



case study

# The impact of manual drilling for the construction of sustainable water-points in Chad

**PRACTICA**  
FOUNDATION

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EnterpriseWorks/VITA

## EXECUTIVE SUMMARY

This case study examines the impact of professional manual drilling operations on the problem of increasing the rate of delivery of improved water supply in Chad.

In the master plan of water supply and sanitation (2002) it was recognized that costly, mechanised drilling alone will not satisfy the water demand in all areas of the country. A decision was made, to actively promote manually drilled boreholes in those areas where such technology was appropriate to increase the coverage of improved drinking water supply in Chad.; This promotional work has, with the support of UNICEF, been implemented through the Ministry of Fishing, Pastoral and Rural Hydraulics. A key part of this strategy has included development of the capacity of Small and Medium Enterprises (SME's) to carry out such work and has further included a mechanism to monitor the quality of the works. This case study shows that effective use of manual drilling in Chad can be highly significant in helping to attain the Millennium Development Goals in the water sector. This is due to:

- favourable hydrogeological conditions in a large part of the country
- dense population within the favourable area
- an existing manual drilling market with plenty of potential for growth
- manually drilled water-points being 3 to 6 times cheaper than mechanically drilled water-points
- quality of construction being the same as water-points that were mechanically drilled
- the use of manual drilling enterprises is estimated to be able to increase the number of wells drilled per year from 750 to 2000- 2500
- manual drilling can be done in area's where accessibility for mechanical equipment poses problems
- significant benefits being available to the local economy if this initiative is used to its full potential

A potential barrier to success is the political instability of the country.

To reach the water sector MDG's established for Chad, it is important that donors and implementing organisations recognise and support manual drilling as a sustainable technological option. Furthermore, manual drilling is considered to have a similar potential in other countries in Sub-Saharan Africa, and may substantially contribute to their attainment of Millennium Development Goals.

# 1. Water Supply Situation in Chad



Women fetching water at a manual drilled well

<sup>1</sup> WHO&UNICEF, Progress on drinking water and sanitation, JMP report 2008

<sup>2</sup> Schéma Directeur pour l'eau potable et l'assainissement du Chad : One hand pump supplies on average 400 people; a self-contained unit (solar or thermal) supplies 1600 people and an open well supplies 600 people. In 2000, the annual drinking water requirement for the total rural population was 43.6 million m<sup>3</sup>; this will raise to 53.6 million m<sup>3</sup> in 2010 and 64 65 million m<sup>3</sup> in 2020.

<sup>3</sup> Integrated plan for Chad's water development and management, SDEA 2003

<sup>4</sup> UN Population Division

<sup>5</sup> Integrated plan for Chad's water development and management, SDEA 2003

<sup>6</sup> Integrated plan for Chad's water development and management, SDEA 2003

<sup>7</sup> WHO&UNICEF, Progress on drinking water and sanitation, JMP report 2008

Overall Chad is ranked sixth in a table of the most water needy countries in the world<sup>1</sup>. This means that 71% of the urban population and only 40 % of the rural population have access to safe drinking water. This limited access and an associated lack of sanitation provision can, directly or indirectly be linked to many individual instances of poverty and child mortality. There is a major need for drinking water-points particularly in the rural areas. This target service level has been quantified as the provision of 20 litres of water per day per inhabitant.<sup>2</sup>

## Country statistics

Size of Chad	1 284 000 km <sup>2</sup> <sup>3</sup> (5th largest country in Africa)		
Number of inhabitants	11.397.000 <sup>4</sup> in 2009 (25thmost populous country in Africaa)		
Average income	2200 USD GNP/inh/year <sup>5</sup>		
Population living below the world poverty threshold	54% <sup>6</sup>		
	<b>In Chad</b>	<b>Urban population</b>	<b>Rural population</b>
Access to water in 2006 <sup>7</sup>	48%	71%	40%
Aimed access to water in 2015 (by the Government)	65%	85%	60%
MDG target access to water	58%		

## 2. History of manual drilling in Chad

Around 1965 the US 'Peace Corps' initiated manual drilling in Chad. This drilling and well development program continued (as far as is known) until 1977; unfortunately, after an average of 3 to 6 months use, most of the installed wells and pumps ceased to function. This was usually due to the inflow of fine sands through the well screen and hence into the piston of the pump. In 1988 'CARE Chad' reintroduced the 'Peace Corps method' and experienced similar problems. Owing to these negative experiences the Government of Chad and the major Donors did not accept manual drilling as a viable methodology.

Since the introduction of manual drilling in the 1960's small manual drilling enterprises have established themselves. Today approximately 43 manual drilling enterprises are active in Chad. These enterprises use varying manual drilling techniques. In addition there are approximately 10 machine drilling enterprises generally based in and around the capital N'Djamena.

The techniques for manual drilling used in Chad have included:

- The sludging method is used in sand and clay soils with an average drilling depth of 30-35 meter, reached in two to four working days. Prices vary between US\$ 1500,- and US\$ 3000,- including a Indian mark pump (US\$ 1000,- on average).
- The jetting method is often combined with a rotation movement and some times used in combination with the sludge method and a maximum drilling depth of 40 to 60 meter is reached in one or two working days, in sand and clay soils. Prices vary between US\$ 2000,- and US\$ 3000,- including a pump. This method is the one most commonly employed in Chad.
- The percussion method has been used by two NGOs in the South to drill through layers of consolidated rock formations. The method has not been popular because borehole completion times tend to be rather long, leading to increased costs. This is, however, to be expected in harder formations Actual cost figures are not available. Occasionally the Auger method has been used to drill starter holes and shallow wells.

An analysis of well histories leads to the following general conclusions regarding causes of well failure:

- Inadequate attention to well design (absence of gravel packs, pistons directly installed in the casing, pistons damaging the casing)
- Inferior material / inadequate construction practice (galvanised filter screens and absence of screen slot size match with gravel pack and formation leading to with inflow of fine sand)
- Little or no knowledge of hydrogeology shown by construction teams or drillers (resulting in, for example, wrongly placed filter screens and/or absence of sealing of impermeable layers.
- Inappropriate sitting of the borehole / water point (resulting in the intrusion of pollution)
- General absence of quality control and lack of accountability

The early failures in sustainable supply maintenance have meant that, until recently in Chad, there has been a rather negative perception of the effectiveness manual drilling techniques. Thus it has been the policy of government to construct

water-points using only mechanical drilling techniques. In the private sector, however, manual drilling has continued since its introduction. This is because most users, individuals or companies, could not afford expensive mechanically drilled boreholes. Over time the effectiveness of manual drilling techniques and the quality of well construction is considered to have substantially improved. Indeed, though this is unknown to donors, a significant proportion of wells awarded under large contracts have been subcontracted to manual drillers in areas where manual drilling was possible. In these cases the quality of construction has, often, been judged to be acceptable. This tends to suggest that both the techniques employed and the enterprises undertaking the work are proving themselves adequate to the task.

Further manual drilling has proved to be an effective way to provide water sources in an emergency context (where issues of accessibility vis a vis mechanised drilling and time saving vis a vis hand dug well construction are critical). Additionally during periods of unrest, when INGO international staff have been evacuated, local private sector enterprises have continued manually drilled water-point construction.

### 3. Market Potential

<sup>8</sup> Access for drilling is not possible in rainy season.

<sup>9</sup> This is an average, in favourable conditions the number could go up to app. 100.

<sup>10</sup> This is an average, some enterprises have an annual capacity of 50 boreholes while others, in favourable conditions can drill to app. 100

<sup>11</sup> Assumption used in Integrated plan for Chad's water development and management, SDEA 2003

<sup>12</sup> Including installation of a pre-delivered hand pump, excluding costs for community participation, quality control, water testing etc. Depending on depth, equipment and location. Costs based on awarded contracts of UNICEF Chad in 2007.

<sup>13</sup> Conversion rate used 1 € = 1,4 US\$

Present drilling market	Manual and semi-mechanised drilling enterprises	Mechanical drilling enterprises
Approximate number of enterprises	43	10
Capacity per enterprise (in bore holes per year) <sup>8</sup>	40 <sup>9</sup>	75 <sup>10</sup>
Total capacity (in bore holes per year)	1720	750
Target group to date	private parties or business enterprises	villages
No of people reached per water point (average assumed)	40 (in case of private owned wells) 400 (for communal wells)	400 (for communal wells) <sup>11</sup>
Increase of number of people with access to drinking water (per year)	68.800 – 688.000	300.000
Cost of a water point <sup>12</sup> (in US\$ ) <sup>13</sup>	1.500 to 2.400	5.300 to 14.000

Building on the existing manual drilling capacity can help Chad to reach the Millennium Development Goals (MDG's). In the Integrated plan for Chad's water development and management it was, in 2000, estimated that, in the rural areas, an additional 10.300 water-points needed to be constructed to reach the MDG's. Between 2006 and 2015 Chad aims to provide safe drinking water to approximately 1.7 million people. If each water point serves approximately 300 people then 5700

new water-points are needed. At the current rate of borehole construction (2470 per year by the whole drilling sector) the MDG's could be met 11.

The rate of progress towards attainment of the MDG's is, however, not only dependent on technical feasibility. Other factors such as availability of funds, adequacy of community participation procedures, suitability of site selection and sus-

tainability play an essential role. Thus it cannot be assumed that expansion of manual drilling activity will happen automatically if no guidance is given. The first step must be for the possible use of manual drilling enterprises to be officially recognised. Second the careful choice of location for the implementation of manual drilling cannot be stressed too highly. At present most manual drilling is privately ordered and thus tend to be concentrated in urban areas and near businesses (where individuals or companies have enough money for a well).

The need for new water-points is, however, much greater in remote village locations<sup>14</sup> and in new refugee camps. Government and NGO's could therefore benefit from a sound allocation strategy. Third for improvement in manual drilling's contribution to water shortage alleviation to be sustained there must be further capacity building on water point maintenance. Too often water-points are not well maintained owing to the non existence or non functioning of local water committees. These points are addressed in the strategy outlined below.

## 4. Strategy for capacity building

### 4.1 Objectives

In order to support the Government of Chad, UNICEF Chad and PRACTICA have developed a capacity building strategy to be implemented over three to four years. The overall objective has been to create a cadre of professional manual drilling enterprises and hence improve the quality of sustainable water-points in Chad. More specifically the aim was to establish an adequate manual drilling sector, which can effectively use manual drilling technology, install hand pumps, and orient communities on maintenance. In order to certify the capacity of private enterprises to complete hand drilled water-points, and to guarantee the quality of completed water-points, a quality assurance mechanism needed to be established, This will operate both in the public and private sectors. To demonstrate the commercial viability and sustainability of the approach and its potential for being scaled up to contribute significantly towards reaching the MDG for safe drinking water access in Chad, 1.000 new water-points (certified by the established quality assurance mechanism) had to be completed using manual drilling technology.

### Parties involved in capacity building of the manual drilling sector

- Ministry of Water in Chad or Directorate of Hydraulic Affairs (DH)
- UNICEF country office in Chad
- PRACTICA Foundation<sup>15</sup>
- Centre de Développement des Entreprises (CDE)<sup>16</sup>
- Private sector / manual drilling enterprises (43 small and medium sized enterprises with a history in manual drilling)
- Social mobilisation actors (Social mobilization is done by different local actors and the ministry)

<sup>14</sup> At this stage there is insufficient data to define unserved (rural) population located in zones favourable for manual drilling

<sup>15</sup> The mission of PRACTICA is poverty alleviation through dissemination of best practices and development and promotion of appropriate water and energy related technologies and services. The activities are meant to directly contribute to the achievement of the Millennium Development Goals. [www.practicafoundation.nl](http://www.practicafoundation.nl)

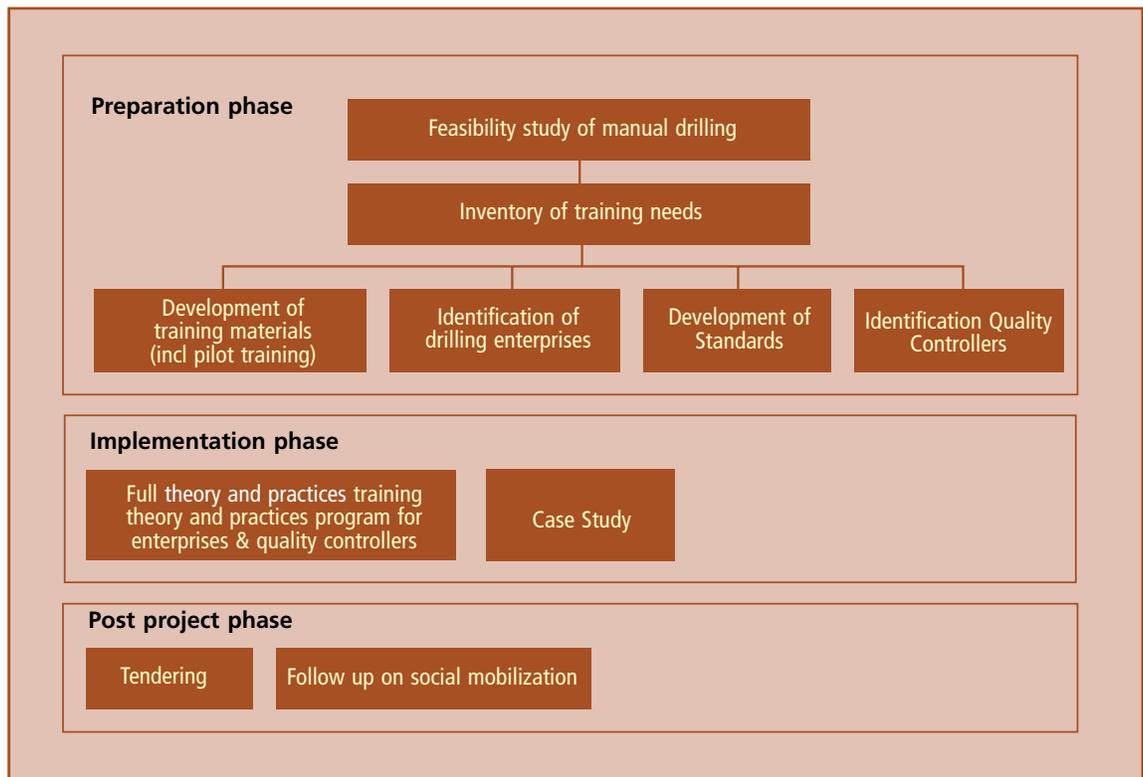
<sup>16</sup> The CDE is a vehicle in Chad to support the development of Chadian businesses. The centre was launched in December 2004, and has developed a network of over 1,100 entrepreneurs in its database. The CDE has trained over 300 Chadian small and medium sized enterprises and helped Chadian firms to date gain US\$12million of contracts with ExxonMobil. The CDE is executed in cooperation with the Chadian Chamber of Trade. UNICEF and the CDE have signed MoU and CDE will assist UNICEF and the DH in the identification, pre-selection, business skills training and evaluation of the manual drilling enterprises in Chad.



Drilling enterprises practising drilling logs during training



Jetting equipment used for manual drilling in Chad



## 4.2 Capacity Development Strategy

The phased capacity building strategy developed by UNICEF and PRACTICA is shown in the diagram below.

### 4.2.1 Preparation phase

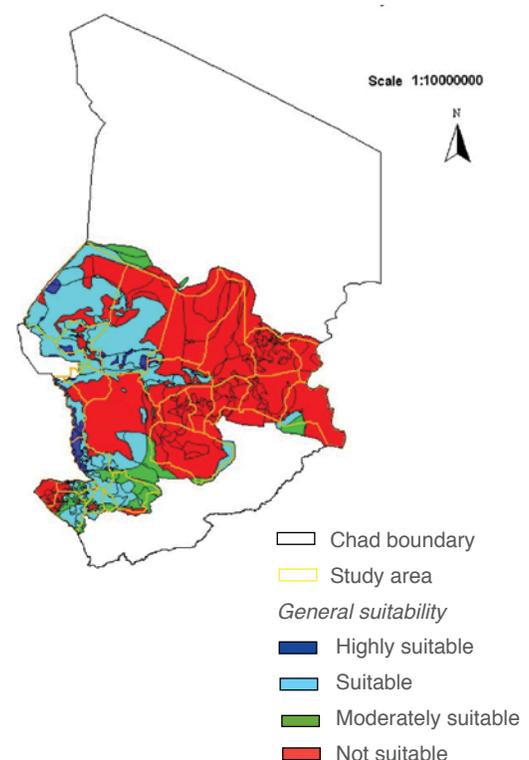
#### 4.2.1.1 Feasibility study

In order to investigate the feasibility of bor hole construction by manual drilling existir data was examined. During this work it w found that in Chad a substantial amount data is available on geology, hydrology ar water quality, but the data is not collected at central point (and thus is not easily accessible to organizations). In the past this has results in a duplication of effort.

Current analysis is based on compilation data from government central data, wat organizations, agencies and drilling ente prises. The data has been confirmed by a sp cial mission in selected regions in central ar Eastern Chad. The data has been used to compile a series of hydrogeological and static wat level maps. This data has been further sun marised as a map of areas suitable for manu drilling. This map covers about 50% of Chac total surface area and indicates that manu drilling may be possible in approximately 50 of the most populated parts of Chad, south the 16th parallel.

### CHAD - Mapping favorable zones for manual drilling

General suitability derived from cross analysis of geological condition and static water level



Work carried out during the feasibility study also revealed that manual drilling had been undertaken in Chad and several existing enterprises were identified. It was also noted that the main problems encountered were often associated with water quality, discharge of manual drilled wells and failure of pumps that had been installed. This led to a request being made to the Chadian government to introduce standardized well design, installation and well development procedures. Further it was requested that the government seek to increase the professionalism of the existing manual drilling sector. It was suggested that this could be accomplished by the establishment of a training program, a quality monitoring system and by the certification of well trained professional enterprises. Such enterprises could then be differentiated from less formally trained operations.

It was expected that an extensive, professional manual drilling sector would increase the well drilling capacity in Chad, and could create a large cost reduction in the price of 'shallow' wells, hence making improved water points accessible to a higher proportion of the Chadian population.

#### 4.2.1.2 Identification of training needs

It was recognised that, in Chad, the low cost drilling sector consists of two sub-sectors i.e. fully manual and semi-mechanised. It was recognised that provided the technical specifications of wells were clearly indicated in the contract and if there is an on-site inspection takes place, successful wells can be constructed using manual technologies. To develop this situation the following training needs were identified:

- The development of supplementary technical training and training material.
- The implementation of a "test" training session
- The training of Quality Control personnel
- Training for an improvement in business skills for small enterprises

#### 4.2.1.3 Development of training materials

This was focussed on three areas of activity. First, as all enterprises had hands on experience with manual drilling the basic operation of equipment was understood, hence the training focussed on connecting their practical experience to theory. Particular attention was given to hydrogeological conditions and the relationship between construction and hygiene. Thus the practical aim was to improve their skills in well installation and well development. Second, with regard to business development CDE developed training which aimed to improve the managerial and administrative skills of the enterprises. Training consisted of elements like commercial sales, commercial documents, price calculation, tendering, invoicing and stock management. Third the training for Quality Controllers focussed on developing familiarity with the standard of work required and to develop expertise in monitoring the attainment of those standards. It is also expected that this group of Quality Controllers will also coach small enterprises in practices to attain the desired quality of construction.



#### 4.2.1.4 Identification of manual drilling enterprises

<sup>17</sup> Some of the criteria were:

- The enterprise should have three years of experience in manual drilling (track record),
- be officially registered as a company or the willingness to get registration within 3 months,
- have a bank account or account in a micro finance institute,
- be willing to pass an evaluation interview of CDE and the DH.

In order to fulfil this task CDE established selection criteria for enterprises. This required the submission of comprehensive documentation which was facilitated by the launch of a large media campaign. This involved both the broadcast on television (in both French and Arabic) and the publication (in a leading newspaper), of requests which asked manual drilling enterprises to come forward. Further it involved travelling to major towns to explain and clarify the conditions and participation procedures. As a result a total of 83 manual drilling enterprises and 16 pump repair enterprises were identified. From the collected documents pre-selection <sup>17</sup> was carried out and CDE visited the pre-selected enterprises to

asses their organisation, equipment and staffing. Finally 43 enterprises were selected.

#### 4.2.1.5 Development of Technical Well Standards

To assure the quality of the water-points to be constructed it was considered essential to have accepted Technical Well Standards. In close collaboration with the Directorate of Hydraulic Affairs these standards have been developed. This process involved four stages: first the preparation of first draft Standards, second the checking of Standards with drilling enterprises and Quality Controllers, third the preparation of the finalised version of the Standards and finally the acceptance of the Standards by the Chadian Government.



Manual drilling using the jetting method



Trainee presenting a drilling log during theoretical training



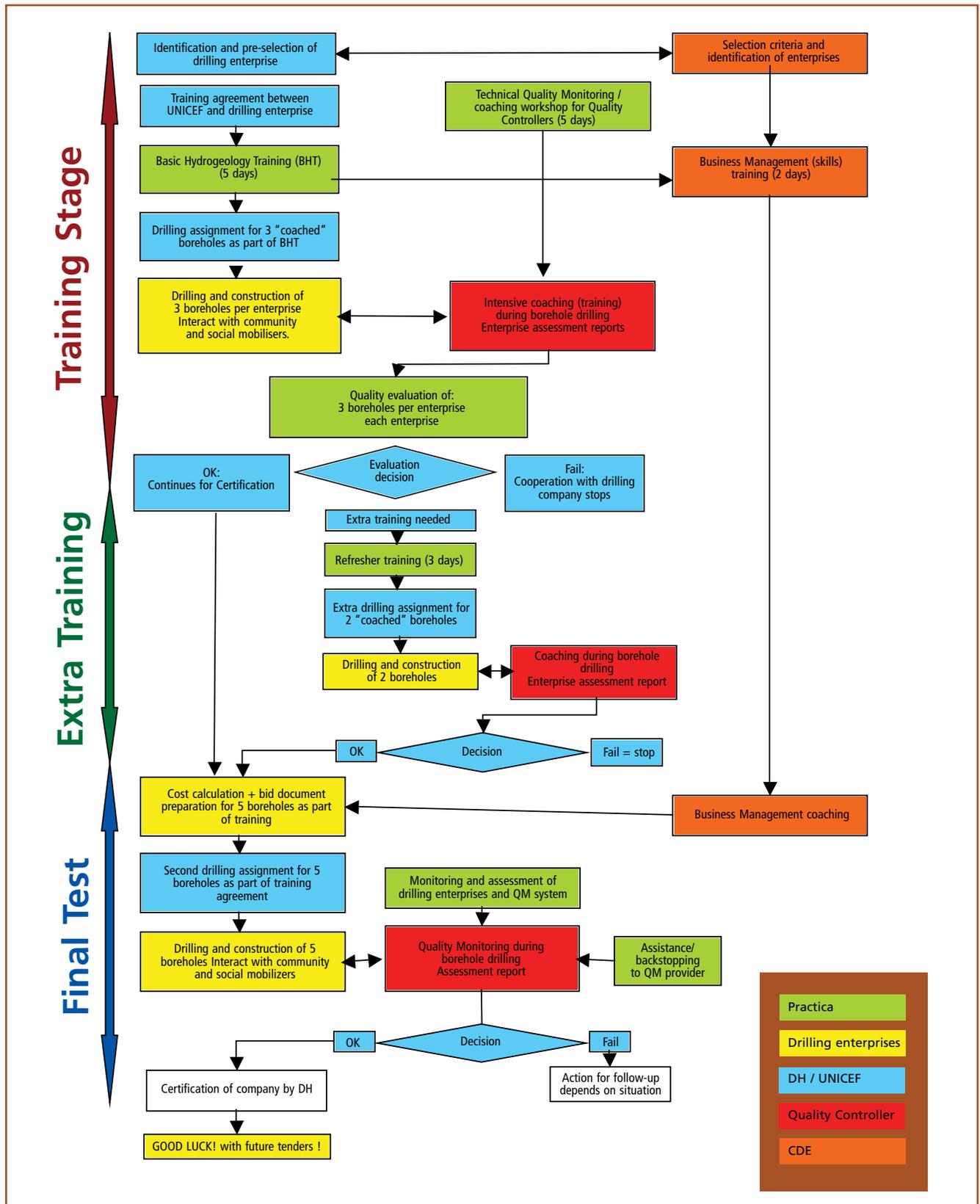
Discussing the quality of a drilling log

#### 4.2.2 Implementation phase

The implementation phase involves running the full training program for enterprises and quality controllers.

#### Training program for enterprises & quality controllers

This program has been devised to be undertaken in 3 stages as shown in the diagram



#### 4.2.1.6 Identification of Quality Controllers

The Quality Controllers have two major roles namely the coaching of the drilling enterprises during the training process and second the certification of the water points based on the Standards. Initially it was intended to divide these functions between differing parties; coaching would be undertaken by people from the private sector with certification being carried out by engineers of the Directorate of Hydraulic Affairs. Owing to a lack of available trained personnel the Water Directorate undertook to complete both tasks and 20 Quality controllers have been selected.

From the diagram it can be seen that at the training stage the focus is on the attendance of the drilling enterprises at a five day hydrogeological session. This followed by the enterprises having to undertake three test drillings that are evaluated by PRACTICA. At this stage the Quality Controllers receive their training in coaching and evaluation. All the drilling enterprises attend two day business development training, followed by coaching

by CDE. The training stage ends with an overall evaluation which leads a decision on how to continue with each of the drilling enterprises; are they rejected, could they benefit from an extra training or could they proceed directly to the final test?

In case an enterprise needs extra training a refresher course of three days can be offered, again including test drillings. The Quality Controllers perform the same coaching tasks. Based on the findings UNICEF and the Directorate of Hydraulic Affairs decide whether a specific enterprise is permitted to proceed to the final test or whether it is rejected with regard to further participation in the programme.

During the final test the enterprises have to prove all their competencies by completing an exercise tender procedure (as shown in the diagram above). If all stages are completed successfully the Water Directorate, based on recommendations of UNICEF, PRACTICA and CDE, will officially certify the drilling enterprise. After being certified, the drilling enterprises can compete in any relevant tender procedure.

### THE STORY OF PIERRE NGOLSOU, DIRECTOR OF A MANUAL DRILLING ENTERPRISE

Pierre lives in the outskirts of N'Djamena with his family of 3 children. He has run Energy Fipompe since 2001 and employs 3 people permanently and 18 part time (average 10 per day). 50% of his work is on manual drilling but he also fabricates treadle and rope pumps. Additionally he farms his 10 ha of land using drip irrigation systems.



Pierre Ngolsou and son

When he started in 2001 he used the sludging method as this required limited investment in equipment (100 US\$ /50,000 CFA) and was affordable. Using this method the construction of a 30 m borehole took 1 week. He charged approximately 1.500 Euro for a borehole (mechanically drilled equivalent 17.200 US\$). At this time he constructed between 5 and 10 boreholes a year. In 2003 he invested 2.600 US\$ in Jetting equipment. Now he can drill a 60m borehole in one day. This together with other technical innovations has helped him to reduce the price of a borehole to approximately 1.78 5 US\$. He now constructs approximately 30 boreholes per year, ( about average output for manual drilling enterprises).

Using his skills he installed a water point on his own premises, where neighbours come to fetch water of good quality. Most of his customers are private clients living near N'Djamena who want a drinking water well on their premises. This is not to have water close by but also to assure water in times of political unrest in the country.

In collaboration with other small enterprises in his area Pierre started the Federation of manual drilling enterprises, FAFORT. Under the auspices of this Federation, small enterprises with little capital could rent machines, cars etc. from each other and could also buy material in bulk and come together to submit tenders for larger scale projects.

Pierre was very happy with the training program offered by UNICEF/PRACTICA/CDE. He has expanded his knowledge and has learnt for example why and how to make sanitary seals. A major attraction for him to undertake this training was to learn how to draw up a drilling log. He now provides his clients with a copy of the drilling log and regards this as a demonstration of his professional approach. The log also helps the owner to discuss technical matters when repairs are required.

Pierre was also happy with the managerial training by CDE and sent some of his staff to be trained. This means he is, no longer, the only person who can undertake administrative tasks within his enterprise. The extra time this gives him has enabled him to work more closely with FAFORT to establish joint enterprise storage facilities. Pierre wishes to continue his training so that he can be certified. This he regards as proof of his professional attitude.

Pierre believes that there is a bright future ahead for manual drilling enterprises. His 5 year old son is already interested in following in his father's footsteps.

Note: FAFORT has proved to be the forerunner of a national manual drilling association see 4.3

### 4.3 Other Capacity Development Initiatives

Having well qualified drilling enterprises, standards and quality monitoring mechanisms is not enough to ensure sustainable drinking water supply. The following aspects are essential:

- *Selection of locations for water-points / Community Development*

Villages applying to DH for a water point are considered according to fixed criteria (such as size of population). An animation team will prepare the village by conducting a community gathering, forming a water committee (including repair men), setting up a water fund and choosing the location for the water point. Selection, based on priorities, will be done by the ministry. Priority is given to locate water-points near schools, which is intended to reinforce the national educational system. Similarly health care centres are given priority in order to assure hygiene practices in the centres.

- *Pump Installation and Repair*

UNICEF has chosen to keep the installation of pumps in the same hands as the drilling, hence requesting a 'package' consisting of a borehole, installation of a pump (delivered by UNICEF) and site clearance and head works / concrete apron. With regard to pump repair, in line with Government policy, which aims to empower users, the system for managing and maintaining modern water-points equipped with hand pumps (HP) is based on Water Point Management Committees (WPMC), a network of pump repairmen, the spare parts marketing network and the Directorate of Hydraulic Affairs.

- *Centralized data collection*

Data relating to the boreholes, including GPS coordinates, are collected by the Water Directorate which operates a central database. Collection of this data is essential to refine mapping of hydro-geological conditions in Chad. It also serves as a source of information in case there are problems with a specific water point.

- *Establishment of a national association of manual drilling in Chad*

The initiative of manual drilling enterprises located near N'Djamena in establishing FAFORT has been noted in the text box above. (see page 11) This organisation has now been replaced by the creation of a national association for manual drilling enterprises namely the Association Tchadienne pour la promotion des entreprises specialisees en forage a faible cout (A.T.P.E.S.FOR.C.). The association aims to improve the capacity of small and medium size manual drilling enterprises by providing sources of information relating to the purchase of materials, drilling at low cost, devel-

opment of business skills and opportunities for marketing. Formed in March 2009 the association has a General Assembly and an Executive Board composed of 11 members elected democratically.

### 4.4 Impact and outcomes

The development and implementation of a strategy to build the capacity of the manual drilling sector requires time, flexibility and perseverance. In Chad the process started at the end of 2005 and owing to some difficulties related with unrest events in the country, has not yet been fully completed.

Despite these difficulties there have been substantial achievements during the period 2006 to 2008. Thus, 208 boreholes have been manually drilled serving approximately 80.000 people. As part of the direct capacity building process 43 manual drilling enterprises are currently in training. Of this total 13 enterprises have reached the stage of being ready for their final test. The government has endorsed the 'Technical well standards' documents and have officially accepted the technique. A group of 20 quality controllers have been trained.

As a result of this capacity building process the response to the larger demand for water-points, both by the non-private and private sector is being facilitated. By 2011 the Government, supported by UNICEF, expects to have established improved drinking water supply to some 300 000 people in 1000 villages and schools using manual drilling. The boreholes established in IDP camps, have served to assist in avoiding conflict between IDP's and host communities over scarce drinking water resources.

### 4.5 Recommendations for Future

The existing capacity building program cannot solve all the issues involved in establishing sustainable water-points. It is suggested that further progress can be made if community awareness raising and motivation activities are enhanced. Practical improvements through these activities could be directed towards pump installation and repair processes. A policy regarding advanced certification (to build on initial certification) and the use of certified versus non certified drilling enterprises needs development. This could lead to improved marketing and brand recognition. As a development of basic data collection, database management and resulting information output could be upgraded. The quality control mechanisms that have been established need to be assessed and adjusted if necessary. Finally the country would benefit from an integrated and sustained approach by major donors in their contribution to achieving development goals in all sectors.

## 5. Conclusions

The Chadian Government, UNICEF and PRACTICA have looked at possibilities that help enable Chad to reach the Millennium Development Goals on accessibility of drinking water. Until recently, manual drilling was not considered as contributing to attain MDG's. Without proper quality control and with an unclear market this technology was formerly not appreciated. This study shows that manual drilling has the potential to complement mechanised drilling and to play its part in achieving the MDG's. This is demonstrated by the following:

- A feasibility study showed that Chad is a country with a high potential for successful manual drilling. This is due to favourable hydrogeological conditions existing in a large part of the country and because of an existing market with considerable potential for future growth.
- Manually drilled water-points are 3 to 6 times cheaper than mechanically drilled water-points and are, therefore, very cost effective.
- Acceptance of technical construction standards has shown that the quality of water from manual drillings is the comparable with that developed by mechanical drilling.

- Using the manual drilling enterprises can potentially increase the number of wells drilled per year from 750 to 2470
- Manual drilling can be undertaken in remote areas (where accessibility is a problem for the large trucks necessary for mechanical drilling).
- Manual drilling is an effective way to provide water sources in emergencies context and in periods of instability.
- Chad has an existing manual drilling sector, which is being improved through this project. The local economy will benefit if this sector is used to its full potential.

In order to reach the MDG's in Chad it is important that Donors and implementing organisations consider manual drilling a qualitative and sustainable option to complement other technologies. Having an appropriate level of funding to be used in combination with an appropriate choice of technique will increase the effectiveness of the efforts to achieve the MDGs. Furthermore, manual drilling could have similar potential in other countries in the world, helping all to reach the Millennium Development Goals.

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- Basic Hydrogeology Training Course, Group B and Finalization of Technical Well Standards, November 2007



UNICEF, Practica and Enterprise Works/VITA have developed a toolkit for African countries wishing to embark on the professionalisation of manual drilling. This toolkit includes Technical Notes, Technical Manuals, Advocacy Materials, Mapping of suitable areas for manual drilling, Case Studies, and Implementation and Training Manuals. This initiative builds the capacity of the local private sector in order to respond to the ever increasing demand for safe water in rural areas

## ADDITIONAL RESOURCES

- Technical Notes
  - The Case for Manual Drilling in Africa
  - Professionalising Manual Drilling in Africa
  - Selection of Well Construction Methods
  - Manual Drilling Techniques
  - Mapping the potential for manual drilling
- Understanding Groundwater & Wells in manual drilling
- Technical manuals on the drilling methods: Rota sludge drilling, Hand Augering, Manual Percussion and Jetting.
- Mapping of the Potential for Manual Drilling (Chad, Madagascar, Niger, Sierra Leone, Central African Republic, Mauritania, and Togo are in process).
- Niger Case Study
- Professionalising the Manual Drilling Sector in Africa to increase access to safe water in rural areas
- The RWSN hand drilling cluster group, see the website [www.rwsn.ch](http://www.rwsn.ch)

*These materials are available on the UNICEF website, [www.unicef.org/wash/index\\_watersecurity.html](http://www.unicef.org/wash/index_watersecurity.html); Practica Foundation, [www.practicafoundation.nl](http://www.practicafoundation.nl) and Relief International/EWV, [www.enterpriseworks.org](http://www.enterpriseworks.org)*

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