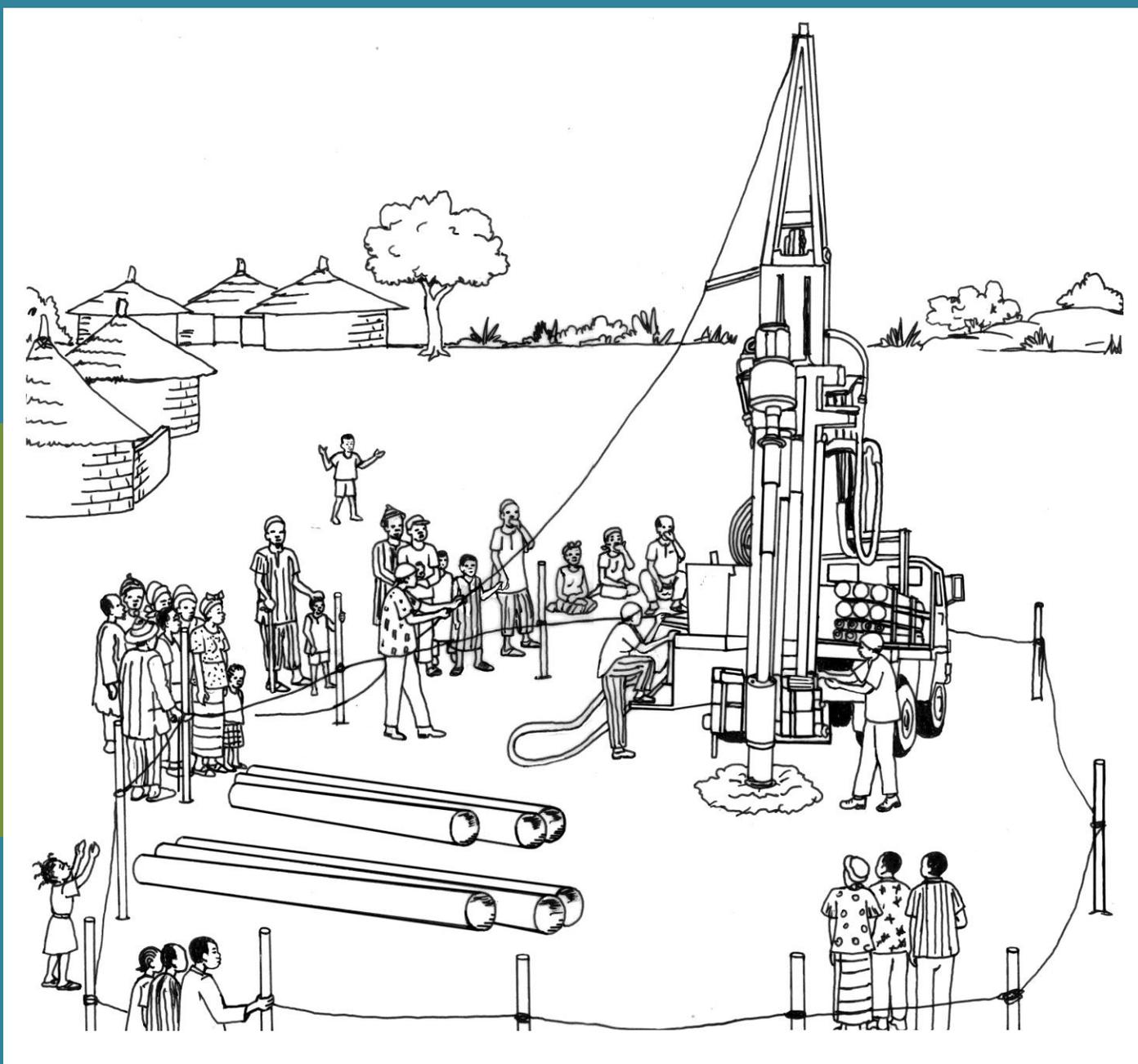




Community monitoring of borehole  
construction: a training guideline

Ref.: 2012-03-E

GWl Technical Series:  
Hardware Quality



## Table of contents

<b>ABOUT THIS SERIES.....</b>	<b>3</b>
<b>ACKNOWLEDGEMENTS.....</b>	<b>4</b>
<b>ABOUT THE GLOBAL WATER INITIATIVE.....</b>	<b>4</b>
<b>INTRODUCTION .....</b>	<b>6</b>
<b>TRAINING OBJECTIVE.....</b>	<b>6</b>
<b>SPECIFIC TRAINING OBJECTIVES.....</b>	<b>6</b>
<b>EXPECTED RESULTS .....</b>	<b>6</b>
<b>TRAINING METHODOLOGY .....</b>	<b>7</b>
<b>TRAINING CONTENT.....</b>	<b>7</b>
MODULE 1: SOCIAL ASPECTS OF IMPLEMENTATION .....	8
MODULE 2: PRACTICAL IMPLEMENTATION .....	10
MODULE 3: DRILLING .....	13
MODULE 4: INSTALLING THE PUMP.....	16
MODULE 5: IMPLEMENTING THE SUPERSTRUCTURE .....	18
<b>BIBLIOGRAPHY.....</b>	<b>21</b>

## About this series

The **GWJ Technical Series: Hardware Quality for Sustainable Water & Sanitation** is a Global Water Initiative tool that was developed in West Africa by Catholic Relief Services (CRS) and Sahel Consulting as a response to common difficulties in rural water & sanitation projects.

Each document in the series addresses a particular aspect of technology choice, design, build and maintenance. All these aspects are important in delivering a reliable and lasting community water/sanitation resource within an increasingly decentralised context.

We aim to influence those with the power and responsibility to get water and sanitation to the rural poor.

We also want to influence the communities themselves to become proactive and break away from their past role as passive beneficiaries.

The tools have been designed and field tested for use with communities, development workers, commune leaders and government technical services. They focus specifically on gaining an informed understanding that will lead these key decision makers to choosing the correct technology, supervising construction to assure quality, putting in place correct operation and maintenance systems, and assuring that revenue generated is adequate to keep that service going.

These tools are not a method in themselves, they presume that anyone using them is already engaged in a robust participatory process.

The **GWJ Technical Series: Hardware Quality for Sustainable Water & Sanitation** includes:

A practical guide for building a simple pit latrine	ref.: 2011-01-E
Assuring Quality: an approach to building long-lasting infrastructure in West Africa	ref.: 2012-01-E
Monitoring checklists : water points and latrines	ref.: 2012-02-E
Community monitoring of borehole construction: a training guideline	ref.: 2012-03-E
Contracting for water point construction: Provisional and final acceptance forms	ref.: 2012-04-E
The essential steps before handing-over a borehole (with hand pump) to the community	ref.: 2012-05-E

Community monitoring during the construction of a gravity-fed, solar powered water supply: a training guideline ref.: 2012-06-E

Making the right choice: comparing your rural water technology options ref.: 2012-07-E

Please use any of the documents freely. They can be downloaded from <http://www.crsprogramquality.org/publications/tag/water-manualsuser-guides>.

We would be most interested to receive feedback from you on the usefulness of this material.

The series is published in French and English. If you translate the material into another language please send a copy to [lambert.nikiema@crs.org](mailto:lambert.nikiema@crs.org), [jeanphilippe.debus@crs.org](mailto:jeanphilippe.debus@crs.org), [suecavanna@sahelconsulting.org.uk](mailto:suecavanna@sahelconsulting.org.uk).

## Acknowledgements

This document was developed by Lambert Zounogo P. NIKIEMA (CRS), Sue CAVANNA (Sahel Consulting), and Jean-Philippe DEBUS (CRS), the Hardware Quality team of the Global Water Initiative (GWI) in West Africa.

GWI project staff from all five GWI countries contributed ideas during the early development stages, and most importantly tested the material in the field. We are indebted to them.

The generous support and encouragement of the Howard G. Buffett Foundation has made this publication possible.

Illustrations:

- Y. Parfait BONKOUNGOU, Ouagadougou, Burkina Faso ([polyart15@yahoo.fr](mailto:polyart15@yahoo.fr));
- François Xavier COULIBALY, Toussiana, Burkina Faso ([illus\\_faso@yahoo.fr](mailto:illus_faso@yahoo.fr)).

## About the Global Water Initiative

The Global Water Initiative (GWI), supported by the Howard G. Buffett Foundation addresses the challenge of providing long term access to clean water and sanitation, as well as protecting and managing ecosystem services and watersheds, for the poorest and most vulnerable people dependent on those services. Water provision under GWI takes place in the context of securing the resource base and developing new or improved approaches to water management, and forms part of a larger framework for addressing poverty, power and inequalities that particularly affect the poorest populations. This means combining a practical focus on water and sanitation delivery with investments targeted at strengthening institutions, raising awareness and developing effective policies.

The Regional GWI consortium for West Africa includes the following partners:

- International Union for the Conservation of Nature (IUCN)
- Catholic Relief Services (CRS)
- CARE International
- SOS Sahel (UK)
- International Institute for Environment and Development (IIED).

GWI West Africa covers five countries: Burkina Faso, Ghana, Mali, Niger and Senegal. Some activities also take place around the proposed Fomi dam in Guinea. For more information on the GWI, please visit: [www.globalwaterinitiative.com](http://www.globalwaterinitiative.com).

## Introduction

Even though the construction of a community water supply is most often supervised and monitored by an experienced technical person, problems with the quality of implementation may occur where the community is a helpless by-stander without the basic knowledge to know if the work is being carried out to a high quality or not. Community involvement in infrastructure supervision allows the community to understand and oversee the implementation of infrastructure, and contributes also to the community's sense of ownership and enables future management. Thus the community does not just receive a finished product but is involved in the work during the construction phase. To allow communities to play this supervisory role, building their capacity is important to enable them to understand the basic principles.

## Training objective

The training aims to provide essential practical information to communities on the different phases of installing borehole equipped with hand/foot pump: the critical aspects of each phase, the quality of materials to be used and the quality of implementation that is expected. The overall goal is to prepare the community to understand what a good quality borehole equipped with a hand/foot pump should be like and how to intervene when these minimal standards are not met.

## Specific training objectives

The training will permit participants to understand:

1. the different phases in implementing a borehole equipped with a hand/foot pump;
2. what implementation of each phase consists of;
3. the key determining elements of each phase;
4. How to evaluate the quality of the infrastructure at each step; and what to do in case the infrastructure is being poorly constructed.

## Expected results

At the end of this training, participants should:

1. Know the different phases of constructing borehole equipped with hand/foot pump;
2. Know how the infrastructure is implemented at each phase;

3. Know the determinative elements of each phase;
4. Be capable to assess the quality of the infrastructure at each step;
5. Have a clear idea of what to do in cases where construction is poorly implemented.

## Training methodology

The training consists of several modules, representing the different steps in constructing a borehole with a hand pump. The training modules are presented in the order that borehole implementation takes place.

For each module, the following specific objectives will be fully addressed before moving on to the following module.

The sessions will include practical demonstrations to allow participants to better understand the topics of that module. To make the training more participatory, participants will be asked in prelude to discuss and describe their experience in relation to issues covered in each module.

## Training content

There are five main steps to constructing and equipping boreholes with hand pumps:

- ✓ Social aspects of implementation (Module 1)
- ✓ Practical implementation (Module 2)
- ✓ Drilling and lining the well (Module 3)
- ✓ Pump installation (Module 4)
- ✓ Constructing the superstructure (Module 5)

The training will be carried out in modules relating to each of these steps.

## Module 1: Social aspects of implementation

Involve the whole village via the Water User Association (WUA) when selecting the areas to install new water points.

		Observation
How was the site for the water point chosen?	Identification of the potential zone for borehole construction: the community indicate the area desired	
What are the determining elements of this phase?	The area chosen for the water point should be officially recognized by the village authorities	A new water point should focus on areas not already covered by an existing water supply
How will you evaluate the consistency or quality of the work?	Involve key decision makers from the village when choosing the site for the new water point and inform the entire village of the area selected for implementation through a GA.	
What actions should be taken?	Going to the selected areas (and not just indicating it) is advised to avoid poor interpretation of the location	

### Methodology / how to run the session:

#### Key learning and discussion points:

- ✓ Discuss equity issues in relation to choosing in a specific case of a beneficiary quarter a site for the water point that is most central to the majority of the inhabitants of this quarter. Drawing a map on the ground can help visualize the water point site options in relation to where the inhabitants live.
- ✓ Remind people their right to be informed about decisions affecting all the water users. This is especially important since the community will be required to pay for water.

This session will use questions, answer, and the sharing of experiences to help participants identify the potential risks in the social aspects of implementation in their own community. Participants will be invited to share experiences which illustrate their various opinions for each of the below:

**Q1.** In a given place, what area should be prioritized for installing a water point and why?

**Q2.** How should this choice be made, and by who?

**Q3.** Who should be informed of the location of the site selected for the new water point and why?

**Q4.** When should other members of the community be informed of the location selected?

**Q5.** How should the indication of the location be made? : Verbal description? Going on site?  
Argue for the different options

At the end of the session, participants will be asked to summarize the main good social practices for assuring community involvement in implementation.

### **Session duration**

About two hours.

### **How the session is organized**

Conducted in plenary.

### **Materials needed**

None.

## Module 2: Practical implementation

The objectives to be addressed in this module are:

- ✓ Prevent influential individuals or groups changing the water point location to their personal benefit when the time comes for implementation (indicating an area other than the one initially selected through consensus in the village);
- ✓ Prevent risky or inappropriate locations (proximity to latrines, cemetery and surroundings, polluted areas, etc.);
- ✓ Ensure technical set standards (distance, etc.) are followed/complied with.

<b>How was the infrastructure site chosen?</b>	Determining the exact place to construct the water point.
<b>What are the determining elements of this phase?</b>	Installing the water point in a risk-free area. Clear identification of the selected area to prevent influential persons changing the water point location.
<b>How will you evaluate the consistency or quality of the work?</b>	<p><u>Before installing:</u></p> <ul style="list-style-type: none"> <li>- Presence of the WUA before the start of/during installation;</li> <li>- WUA indicates the place selected to the team in charge of installation.</li> </ul>
<b>What actions should be taken?</b>	<p><u>At commencement of installation check that:</u></p> <ul style="list-style-type: none"> <li>- The site is at an adequate distance (prescribed distance) from any source of pollution (minimum 30m);</li> <li>- The site is not situated in a low-lying area vulnerable to flooding;</li> <li>- The place is not situated in a sacred area with no allowed access or with restricted access.</li> <li>- The area selected is at least 300 m from another water point except for a valid reason.</li> </ul> <p><u>After installation:</u></p>

- Marking and protection of site
- Public information on how the site was selected for the water point.

## Methodology / how to run the session:

### Key learning and discussion points

- ✓ Risk related to a bad siting (e.g. cemetery and surroundings)of the water point
- ✓ Complying with minimal distances between water point and source of pollution
- ✓ Drainage to permit uninterrupted access to the water point all year round even during the rainy season
- ✓ Who in the community should monitor implementation?
- ✓ Who should be informed of the sites selected?

Ask participants to explain how implementation should be carried out in the field. Then ask them the following questions (NB a) participants should be invited to share experiences which could illustrate various opinions b) the facilitator should provide the answers that were not mentioned by participants):

**Q1.** Who should indicate the team in charge of installation what area was selected for infrastructure and why?

**Q2.** If the place chosen by the implementation team is a sacred area, what should be done?

**Q3.** What other places do you think should be avoided and why?

(Certain specific places should be mentioned (cemetery, flood plains or low-lying areas, polluted areas); if these are not mentioned, mention them and ask participants why they should be avoided).

For sources of pollution, indicate the minimum distance and the possibility of eliminating some sources of pollution (if latrines, garbage dumps, ponds, banco pool)?

**Q4.** Do community members need to be present during implementation and why?

**Q5.** How do you ensure that the area(s) selected for installation will be found again when the machines arrive? What should community representatives do who assisted in installation?

**Q6.** Should one inform the entire community of the sites selected?

During the various parts of the session, let participants debate and argue to make sure that all opinions are expressed.

At the end of the session, ask participants to summarize the best practices for practical implementation.

### **Session duration**

The session will last about two hours.

### **How the session is organized**

The session will be carried out directly as a plenary.

### **Materials needed**

None.

### **Preparation**

Know how water can be contaminated by different sources of pollution (latrines, garbage dumps, etc.).

## Module 3: Drilling

The following aspects will be covered in this module:

- ✓ Avoid errors or influential individuals/groups changing any aspects during implementation of the infrastructure;
- ✓ How to ensure that essential parts of drilling (drilling equipment: tubing, gravel) are appropriately carried out;
- ✓ Check to see that the quality of water at the end of drilling is visually pleasing.

<b>How was the infrastructure implemented?</b>	Infrastructure implemented by drilling machines.
<b>What are the determining elements of this phase?</b>	Do not drill in any other site than the one that was identified with the community at the planning stage. Quality of materials used during drilling. Quality of water after drilling the infrastructure.
<b>How will you evaluate the consistency or quality of the work?</b>	<u>Before starting to drill &amp; build the infrastructure</u> - Ensure that the official representatives of the community are present for the beginning of the implementation;
<b>What actions should be taken?</b>	<u>During drilling</u> - See that the casing tubes used to line the borehole are not broken; - See that the lower casing strainer tubes are used (not hand sawn slotted tubes) at the level of the water influx; - Check that the size and type of gravel is consistent with the design specification  <u>During development</u> See if water is clear and note the time taken for clean water to come out when water is struck at the time of drilling

## Methodology / how the session is conducted:

### Key learning and discussion points

- ✓ Technical characteristics of a borehole (use visual medium);
- ✓ Quality of materials used for a borehole
- ✓ Borehole cleaning (development) process after the drilling and casing

Ask participants to explain (according to their experience) how drilling is conducted. Then ask the following questions:

- **1.** Which community members should notify the company in charge of drilling of the site selected for the borehole and why? (Participants are invited to share their experience, which serve to illustrate various viewpoints).
- **2.** Draw a picture or diagram to illustrate the drilling process (water infiltration, capture screens & water inflows, water filtering through the gravel packing, etc.).
- **3.** Ask participants to debate what qualities or characteristics of PVC tubing and gravel pack make a good quality borehole.

These characteristics are:

- For the strainers: allow water to flow in without clogging too much, allowing fine elements to pass during the development (the slots should not be too small), retain larger elements behind the screens during the borehole use (the slots should not be too large).
- For the gravel filter pack: retain the coarse elements of the aquifer (water table) and let other elements filter through during the development (drill cleaning).

Note: Ensure you have prepared in advance to show the participants adequate samples of screens and samples of good and poor quality gravel (PVC sawn, non-siliceous and non-rounded gravel).

- **4.** Ask participants to describe the characteristics of good quality water.
- **5.** Explain the process and equipment used for constructing a borehole (cleaning the drill) that takes at least four hours or more, if necessary, until water is clear.

- **6.** At the end of the session, ask participants to
  - a) Summarize the types of materials to use, how to clean a borehole, and what water should be like at the end of the development.
  - b) Discuss what to do if:
    - The borehole is drilled in a place other than what was decided by the committee;
    - Poor quality materials are used or poor practices are used;
    - The water does not become clear.

### **Session duration**

The session will last about two hours.

### **How the session is carried out**

The session will be carried out directly as a plenary

### **Materials needed**

- Diagram of a borehole;
- Good quality sample of a gravel filter pack;
- Poor quality sample of gravel;
- Good quality sample of a PVC strainer;
- Sample of a hand sawn slotted PVC tube (poor strainer).

### **Preparation**

- Know good quality gravel;
- Understand the stages of drilling and developing a borehole.

## Module 4: Installing the pump

The goal of this module is to:

- ✓ Allow community members to evaluate pump installation: Is the depth at which the pump is installed conforms to the required depth based on the pumping test?

<b>How is the infrastructure implemented?</b>	The installation of the pump is done by a business or a pump supplier.
<b>What are the determining elements of this phase?</b>	A good quality pump is properly installed and is placed at the required depth.
<b>How will you evaluate the consistency or quality of the work?</b>	It is impossible for communities to assess the quality of the pump, but they can evaluate the depth at which the pump is installed and compare that with the information given to them by the project.
<b>What actions should be taken?</b>	Ensure that the pump has no leaks: water must leak before five strokes of the pump.

### Methodology / how to run the session:

#### Key learning and discussion points

- ✓ Know the right depth of installing the pump cylinder (some meters below the water level in the driest season and after pumping at the maximum yield of this borehole during the whole season)
- ✓ How to check that the pump has no leaks: You should not need to pump more than five times before water comes out of the pump nozzle.

Discussions will be based on their knowledge of well dewatering, where the level of water varies depending on the time of year and the level of usage. Understanding that these realities are also applicable for boreholes is important. For the pump to be able to deliver water at any time, the pipe needs to be long enough to be submerged in water at all times of the day and in all seasons.

Ask the following question:

- **Q1.** How do you know what length of pipe to use to make sure to always have enough water when the pump is used?

Listen to the explanations and give the correct explanation if the participants' responses are not satisfactory. Pump testing allows one to test the borehole and estimate for an average flow rate what will be the water level at the end of the dry season. Based on this, a few meters are added to this level to determine the total pipe length.

Discuss how or who should give this information (length of pipe to use for the pump).

At the end of the session, discuss with participants what they should do if:

- They determine that the pump is not installed at the right depth;
- The pump has leaks.

### **Session duration**

The session will last about 30 minutes

### **How the session is organized**

The session will be carried out directly as a plenary.

### **Materials needed**

- Well diagrams with different water levels (different lengths of cord necessary for the borehole).
- Borehole diagrams with different water levels and sufficient lengths for pipes to always be submerged in water year round.

### **Preparation**

None

## Module 5: Implementing the superstructure

The goal of this module is to help community representatives understand the function of the superstructure, and how to evaluate the quality of the construction of the superstructure:

- ✓ The purpose of the different parts of the superstructure;
- ✓ The overall quality expected for the different parts of the superstructure
- ✓ The quality of the aggregate material;
- ✓ The way the blocks are made;
- ✓ The manner in which the concreting and plastering are done.

<b>How is the infrastructure implemented?</b>	The infrastructure is constructed by a contractor
<b>What are the determining elements of this phase?</b>	Implement a quality superstructure (quality of concrete and blocks) that permit a complete seal between the surface and the water source and avoid any stagnant water pooling around the platform and drill
<b>How will you evaluate the consistency or quality of the work?</b>  <b>What actions should be taken?</b>	<p><u>The quality of the materials used is crucial</u></p> <ul style="list-style-type: none"> <li>- Check that the sand and gravel used does not contain debris or soil;</li> <li>- Check that the cement used is fresh, comes from a new bag that is tightly closed, dry and has no lumps;</li> <li>- See if the water used is clear (not cloudy).</li> </ul> <p><u>The superstructure must help protect the water quality and limit animals access of to the point of use</u></p> <ul style="list-style-type: none"> <li>- See if the coping and the concrete floor around the borehole are correctly built, so as not to allow water infiltration into and around the immediate drilling area;</li> </ul> <p><u>Proper preparation of blocks is necessary</u></p> <ul style="list-style-type: none"> <li>- See if the area chosen to make the bricks is shaded;</li> <li>- Count the number of bricks made from one bag of cement (one bag of cement should make 40 bricks of 15cm each);</li> <li>- See if bricks are correctly watered morning and night, for at least 14 days and dried in the shade.</li> </ul>

Proper preparation of concrete and proper plastering is essential

- Verify that the concrete is watered morning and evening after the setting period for at least one week;

Check that the plastered areas are watered morning and evening after the setting period for at least one week.

## Methodology / how the session is conducted:

### Key learning and discussion points

- ✓ Good quality concrete requires good quality materials and adherence to the specific rules of mixing and curing.
- ✓ The role of the platform in protecting the groundwater source and the physical characteristics of a good platform.

This session will revolve around the following principles:

- the various parts of the superstructure have a function, and their construction should be of a quality that meets that function ;
- A good quality infrastructure cannot be constructed with poor quality materials;
- Good quality materials alone are not sufficient, they must be used correctly.

Ask participants to identify the various parts of the superstructure (coping concrete floor, walls, drainage channel, soak away pit) and specify the use of each part. Engage the participants discuss what would happen if any of the parts did not work well.

Ask participants to list the key components for the making of bricks and concrete. Make additions and/or corrections where needed.

Ask participants to summarize the requirements for obtaining quality results. Complete their understanding by further explanation when you note that participants' responses show insufficient level of understanding. Explain what will be the effect of using poor quality materials.

Provide and show participants good and poor quality samples of each of the materials (sand, gravel, cement).

For good practices, ask participants to indicate what they should not do when making bricks or cement, and ask why: for the implementation site, for the proportions of materials used (number of

bricks/ bag of cement, etc.), for mixing the materials, and for watering the concrete during the curing process.

■ Ask participants how to verify that the blocks were done well: listen to the answers and give the right answer if it was not provided (no crumbling when pressed with fingers, does not fall apart when dropped from a height of one meter). Do a practical test with participants.

■ At the end of this session, ensure that participants can summarize the usefulness of the superstructure, the quality of materials to be used and good practices for making bricks and concrete.

■ Discuss with participants what should be done if:

- Poor materials are being used and/or if the wrong mix of concrete is used;
- The bricks are cured in the sun;
- The bricks or the different cement or mortar (plaster) are not adequately watered (morning and evening, for the correct amount of time)

### **Duration of the session**

The session will last about two hours.

### **Organization of the session**

The session will be carried out directly as a plenary; no subgroups.

### **Materials needed**

- Good quality samples of sand and gravel
- Poor quality samples of sand and gravel
- Several concrete blocks to test examples of both good and poor quality (test for erosion, strength and impact resistance).

### **Preparation**

Understand the consequences of the use of poor materials and poor practices when making concrete blocks and concrete.

## BIBLIOGRAPHY

- Agence Française de Développement, 2011, Guide méthodologique, Réalisation et gestion des forages équipés d'une pompe à motricité humaine en Afrique subsaharienne, septembre 2011.
- Arjen van der Wal, 2009, Connaissances des méthodes de captage des eaux souterraines appliquées aux forages manuels, Fondation PRACTICA, Janvier 2009.
- Babacar Dieng, 2005, Hydrogéologie et ouvrages de captage, Groupe EIER-ETSHER, Juillet 2005.
- Cathy Solter, November 1997, Curriculum de Formation d'Ensemble de Santé Reproductive et Planification Familiale, Module 1: introduction à la planification familiale et à la sante materno-infantile et une vue générale des méthodes de planification familiale, Medical Services Pathfinder International.
- Denis Zoungrana, 2003, Cours d'approvisionnement en eau potable, EIER.
- M. KOKOLE Koffi Agbévidé, Cours de technologie de construction, Tome I : Formation pratique des formateurs du tâcheron de bâtiment, 2iE, Décembre 2005.
- TALICA Consulting Inc, Programme de formation en gestion de projet – curriculum.

## The GWI Technical Series: Hardware Quality for Sustainable Water & Sanitation:

A practical guide for building a simple pit latrine.

ref.: 2011-01-E



Contracting for water point construction: Provisional and final acceptance forms.

ref.: 2012-04-E



Assuring Quality: an approach to building long-lasting infrastructure in West Africa.

ref.: 2012-01-E



The essential steps before handing-over a borehole (with hand pump) to the community.

ref.: 2012-05-E



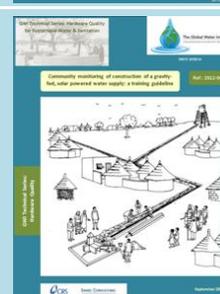
Monitoring checklists: water points and latrines.

ref.: 2012-02-E



Community monitoring during the construction of a gravity-fed, solar powered water supply: a training guideline.

ref.: 2012-06-E



Community monitoring of borehole construction: a training guideline.

ref.: 2012-03-E



Making the right choice: comparing your rural water technology options.

ref.: 2012-07-E



These documents are also available in French.

The main authors are Lambert Zounogo P. Nikiema (CRS), Sue Cavanna (Sahel Consulting) and Jean-Philippe Debus (CRS).



**The Global Water Initiative**  
A Partnership Funded by the Howard G. Buffet Foundation