



Ministry of Water, Cooperatives and Rural Development, Northern Bahr el Ghazal,
Republic of South Sudan

Framework & Handbook
for the
Operation and Maintenance
of Rural Water Supply Services



A Politically Enabled Public Private Partnership

March 2015

Foreword

The vision is for Northern Bahr el Ghazal, through its own leadership and involvement of communities, to ensure sustainable access to safe water for all in the state.

The Ministry of Water, Cooperatives and Rural Development, Northern Bahr el Ghazal state, believes that achieving this vision is possible if all agencies supporting Water, Sanitation and Hygiene (WASH) in the state join hands and follow a coordinated, collaborative and professional approach. The capital cost of new infrastructure and rehabilitation is subsidised. Services are managed by communities, but communities receive follow-up support for this from government and other WASH agencies. Community management is underpinned by extensive communication. Rural water supply services are maintained by handpump mechanics. Spare parts are available in the state, but have to be purchased by the water users.

This Framework & Handbook for the Operation and Maintenance of Rural Water Supply Services has been developed by the state Ministry in collaboration with agencies supporting WASH activities in Northern Bahr el Ghazal state. Its development was supported by the Swiss Agency for Development and Cooperation (SDC). The framework is guided by the Draft Policy Paper for Operations and Maintenance of May 2013 and the Planning and Strategy Workshop in Wau in August 2013.

The Handbook reflects a major shift in policy for the Government of Northern Bahr el Ghazal, towards a more sustainable model. This places more responsibility on communities as beneficial owners of the water points to pay for operations and maintenance, and to make a contribution towards major repairs and rehabilitation. Clear communication of these changes, by the Ministry and implementing agencies, will be essential for its success. It will be important to use a range of channels including commissioners, traditional leaders, churches and other networks and through radio.

Abbreviations

IAS	International Air Services
MWCRD	Ministry of Water, Cooperatives & Rural Development
NBeG	Northern Bahr el Ghazal
O&M	Operation and Maintenance
WIMS	WASH Information Management System

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Introduction

The “Northern Bahr el Ghazal Framework and Handbook for Operation and Maintenance of Rural Water Supplies” sets out how to ensure that rural and urban¹ dwellers benefit from affordable drinking water services that are effectively managed, protected and maintained. The Framework and Handbook sets out common procedures and provides practical guidance for the planning & implementation of water supply improvements in Northern Bahr el Ghazal (NBeG) state. These procedures are to be adhered to by all government and non-government agencies striving to increase or sustain drinking water supply services in NBeG state through boreholes fitted with handpumps.

Operation and Maintenance (O&M) of rural water supply services in NBeG is community-based, with the communities taking responsibility to manage the facility, collect fees and pay for regular maintenance and repair. Preventative maintenance is undertaken by community-based caretakers. Maintenance and repair work is performed by hand-pump mechanics who provide services to more than one community.

Approved handpump mechanic are either “volunteers” or on the county government pay role. Every approved “volunteer” handpump mechanic is a member of a registered county-based handpump mechanic association. The community pays both volunteers and government staff for their maintenance services.

Spare parts are provided in the state by private enterprises. Once facilities have been formally handed over to the community, regular back-up support and follow-up of community management is provided by government and non-government agencies in the state.

¹ ‘Urban’ areas in Northern Bahr el Ghazal are currently characterised as large villages, or conglomerates of villages with point sources of water – akin to rural supplies.

Communication of roles and responsibilities to all stakeholders, including water users, is an on-going process and involves political as well as traditional leaders, media, and religious organisations and all implementing agencies.

The South Sudan National Ministry of Electricity, Dams, Irrigation and Water Resources follows a 'one policy approach' whereby state policy is directed by national policy. The NBeG State Framework for the O&M of Rural Water Supply Services is the state Government's response to Section 4 of the National Water Policy (GoSS, 2007) i.e.:

- Section 4.1.5 *"rural communities shall be supported to take an active role in planning, managing and financing RWSS schemes on a sustainable basis"* and
- Section 4.2.6 *"to encourage users to contribute towards O&M costs while ensuring that the poor are not disadvantaged"*.
- Objective 4.2.3 for effective structures to manage delivery of rural water supply services at the lowest appropriate level. Both hand-pump and water yard facilities in South Sudan are managed at community level: *"following years of protracted conflict, rural communities have only limited capacity to contribute towards the capital costs. However it is generally agreed that communities can reasonably be expected to contribute towards the costs of operation and maintenance"*.

This framework also responds to the state's transition from an emergency situation through recovery to development and self-reliance, and the end of free spare parts distribution in South Sudan by UNICEF in 2013.

The vision is for Northern Bahr el Ghazal, through its own leadership and involvement of communities, to ensure sustainable access to safe water for all in the state.

Due to limited resources, not everyone can be served immediately.

Definitions

Table 1 Definitions for the O&M Framework

Term	Explanation
Operation	The day-to-day use of a facility to deliver clean water according to design. This includes pumping the water or opening the tap. In the case of a water yard it may include switching on the generator, or the connection between the pump and the solar panels. It includes locking and unlocking the facility, or guarding it.
Preventative Maintenance or Protection	<p>The activities that are carried out to keep the water facility in good working order. In the case of a handpump, these activities include keeping the platform, drainage and surroundings clean and keeping the fence good condition. On a monthly basis it is necessary to undertake routine servicing of the above ground parts:</p> <ul style="list-style-type: none">■ open the pump head and grease the chain,■ check that the handle axle nuts and chain bolt and “Nyloc” nut are tight,■ make sure that the flange bolts and nuts are tight,■ repair holes and cracks on the pump platform■ clean the drainage and repair cracks. <p>Ideally, there should also be routine checks and servicing of the below ground parts every three months so that wearing parts are replaced before there is a complete breakdown.</p>

Term	Explanation
Minor Repair	Activities done to fix a pump that is not operating as it should or is broken down. Includes the replacement of fast wearing parts such as the chain, pipes rods or cylinder.
Major Repair	A complete overhaul of a handpump that is beyond minor repair. It includes: <ul style="list-style-type: none"> ■ fishing out broken pipes ■ replacement of the rising mains.
Rehabilitation	A complete borehole or platform overhaul including: <ul style="list-style-type: none"> ■ cleaning or re-development of the borehole due to incrustation of the screen, siltation or poor development at the initial construction stage ■ replacement of the platform or drain
Follow-up support	The process where an extension worker (government or development partner) visits a community to encourage, motivate and reinforce practices until they becomes habitual. It also includes helping communities and committees to deal with problems they encounter for the “first” time. The turnover of committee members means that something experienced every few years may be a “first” time for the individuals involved.

State Framework for O&M

Water supply services can only be effectively operated and maintained if quality infrastructure is built in the first place, and if all stakeholders understand, and fulfil their roles and responsibilities from the outset.

Recognising this, the Framework considers the pre-construction and construction as well as the management phases of rural water supply service delivery. Although organisations differ as to how phases are carried out, it is expected that all agencies operating in NBeG follow the steps set out in Table 2.

In order to enable organisations to align with the O&M Framework as well as jointly raise professional standards, the MWCRD provides a platform for coordination between different stakeholders in the form of the WASH cluster and WASH coordination meetings. This platform also provides the space to amend the O&M Framework in future in light of learning or changes in the context.

Table 2: Phases of Water Supply Service Delivery

Phase	Activity
Pre-construction	Diagnosis of reason for breakdown (in the case of major repair or rehabilitation)
	Community selection and engagement
	Community mobilisation and training
	Selection and training of committee & caretaker
	Siting
	Procurement & Contract Award
Construction	Supervision of construction
	Mobilisation of equipment, drilling, borehole design, well development, pump test, completion and water quality testing.
	Selection of materials/pump
	Pump installation
	Fencing
Post-construction/ Management of Services	Handover of facilities to community
	Community management
	Spare parts availability
	Maintenance services
	Collation of borehole completion reports and entry into WASH Information Management System (WIMS)
	Monitoring of services
	Back-up/follow-on support to communities

Figure 1: Four core principles for rural water services in NBeG



The Framework comprises four core principles summarised in **Figure 1** and described below:

- All government agencies, NGOs, donors and private enterprises that undertake water supply activities in NBeG follow a **coordinated, collaborative and professional approach**. Coordination of all stakeholders is facilitated by the MWCRD. Monthly and quarterly meetings provide the space for coordination and joint planning. If gaps in skills and knowledge for the state are identified, these are shared and solutions sought to raise them. Likewise, opportunities are put forward at the meetings.
- Government, with the support of its development partners **subsidises the capital costs** of new water supply facilities as well as major repair or rehabilitation (see p. 19), thus providing services to communities. Boreholes installed with handpumps are intended to supply water to 250 people.

- **Communities manage** their own water supplies and pay for their repair. In order to fulfil their roles and responsibilities, government and all other agencies provide sufficient sensitisation and subsequent training of communities. In the long term, a system of community applications for water source improvements will be established. Government and development partners undertake post-construction monitoring and provide follow-up support (e.g. training and support with conflict resolution) to enable communities to continue to finance and run their water supplies. Government, development partners and private enterprises use a range of communication channels and approaches to reinforce key messages to communities as well as to listen to community perspectives.
- Volunteer (private) and public handpump mechanics provide **maintenance services** to communities to maintain and repair their water supplies. Communities pay the mechanics against a schedule of rates, based on the type of repair. Private sector spare parts dealers at county level sell spare parts. No agency distributes, or installs free spare parts for handpumps in the state other than as an emergency response in designated camps for Internally Displaced Persons (IDPs) and Refugees. The spare parts system is supported by government and development partners, by training, setting up revolving funds, guaranteeing purchase of pump parts and other materials from stockists.

A coordinated, collaborative & professional approach

Coordination & collaboration

The mandate of the MWCRD is to:

Increase reliable access to rural and urban water and sanitation services to improve health and livelihoods, and to strengthen water resources management and planning in the state to drive economic development.

The Ministry's responsibilities also include monitoring and regulation, planning for future needs and overseeing the implementation of new infrastructure investments. In addition the Ministry is responsible for the coordination of all agencies undertaking WASH activities in the state. The Ministry hosts two types of coordination meetings:

- Monthly WASH Cluster meeting (2-3 hours)
- Quarterly WASH Coordination meeting (one day)

There is also an annual review of Water Resources and WASH (two days).

It is expected that the monthly and quarterly meetings will be attended by at least one representative from all agencies undertaking, or planning WASH activities in the state. This includes NGOs, CBOs and county, as well as state government agencies. All organisations are expected to facilitate their own attendance of these meetings. If there are limited financial resources for county governments, all agencies in the WASH community are expected to join hands and find a way of ensuring that they can attend.

The Ministry collates the information presented at the monthly and quarterly reports and uses it for its annual report, which should ulti-

mately cover one Government of South Sudan financial year (July to June).

The annual report is presented by MWCRD at the annual Water Resources and WASH Review, where key milestones are agreed and set for the coming year.

As part of the collaborative approach, MWCRD expects all donors and implementing agencies to inform the Director when they are planning to support or implement work in the state, and prior to work commencing once funding has been approved. Implementing agencies are expected to provide half-yearly updates on plans and achievements. Agencies are also expected to work closely with the relevant county WASH unit.

Professionalism

Professionalism is defined as the skill, good judgment, and behaviour expected from a person or organisation who can undertake a job well. All professions, including rural water supply require special education or training, and skills.

As South Sudan and NBeG moves from a humanitarian situation to one of development, there is need to build and develop capacity and raise the professionalism of stakeholders. Government and the private sector in particular need to be able to undertake their work properly.

All stakeholders need to know their roles and responsibilities in relation to the activities set out in Table 2, and undertake them to the highest professional standards. Key roles and responsibilities at community level are set out in Table 4. Table 5 sets out the roles and responsibilities for siting, construction and supervision.

All agencies prepare short written reports covering the phases and activities set out in Table 2 and submit them to the County commis-

sion and Ministry. Reports are consolidated at county and state level on a quarterly basis.

Community management plus follow-up support & communication

Community Management

A water management committee must be established at each borehole. Ideally, it should be in place prior to construction of new facilities, or rehabilitation. Table 4 describes the key roles and responsibilities of the community and the committee. The village chief/elders have a key role to play in encouraging the water management committee and mediating conflicts that arise in the management, fee collection, and O&M of the service. Problems that cannot be solved at this level should be taken to the Payam Administration, and ultimately the County Commission. Wealthy individuals may be able to solve problems such as payment for maintenance but they may also wield influence in the community as a result.

Communities are expected to levy 2 to 5 SSP/month/household (at 2014 prices) to cover costs of handpump O&M. Annex 1 provides the rationale for this estimate. Higher tariffs will be required for water yards with submersible pumps, where the water tariff is based on levels of usage (1 SSP for 5 jerry cans).

Table 3 sets out the recommended schedule of charge rates for repairs by handpump mechanics, with 50% paid in advance and 50% upon satisfactory completion of the work. Note that additional transport costs may be charged. Community members must also pay for spare parts of their handpumps and water yards.

Table 3: Schedule of Charge Rates for Repairs by Handpump Mechanics (at 2014 prices)

Type of Repair	Rate (SS)P
Routine Maintenance	30 – 50
Minor Repair	150
Major Repair	300
Rehabilitation	500+ (rate depending on scope)

Table 4: Key roles and responsibilities at community level

Community	Water User Committee
<p>1. Select or elect a water user committee of 7 to 12 members including chair, deputy chair, secretary, treasurer, caretaker(s) and members. Decide how the local political leadership is to be involved in the committee. Decide how women are to be represented.</p>	<p>1. If the village is receiving a new water facility, the committee is responsible for:</p> <ul style="list-style-type: none"> a. Collecting the initial contribution, to be used in the maintenance and repair fund. b. Managing the construction of a fence to protect the facility from animals.
<p>2. Determine and set out in writing:</p> <ul style="list-style-type: none"> a. The tenure of office for the committee, b. How to replace the committee members in case they do not fulfil their roles or leave the job/community. c. Record keeping requirements. d. Accountability and reporting mechanisms. e. All by-laws for the water supply 	<p>2. Organise a meeting with the entire community every three months to discuss operation and protection of the facility and fees. Provide the community with an account of how much has been collected and from whom, how much has been spent, what it has been spent on and what the balance is. Short minutes of the meeting should be taken.</p>

Community	Water User Committee
<p>3. Decide whether it wants to try and protect the facility from breakdown by having it serviced regularly or whether it wants to only fix it when it breaks down. This decision should be reviewed every three to six months.</p>	<p>3. Make sure that the area at the pump is kept clean and that the pump is not damaged by children playing on it. In the initial months the committee must ensure that every member of the community knows how to properly operate the facility.</p>
<p>4. Set and review user fees to pay for the protection and repair of the handpump.</p>	<p>4. Collect and store all user fees and keep records of collection as well as expenses. Look after the handpump tools.</p>
<p>5. Pay a regular fee for the operation and maintenance of the handpump to the committee. If the fees are insufficient e.g. for a large repair, an additional amount may need to be raised.</p>	<p>5. If the committee decides to ensure pump protection, it must agree with the handpump mechanics that they will come and service the pump every three months. The committee should supervise the mechanic and pay him/her from the O&M fund and receive a receipt.</p>
<p>6. In case the committee is not fulfilling its roles and responsibilities as agreed the community should first contact the chief, and then the Payam Administration for assistance in conflict resolution.</p>	<p>6. In the case of a breakdown the committee should directly contact the designated handpump mechanic or contact the Payam to undertake an assessment and repair of the facility. The committee should supervise the mechanic and pay him/her from the O&M fund and receive a receipt. If the breakdown is considered beyond the capacity of the community this needs to be reported to the Payam Administration.</p>
	<p>7. The committee may either decide to purchase the spare parts itself from a supplier or may request the handpump mechanic to buy them on its behalf.</p>

Box 1: Checklist of Minimum Standards for Community Management

1. The community has made a written request to the Payam, which is then forwarded to the county commission.
2. The community has formed a WASH committee through a fair and transparent selection process
3. The whole community is aware of its roles and its responsibility for the source
4. The community has collected # SSP towards the construction cost and paid it to the WASH Committee Treasurer
5. The community has constructed a fence around the handpump apron
6. The water user committee has quarterly meetings with minutes
7. The water source log book is available and is used to record major events
8. The committee collects regular fees from water users
9. Water source accounts of income and expenditure are readily available
10. An annual meeting is held by the community with a full report by the committee

WASH agencies (government and NGOs) undertake face-to-face sensitisation and training of communities for new water supply sources, or rehabilitations. This enables the community members to understand their roles and responsibilities for O&M (Table 4). Key skills that need to be developed are set out in Box 2.

Box 2: Key skills for community management

- Organising and running meetings
- Taking minutes
- Record-keeping
- Raising funds for a common purpose
- Collecting user fees
- Managing finance, including accountability and reporting
- Reporting back to the community
- Preventative maintenance (or protection)

Handpump mechanics must do their work properly. If a community is not satisfied with the services received, the water user committee

should inform the Payam WASH Supervisor and/or the Assistant Commissioner.

Monitoring and Follow-on Support

Depending on the availability of human and financial resources, communities with handpumps should receive an annual follow-up visit by an appropriate County Administration representative or the Payam WASH Supervisor. This visit should enable key issues and conflicts to be discussed on the spot. Requirements for refresher training or re-election of the committee should be noted and incorporated into work plans as well as discussed at WASH coordination meetings.

The Boma or Payam may hold an annual competition to determine the best committee or community management in the Boma or Payam. Ideally, criteria and scoring should be developed by selected community representatives from the area.

Data collection can be undertaken by handpump mechanics. However, this requires guidance about what to collect, clear lines of reporting to the County, and agreement on how to finance community visits.

Communication

Several communication channels are used in order to raise awareness of community members of the importance of clean water and to clarify how they can best operate and maintain their supply:

- Regular (e.g. every two weeks) radio broadcasts (Box 3)
- Face-to-face exchange between community members and well-informed local leaders, e.g.
 - County commissioners (including initial speeches when new in office)
 - Assistant commissioners

- Village chiefs,
 - Payam administrators,
 - Members of Parliament (MPs)
 - Ministers
- Face-to-face sensitisation and training of communities by government staff and other WASH agencies
 - Posters in government and NGO offices that clarify roles and responsibilities for maintenance, and where spares can be obtained.

Box 3: Radio is an effective way to communicate with water users



Ideas for Radio Broadcasts

- Community members text in their questions to Government and other WASH agencies
- Information about where to buy spares, current prices and professional handpump mechanics.
- Dramas about clean water, leadership, problem solving, collecting user fees, transparency, dealing with conflicts, fence construction, handpump mechanics.
- Interviews with successful committees
- Competitions for schools and communities

It may be useful to launch an operation and maintenance campaign, both through the media and by direct visits to enable re-training of communities.

Subsidised capital cost and rehabilitation of infrastructure

Investments

Government, with the support of its development partners, subsidises the capital cost of new or rehabilitated boreholes fitted with a community handpump. The target for settled communities is at least one safe water source for 250 people. In the case of rehabilitation, a full diagnosis needs to be undertaken to determine the cause of the breakdown (Annex 2).

Communities are expected to contribute cash as an initial deposit into the maintenance fund. The policy of the Ministry is that settled communities should pay 2000 SSP² towards major repairs and rehabilitation³. External support agencies, and when funds permit government, may cover the full additional costs.

Communities and households who cannot benefit from subsidised water sources in the near future are encouraged to improve their own drinking water supplies as much as possible (such as by digging or upgrading hand dug wells).

Technology Choice

Ultimately, the government of NBeG intends to ensure that water users are offered a choice of technologies to provide water services. However, in the meantime, the main technology for rural dwellers is a borehole fitted with an India Mark II handpump. Annex 3 provides an extract of the specifications. It should be noted that Galvanised Iron

² Exceptionally the Ministry will allow a reduction to 1500 SSP for remote rural communities with low socio-economic status.

³ Policy to be reviewed at the end of 2015

(GI) pipes are not to be used in groundwater with a pH of less than 6.5 as they will corrode.

Table 5: Roles and Responsibilities for Siting, Construction & Supervision

<p>The Community members are the end users of the water supply. They must be included in the process of siting and design so that the finished water point can meet their needs. There are cases where the Community is involved in supervision, but they should not be responsible for technical or contractual details unless their capacity has been built extensively.</p>
<p>The Client is the organisation or community that is contracting out the borehole construction. Their responsibility is to fulfil regulatory requirements and ensure that the borehole is properly sited and that well-trained and experienced supervisors are present on site for the full duration of drilling operations.</p>
<p>Borehole siting should be undertaken by someone with suitable training and experience (preferably a hydrogeologist). Well siting involves the identification of features on the ground that may be favourable for groundwater occurrence; and selection of the most suitable geophysical method or methods and interpretation of the findings and consultation with the end users.</p>
<p>Note that even if local government is not the client, it is still important for them to be involved in the process. The local government (payam or county level) should attend a pre-mobilisation meeting with the drillers as well as the end of construction supervision.</p>
<p>The Funding Organisation pays for the borehole. It may be the Client, or another organisation such as an international development partner or NGO. The funding organisation should not impose conditions that create perverse incentives or undermine the long-term sustainability of the finished borehole (e.g. by insisting that the cheapest bid is accepted regardless of quality). It should work within national or local government systems.</p>
<p>The Regulator issues permits or licenses for drilling or abstraction. Legal requirements should be established by the Client early on to avoid delays.</p>
<p>The Project Manager is usually responsible for a wider project. The drilling will be just one component within a project plan comprising community train-</p>

ing/mobilisation, pump technology choice, water point design and construction, and establishing or strengthening a rural water supply service.

The **Supervisor** is sometimes called the 'Rig Inspector'. Supervision is usually done either by the Client's staff or by a consultant. The Supervisor may be a hydrogeologist, an engineer, or a technician. Although the Driller and the Supervisor work together to deliver the product, their roles are different. The Supervisor's responsibility is to ensure that the Driller adheres to the technical specification, makes all the required measurements, keeps all records accurately and ensures that health and safety procedures are adhered to.

The **Driller, or Contractor**, is the organisation that physically does the drilling. Sometimes, this will be an independent private sector company. In other cases, it will be an in-house team working for a government agency or NGO. The Driller's responsibility is to drill the borehole as specified. Each Driller should have a designated 'Record Taker' who should remain on site at all times, with the duty to collate all the measurements and complete all the forms.

Handover

The agency subsidising the new facility or rehabilitation must ensure that there is a formal celebration and handover of the water facility with speeches from Boma and Payam leaders, village chief, members of the committee and community members. The handover ceremony should also include a reiteration of the roles and responsibilities of all stakeholders.

Maintenance services and spare parts supply (with no free spare parts)

Caretakers

Every community selects a caretaker or caretakers. The caretaker is responsible for keeping the site clean, maintaining the fence, security and routine pump maintenance (including greasing the chain and

tightening the bolts). The caretaker must be trained and equipped by the agency that is subsidising the infrastructure.

Handpump Mechanics

Handpump mechanics are at the heart of NBeG's O&M System. All approved mechanics in NBeG have been trained and certified to a certain standard, and are issued with an identity card. All approved handpump mechanics are either "volunteers" (and members of a county-based handpump mechanic association), or they are government staff. All members have access to the necessary tools and to suitable transport (e.g. for hire).

Every handpump mechanic should have a log book to keep note of the services provided to communities.

The state and county government in collaboration with WASH agencies operating in NBeG hold an annual meeting for the approved handpump mechanics, including refresher technical training, business training and peer-to-peer sharing of experiences and problem-solving.

In the future, MWCRD may launch competitions for the "best handpump mechanic" and "best handpump mechanic association".

Handpump Mechanic Association

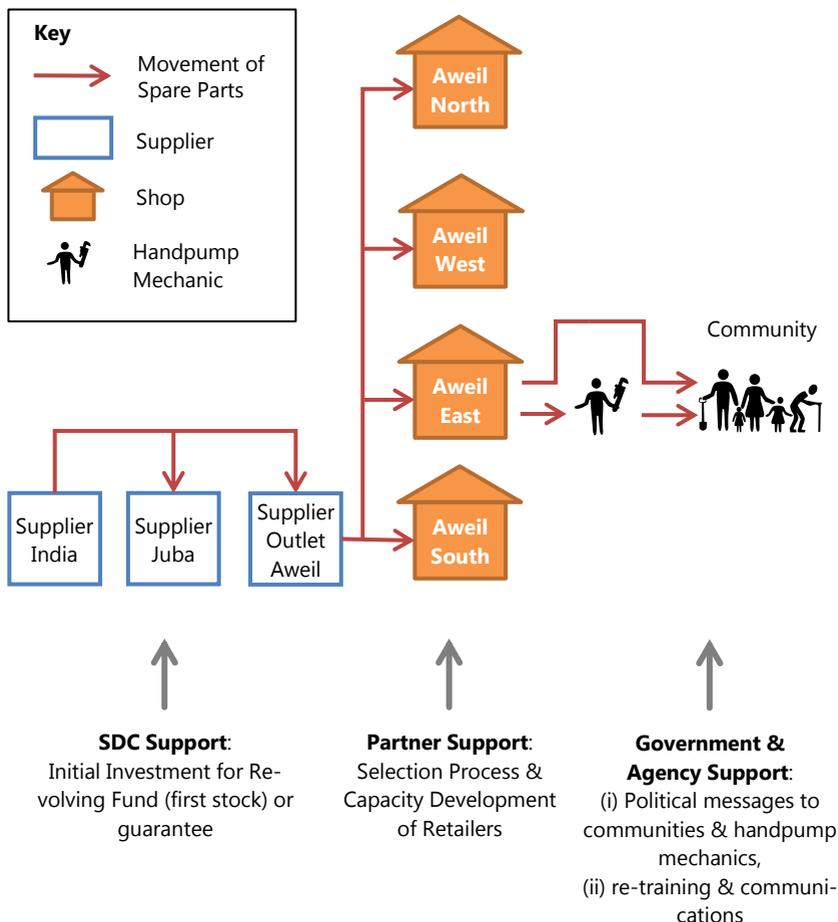
There is one handpump mechanic association in each of NBeG's five counties. All associations are registered as legal entities and, where possible, should have a bank account.

Spare Parts Supply

No free spare parts are distributed. Quality spare parts are available from private enterprises. UN Agencies, NGOs, and bilateral agencies are only to provide free spares in the case of emergencies, which are defined as designated camps.

In NBeG, government will encourage an ISO certified supplier to make quality pumps, and spare parts are available for purchase in Aweil. In 2015 agencies are kick-starting stockists in each county.

Figure 2 Handpump Spare Parts Supply Chain for NBeG



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Annex 1: Finance Requirements

Communities

Table A1.1 provides an estimate of the annual cost to be paid by the community to operate and maintain a borehole fitted with an India II handpump at 2013 prices). Assuming that a community comprises 50 households, 2 SSP per month would need to be collected. If there are only 25 households in the community, 4 SSP is required. This assumes that the fees collected in the first years can be kept for subsequent years.

Table A1.1: Cost Components for Operation and Maintenance (2014 Prices)

Component	Who Pays	Unit Cost (SSP)	No of Units/year	Annual Cost
Labour and transport for repair	Community	300	2	600
Fast moving parts	Community	100	2	200
Transport to collect fast-moving parts	Community	50	2	100
Slow moving parts (every 2 years)	Community	400	0.5	200
Major repair or rehabilitation (every 5 years)	Community pays contribution	500	0.2	100
Annual Total for Community				1,200

Follow-on support

The Government and support agencies also incur costs to follow-up and retrain communities as well as supporting major repairs and rehabilitations beyond the affordability of the users. Table A1.2 provides a rough estimate for the cost of supporting an asset base of 500 hand-pumps (using 2014 prices). It assumes that every year, 250 communi-

ties are visited, 100 committees are re-trained and 50 sources are rehabilitated (at a cost of SSP 4,000). Resources for the retraining of handpump mechanics, sensitisation of local leaders and visiting pump supply shops/outlets are also included.

The total (equivalent to about US\$64,000, or \$128 per pump) is considerably higher than the resources currently available for WASH at county government level. This illustrates the importance of planning, coordinating with other agencies in the state and pooling resources to ensure follow-on support.

Table A1.2: Estimated Annual Cost to Government/Agents of Supporting 500 pumps (SSP at 2014 Prices)

Component	Unit	No	Cost	Amount
Major repair (50 per year)	Lump Sum	50	4,000	200,000
Monitoring and follow-up of water users (fuel & DSA assuming four communities per day – 10 SSP/l)	Day	62.5	50	1,250
Re-training (includes fuel, DSA & IEC materials assuming an average of two days per community)	Community	100	400	40,000
Support to conflicts and problem-solving	Community	50	200	10,000
Retraining of pump mechanics (two days)	Participant-days	30	80	2,400
Sensitisation of local leaders (lunch & refreshments for 20 people)	Meetings	6	400	2,400
Monitoring of pump supply shops (fuel for monthly visit)	Visit	12	40	480
Total cost				256,530
Cost per pump (assuming 500 pumps)				513

Annex 2: **Diagnosis of Poor Functionality and Breakdown of Handpumps and Boreholes**

In all cases of breakdown, an assessment should be carried out to diagnose the problem. In the case of major breakdown, which may even require rehabilitation, it is important to establish whether the supply is worth rehabilitating or not. It is essential to assess the following:

- The duration the borehole worked for before breaking down. If it worked for several months beforehand, it is likely that it can be rehabilitated, but if it stopped working only a few days after construction it might be due to poor construction and be difficult to rehabilitate.
- Whether the supply has failed because of a problem with the pump, or with the borehole itself. Table A2.1 sets out technical causes of poor functionality and failure of the India II pump. Note that in the case of highly corroded pipes within a short duration, there is need to measure the pH of the water and determine whether Galvanised Iron rising mains should be installed. Galvanised Iron rising mains should not be installed when the PH < 6.5.
- In the case of siltation of the borehole, it is necessary to determine whether:
 - this is due to inadequate borehole development, which could be redone or
 - whether poor construction such as inappropriate gravel packing and/or the working screen slot size is the case. In such cases it may not be worth rehabilitating the borehole (MWR, 2014).

Table A2.1 Technical Causes of Poor Functionality and Failure of India II Pump (adapted from Skat, 2008)

Trouble	Possible Causes	Remedy
Pump works easily but no flow of water	Worn cup seals	Pull out rising mail, open cylinder and replace worn cup seals.
	Water level dropped below cylinder	Add more riser pipes and pumprods.
	Broken chain	Replace chain.
	Check valve jammed (not closing)	Pulling out rising main, open cylinder and check function of check valve. Replace if necessary.
	Pumprod disconnected	Pull out rising main and join disconnected pumprod.
Delayed flow or little flow of water	Check valve leaking	Pull out rising main, open cylinder and check whether the check valve is leaking. Replace it if necessary.
	Worn sealing rings	Pull out rising main, check sealing rings and replace if necessary.
	Worn cup seals	Pull out rising main, open cylinder and replace all worn cup seals.
	Damages rising main (leaking pipe threads or severe pipe corrosion)	Pull out rising main, check all riser pipes and make replacements if required. Severe pipe corrosion should to be reported to county government.
Folding of chain on down stroke	Plunger jammed inside cylinder	Pull out rising main, open cylinder, check size of plunger and cylinder and replace wrong or defective components.
	Top rod is too long, plunger is sitting on top of the check valve	Take off pump head, check correct length of pumprod assembly and trace top rod if needed.

Trouble	Possible Causes	Remedy
Noise during pump operation	Lack of grease on the chain	Grease chain.
	Worn ball bearings	Replace ball bearings.
	Shaky foundation	Check foundation and make necessary repair.
Shaky pump handle	Loose handle axle nuts	Tighten handle axle nuts.
	Worn or damaged spacer	Replace spacer.
	Worn or damaged axle	Replace axle.
	Worn ball bearings	Replace ball bearings.
	Bearings loose in bearing house	Replace handle assembly (for possible repair).

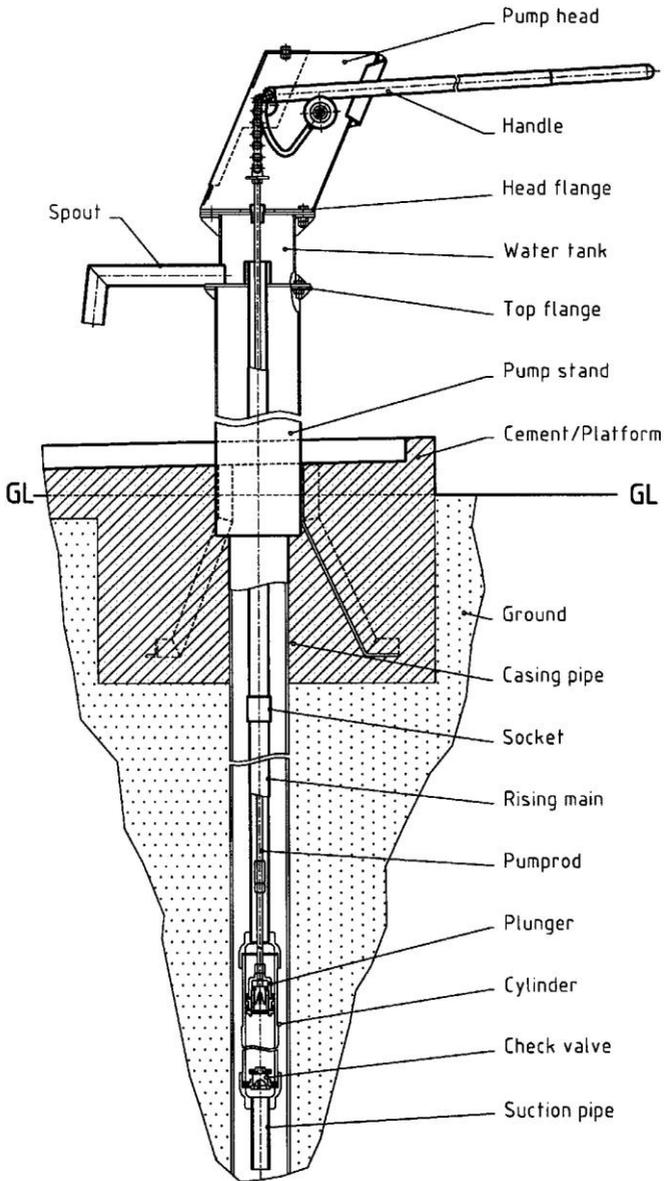
Annex 3: India Mark II Extract Specifications

Good quality materials, which adhere to specifications, increase the lifetime of a pump considerably. Therefore all pump components need to be checked strictly prior to installation. Key publications are:

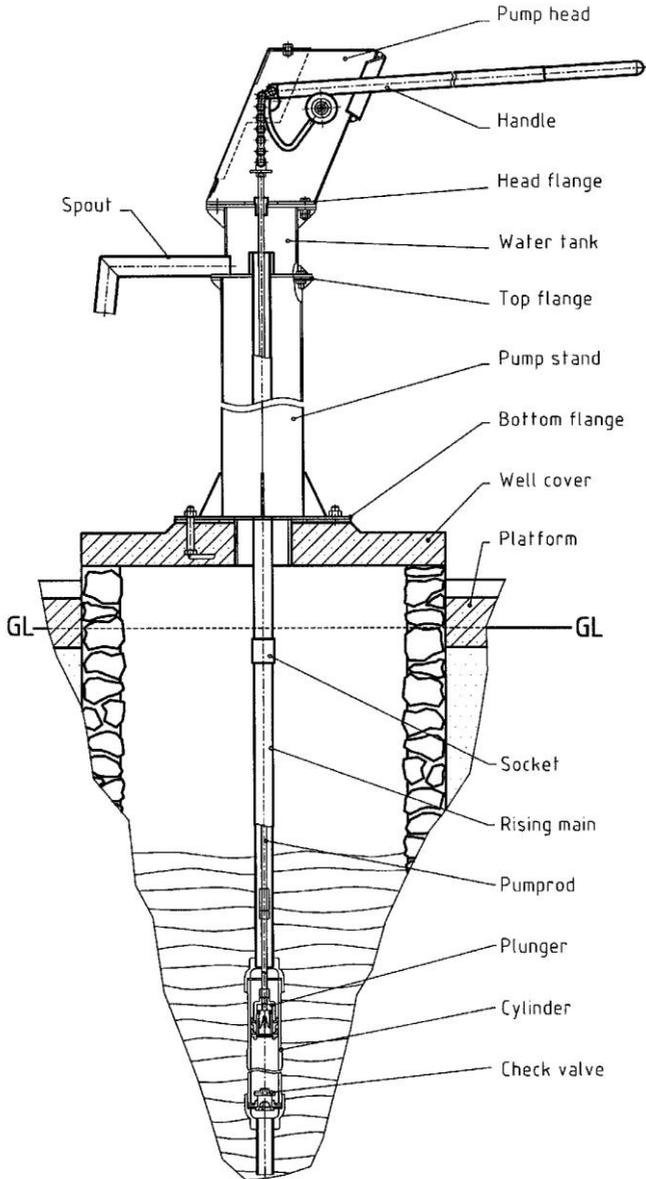
- Skat (2007) *India Mark Handpump Specifications (Revision 2-2007)*, Rural Water Supply Network, Switzerland, available from: <http://www.rural-water-supply.net/en/resources/details/327>
- Skat (2008) *Installation & Maintenance Manual for the India Mark II Handpump*, Rural Water Supply Network, Switzerland, available from: <http://www.rural-water-supply.net/ressources/documents/default/1-328-34-1384355371.pdf>

Note: Galvanised Rising Mains should not be used in aggressive waters (pH < 6.5).

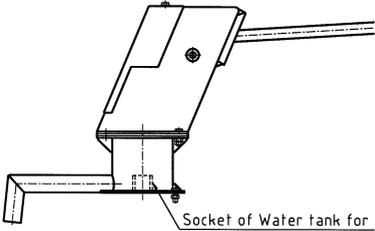
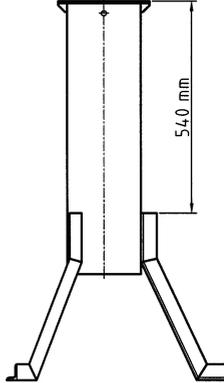
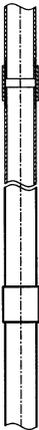
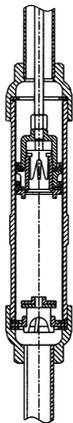
Drawing of an India Mark II Pump installed in a Borehole (Skat, 2008)



Drawing of an India Mark II Pump installed on a Dug-well (Skat, 2008)



Select Components (Skat, 2008)

<p>Pump head with standard handle and water tank</p>  <p>Socket of Water tank for</p>	<p>Pump stand with 3 legs drawing No. B2048</p>  <p>540 mm</p>	
<p>Rising Main</p>  <p>Galvanised GI pipe with sockets (1 ¼" medium)</p>	<p>Cylinder arrangement</p>  <p>Cast-iron cylinder, brass plunger and foot valve drawing No. A2350</p>	<p>Pumprod arrangement</p>  <p>MS- Pump rods with threaded connectors drawing No. A2370</p>

Annex 4: Description of Spare Parts

Drawing No (Skat, 2007)	Description of spare part	Qty/ pump	Fast/ Medium/ Slow Moving*
Pump head			
B2304	Head assembly (welded and hot-dip galva-nised)	1	S
B2320	Front cover assembly (welded and hot dip galvanised)	1	S
C1017	Hexagonal bolt M12 x 40 (for Pump head/Water tank)	4	M
C1016	Hexagonal nut M12 (for Pump head/Water tank)	8	M
Pump handle			
B2326	Handle assembly (welded and hot-dip galvanised)	1	S
B2346	Chain assembly	1	M
C2332	Spacer (electroplated)	1	S
C2333	Handle axle (Stainless Steel)	1	S
C2334	Axle washer (electroplated)	1	S
C1035	Ball bearing (double shielded)	2	F
C1016	Hexagonal nut M12 (for Handle axle)	2	S
Third plate			
B2335	Third plate assembly (welded and hot-dip galvanised)	1	S
Water tank			
B2340	Water tank assembly (welded and hot-dip galvanised)	1	S
C1017	Hexagonal bolt M12 x 40, (for Water tank/Pump stand)	4	M
C1016	Hexagonal nut M12 (for Water tank/Pump stand)	8	M

Drawing No (Skat, 2007)	Description of spare part	Qty/ pump	Fast/ Medium/ Slow Moving*
Pump stand			
B2348	Stand assembly (welded and hot-dip galvanised)	1	S
Pumprods			
B2373	Pumprod assembly (Mild Steel, threaded, hot dip galvanised)	x*	M
B2555	Plunger rod assembly (Stainless Steel, threaded)	1	M
Rising main			
C2365	Riser pipe (GI pipe, 1 1/4", medium, threaded, hot-dip galvanised)	x*	M
C2366	Socket (GI pipe, 1 1/4", medium, threaded, hot-dip galvanised)	x*	M
Pump Cylinder			
C2351/52	Cylinder (Cast iron, painted with Brass liner C2352 fitted)	1	S
C2353	Reducer cap (Cast iron, outside painted)	2	S
C2354	Sealing ring (Nitrile Rubber)	2	S
Plunger and Check valve			
C2355	Plunger body (Brass component)	1	S
C2356	Follower (Brass component)	1	S
C2357	Spacer (Brass component)	1	S
C2358	Upper valve (Brass component)	1	S
C2359	Cup seal (Nitrile Rubber)	2	F
C2360	Rubber seating (Nitrile Rubber)	1	M
C2361	Check valve (Brass component)	1	S
C2362	Check valve seat (Brass component)	1	S
C2363	Seat retainer (Brass component)	1	S
C2364	Rubber seating (Nitrile Rubber)	1	M

Drawing No (Skat, 2007)	Description of spare part	Qty/ pump	Fast/ Medium/ Slow Moving*
Other components			
	Grease multipurpose – for greasing chain assembly	1 can	F
Installation and Maintenance Tools			
A2443	Pumprod vice assembly (for installation of Pumprods)	1	S
B2420	Connecting tool assembly (for installation of Pumprods)	1	S
A2470	Pipe clamp assembly (for installation of Riser pipes)	1	S
A2478	Bearing mounting assembly (for installation of Ball bearings)	1	S
C2476	Chain support (for installation of Chain assembly)	1	S
C2477	Axle punch (for installation of Handle axle)	1	S
A2515	Pipe vice assembly with Clamping & Fixed jaws for 1 1/4" (for installation of Riser pipes)	1	S
B2545	Lifting spanner 1 1/4" (for installation of Riser pipes)	3	S
C1005	Spanner 19 (for M12 hexagonal bolts and nuts)	2	S
C1137	Spanner 17 (for M10 hexagonal bolts and nuts)	1	S
C1081	Spanner 24 (for M16 hexagonal nuts)	1	S
*	Slow Moving (S)	> 6 years	
	Medium Moving (M)	2 - 5 years	
	Fast Moving (F)	1 – 2 years	