth and quality of aquifers). The water requirements for human consumption, livestock and agriculture are tabulated according to regions, based on 15 liters/day/capita for nomads, 20 liters/day/capita for sedentary people, and 30 liters/U.B.T./day\* for livestock.

Particularly important for purposes of the WASH team are detailed lists of available water sources, i.e., deep wells, hand-dug open wells, springs, "mares" (rainwater filled depressions), small barrages across "oueds" (seasonal streams), and "ograts" (small funnel shaped water holes). The list

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\* U.B.T. is "Unite de Betail Tropical" where 10 U.B.T. corresponds to 10 head of cattle, 7 head of camels, and 60 head of sheep and goats.

of deep wells gives the location, number, coordinates, depth, yield, water quality, static water level, and geology of 256 wells, indicating also whether the well is equipped with a pump or capped.

The report also contains data on the construction and equipment costs of the different types of wells, recurring costs, and the cost per cubic meter of water.

Advantages and disadvantages of the different types of wells and equipment are listed (rope and bucket, hand and foot pumps, diesel electric, solar and wind pumps) and evaluated on the basis of cost, maintenance problems, pollution (open or closed wells), sufficiency of water yield and user familiarity with the type of well and equipment.

The final result of the UN report MAU-77-002 are maps that feature much of the above described information: extent and depth of groundwater, location of dry wells and producing wells, seasonal water sources saline aquifers, geology, topography roads and more. The map consists of three large sheets that cover the country on a scale of 1:1,000,000. The information in the report is based on actual field data and tests by U.N. teams over a three year period and certain supplemental information provided by GIRM.

#### 3.4 Review of Gannett Fleming Corrdry and Carpenter, Inc. Report

This report, entitled Assessment of Environmental Effects of Proposed Developments in the Senegal River Basin was prepared for the Organisation pour la Mise en Valeur du Fleuve Senegal. Only the undated edition entitled Partial Report for Groundwater was reviewed. This section described aquifers of the Senegal River basin including portions of it in Mauritania. Although the previously described UNDP report portrayed aquifers in map form no descriptive notes about them were included. For informational purposes the description of those aquifers were exerpted from the Gannett Fleming Corrdry and Carpenter report and are included in this report as Appendix E.

#### 3.5 Review of the USAID/Mauritania 1983 Disaster Plan

This document provides basic historical information on the disaster and disaster relief organizations (including American and international) and provides useful background information. Since the document dealt primarily with food, communications, and other matters not related to water it was not felt necessary to extract any of the materials for purposes of this report.

Population figures were thought to be of interest but the document only provided generalized population tables. Instead, population figures adopted for the current immunization program have been included as Appendix C. While this list is felt to be only an approximation of the population it is the best that is currently available.

### 3.6 Review of World Health Organization (WHO) July 1983 Report

The WHO report entitled Project ICP/BSM/002 (2eme version), Etude sur la Planification du Secteur Eau Potable Et Assainissement, Republique Islamique de Mauritanie Decennic Internationale de l'Eau Potable et Assainissement is a planning document for hydraulic projects to be undertaken during the 1981-1990 International Water and Sanitation Decade. The report is extremely long and some of the "facts" on the current situation should be taken, however, with a great deal of reservation. The report contains GIRM supplied data that could not be confirmed by WASH team observations. The various sections of the Direction de l'Hydraulique, for instance, and the professional specialists and technicians therein appear to exist only on paper. However, when used with proper caution, the report presents a great deal of useful data such as, for example:

- (a) Water supplies for larger towns (1,200 to 20,000 peoples) population numbers, current and potential future water sources.
- (b) Population distribution and type (nomadic, rural and urban)
- (c) Total water requirements for (b) above
- (d) List of water and sanitation projects with guaranteed funding as of July 1983
- (e) Balance sheet for water and sanitary projects as of November 1982 (moneys spent and moneys allocated until 1985)
- (f) List of water and sanitation projects scheduled for the Water Decade. Starting dates, foreign and local money components, numbers of beneficiaries.
- (g) Government departments involved in water and sanitation projects. Direction de l'Hydraulique, Societe Nationale d'Eau et d'Electricite (SONELEC), Direction of Rural Development (SONADER), Direction de la Sante. Their legal responsibilities, organization, personnel, projects completed 1973-1983, future projects.
- (h) Personnel requirements and training needs until 1990
- (i) Detailed lists if projected water and sanitation projects until 1990. Time schedule, and foreign and local financing.
- (k) Population projections 1980-2000 for Nouakchott, other urban areas, rural sedentary populations, and nomadic populations.
- (l) Mauritania Aquifers, possible yields from hand dug wells and deep wells in cubic meters per hour.
- (m) Cost of hand dug wells and deep wells
- (n) Number of hand dug and deep wells required until 1992

- (o) Criteria for choosing the method (i.e., rope and bucket, handpump, motorized pump) of using wells such as yields required, capacity of aquifers, livestock or human use.
- (p) Cost of pumped water (by hand or by motor).
- (q) Total cost, and cost distribution, for building 735 deep wells and 1,000 hand-dug wells, with an average depth of 37 meter, during the Water Decade.

### 3.7 Review of November 1983 GIRM Emergency Action Plan

#### 3.7.1 Summary and Comment

The plan differentiates three types of wells and water supplies according to use, (i.e., domestic, livestock, and agricultural) and concentrates on the first two which generally serve a common purpose.

This document includes a tabulation of the equipment of the nine well building brigades and its condition. The brigades are responsible for constructing open, large diameter wells only. This tabulation appears overly optimistic since the two brigades visited (Aleg, Tjikikja) had neither usable equipment nor explosives (compressors, jackhammers, air pumps, trucks, dynamite). These two brigades were operational but only where wells could be completed in unconsolidated sands. Another tabulation shows the water sources of the major population centers, the organization responsible for water supply, and the open wells and deep wells programmed for 1983-84.

The GIRM plan also lists the necessary machine spare parts, materials, dynamite, gas and oil, etc., to keep one team in each of the nine brigades going. Each brigade generally has two or more teams. This list shows no trucks or Landrovers although the trucks of the brigades visited were beyond repair. Total cost of listed equipment is 24 million UM (\$480,000).

The list from the Direction Hydraulique and the two visited brigades are more detailed and realistic. These separate lists are attached as Appendix D.

The brigades do not drill deep wells (forages). They build only the large diameter (1.80m) open wells (puits peu profonds) which are up to 75m deep. Brigades also deepen, clean, and repair existing open wells. In sandy soil, they do one meter in three-to-four days. In rock they do six meters per month.

The only livestock pasture left in Mauritania is in the Gorgol, Guidimaka, and Hodh regions in the southern and southeastern part of country. That is where the nomads and their herds are concentrated. The Emergency Plan schedules seven open livestock wells for this area at a cost of 13 million UM (\$260,000). The GIRM plan notes that Fond Europeen de Developpment (FED) is financing the complete re-equipping of two well building teams in southeastern Mauritania. Also, in the Hodh region a "hydraulic program" is about to start which consists of partial re-equipping of two well building teams and some 20 open wells; the origin of such financing is not furnished.

Due to the planned actions described above, the budget of the Emergency Plan does not include money for the two Hodh areas nor for the domestic well program of the Kaedi and Aioun well brigades. The planned actions will serve both for human and livestock water supply.

The Emergency Program foresees the equipping of 20 existing deep wells with diesel generators and pumps at a cost of 30 million UM (\$600,000). It is noted that these should be selected from the list of existing deep wells contained in the GIRM Emergency Action Plan.

This list shows 18 deep wells along Nouakchott-Kiffa road with yields of 20-50 cubic meters per hour of which five are supposed to be equipped. The list is not correct since it is known for a fact that the two "equipped" wells at Makta Lajar are non-existent. Also, there appeared to be other wells with equipment along the road, although equipment was usually not in operating condition.

This list also shows 38 non-equipped deep wells between Kiffa-Timbedgha.

This list shows nine "equipped" wells that were drilled under the 1973 Emergency Plan. Nothing is known about these wells and their conditions.

The list does not include any of the 36 transit-forage program wells of which 26 were completed according to a verbal report from the UNDP. Director in Nouakchott.

## Chapter 4

### COMMENT ON PUBLIC HEALTH CONDITIONS

#### 4.1 General Discussion

The USAID funded Mauritanian Project No. 682-0202 for Rural Medical Assistance for the Trarza Region was closed out as of December 1982. One of the elements of this program was the training of community health workers.

A new program for which a request for proposals is now being circulated is entitled Mauritanian Rural Health Service (682-0230). This new training program, along with many other activities, calls for retraining of approximately 150 community health workers in the Trarza Region, 50 in the Guidimaka Region and 50 in another region not yet selected. The observations of the WASH team is that such programs are badly needed.

Along with a program of providing more and better water the WASH team observed that there was almost a total lack of awareness among all levels of Mauritanian society of the relationship of drinking water to health. The same might be said about personal hygiene and sanitation.

For immediate and long term interests the possibility of providing some basics community health information and skills to midwives and nurses who attend MCH Centers in other regions is recommended.

At the one such center visited at Bogue the Chief of the MCH Center requested information on better and larger capacity filters than the commercial candle type filter now used.

#### 4.2 Public Health and Communicable Disease Problems

The severity of the present drought has resulted in a lowering of the general villagers standard of living to one that is bare subsistence. For a majority of the population even this level is maintained principally by the governments distribution of food.

Because of the bare subsistence of the great majority of the population their resistance to disease is very low. AID/Nouakchott personnel have told us that nutritional status reports received from trained observers during the summer of 1983 and since indicate extreme levels of moderate to severe malnutrition in drought stricken areas. In the last few months USAID, GIRM and other donor nutritional survey teams (in the field) have verified these reports. Also, Catholic Relief Services records and Red Crescent/Red Cross reports show 40 to 70 percent of the population under five years suffer significantly from malnutrition in various drought stricken areas according to the WHO weight/height ratio standard employed in the development of this information. Of even greater concern is the fact that in some areas over 10 percent of all children from 0.5 to 5 years of age could be termed severely malnourished.

USAID is actively engaged in assisting GIRM to mitigate the problem described above through food distribution. Also, in regard to public health a number of significant activities have been initiated including an ambitious immunization program. However, in addition to the serious need to improve and augment water supplies (described in other sections of this report) a definite need exists in basic public health education of the general population. Even nurses and nurse's aids who staff rural health centers appear to be interested in, but unfamiliar with, how disease are transmitted beyond some vague concept about polluted water supplies.

## Chapter 5

### RECOMMENDATIONS

#### 5.1 Recommended Immediate Action: USAID/Mauritania

Under present circumstances suffering and dislocation are inevitable. However, efforts should be made to minimize the problems where it is possible to do so. Information gathering is an initial step, and the WASH Team recommends that USAID/Mauritania immediately enlist the cooperation and assistance of Peace Corps volunteers to assess the water supply status of the villages in Trarza, Brakna, and other regions or parts of regions which are to receive assistance. This need not wait for Washington-based decisions or concerns regarding AID understaffing, budget cuts, or other commitments. The planned visit of the Design Team for Human Resources should be delayed if it would interfere with such an effort. No interjection of expertise is required, only a basic understanding and some management skills. Preparation of instructions can be minimal.

Field personnel engaged in the activity should be provided maps and a list of villages to be visited. Some form of measuring device should be provided like a 30 meter steel tape and a two meter long (jointed or folding) weighted stick provided with a means to attach it to the tape. This stick should be left unpainted so that the wet and dry areas are readily visible. If steel tapes are not available, an improvised reel and strong cord with an alternative means for measuring will be needed. The reel and cord (approximately 70 meters long) should be standard equipment for measuring deep wells. Also a record form should be prepared for the field teams.

The record form should include blanks upon which to record the following:

- o Name of village and number of people in the village.
- o If village is without a well, what is the source of water?
- o Where is present water source (name, type, and distance)?
- o If former or present supply is a well or wells, then:
  - how many wells?
  - village population
  - was or is well (or wells) used by other than local villagers? By approximately how many people?
  - has well been deepened by blasting (either at original construction or at a later date)
  - well diameter (measured on the spot)
  - depth of well (measured on the spot)
  - depth of water as shown on 2 meter stick by wet mark (if over 2 meters tie or tape flags at 3 and 4 meters and estimate depth by visual observation of flags in respect to water level)

If the well is dry, field personnel should explain clearly to villagers that it can be deepened and it should not be filled in with rubbish as has been observed in some instances.

The form should include the date and identity of team members.

A separate activity that should be initiated without need for special technical assistance and where Peace Corps volunteers might also be utilized is in the development of portable sand filters at health centers. Among a weakened population a patient or family member visiting a rural health center can spread disease if a safe source of drinking water is not available. USAID/Mauritania could finance 55 gallon drum sand filters in kit form (UNICEF or comparable design plans are available in the AID office) (see instructions, Appendix F). Peace Corps volunteers could provide instruction in assembly and operation of these filters at a basic instruction site where food, return transport, and a filter kit would be provided a rural health center staff member.

## 5.2 Recommendations Specifically for OFDA

Actual specific recommended OFDA involvement and estimates for dollar funding necessary to support such involvement is as follows:

<u>Duration</u>	<u>Activity</u>	<u>\$ Funding Estimate</u>
<u>1 year</u>	<u>Emergency Water Program Monitor</u> (personal services contract) to provide management and coordination to the overall program.	\$130,000 to \$150,000
<u>14 weeks</u>	<u>Well Program Advisor</u> to help develop the program details and provide the necessary expertise to instruct PVO personnel in the various program elements and actually engage in certain field activities necessary to insure that activities are appropriate or change direction if necessary.	\$57,000 to 65,000*
<u>7 weeks total</u>	Short Term Experts/Technicians - two at 30 days each - estimated for assistance in pump and mechanical problems (mechanical pump man deemed mandatory for pump specifications and installation supervision).	\$27,000 to 32,000*
	8 mechanical (animal powered) pumps including installations	<u>28,000</u>
	TOTALS	\$242,000 TO 275,000

\* Contract with a firm for services.

### 5.3 Suggested Intermediate and Long-Term Water Supply Improvements

The following is a list of suggestions for intermediate and long-term water supply improvements. In connection with these less urgent improvements, the presence in country of capable and knowledgeable persons for the emergency program should be used to undertake an assessment for some of the longer term proposed activities. Where such is appropriate it has been so indicated.

- o Replacement of GIRM's hand dug well Brigades equipment and supplies where appropriate. This is urgent but effects are intermediate (six months to one year). United Nations funding and management is anticipated (PL 480 local currency transfer to dollars uncertain).
- o The aquifer used along the Senegal River between Boghe and Rosso consists of sand with some clay. The unconsolidated sands provide an excellent potential for installing small diameter wells by simple drilling techniques and simple locally fabricated equipment. Hand augering, dry bucket digging, sludger drilling (widely used on the Indian Subcontinent) or water jetting all appear possible. PVO personnel, with little experience, can direct fabrication of equipment and provide training in methods felt most appropriate. Small diameter wells will require handpumps; Red Crescent experience with handpumps is encouraging and it would be desirable to provide evaluation of the above within the emergency time frame if possible.
- o Assess problems relating to repairs and parts replacement necessary to operate diesel generator pumping units for which GIRM accepts responsibility.
- o Training program for well pump operators in preventive maintenance procedures and keeping pumping equipment from breaking down.
- o Assess repairs necessary to put the 4th Ingersol-Rand drilling rig into operation.

In connection with public health intermediate and long-term programs a program for instruction and assistance in improved latrine design and expansion of program of personal hygiene education should be incorporated into the Rural Health Service Project (682-0230).

APPENDIX A

Memorandum from Martin D. Howell  
of AID/OFDA to Vic Wehman AID/S&T/HEA

November 28, 1983

MEMORANDUM

FOR: S&T/HEA:Mr. Vic Wehman  
FROM: D/OFDA:Martin D. Howey *M.D.H.*  
SUBJECT: Mauritania Drought Disaster - Request for Technical Assistance  
from WASH Project

USAID Mauritania has requested a technical assessment of hydrological conditions of subject disaster (See Nouakchott 4982 and 5213, attached). OFDA is therefore requesting the assistance of the WASH Project in providing a technical assistance team to carry out the following efforts:

- 1) Identify emergency disaster relief activities needed to assist the GOM in providing water and sanitation facilities to the drought stricken areas of that country; and
- 2) Identify targets of opportunity for long term health, water, and sanitation actions arising out of the drought emergency.

We are requesting that the team will consist of the following specialities:

- Hydrogeologist/well driller
- Public Health/Sanitation Expert
- Board based water resource engineer

The team should arrive in Mauritania in late November or early December. During their stay in-country they will work with the Mauritania Commission for Food Security (CSA) and they will serve as the liaison with the Ministry of Hydraulics and Energy.

Please provide OFDA a copy of the team's final report. Your assistance in this effort is greatly appreciated.

Attachments: a/s

APPENDIX B

USAID/Mauritania  
WASH Team Briefing Documents

## memorandum

DATE: November 30, 1983 *Chris Brown*

REPLY TO  
ATTN OF: Christopher Brown, OPI/HNP

SUBJECT: Drought Emergency Hydrological Assistance; Scope of Work for Wash Team.

TO: John Topik  
Ralph Preble  
Sguyen Sy Tin

First, on behalf of the Drought Assistance Team and the Mission, I'd like to welcome you to Mauritania and thank you for your willingness to come here on such short notice and so late in the year. This folder contains some essential information on life in Nouakchott, as well as background information on the progress to date of drought assistance efforts in water and sanitation. This memo will provide a rough scope of work for your visit. A calendar of activities for the first week and a half is attached.

For the past month, the GIRM and the principal foreign donors have been meeting as the "Commission Nationale d'Assistance aux Populations Eprouvées par la Secheresse" to develop a "Plan d'Action" and implement emergency assistance activities. This plan has been completed and, in the area of water resources development, three proposals have been put forward:

1. Human Water Supply: This proposal focuses on strengthening regional well drilling teams to permit the deepening and rehabilitation of village wells;
2. Animal Water Supply: This component includes exploration, construction and rehabilitation of wells for livestock use, concentrated in the Guidimaka, Gorgol, and the southern part of the two Hodh regions; and
3. Integrated Water Supply: This element consists of the rehabilitation, including installation of diesel or electric pumps on 20 to 25 wells situated along the main east-west highway, for integrated human, small livestock and guardening uses.

.../...

As outlined in the memos enclosed in this packet, there are drawbacks from USAID's point of view with each of these proposals. USAID's major considerations in hydrological drought assistance could be summarized as follows:

- Our inclination is to avoid investing in livestock water supply activities. Such activities could accelerate desertification and encourage increase in herd size;
- USAID has committed itself to assisting primarily, but not exclusively, the Trarza, Tagant and Adrar regions. The principal needs in water assistance, however, may not lie in these three regions;
- According to a recent CILSS financed national hydrological study (BURGEAP, September 1982), Trarza is the most thoroughly covered region in community wells, (90 percent of all communities over 100 people have wells) but Tagant, Gorgol, Guidinaka and Assaba have coverage rates of at most 25 to 30 percent ; and
- An important consideration in developing emergency water interventions should be the possible resettlement of elements of the rural population, and the water needs of the displaced people at the resettlement sites. Furthermore, this movement will for the most part be towards the seven regions situated along the Senegal River, which the BURGEAP study identifies as the priority areas for water resources development. (see attached map).

Based on these hypotheses, USAID would like to develop a set of short-term and medium-term water and sanitation interventions. In the short term, up to UM90 million (\$1.64 million) in 1981 PL-480 local currency generations are available for drought relief efforts, preferably oriented toward village water supply. UNDP has also proposed that up to \$1 million of possible grant funds be used in coordination with USAID for this purpose. In the medium-term, USAID is interested in developing a village water supply project with a private voluntary organization. Cables requesting expressions of interest have already been sent to several PVU's. To date, International Human Assistance Programs (IHAP) and care have expressed interest.

In order to fulfill these objectives, the following scope of work has been outlined for your visit:

1. Examine the GIRM "Plan d'Action" and the major documents and studies concerning hydrology in Mauritania to determine the feasibility and nature of an appropriate short-term USAID intervention, if any;

.../...

2. Identify the sites, if possible, for the emergency intervention;
3. Outline the administrative and technical steps required of USAID, the GIRM and other concerned parties over the coming six months to implement any emergency water and sanitation activities; and finally,
4. Comment on possible medium-term measures which USAID could fund in the hydrology sector.

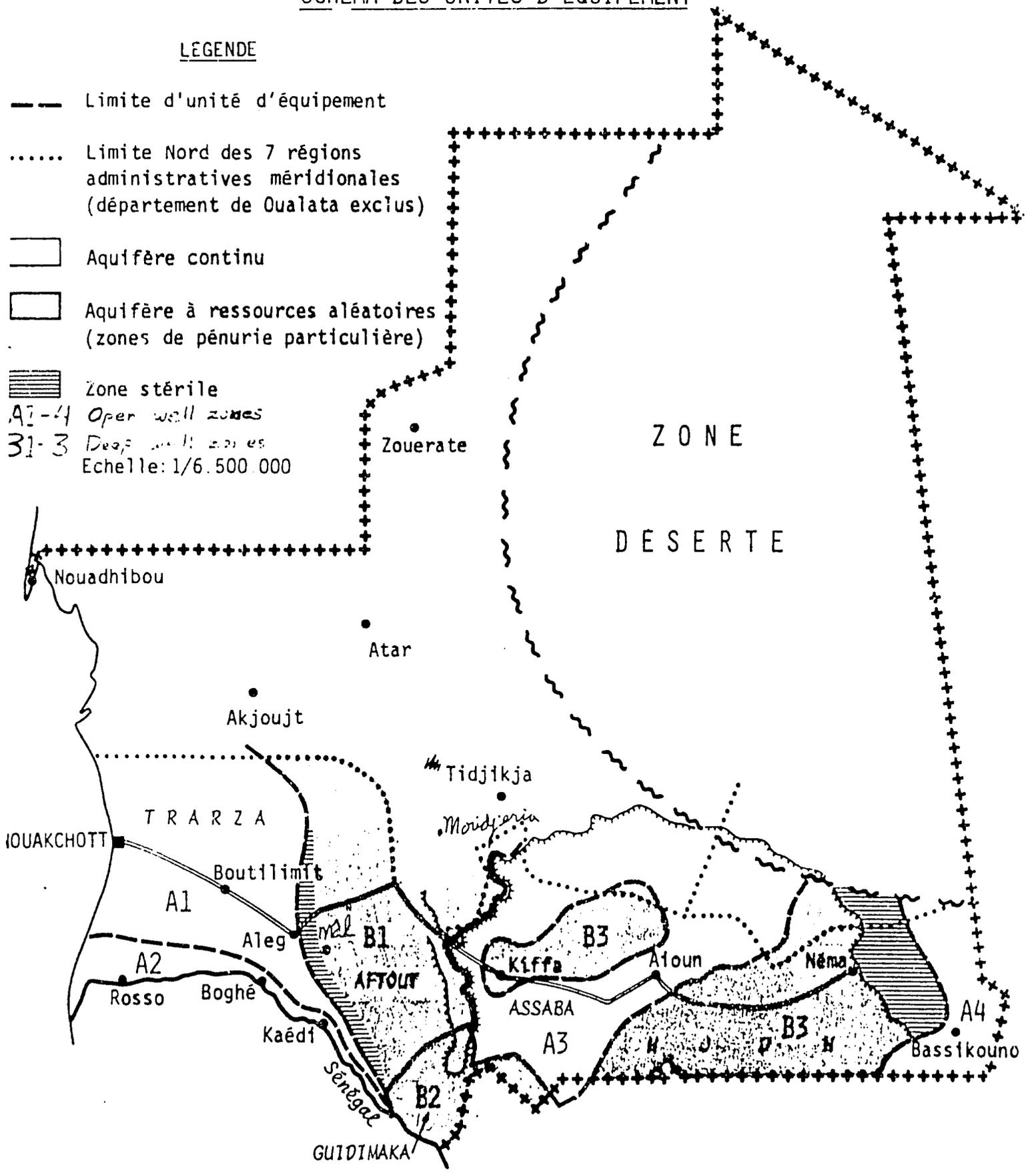
The attached calendar outlines a series of meetings on Saturday, December 3, to orient your efforts, followed by a field trip for five or six days beginning on Sunday, December 4. The proposed field trip itinerary would include two vehicles setting out together along the main highway and then separating, one to visit the Tagant region to the north, the other to visit the river regions of Brakna and Gorgol to the south. We expect that representatives of the Ministries of Water and Health will accompany us on this trip. Upon our return, you will be free to continue interviews and research, and draft your report. The final product expected from your visit is a finished report in English summarizing your findings and containing recommendations which respond to the above scope of work.

cc: Richard Goldman/SA/DIR  
Campbell McClusky/PROG  
Mike Kerst/OPI/F&A

SCHEMA DES UNITES D'EQUIPEMENT

LEGENDE

- Limite d'unité d'équipement
  - ..... Limite Nord des 7 régions administratives méridionales (département de Ouakata exclus)
  -  Aquifère continu
  -  Aquifère à ressources aléatoires (zones de pénurie particulière)
  -  Zone stérile
  - A1-4 *Open well zones*
  - B1-3 *Deep well zones*
- Echelle: 1/6.500.000



WASH TEAM CALENDAR

Saturday, 3 Dec.

9:00 Meeting with Dr. Lo Boidé CNH

10:00 Meeting with Director of Plan, Assane Diop

11:00 Meeting with Mr. Sidi El Moktar, Director of Water

Sunday, 4 Dec.

Leave at 06:30 for field in two vehicles:

Vehicle A: (Ralph Preble, John Topik, Chris Brown,  
Ministry of Water Rep.)

Vehicle B: (Sguyen Sy Tin, Betsy Brown, Ahmed Salem O/ Mohamed Vall,  
Medecin Chef of Brakna)

Spend night in Aleg or Mâl (both vehicles)

Monday 5 December.

Vehicle A: reaches Kaedi

Vehicle B: reaches Moudjéria

Tuesday 6 December: Vehicle A reaches Tidjikja  
Vehicle B stays in Kaedi area

Wednesday, 7 Dec: Vehicle A visits oasis near Tidjikja  
Vehicle B reaches Bogue

Thursday 8 Dec. Vehicle A return to Nouakchott  
Vehicle B returns to Nouakchott

WASH TEAM FIELD TRIP

Monday, 5 December

Vehicle A : (John Topik, Chris Brown, Ministry of Water Rep.)

CRS Vehicle: (Steve + Jill Hilbert, Mr. Hoang)

Vehicle B : (Ralph Preble, Nguyen Sy Tin, Betsy Brown, Ahmad Salem O/  
Mohamed Vall)

Spend night in Aleg or Mâl (all vehicles).

Tuesday, 6 December

Vehicle A and CRS Vehicle: Reach Kaedi via *Monguel*

Vehicle B : Reaches ~~Moudjeria~~

Wednesday, 7 December

Vehicle A and CRS Vehicle: Reach Tidjikja

Vehicle B : Stays in Kaedi Area

Thursday, 8 December

Vehicle A and CRS Vehicle: Arrive in Moudjeria

Vehicle B : Reaches Boghe

Friday, 9 December

Vehicle A and CRS Vehicle: Return to Nouakchott

Vehicle B : Returns to Nouakchott

December 15 - 16

Possible second field trip overnight to Rosso, Boghe and back.

## memorandum

DATE: November 27, 1983

REPLY TO  
ATTN OFChris Brown, OPI *Chris Brown*SUBJECT: Drought Emergency Hydrological Assistance;  
Meetings at Ministry of Plan

TO: Peter Benedict, DIR

On Sunday, November 20 and Wednesday, November 23, meetings were held at the Ministry of Plan, under the chairmanship of Mr. Assane Diop, Director of Planning, to discuss possible activities, and means of coordinating the various aid donors' efforts, in the area of hydrological assistance for the drought. UNDP was represented by Mr. Ake Nerman, the Ministry of Water by Mr. Donnat, a French technical advisor, and USAID by Chris Brown.

The first meeting began with a description by Mr. Donnat of the three main thrusts of the CMSN's water relief package contained in the "Plan d'Action." The most detailed proposal, he said, was a plan to refurbish and expand the network of livestock wells in the four regions where pastureland is expected to be available during the next year (Gorgol, Guidimaka, and the southern portions of the two Hodhs). This proposal met with a cool response from the others at the meeting, including Mr. Diop. The second component, also coolly received, was a vague proposal that significant amounts of well drilling equipment be purchased to strengthen the regional well drilling teams and permit exploration for new water points. The third proposal, which became the focal point of both meetings, was that approximately 24 existing (capped) wells situated along the national east-west highway be equipped with pumps for use by village communities for human, small scale livestock and gardening purposes. When asked whether 24 wells could be found along the road near existing communities, Donnat said that he believed that they could, but a field trip would be required to identify the actual sites. Diop then requested that Donnat prepare a report for Wednesday's meeting with as much detail about the potential sites as possible, including cost estimates for well rehabilitation.

Also at the Sunday meeting, Mr. Nermann announced that UNDP has reserved \$1 million for emergency water assistance, and that in conversations with USAID Director Benedict, had expressed the hope that USAID and UNDP could collaborate in this area. He implied that one possible use of his funds would be to procure well drilling or exploration equipment through U.S. excess property channels. For USAID's part, Brown indicated that a three person water and sanitation team was expected in Nouakchott during the first week in December, and that USAID would decide, with the team's assistance, which activities to fund with up to UM90 million (\$1.64 million).

in local currency Title II generations, which might be made available for that purpose. Nermann expressed the hope that this team could help guide the interventions of other donors, such as UNDP, which are also interested in this sector.

At the Thursday meeting, Donnat estimated that it would cost about UM50 million (\$910,000) to open 24 wells, and equip them with generators and electric pumps and some simple gardening and irrigation equipment. Donnat said that to fulfill the integrated purpose outlined for these wells, either an electric or a diesel pump would be required. Although the diesel pump is apparently cheaper to run, it is much more difficult to maintain in isolated locations. Diop summarized most of the participants' views when he suggested that the program's goals would have to be reduced to the point where most, if not all, of the wells targeted for emergency assistance, could be equipped with simpler, preferably human-powered pumps.

Diop requested that the USAID team be made aware of this possible project, and that it come to Nouakchott with as much information as possible on alternative well pump technologies. Donnat and Diop both stressed their ministries' willingness to facilitate, in any way possible, the work of the USAID hydrological team, and Donnat recommended that Mr. Terryre, another advisor to the Ministry of Water, be considered the Ministry's contact person on drought matters in the coming months.

cc: Richard Goldman, SA/DIR  
Mike Kerst, OPI/F&A  
Campbell McClusky, PROG  
John Topik, Ralph Preble, Sguyen Sy Tin, Wash/Hydro Team

OPI:CBrown:mmh 11-27-83

memorandum

DATE: November 27, 1983

APPL TO  
ATTN OF

Chris Brown, OPI *Dru Barron*

SUBJECT:

Drought Emergency Hydrological Assistance; Meeting with Dru Barron, FED.

TO:

Peter Benedict, DIR

*Share with [unclear]*

Mr. Dru Barron, FED Technical Advisor met with Peter Benedict, DIR, Richard Goldman, SA/DIR, and Chris Brown, OPI on November 22 to discuss his experience in water development activities in Mauritania, and to explore possibilities of donor coordination in this sector during the drought. The meeting brought to light several important constraints to water resource development activities in Mauritania and identified several major donor financed water projects currently under way. The following is a summary of the main points discussed.

Concerning the GIRM Plan of Action for the drought, Barron noted that it was inappropriate to invest large amounts of resources in livestock water supply, as this tends to increase herd size and accelerate environmental degradation. He felt that the GIRM's second proposal, to rehabilitate 24 wells along the east-west highway for integrated human, small livestock and gardening purposes, may suffer from some of the same weaknesses as the "36 Forages" Project. This project built 36 community wells, mostly in Trarza, for the same purpose but failed to generate the gardening, irrigation or water management activities which were to justify the investment. As for the third component of the Action Plan, (purchase of equipment) Mr. Baron noted that the Ministry of Water has great difficulty maintaining the equipment already on hand, and that the problem lies in the Ministry's inability to fund equipment maintenance and repair.

*C. Brown  
Obtain similar  
from*

A major policy constraint to water development in Mauritania, Mr. Barron said, was the lack of a GIRM water strategy. Although GIRM officials frequently stress the importance of water resource development, little effort or energy seems to be devoted to addressing the problem at the policy level. For example, it was 3 1/2 years after the start of the UN Water Development Decade (June 1983) that the GIRM finally formed its National Water Committee. According to Mr. Barron, this committee has yet to hold a substantive follow-up meeting.

.... / ....

Water resource development efforts are also constrained, said Mr. Barron, by an institutional conflict between the Ministry of Water and Energy's two main implementing arms: the Directorate of Water (Direction d'Hydraulique) and the electric power parastatal (SONELEC). Apparently these two organizations are both charged with development and maintenance of wells and their pumps. Hydraulique's current policy is to construct and install a well facility, and then require the local population to maintain it, virtually without outside assistance. SONELEC for its part, refuses to assist in maintaining any facility established by Hydraulique. A second aspect of the institutional problem is that the Directorate of Water claims that it has a monopoly on well exploration and construction in Mauritania, and therefore discourages efforts to directly involve communities in these activities. These problems are discussed in detail in a report entitled "Evaluation des Problèmes Techno-Economiques de la Direction d'Hydraulique", which USAID will obtain as soon as possible for the WASH hydrological team's reference.

The above constraints have hampered the progress of most of the current foreign donor financed water activities in Mauritania. The FED is currently working on urban water supply in Selibaby, Aioun and Atar, but progress is being slowed by disagreement with Hydraulique over the degree of community participation to be included in the design and rehabilitation of these supply systems. FED is also financing some livestock water development in its "Elevage dans le Sud-Est" Project, and is interested in funding the development of small-scale solar desalination facilities for Imraguen fishing communities along the coasts. UNDP has already established a solar desalination pump in one Imraguen village (Blawak) which is capable of producing 100 litres of water per day. UNDP is also funding, with the World Bank, the development of improved "village level operated and maintained" (VLCM) pumps. Mr. Barron thought that this research might provide some designs for use in an emergency water assistance program. Finally, GTZ is drilling for water/<sup>well</sup> Saudi financing in Tagant and Adrar. This program, however, seems to be encountering some resistance from local administrative authorities, who apparently hope to influence the selection of well sites.

Mr. Goldman suggested that in view of this experience, private voluntary organizations may be best suited to carry out village water supply activities in Mauritania. Mr. Barron agreed with this assessment, and at Mr. Benedict's suggestion, also agreed to organize a meeting between UNDP, GTZ, FED and USAID to discuss possible hydrological drought relief efforts.

.../....

cc: Richard Goldman/SA/DIR  
Mike Kerst/OPI/F&A  
Campbell McClusky/PROG  
John Topik, Ralph Preble, Sguyen Sy Tin WASH/Hydro Team

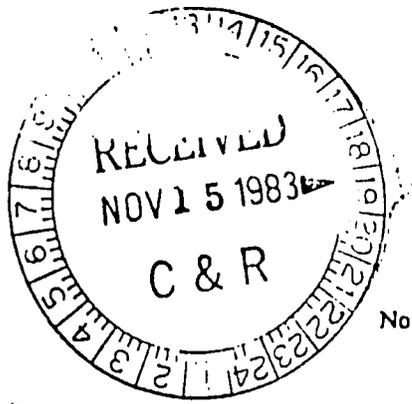


رئاسة الحكومة

Présidence du Gouvernement

مفوضية الامن الغذائي

Commissariat à la Sécurité Alimentaire



جمهورية الإسلامية الموريتانية  
République Islamique de Mauritanie

عدل - اخاء - شرف  
Honneur - Fraternité - Dignité

Nouakchott, le 15 NOV 1983

B. P. 377 - Tél. 514-58

Le Commissaire المفوض

N: 690

à Monsieur le Directeur de l'USAID

URGENT

NOUAKCHOTT

RECEIVED

NOV 15 1983

Suite à vos entretiens avec Monsieur le Commissaire et Monsieur le Ministre de l'Energie et de l'Hydraulique, j'ai l'honneur de vous informer que le Gouvernement Mauritanien compte utiliser le fonds de quatre vingt dix millions d'ouguiya de 1981 initialement destiné à la commercialisation de la production locale, pour la réalisation d'un programme de forages dans les régions affectées par la sécheresse et celles où existent des pâturages.

Le problème de l'eau se pose en effet dans ces régions de façon lancinante. Tout le bétail du pays sera par la force des choses concentré dans les régions à la recherche de pâturages, notamment dans le Guidimakha et le Gorgol. Ce bétail est déjà confronté au problème de l'eau.

Le programme envisagé doit permettre la réalisation de puits pastoraux avant le début de l'année pour répondre aux besoins créés par la difficile situation que connaît le pays cette année.

Je souhaiterai donc avoir la confirmation de votre accord pour l'utilisation des fonds précités pour l'exécution de ce programme.

Il est prévu ainsi que les fonds soient mis à la disposition des Gouverneurs des régions qui exécuteront les forages sous le contrôle technique de la Direction de l'Hydraulique. Bien entendu vos services seront associés à ce contrôle à travers l'expert que vous comptez faire venir en Mauritanie dans les prochaines semaines.

	C	NF
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GT		
MO		
DPI		
TA	X	
ANP		
FR		
IG		
CONF		
PH / TVL		
DATE		

Une étude détaillée sous une forme de requête vous parviendra incessamment. Mais le Ministère de l'Energie et de l'Hydraulique souhaiterait pouvoir disposer d'une avance sur le financement prévu de 20.000.000 UM afin d'acheter dès à présent sur place et dans les pays voisins les matériels et matériaux indispensables, strictement nécessaires aux ouvrages envisagés.

Je vous demande donc de bien vouloir m'autoriser à accorder cette avance./-

P. Le Commissaire Absent et P.O.

Le Commissaire Adjoint

MOHAMED OULD RADETTA

المندوب  
ال  
Commissaire

Ampliations

P/CMSN/CE

PM

M. E. H.

UNITED STATES OF AMERICA  
AGENCY FOR INTERNATIONAL DEVELOPMENT

Nouakchott, Mauritania

United States Address

USAID / Nouakchott

Agency for International Development

Washington, D. C. 20523

International Address

U. S. A. I. D.

Ambassade Américaine

Boite Postale 222

Nouakchott, Mauritanie

22 NOV 1983

Commissioner for Food Security  
Commission for Food Security  
Presidency  
Nouakchott, Mauritania

Dear Mr. Commissioner:

to

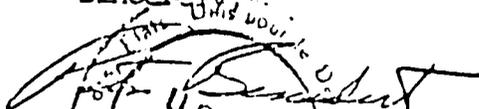
I have the honor of referring/CSA letter No. 690, dated 8 November 1983, concerning the proposed 90 million UM well drilling program for the regions of the country most severely affected by drought. As you know from our previous meetings and my meeting with the Minister of Energy and Water, the U.S. Mission in Mauritania recognizes the crucial role that alleviating the nation's water shortage can play in overcoming the hardships of this difficult period.

We look forward to receiving, as soon as possible, detailed project proposals for water projects. We will carefully review these proposals with the assistance of a team of hydrological experts who are expected to arrive in Nouakchott at the beginning of December. We will advise you of the team's arrival, and will send their curriculum vitae to the Minister of Energy and Water.

The approval of the request by the Ministry of Energy and Water for a 20 million UM advance must be postponed pending a resolution of a number of items. These items include, inter-alia, a detailed presentation of the project, a determination of administrative modalities and cash flow procedures, and an allocation of resources to the needs of the human as opposed to the animal population of the regions in question. The provision of drugs and food to help meet the needs of Tagant, Adrar, Trarza and other affected regions will not be effective unless there is also an adequate supply of water for human consumption.

We look forward to early resolution of our mutual concerns and in this context I have instructed Mr. Kerst, Mr. Hough and our Drought Relief Team to spare no effort in supporting the emergency activities of your Government.

Sincerely,

  
Peter Benedict  
Director  
USAID/Mauritania

cc: Commission Nationale Pour l'Assistance  
des Populations éprouvées par la Sécheresse, CMSN  
Ministry of Energy and Water.

APPENDIX C

Population Estimates

## ANNEX I

## Immunization Data

1. FIXED CENTER IMMUNIZATION TARGET POPULATION

1985 Population Estimate

Annual Population Incidence  
(from 1985 onwards, exclusive of rate of increase)

Region No./Name	Urban Center with MCH Clinic *	1985 Population Estimate		Annual Population Incidence (from 1985 onwards, exclusive of rate of increase)		
		Region Total	(Approx) Urban & Urban	for BCG, DTP, Polio 3-24 months (5%)	for Measles 9-24 months (4%)	Pregnant Women Tet. Toxoid (3%)
0) Nouakchott		503,000				
	Teyaret	49,150		2,450	2,000	1,500
	Ksar	69,200		3,450	2,750	2,050
	Toujounine	70,550	100	3,550	2,800	2,100
	T'vrakzein	26,600		1,350	1,050	800
	Sebkhia 1, 2	121,150		6,050	4,850	3,650
	Elmina 1, 2	166,350		8,350	6,650	5,000
1) Hodh El Charghi		148,000				
	Nema	12,000		600	500	350
	Timbedra	9,700	15	500	400	300
2) Hodh Charbi		120,000				
	Aioua	11,500		600	500	350
	Tintane	12,000	20	600	500	350
3) Assaba		135,000				
	Kiffa	17,400		850	700	500
	Guerou	7,200	18	350	300	200
4) Gorgol		70,000				
	Maghama	7,300		350	300	200
	M'Bout	7,100	27	350	300	200
	Kaedi	31,500		1,600	1,300	1,000
5) Brakna		160,000				
	Bababe	5,200		250	200	150
	Aleg	10,500	20	550	450	350
	Roghe	9,800		500	400	300
	Maghtar Lahjar	6,100		300	250	200
6) Trarza		230,000				
	Mederdra	4,600		250	200	150
	Boutilimit	12,200	20	600	500	400
	Rosso	30,300		1,500	1,200	900

Target Population and Vaccine Requirements  
 Annex I

TARGET POPULATION - IMMUNIZATION

Region No./Name	Urban Center with MCH Clinic	1985 Population Estimate			Annual Population Incidence (rounded)		
		Region Total	Urban	% Urban	for BCG, DTP, Polio 3-24 months (5I)	for Measles 9-24 months (6I)	Pregnant Women Tet. Toxoid (3I)
7) Adrar	Atar	58,000	22,000	38	1,100	900	650
8) Nouadhibou	Nouadhibou	28,000	27,400	98	1,400	1,100	800
9) Tagant	Tidjikja	70,000	13,000	19	650	500	400
10) Guidimaka	Selibaby	90,000	7,900	9	400	300	250
11) Tiris Zemmour	Zouerate	24,000	21,700	90	1,100	900	650
12) Inchiri	Akjoujt	16,000	10,050	63	500	400	300
<b>TOTAL</b>		<b>1,752,000</b>	<b>799,450</b>	<b>46</b>	<b>40,100</b>	<b>32,200</b>	<b>24,050</b>

NOTE: a) Region Totals from Office of Statistics, Ministry of Plan

b) Calculation basis for Nouakchott: 378,000 (1982 census of each arrondissement); for other areas: 1977 census.

c) Annual Rate of Increase for Nouakchott: 10% from 82-89  
for other urban areas: 7% from 77-85

\* The choice of fixed centers was made on the basis of a total population of 7,000 plus within a 5 km radius, with the exception of Bahabe, Haghtar Lahjar, and Mederdra.

2. MOBILE TEAM IMMUNIZATION TARGET POPULATION

B. MOBILE TEAMS

REGION Name	PREFECTURE	PROJECTED REGIONAL POPULATION in 1985			ANNUAL POPULATION INCIDENCE 1985		
		Total	Rural Sedentary	% Rural Sedentary	3-24 months (5%) (% of rural sedentary population only)	9-24 months (4%)	pregnant women (3%)
1) Bodh Charghi		148000	65000	44%	3250	2600	1950
2) Bodh Charbi		120000	58000	48%	2900	2350	1750
3) Assaba		135000	85000	61%	4250	3400	2550
4) Gorgol		170000	127000	75%	6350	5100	3800
5) Brakna		160000	99000	62%	4950	3950	2950
6) Trarza		230000	97000	42%	4850	3900	2900
7) Adrar		58000	24000	41%	1200	950	700
8) Nouadhibou		28000	1000	4%	No mobile team		
9) Tagant		70000	28000	40%	1400	1150	850

10) Guidimaka	90000	77000	85%	3850	3100	2300
11) Tiris Zemmour	24000	3000	17%		No mobile team	
12) Inchiri	16000	2000	13%		No mobile team	
TOTAL	1249000	666000	53% <sup>1/</sup>	33000	26500	19750

<sup>1/</sup> This is 38% of 1985 National Population total of 1,752,040 including Nouakchott population of 503,000.

**APPENDIX D**

**Lists of Requested Materials and Equipment for  
the Government Well Construction Teams**

LISTE DU MATERIEL NECESSAIRE

1 Berliet  
1 Compresseur : marteau picqueur - marteau perforateur  
50 m tube flexible  
1 treuil  
1 cofrage 1,80 m  
1 cofrage de 1,36  
Sceaux 8  
Pioches 8  
Pêles 8  
1 tente  
1 boite pharmacie  
Dynamite  
Detonateur

6 équipes = 6 x 10 = 60 personne

BRIGADE TIDJIKJA

REMISE EN ETAT DU MATERIEL

1) MATERIEL ROULANT ET ENGIN

-	Remise en état du camion Berliet .....	600,000 UM
-	Remise en état de la Land Rover .....	400,000
-	Pièces détachées pour 2 compresseurs.....	450,000

II) MATERIEL DE FORAGE

-	3 marteaux perforateurs .....	450,000
-	3 marteaux piqueurs .....	300,000
-	4 pompes à air comprimé .....	600,000
-	600 m de tuyaux A-C .....	200,000
-	Materiel divers (           aiguilles etc).....	500,000

III) MATERIAUX

-	1500 bg d'explosifs .....	1,000,000
-	6000 détonateurs .....	600,000

DIRECTION DE L' HYDRAULIQUE

Service de l'Infrastructure Hydraulique

Bureau de l' Hydraulique Pastorale

-----

*List of Requested Material  
for the Brigades that dig  
Large Diameter (1.80m) Open Wells  
(Puits)*

-= LISTE DE MATERIEL POUR BRIGADES HYDRAULIQUES = -

Pouvant être acquis sur Fonds USAID

Désignation des Matériels	Quantités
: Camions 4x4 Moteur Diesel, charge utile 8 tonnes, porteurs de treuils :	12 Un:
: Treuils mécaniques, Force à brin = 1200 kgs, hauteur sous fleche 3,50 :	
: mètres, longueur de cable enroulée en $\varnothing$ 10 mm = 150 m. Moteur Diesel :	12 Un:
: Camions citernes 4x4, moteurs diesel, capacité 6000 l. :	12 Un:
Rouleaux de cable d'acier anti-giratoire $\varnothing$ 10 mm en rouleaux de 1000m:	3 Un:
: Foreuses de reconnaissance, légères, pour recherche en $\varnothing$ 1, 1/2 et 2 :	
: pouces en rotary, pour reconnaissance peu profonde. :	6 Un:
: Lots d'équipements complets pour 100 mètres pour foreuse ci-dessus:	6 Un.
: Foreuse de reconnaissance légère, type warsop, pour reconnaissance :	
: en rotation et percussion dans terrain rocheux :	12 Un:
: Lots complets d'équipement pour foreuse ci dessus, pour 100 mètres :	12 Un:
: Compresseurs à pistons, Moteur Diesel, débit 2400 l.mn. à 7/8 kgs cm2:	
: sur skid :	10 Un:
: Marteaux perforateurs, 18 à 20 kgs emmanchure 22 Hex 108 mm, à air :	
: comprimé ( pneumatique ) :	20 Un:
: Fleurets lonobloc pour marteaux perforateurs ci-dessus L = 800 mm :	1000 ":
: Marteaux piqueurs, de 20 kgs, pneumatiques ( à air comprimé ) :	20 ":
: Aiguilles pour marteaux piqueurs ci dessus :	1000 ":
: Quadripodes avec deux tubes reliés en échelle. hauteur sous tete de :	
: l'usage 3.50 mètres = 7.00 mètres	

-- LISTE DE MATERIELS POUVANT ETRE ACQUIS --

Fonds USAID . ( Suite )

-----

: Désignation des matériels	: Quantités	:
: Palans à Chaîne force 5 Tonnes	: 30 unités:	
: Crochets de sécurité pour levage 5 tonnes	: 30 " :	
: Tuyaux pour conduite air comprimé à 8 kgs cm2 ( Drilling) Ø 19 mm	: 1000 metres	
: Tuyaux pour pompes d'exhaure au diamètre de l'orifice de refoulement:		
: des pompes pneumatiques à membrane ou palettes décrites ci dessous	: 1200 " :	
: Pompes pneumatiques à membrane ou palettes débit 15 M3 d'eau à 1'		
: heure sous 25 mètres de colonne d'eau	: 10 unités:	
: Raccords express pour tuyaux à air comprimé Ø 19 mm	: 200 " :	
: Raccords express pour tuyaux d'exhaure des pompes pneumatiques	: 200 "	
: <u>PIECES DETACHEES DE REPARATION ET ENTRETIEN POUR 3 ANS</u>		
: Four camions portreuil 4x4 Diesel C.V. 8 tonnes en lots	: 12 unités:	
: Four camions 4x4 citernes de 6000 l.	: 12 " :	
: Four treuils à moteur Diesel, force levage 1 brin = 1,2 Tonnes	: 12 " :	
: Four foreuses de reconnaissance légères en lots pour rotary	: 6 " :	
: Four foreuse de reconnaissance legeres en lots pour percussion		
: rotation	: 12 " :	
: Four compresseurs à Pistons; moteur Diesel, débit 2400 l.mn. à 7 kgs	: 10 lots :	
: Four marteaux perforateurs 18 ou 20 kgs pneumatiques lots	: 20 " :	
: Four marteaux piqueurs de 20 kgs , pneumatiques lots	: 20 " :	
: Four pompes à membrane ou palettes , débit 15 M3H sous 25 mCE lots	: 10 " :	
: _____		

REPUBLIQUE ISLAMIQUE DE MAURITANIE  
MINISTERE DE L'HYDRAULIQUE ET DE L'ENERGIE  
DIRECTION DE L'HYDRAULIQUE  
SERVICE INFRASTRUCTURE DE L'HYDRAULIQUE

NOUAKCHOTT le, 14 Novembre 1983

BUREAU FORAGE  
05/83/027

*List of Requested Material  
for  
Deep Well Drill Rigs.  
(Forages).*

Objet : liste de matériel suite  
à proposition de l'USAID

Le Chef du Bureau Forage

à

Monsieur le Directeur de l'Hydraulique  
S/c du Chef de Service de l'Infrastructure Hydraulique,

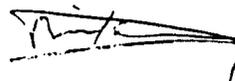
Veillez trouver ci-joint une liste de matériel de forage  
suite à la proposition de l'USAID.

Il n'est pas souhaitable de diversifier notre matériel,  
pour des raisons de pièces de maintenance, c'est pourquoi  
j'ai précisé la marque de la sondeuse de reconnaissance ainsi  
que celle du compresseur avec son débit et sa pression néces-  
saires à nos outils, (il est évident que si le compresseur  
ne répond pas aux caractéristiques que nous demandons, il  
sera sans utilité pour le bon fonctionnement de nos outils  
de forage).

En ce qui concerne les outils complémentaires à nos  
sondeuses, ceux-là doivent se trouver, puisqu'ils répondent  
aux normes américaines.

Le Chef du Bureau Forage

Denis CRISEMUR



LISTE DE MATRIEL :

1 Sondeuse de reconnaissance rotary - marteau fond de trou, marque "cyclone-drill Ingersoll Rand" montée sur camion tout terrain et entraînée par un moteur auxiliaire. 50 tiges  $\emptyset$  3".

5 masses tiges  $\emptyset$  3"  $\frac{1}{2}$

1 pompe à boue Gardner-Denver 5 X 6 montée sur le camion

1 Compresseur mobile marque ingersoll/rand caractéristique : 21m<sup>3</sup> à 17 bars

1 lot de réductions pour tiges, masses - tiges et tricônes

2 camions - citerne de 8000 litres

Pièces détachées permettant 3 années de fonctionnement pour :

- moteur camion porte-sonde
- moteur auxiliaire entraînant la sondeuse
- compresseur
- parties mécaniques et hydrauliques de la sondeuse
- pompe à boue
- moteur camions-citerne

OUTILS COMPLEMENTAIRES A NOS SONDEUSES

2 REDUCTIONS 6 5/8 REG API X 2 7/8 IF (FXF)  
 2 " 6 5/8 REG API X 2 7/8 IF (IXF)  
 2 " 6 5/8 REG API X 6 5/8 API (FXF)  
 4 " 3 1/2 REG API X 2 7/8 IF ( FXF)  
 2 " 7 5/8 REG API X 6 5/8 REG API (FXF)  
 2 " 3 1/2 IF X 2 7/8 IF (IXF)  
 2 " 4 1/2 REG X 2 7/8 IF (FXF)

4 TETES DE LEVAGE 2 7/8 IF  
 2 " " 2 3/8 F E  
 2 " " 6 5/8 REG  
 2 " " 7 5/8 REG

10 TRICONES Ø 17" 1/2 (terrain tendre)  
 10 " Ø 15" " "  
 10 " Ø 8" 1/2 " "  
 10 " Ø 8" 1/2 (terrain dur)  
 20 " Ø 6" 3/4 " "  
 20 " Ø 6" 1/4 " "  
 20 " Ø 4" 1/2 " "

APPENDIX E

Description of Groundwater Aquifers Excerpted from Gannett  
Fleming Corddry and Carpenter Report

1. Description of Ground water Aquifers

The following description of aquifers within the Senegal River Basin is taken from the Partial Report for groundwater prepared by Gannett Fleming Corrdry and Carpenter, Inc. in association with ORGATEL Societe Africaine d'Etudes Techniques (Dakar, Senegal) for the Organisation pour le Mise en Valeur du Fleuve Senegal (OMVS). The numbers assigned to the different aquifers provide reference to the map location for these aquifers as shown on the location of Aquifers map (Fig. 4.2.-1).

The aquifers in Mauritania have a wide range of characteristics. The alluvial valley of the Senegal River is composed of unconsolidated deposits: whereas, the bedrock exposed near M'Bout is predominantly granite and schist.

Senegal River Alluvium (1)

This unconfined deposit is composed of sand, clay and gravel, and is permeable. Recharge of this general aquifer is from the river channel, floodplain inondation and direct infiltration of rainfall. While the size of the resources is small due to its limited area, it is very significant as a source of water to the inhabitants of the valley. Wells tend to be shallow (2-10 meters) and can be easily dug by hand. For bored wells, flows up to 30 cu m/hour with a two meter drawdown are possible (BRGM, 1975).

Dune Sands (2)

Dune sands formed and transported by wind cover a large part of Mauritania. They intrude into the Senegal River Basin near Kiffa. Potential water yields vary with the morphology but is generally low due to the low degree of recharge from rain.

Continental Terminal (3)

This formation was deposited during the end of the Tertiary geologic period throughout most of Senegal and parts of Mauritania. The sources of recharges are infiltration of rain and water from the downstream reaches of the Senegal River. The formation consists mostly of sand with some clay. Although the aquifer thickness varies, it is typically about 100 to 200 meters thick (BRGM, 1975). The aquifer is unconfined or semiconfined depending on its relationship to clay layers. The average capacity is 30 cu m/day per meter of drawdown (BRGM, 1975), although it is reported that this value can vary widely.

Eocene Limestone (4b)

This unconfined, discontinuous aquifer is composed mostly of limestone and dolomite. The Continental Terminal formation covers it to the west of the Kaedi Alegona, and it is bordered on the east by schist in the PreCambrian crystalline formation. Piezometers have indicated that the Senegal River provides some recharge to this formation. The available flows from wells indicate that values up to 100 cu m/hour can be obtained.

Dry Limestone Formation (9a)

BRGM (1975) does not consider this formation to be a source of groundwater and refers to it as biseau sec (dry crust) or zone sterile.

Cambrian Sandstone (11)

This formation is a discontinuous aquifer and consists of sandstone and some clay. There are also local minor deposits of limestone, and dolomite. Water is usually found in small pockets of alluvium, shallow alternations and fractures. Typical flows are 0.5 to 2.0 cu m/day.

Precambrian (12)

This bedrock formation is composed predominantly of schist and granite. The outcrop or portion of the formation exposed to overlying soils extends along a north-south axis along the eastern border of the Senegal-Mauritanian sedimentary basin. It is usually necessary to drill to depths of 100 to 150 meters to obtain sufficient water yields. Maximum flows are normally on the order of 25 cu m/day. However, at Akjoujt it is possible to attain flows of 1000 to 2000 cu m/day due to the intensely fractured strata (BRGM, 1975).

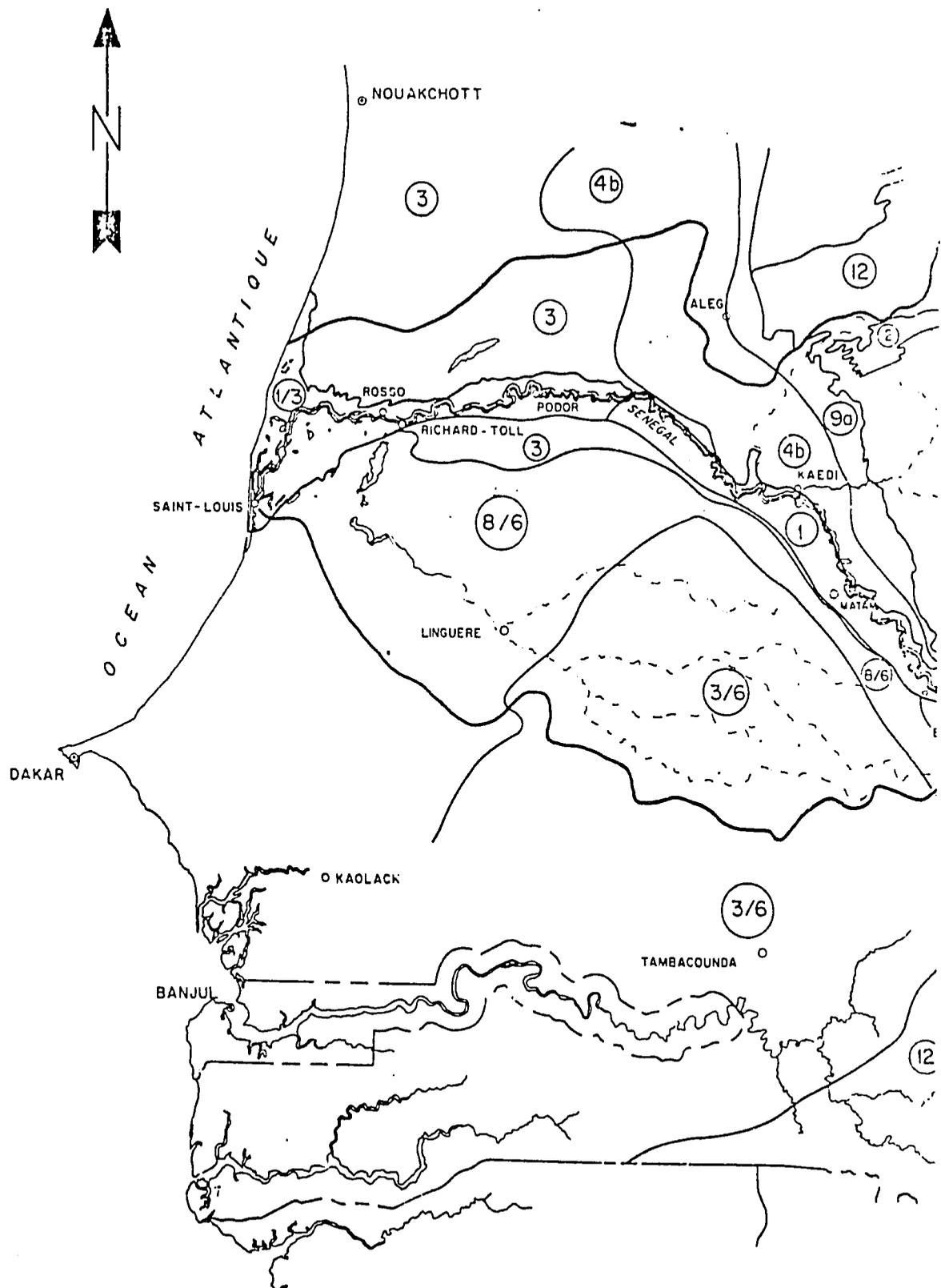
Groundwater Resources of the Senegal River Basin  
in Mauritania

Map Number	Aquifer Name	Type of Formation	Area* (Km <sup>2</sup> )	Renewable Resources (10 <sup>3</sup> m <sup>3</sup> /Km <sup>2</sup> /yr )	Exploitable Resources (10 <sup>6</sup> m <sup>3</sup> /Km <sup>2</sup> )	Storage	
						Coefficient (10 <sup>-2</sup> )	Drawdown (m)
1	Senegal River Alluvium	Alluvium	1,530	0-25	0.05-0.10	1-2	5
2	Dune Sands	Sand	129,000	0-25	0.17-0.37	2-8	5
3	Continental Terminal	Sand/Sandstone	54,400	0-10	0.40-0.90	2-8	1/3 Aquifer thickness
4	Eocene Formation	Limestone	40,300	0-10	0.15-0.30	1-5	10
11	Cambrian Sandstone	Sandstone	77,500	0-25	-	-	-
12	Precambrian Schist (bedrock)	Schist/Granite	57,800	0-25	-	-	-
12	Precambrian Schist	Schist/	148,000	0-100	-	-	-

\*Area is total area of an aquifer, not restricted to basin

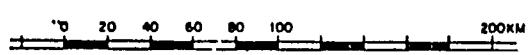
Note: No data of this type was found for aquifer 9a, limestone formation

Source: BRGM, 1976



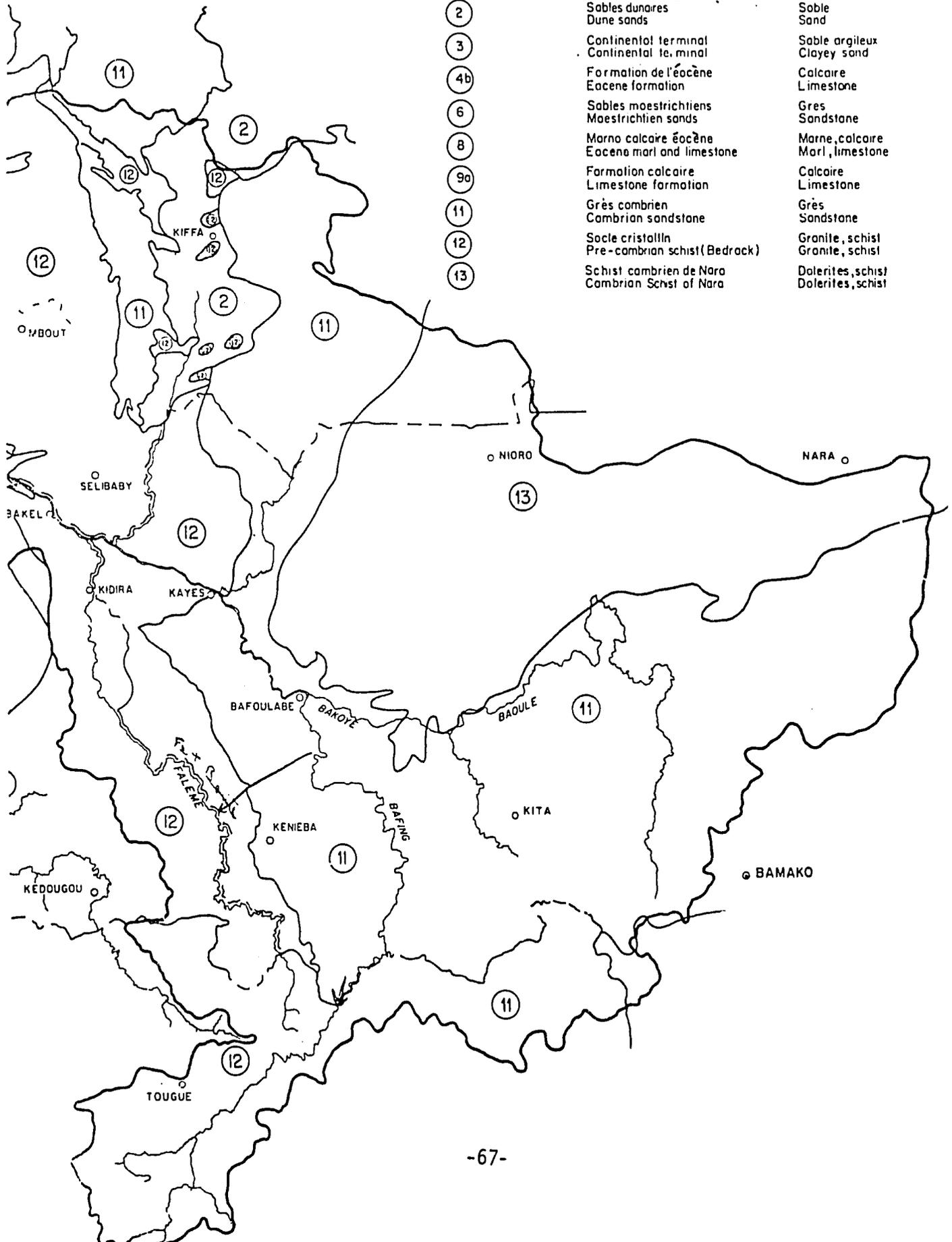
**LEGENDE**

- |                             |     |                   |
|-----------------------------|-----|-------------------|
| Limite du bassin            | ——— | Bassin boundary   |
| Limite des nappes aquiferes | ——— | Aquifers boundary |
| Fleuve                      | ——— | River             |
| Cours d'eau                 | ——— | Streams           |
| Villes                      | ○   | Towns             |
| Capitales                   | ●   | Capitals          |



SITUATION DES NAPPES AQUIFÈRES  
LOCATION OF AQUIFERS

AQUIFÈRE N° AQUIFER N°	NOM NAME	TYPE DE FORMATION TYPE OF FORMATION
1	Alluvions du fleuve Senegal Senegal river alluvium	Argile sableuse Sandy clay
2	Sables dunaires Dune sands	Sable Sand
3	Continental terminal Continental terminal	Sable argileux Clayey sand
4b	Formation de l'éocène Eocene formation	Calcaire Limestone
6	Sables moestrichiens Maestrichtien sands	Gres Sandstone
8	Marno calcaire éocène Eocene marl and limestone	Marne, calcaire Marl, limestone
9a	Formation calcaire Limestone formation	Calcaire Limestone
11	Grès cambrien Cambrian sandstone	Grès Sandstone
12	Socle cristallin Pre-cambrian schist (Bedrock)	Granite, schist Granite, schist
13	Schist cambrien de Nara Cambrian Schist of Nara	Dolerites, schist Dolerites, schist



## APPENDIX F

### Instructions for Making Water Filters

# PUBLIC HEALTH ANNEX I

## UNICEF WATER FILTER

APPROVISIONNEMENT EN EAU  
Eau de boisson

Filtre à sable et charbon de bois

الفلتر العظاء من الداخل

ceggu njaareendi e yulbe

ketunde ti seyinnen da Kore.

seggükaayu ndox buñu defare he

prototype ou essai	X
expérimentation large	
utilisation courante	

classification

### ORIGINE

la vulgarisation de ce type de filtre a débuté en Mauritanie à la suite d'une première expérience conduite en 1982 dans le village Peul de Ndilingkaa dans la région de Rosso sur le fleuve Sénégal. En 1983 un programme de diffusion est réalisé dans le cadre du projet PRODIS conduit par les services publics régionaux de Rosso sous les auspices du Gouverneur de Région et avec l'appui de l'UNICEF. De son côté, l'Institut des Langues Nationales utilise ces fiches dans son programme national d'alphabétisation.

### ENVIRONNEMENT

Moins de 16% des Mauritaniens peuvent disposer d'eau saine. 30% des villages du pays n'ont pas de puits protégés et s'alimentent soit dans des mares, soit dans des puits pollués. Les maladies propagées par l'eau sont le premier facteur de mortalité infantile : en zone rurale, un enfant sur quatre n'atteint pas sa première année.

La lenteur inévitable de la réalisation des programmes de puits et de forages, par ailleurs très coûteux, rend indispensable la mise en place rapide de solutions alternatives pour purifier l'eau des mares de surface. De plus, on peut constater à l'expérience que cette solution simple de filtre est aisément prise en charge au niveau villageois.

### PRINCIPE

Le principe est celui du filtre à sable à flux montant complété par l'introduction du charbon de bois dont la très haute capillarité en fait un excellent piège à bactéries. L'eau introduite au niveau bas est ainsi progressivement débarrassée de ses impuretés en remontant du bas vers le haut.

### EXEMPLE

l'installation décrite ci-après est précisément celle qui fonctionne depuis 1982 dans le village de Ndilingkaa. Sa conception s'est inspirée de la fiche GRET T22.

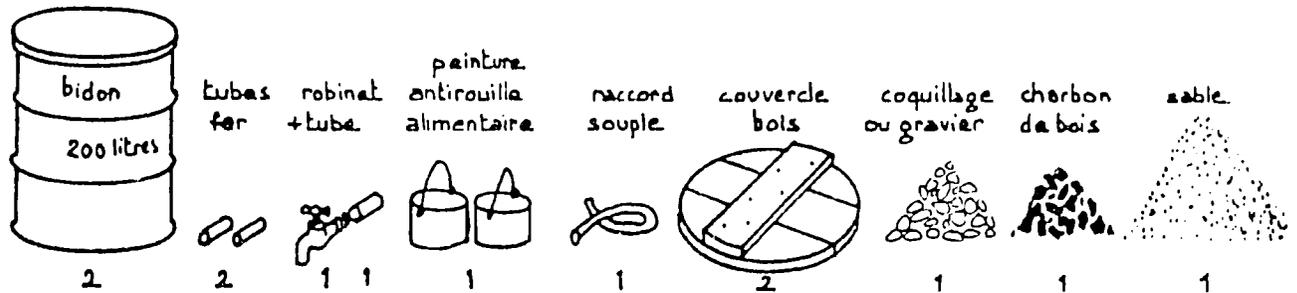
### COMPLEMENT D'INFORMATION

- Gouvernance de la Région du Trarza B.P. 1 Rosso République Islamique de Mauritanie
- Ministère de l'Hydraulique et de l'Habitat BP356 Nouakchott République Islamique de Mauritanie
- Institut des Langues Nationales B.P. 660 Nouakchott.
- PRODIS Projet de Développement Intégré de Rosso - SATARA BP 23 UNICEF, 43 avenue Albert Sarraut Dakar Sénégal
- Fiche conçue par Alain Halter prof. Lycée de Rosso et Serge Theunynck UNCHS P.O. Box 30020 Nairobi
- Traduite en hassanya par Nagi Ould weddou traducteur au M.H.H.
- en pulaar par Aamadu Umas Jah Chef division Pulaar à l'ILN
- en sooninke par Mamadu Saamasa Chef division Sooninke à l'ILN
- en wolof par M'Bayi Tunbo Chef Département Documentation et Publication à l'ILN

materiel	dimensions	quantité	où le trouver	prix UM
bidons fer	200 litres	2	récupération futs d'huile	1.000
tubes fer	∅ 20-27 longueur 10cm	2	récupération	-
robinet + tube fileté	∅ 20	1	quincaillerie	400
peinture antirouille - alimentaire		2kg	S.M.C.T (1)	1.300
tuyau plastique (raccord)	∅ 25	1m	quincaillerie	50
couvercle bois	∅ 65		marchand de bois	550
coquillage (ou gravier)	∅ 5cm	3 seaux	plage	-
charbon de bois	morceaux 4 cm	3 seaux	charbonniers	150
gros sable	∅ 1-2 mm	6 seaux	plage	-
TOTAL MATERIEL				3.450

130FF = 1000 UM    1 US \$ = 53 UM

(1) Nouakchott



matériel et matériaux à préparer pour fabrication du filtre

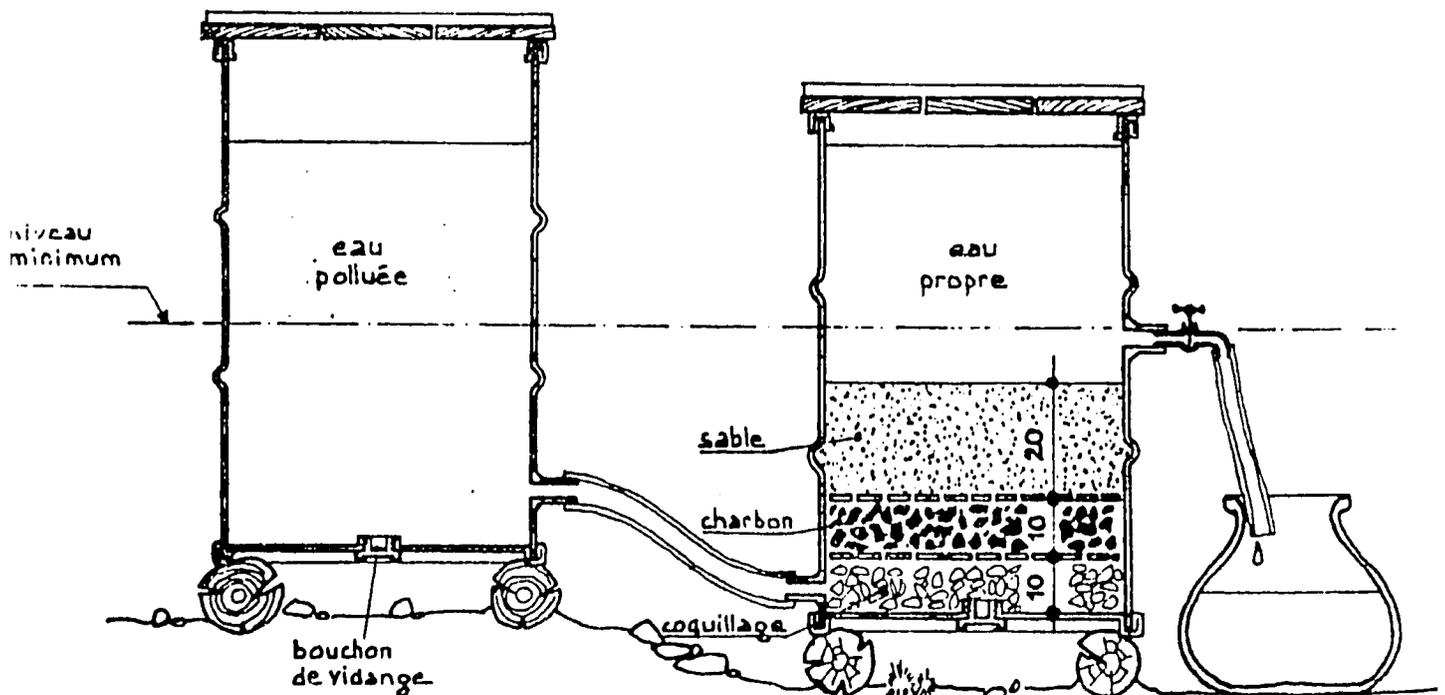
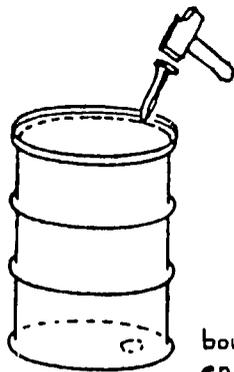


schéma de l'installation

Fais la coupure à l'intérieur du rebord



matériel nécessaire  
1 marteau  
1 ciseau

bouchon de vidange en bas

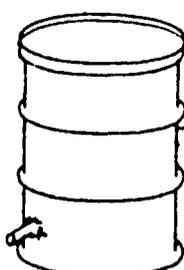
1. découpe le fond de chaque bidon

bidon eau sale



hauteur 10cm

bidon eau propre



5cm

le tube fileté doit être soudé sur le côté pour se vider simplement

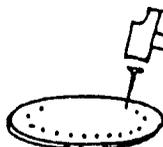
2. fais souder les deux tubes simples et le tube fileté

3.1.



matériel 1 craie  
dessine à la craie des ronds espacés de 5cm

3.2.

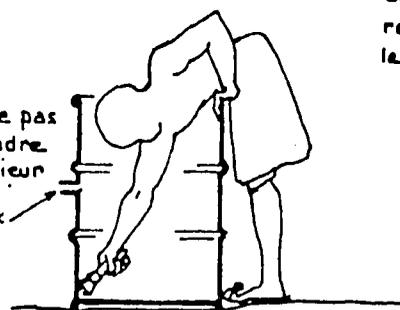


matériel 1 clou, 1 marteau  
sur les ronds, perce des trous tous les 5cm

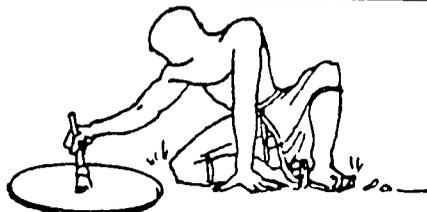
3. perce les fonds que tu as découpés

pour la façon d'utiliser la peinture, renseigne toi chez le marchand

n'oublie pas de peindre l'intérieur des tuyaux



4. peinds l'intérieur des bidons pour empêcher la rouille

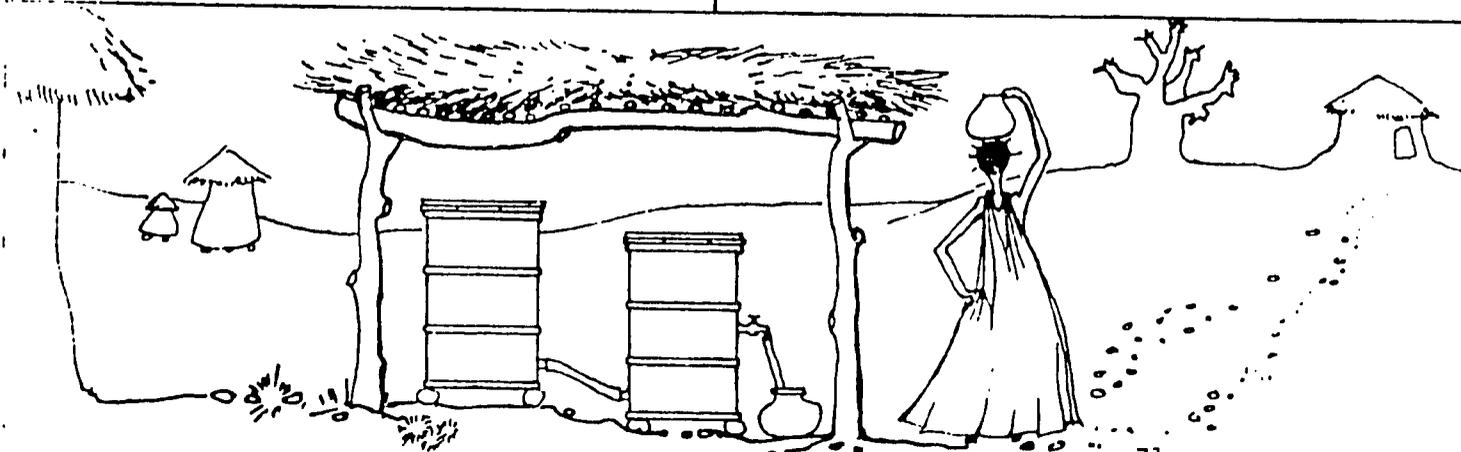


5. peinds les 2 fonds que tu as percés et refais les trous avec un petit clou



lave le sable le charbon et le coquillage jusqu'à ce que l'eau de lavage soit propre

6. lave les matériaux dont tu vas remplir les bidons



7. protège l'eau contre la chaleur du soleil