



Platform Design for Handpumps on Dug wells

Construction Guidelines



Revision 1-2008

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This manual is a guide for the construction of platforms for handpumps installed on dug wells.

A construction guideline for platforms made of concrete is included in this manual, but the the platform could also be made of "brick masonry" or "stone masonry".

This manual results from work carried out by UNICEF Eritrea in collaboration with SKAT, Swiss Resource Centre and Consultancies for Development.

These guidelines are intended to assist the local "Installation Groups" to produce a good quality platform (including the well cover & manhole cover) for the handpump with material, which is locally available and to improve the sustainability and the hygiene condition around the water point.

Suggestions for improvements and requests for further information are welcome and should be sent to SKAT at the address given below.

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1. Introduction

1.1 General

Sustained safe drinking water supply and sanitation facilities are essential to improve the living conditions of the rural population. The provision of safe water helps to combat water borne diseases and improves community health in general. Benefits of a safe water supply can reach far beyond considerations of public health and have a positive influence on the general well being, economic status and quality of life in a community.

1.2 Protection of Water Source

If a well site is chosen and the well dug into the ground at a site which is elevated and away from water logged areas during the rainy season, the water which percolates from an underground aquifer into the well should be pure enough to drink.

However, a water point obviously attracts a great deal of human contact. This is a potential source of contamination and should be protected against.

The safety measures are as follows:

1.3 Well Siting

a) The well should be in an elevated place, so that during the rainy season the water will run away from it, rather than into it.



- b) It should be at least 30 m away from a latrine and uphill of the latrine.
- c) It should be at least 30 m away from an animal pen, and uphill of the pen.
- d) It should be well away from any depressed area in the ground, such as hollows that are used for rubbish tipping, hollows used for brick making or any other areas where water might collect.



1.4 Hygienic Environment around the Pump Platform

Throughout the water supply process, it is vital to bear in mind the important linkages between health, hygiene education and water. An awareness of the intimate relationships between these factors should be made clear to all water users.

Before the arrival of a new or improved water supply system, the water users of a village should receive hygiene training with regard to the collection, storage and use of water. For example, the transmission of disease through contaminated water might not be known by the community.

Cleanliness in the area of the water point is an important factor in the overall impact of the introduction of a new or improved facility.

If the surrounding area is not kept clean and free of animals, debris, waste & stagnant water the water point could become a hub for the transmission of many infectious diseases.

In this respect, the ability of the community to manage the system and ensure regular cleaning of the water point is vital.



1.5 Platform Design

If the area around a well is allowed to become dirty, and waste and stagnant water is allowed to accumulate, it will become a source of infection for the users. Standing in bare feet in stagnant water or mud is a serious health risk in the tropics since the open water provides an ideal breeding ground for many types of parasite or disease carrier. Awareness of the direct links between hygiene and water must start at the collection point, otherwise the possible benefits from an improved water supply will be lost.

The construction of a platform (or slab) at the wellhead is an important contribution to the general hygiene in a community. In addition to discouraging the accumulation of stagnant water at the surface, the slab will help to prevent the contamination of the well through the infiltration of dirty water back into the aquifer.

The following points are important:

- a) Consultation with the community is a must before a decision is taken on the platform layout.
- b) It is important that construction of the slab does not commence until the soil around the well, which was disturbed by the construction activities, has settled properly.



- c) The slab should be made from reinforced concrete of good quality. It must be large enough to collect spill water, which then can run away thorough the drainage channel.
- d) All surfaces must slope towards the drainage channel and edges of the slab must be raised.
- e) The slab should be well reinforced with steel wire, to prevent cracking (dirty water is passing easily through cracks in the platform and can contaminate the well beneath).
- f) Where possible, the drain can lead to an area of vegetation, such as banana plants or a vegetable garden. If this is not an option, a soak-pit can be built or a trough for watering livestock can be provided at the end of the drainage channel.

The shape of the slab is not as important as its capacity to drain water away from the well as quickly as possible and to ensure wastewater dispersal in a hygienic manner.

1.6 Fencing of the Water Source

In addition to constructing a slab, it is important to erect a good fence around the water point. This can be done immediately after the construction of the well is finished, and should give enough space to operate the handpump.

The advantages of fencing are that it serves to define quite clearly, for the whole community, the area of the well and it keeps animals away from the wellhead. In some cases, it may be necessary to have a gateway to keep out smaller animals such as pigs and goats.

The fencing should be made of suitable local materials like wood or stones. Problems of replacement and repair can be avoided altogether, by using a living hedge as a fence. Whatever type of fencing is used, it is important that access by the well users is guaranteed.



Perfect fencing of Water point

2. Dug wells

2.1 Well Types

Unlined wells



Lined well with Concrete rings





Lined well with Bricks or blocks





3. Platform Construction (concrete version)

The top ring of the lined dug well needs to be reinforced by an additional layer of bricks.

The face of the reinforced top ring should protrude the soil by 30 to 50 cm and need to be covered with a plastic sheet.

Logs should be laid over the opening of the top ring as a protection against falling into the well.



Step by step manufacturing of the platform is explained in the following sequences:

3.1 Setting out and Marking the Foundations

 After the decision has been made, in which direction the spill water of the platform needs to be drained, mark the outline of the platform and the drainage channel.

> For the decision about the direction of the drainage, the advantage of the natural slope of the area needs to be taken into consideration

b) Clear the platform construction area of bush and surface irregularities.

3.2 Digging the Foundation Trench

- a) Dig the trench for the foundation carefully and make sure that the marked outline of the platform does not get damaged during digging.
- b) The foundation trench is finished as soon as the depth of 40 cm is reached, (uniform), which can be checked from any point of the prepared surface (see picture).
- c) Tip the earth from the excavations far enough from the worksite to ensure easy handling of the steps to follow. Do not tip earth downhill of the worksite.





3.3 Filling the Foundation with Concrete

Before starting with any concrete work, check whether all preparation work is completed, so that the different cement work (wet in wet system) does not get interrupted too long.

It is very important that enough raw material has been collected to complete steps 3.3, 3.4, 3.5 and 3.6 without interruption before any mixing of concrete should start.



- Reinforcement bars or netting,
- Shuttering material (or form work) for the platform ring and drainage channel,
- Steel bars for connecting platform and drainage channel (2 off)

(See also 5.1 List of Material required on page 17)

- a) Prepare enough concrete for filling the entire foundation space up to the ground level.
- b) The mixture for the concrete must be made according to the formula 1 : 2 : 4 (see also information on 5.2 Cement Mixtures, on page 17).
 For measuring the correct volume, of the dry mixture, use only one container or else.

For measuring the correct volume, of the dry mixture, use only one container or else, containers of the same size.

- c) If the dry concrete mix is homogenous (overturning the mixture at least 3 times with a scoop or shovel), mix it again with a little water to get a semi fluid mass. Avoid adding too much water to the mixture, because a concrete made with a watery mixture will never reach the required strength.
- d) Before the concrete is compacted, check again the flange of the pump stand for horizontality and adjust if necessary.
 Compact with a vibrator or by hand (use a tamper) to remove trapped air.



3.4 Reinforcement of Platform and placing of Shuttering

- a) Place (and bind together) suitable reinforcement bars on the platform area, or lift preformed netting over the pump stand.
- b) Support the reinforcement with small stones or with the help of cement cubes in order to lift it to the required height.

The position of the reinforcement should be between 2 to 3 cm below the finished surface of the platform.



c) Place the shuttering (formwork) and support it with pegs, profiled planks or large stones.

3.5 Casting the Well Platform

- a) Prepare enough concrete for casting the platform (see also 5.2 Cement Mixtures, on page 17).
- b) Fill the platform with a concrete layer of 12 cm and compact by tamping.
- c) After a curing time of approximately 1 to 2 hours, the shuttering can be removed carefully.
- d) Prepare enough mortar for the Topping Coat, the final layer for the slope and the placing of bricks for the outer ring of the platform (see also 5.2 Cement Mixture, on page 17).
- e) Now the Topping Coat for the platform can be applied.
 Make sure that the slope of the

platform is in the right direction.

 A short while after applying the top coat (15 to 30 minutes), the bricks for the outer ring can be placed. $\frac{120}{120}$



g) Finishing work, like the top layer for the outer ring and radii between the platform and the top ring/outer ring can be made.

3.6 Casting the Drainage Channel

As soon as the well platform is completed, all work for casting the drainage channel can be started. <u>Proceed as follows:</u>

- a) Dig the required trench for the drainage channel. Make sure that the 2% gradient on the downward slope of the platform continues right to the end of the channel.
- b) Paint the protruding steel bars with heated bitumen (against corrosion).
- c) Place and secure the formwork of the 6m long drainage channel and place reinforcement bars or netting if required.
- d) Prepare a sufficient amount of concrete and cast a layer of 12 cm.
- e) After a curing time of approximately 1 to 2 hours, the shuttering can be removed carefully.
- f) Prepare mortar for the topping coat and enough bricks for the two rims of the drainage channel.
- g) Apply topping coat to the channel and make sure that the slope is uniform.
- h) The bricks can be placed 15 to 30 minutes after the topping layer has been completed.



- After the bricks are in position, the topping work like finishing and smoothening of all surfaces of the platform and drainage channel can start (see finishing details in the drawing below).
- j) Make sure that all top corners of the platform ring and the rims of the drainage channel are made with chamfers and a radius is applied between the platform and the ring, etc.

- k) Take care to match the entry level of the drainage channel with the platform water exit.
- I) Following the final touch of the drainage channel, the area of the "hard core layer" can be marked and the bricks can be placed.
- m) As soon as all final work is completed, all cement work needs a curing time of at least one week (see also 3.7 Curing of Concrete Work on page 10).
- n) Make sure that the finished platform and drainage channel are well protected from being destroyed, by covering with thorn bush etc.

For details of platform and drainage channel see drawing below:



Detail Section of Pump Platform

Section of Drainage Channel

3.7 Curing of Concrete work (Platform and Drainage channel)

Following the final touch of the platform and the drainage channel, a curing time of at least one week is needed.

During the curing period, the platform and drainage channel must be watered regularly, so that the concrete never gets dry.

Therefore it's advisable to make partitions of clay or other material so that the water is blocked from draining.

Direct sunlight must be avoided during the whole time of the curing



Watering the new platform

period and therefore the concrete work must be covered with wet Hessian cloth or wet soil or sand.

After every watering of the water point, cover the well platform and drainage channel with thorn bush, for protection from being destroyed by people or passing animals.

3.8 How to make a Soak pit

Construct a soak pit if no natural drain is available.

Excavate a hole and fill it with stones, broken bricks, gravel and sand.

To prevent sand from being washed away, fix a mud pot (with holes in the bottom) at the end of the drainage channel, so that the spill water can drain slowly (see picture).

3.9 Disinfecting the Well

As soon as the curing time is over and the platform is ready for installation of a handpump, the well needs to be disinfected with chlorine.

Many of the common diseases are carried by water. The disease carrying organisms found in the water can be effectively killed by disinfecting water with chlorine.

Therefore it is recommended to disinfect the well shortly before the installation of the handpump takes place.

Proceed as follows:

- a) For save disinfection it is recommended to use between 150 to 200 grams of bleaching powder per m³ stored in the well casing.
- b) Check amount of water collected in the well casing and calculate how many grams of bleaching powder are required.
- c) Mix the required amount of bleaching powder thoroughly in 15 litres of water (in a bucket) and pour it into the well.

3.10 Hard Core Layer and Fencing of the Platform

A hard core layer should be placed around the platform. This acts as a protection of the concrete platform and prevents spill water to create a swampy muddy area.

Proceed as follows:

- a) Mark the outside line of the hard core layer as shown in the picture below.
- b) Dig as much as required, so that the brick or stone layer is level with the ground surface when finished.
- c) Bricks or stones are placed on mortar or sand and the joints are filled with mortar.







- d) The placement of logs or any other suitable material for fencing can only be started after the hard core layer has cured (approximately one week).
- e) The entrance of the fence should be able to be closed or be made as narrow as possible, so that no animal is able to enter the well point (see drawing).

4. Well Cover Construction

4.1 Well Diameters

The outer diameter of the "Head wall" of a Dug well is a very important factor for selecting the appropriate well cover type.

For Dugwells with large diameters (exceeding 180 cm) require two beams for supporting the well covers.

The beams have to be placed as such that they are in line with the drainage channel and that they are 80 cm apart from each other (see picture).

For selection and manufacturing of the beams see under 4.2 Supporting Beams on page 13.

Depending on the well diameter, well covers need to be designed as such that they can be handled by humans. Therefore it is advisable to manufacture

well covers in one piece only for well diameters below 180 cm.

Well covers between Ø180 to 260 cm, should be split in two.

Well covers between Ø260 to 400 cm, should be split in three.

(See also under 4.3 Selection of Well Cover Type on page 13 and 4.4 Well Cover Details on page 13.)

Placing of beams and well covers must be made as shown in the 4 pictures.









4.2 Supporting Beams (Selection and Technical Details)



Sizes for beams and dimensions of material required

Leasth V V Height V Width 7 De have A Peace P Pinding wine					
	neight t		Re-Dars A	Drace D	billung wire c
1.8 to 3.0 m	22 cm	15 cm	Ø12 mm	Ø8 mm	Ø1mm
3.0 to 4.0 m	30 cm	20 cm	Ø16 mm	Ø10 mm	Ø1 mm
For dug wells with an outside ring \emptyset over 4 m, no concrete cover is advisable					

4.3 Well Cover Types (Selection)



4.4 Well Covers

(Technical Details)



* SEE DRAWING OF PUMP FLANGE

Single Well Covers

Well outside Ø X	Dimension Y	Dimension Z	Cover thickness W	Dimension a $lpha$	Dimension b $lpha$
1.2 to 1.5 m	50 cm	30 cm	Ø10 cm	according to pum	p configuration
1.5 to 1.8 m	50 cm	35 cm	Ø10 cm	according to pum	p configuration
For dug well covers with an outside Ø over 1.8 m, covers need to be split and supported by beams					



* see drawing of pump flange

Well Cover split in 2 pieces (only to be used when well ring is supported by 2 beams)

Well outside Ø X	Dimension Y	Dimension Z	Cover thickness W	Dimension a st	Dimension b st
1.8 to 2.2 m	50 cm	45 cm	Ø8 cm	according to pur	np configuration
2.2 to 2.6 m	50 cm	55 cm	Ø8 cm	according to pur	np configuration



* see drawing of pump flange

Well Cover split in 3 pieces (only to be used when well ring is supported by 2 beams)

Well outside Ø X	Dimension Y	Dimension Z	Cover thickness W	Dimension a st Dimension b st
2.7 to 3.0 m	50 cm	45 cm	Ø8 cm	according to pump configuration
3.0 to 3.6 m	60 cm	60 cm	Ø10 cm	according to pump configuration
3.6 to 3.9 m	60 cm	60 cm	Ø10 cm	according to pump configuration



4.5 Manhole Cover (Technical Details)

Clear span size Y

Cover size X

Dimension A

Re-bar length B

* DISTANCE ACCORDING TO THE HOLE POSITIONS OF THE FLANGE PLATE

4.6 Well Cover Manufacturing

Mark a circle with the required diameter on a flat piece of soil. Place pricks along the outside of the marked circle and cover the whole area with plastic sheets (old bags etc.).

Place the Anchor assembly in the required position including the plastic pipe, the Manhole cover and 2 Cover handles.

Place Reinforcement bars and fix the position with wires (also Anchor assy. & Manhole cover).





For resting the Reinforcement bars, Anchor assembly, Manhole cover and 2 Cover handles in the required height, use small stones or cement cubes.

Prepare enough cement for casting the Well cover.

Before filling the concrete, tie a small rope or string around the circle made from pricks, in order to keep the exact shape.

Fill concrete and make sure that no air bubbles are trapped in the concrete (tamping).

After a curing time of approx. 1 to 2 hours, the pricks can be removed and a final layer on

the top face and at the circular face including the details of the manhole and flange arrangement can be applied.

After 24 hours of final curing time, the cove can be turned over and a final layer to the back face can be applied.

Full strength of the well cover (maximal load) is only reached after a time of 10 days of curing.

Only place the Well cover onto the Well head, when the curing time is completed, in order to avoid collapsing of a cover when people are standing on it.



4.7 Curing of smaller Concrete Components (Well- & Manhole Covers)

Following the final touch well covers and other concrete work needs a curing time of at least one week.

During the curing period of all concrete components have to be watered regularly, so that the concrete never gets dry.

Direct sunlight must be avoided during the whole time of the curing period and therefore medium sized parts like well covers should be cured in a shady place or must be covered with wet Hessian cloths or wet soil or sand.

Small parts like manhole covers can also be cured completely immersed in water.

5. Others

5.1 List of Material required

Materials and Consumables for the Construction of a Dug well Platform & Covers

Item	Approximate Quantity
Washed sand (without too much mud content)	2 cubic meters
Gravel (approximately Ø20 mm)	4 cubic meters
Cement, bag of 50 kg	8 bags
Burned bricks (3" x 4.5" x 9")	100 nos
Wire netting for platforms (50 x 50 x Ø3 mm wire mesh)	4 x 4 m
Binding wire for connecting wire netting	10 m
Hessian cloth for covering the platform (jute bags)	20 to 30 bags

5.2 Information on Cement Mixtures

The composition of a **Concrete Mixture for Foundations** should be according to the formula **1** : **2** : **4** - this means:

- 1 volume of cement,
- 2 volumes of sand,
- 4 volumes of gravel.

The composition of a **Concrete Mixture for Casting Platforms, Covers and Beams** should be according to the formula **1** : **2** : **3** - this means:

- 1 volume of cement,
- 2 volumes of sand,
- 3 volumes of gravel,

The composition of a **Mortar Mixture for Topping Work** (and constructing brick work) should be according to the formula **1** : **3** - this means:

1 volume of cement,

3 volumes of sand

5.3 Supporting Documents

Series of Manuals on Drinking Water Supply

- Vol. 1, Management Guide
- Vol. 3, Building Construction
- Vol. 5, Hand-dug Swallow Well
- Vol. 6, Drilled Wells
- Vol. 7, Water Lifting

Platform Design for Handpumps on Boreholes

5.4 Notes of Common Mistakes

6. Attachments

6.1 Examples of Platform Designs





