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BUILDERS MANUAL
FOR THE CONSTRUCTION OF
SHALLOW WELL

Acknowledgements

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1. Introduction

This manual has been prepared based on the experiences gained during the training course of well contractors who were fifteen at Amutanga during the period of four weeks. This training course has been organised by FINNIDA and UNICEF. The manual is prepared as a reference by supervisors and contractors in carrying out their daily work of constructing wells and should provide help for contractors to continue their work even without external support. The contractors have also received basic training in communication and community mobilization during the training course.

Photographs taken during the training course are used to illustrate step by step how to construct wells using different methods.

The approach is to develop rural communities' capacity and the ability of the beneficiaries to enable them in future to take full responsibility for the construction and management of their water points, using low cost technology and local materials.

The provision of an adequate supply of clean water and safe excreta disposal is of great importance in improving community health. New water supplies and sanitation facilities alone can not have much effect on the health of the community unless the people learn why new facilities are necessary, in what way it can contribute to a better health and also how to maintain it.

About 75% of the communities in rural areas are using shallow wells which are not protected. It is our aim to protect these existing "Omifima" and "Oondugu" in order to improve the health and hygiene of the beneficiaries.

When starting a well construction it is therefore very important that the project workers explain the benefits of the new water supply and promote health as an important advantage of water development.

This manual has been developed to be more general so that it could be used in all shallow well construction in Cuvelai region. It will be upgraded from time to time depending on the experience from the field.

2. Aims and Objectives

The aims and objectives of this manual is to help supervisors and contractors to be able to:

- * build wells using;
 1. bricks
 2. blocks
- * make mixture of concrete
- * make bricks and blocks
- * install concrete reinforcement
- * take measurements
- * use tools and equipments needed in well construction.
- * involve local community members in well lining

3. Safety for the well crew

Well construction is dangerous work, therefore, great care is needed to avoid accident which can result in serious injury or death. The supervisor must ensure that members of the crew are using and know how to use protective clothing such as: overalls, helmets, gum boots, rope handling gloves, safety belts, etc.

The supervisor of the crew should ensure that each member of the team is: sober on duty, carrying out the duties according to the instructions, abide by safety regulations, cooperative and be on site on time as requested.

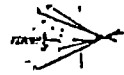


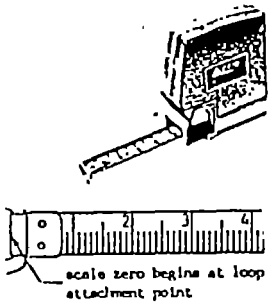

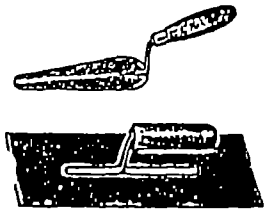



4. Community participation and its role



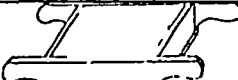




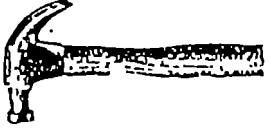
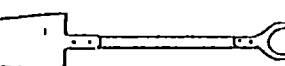



Since the mid 1970s participation of the beneficiaries in the construction of their development activities has become increasingly influential in the planning of rural development. In rural development, participation is concerned with how to bring about some meaningful involvement of the people who live in rural areas in development projects.

The role of the community in well construction is very important, therefore, it is essential that the people are informed about the work plans. It is also important that the people are given every opportunity to discuss their needs with the project representatives. Information can be shared at meetings. It is at these meetings that the community can express themselves and find out more about how the well contractors will operate, what contributions and assistance are expected from the community, how to form a water point committee, who will maintain the well after handing over. etc. Here are the responsibilities of the community, contractors and the project.

<u>Community</u>	<u>Contractors</u>	<u>Project</u>
Digging	Collar or well foundation	Provide
Back filling	Production of bricks or	materials
Collecting sand	blocks	Mobilise the
Fence making	Windlass + cover slab	community
Clearing the site	Apron	Pay the
Help the contractors	Final touch	contractors
in their work	Lining the well	Deliver the
		materials

5. Tools and equipments needed in well construction and materials needed by contractors

Name	Description	Function	Drawing
Tripod	support with three legs	for lifting heavy loads	
Safety belt	broad belts from nylon around waist and shoulder	for lifting and catching people	
Overall	loose dress covering the usual clothes	for protection during work	
Measuring tape	tape in enclosed metal case having a return spring, graduation metric or inch	for measuring short distances in carpentry or concrete work or brick work	
Mould	hollow form into which mortar or concrete is poured	to give a desired shape	
Trowels	from steel with wooden handle, or from wood, in different sizes and shapes	for brick, concrete, spreading mortar, plastering, rough cutting of bricks	
Oil can	with reservoir, spout and pressure pump	for oiling tools, etc.	
Spirit level	from wood or steel having two vials, one level and one plumb	for levelling and plumbing short distances	
Helmet	from plastic, textile fittings tape fastening	for reducing the risk of injuries from falling objects	

Gum boot	high boots made of rubber	for protection of foot	
Pick-axe	from steel with one broad sharp and one pointed end and a wooden handle	for loosening hard soil when digging	
Sand measuring box	A wooden mould	for measuring sand	
Building bucket	from plastic	for carrying materials	
Brick layer's line	nylon thread	for building straight line	
Combination plier	having single joint and pipe jaws	for all kinds of work	
T-square	a metal square with right angle	for making right angles or 45° on timber	
Hammer	with round, crowned face and split neck	for all hammer works	
Spade	shovel-like tool but with straight edge	for cutting and digging into soft soil with the additional help of the foot	
Wheel barrow	with one tyre, strong frame and two handle	to move loads	
Ladder	two long bars with short bars across as steps	for climbing up or down	
Tent	cloth shelter supported by poles and ropes	for providing shelter	

6. Making of concrete

Concrete is a mixture of cement, sand, aggregate and water. Various proportions of concrete mixture are called for by different uses. For example, lining normal water tight slab, the contractor will use a ratio of 1:2.5:5 (cement, sand, aggregate). While for instance for intake where porous concrete is needed the proportion is 1:1:4. What does these numbers tell us? It should be noted that 1 unit of cement plus 2.5 units of sand plus 5 units of aggregate (gravel) do not produce 8.5 units of concrete. Rather they tell us that if you are using a bucket for example, 1 bucket of cement plus 2.5 buckets of sand plus 5 buckets of gravel will produce a concrete which is water tight.

To make good concrete or mortar, the contractor should note the following rules:

- * use clean sand, gravel and sweat water
- * remove all organic materials such as grass, leaves and mud
- * use the materials in the correct ratio
- * mix the concrete very well to ensure maximum strength, first mix sand and cement while dry and turn it over at least four times until it has an even grey colour, add water and turn over again three times, add gravel and turn over again.

7. Making of mortar

Mortar is a mixture of cement or lime or silt, water and sand. It is used for making bricks, blocks and also connecting bricks or blocks in a wall. The ratio used in making bricks is 1:6 and the proportion for making blocks is 1:4. It should be noted that mortar from sharp sand which has angular grains has great strength but not easy to work with. On the other hand, mortar from loamy sand which has round grains is weak and must be avoided.

8. Different methods of constructing wells

There are lots of different methods used in constructing hand dug wells world wide, but, in this manual only three methods which were dealt with are described. These methods are: Lining the well with normal bricks; Lining the well with inter locking blocks; Sinking the well with wired blocks. These methods were chosen to see which one could suit in our region and be affordable by the beneficiaries.

8.1. Lining the well with normal bricks

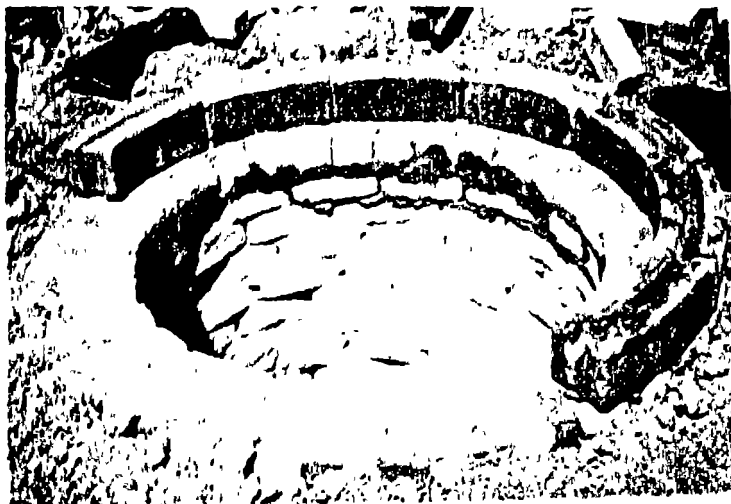
In lining wells, it is very important to see that the foundation is levelled. Using normal bricks, the foundation has to be of porous concrete not to block the sources of water.



This is how the well looked like before the construction. Here one could clearly see how difficult it is to get water from the well.



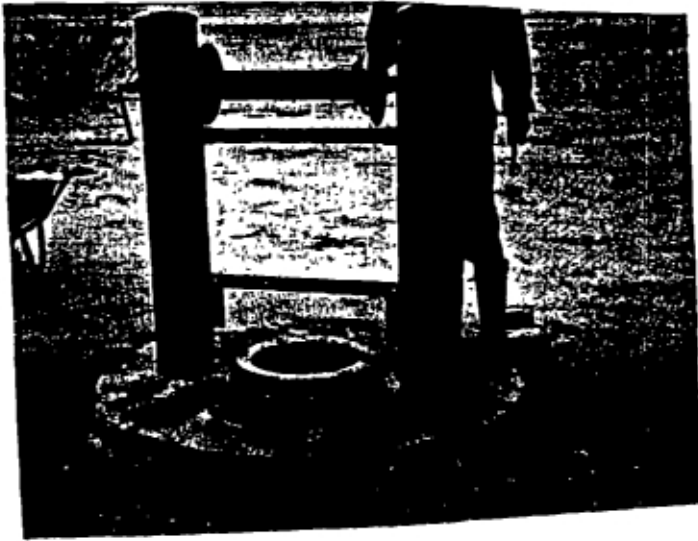
The construction has started with the porous concrete of ratio 1:1:4 (cement:sand:gravel) which is the foundation. The water could enter the well without hinderance. As construction goes on, backfilling is needed to an able the contractors to carry on with the lining work.



The outside diameter of this well is 1.2 m. Since the diameter of our cover slab is 1.5 m, the diameter of the well has also to be increased to that of the cover slab. In doing this normal bricks were placed differently as can be seen then, inter locking blocks were used to enlarge the diameter.



Clean always the bricks before using them. Remember to back fill from time to time when needed and to compact.



Making of the cover slab and the windlass. It is done in two parts 1. the cover slab and the man hole. 2. windlass stand.

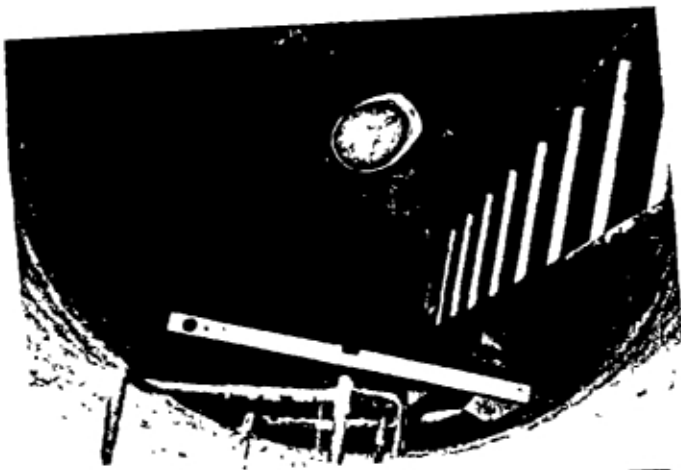
8.2. Lining the well with inter locking blocks



The foundation of this well is made of collar placed on a hard rock.



Lining of the wall has to start from this collar. The inside diameter is 1.2m and outside diameter is 1.5m.



Since the diameter of the well was not circular, three pillars were added to provide additional support.



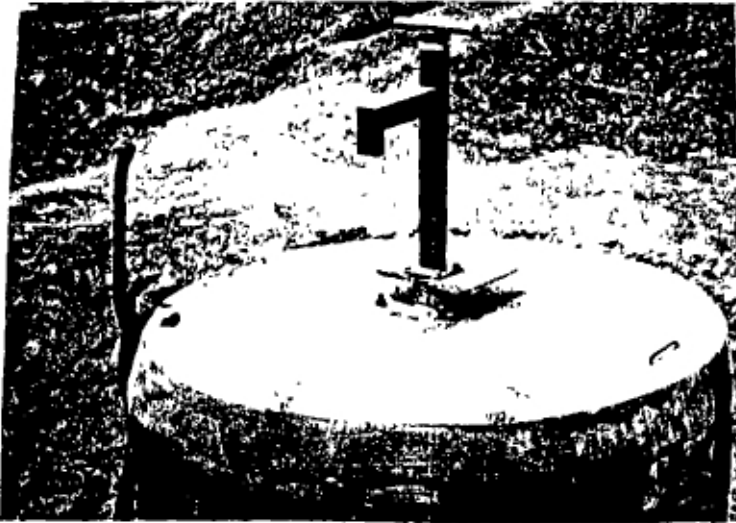
At every fourth courses, a step and a reinforced wire round the course are placed.



Community participation is high during the back filling.



Making of the cover slab of a pump. The concrete is poured in the mould half full, then the reinforced bars are placed on top. Later the mould is filled with concrete. The bolts have to reach the reinforcement bars in order to keep the base plate in position.

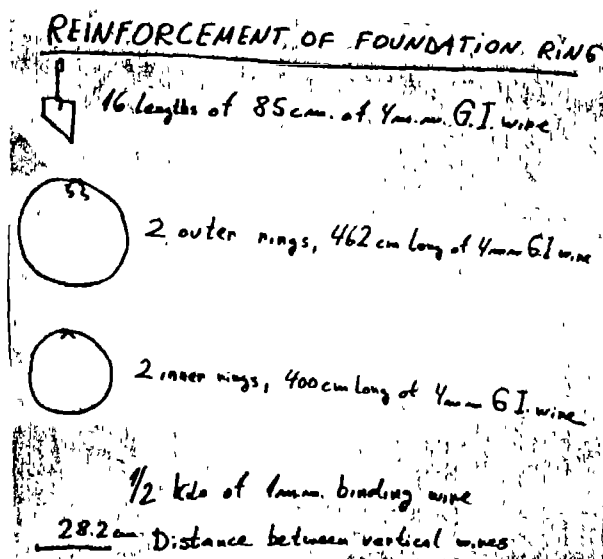


Installation of the pump. The pipes are connected outside the well and placed inn. This is how it look like after the connection is done.

8.3. Sinking the well with wired blocks



The soil is cut into a cutting ring form. This tool is used to shape the soil into the cutting ring form.



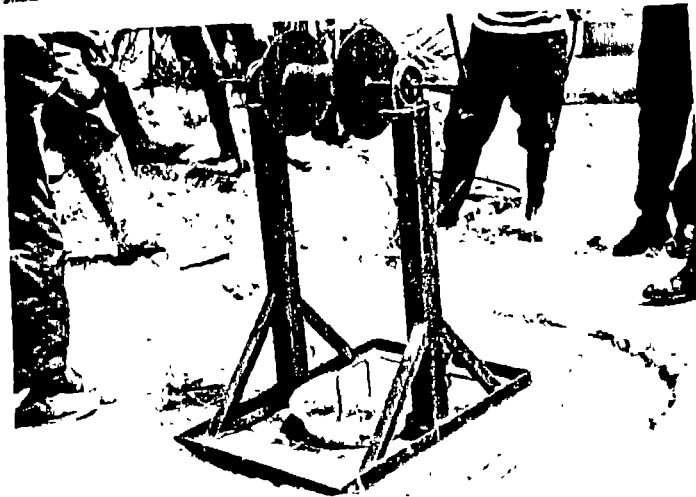
How to make the cutting ring. First is the reinforcement of the cutting ring. 16 pieces of 4mm G.I. wire 85cm long, 2 outer rings of 462cm long, 2 inner rings, of 400cm long, half kilo of 1mm binding wire are used. The distance between the vertical wires is 28.2cm



This is how the reinforcement look like when it is done.



Reinforcement is then placed into the excavation made for the cutting ring, thereafter the mortar is poured inn. From there, lining continues. Also at every fourth course, a step and a reinforcement wire is placed. Since this method is sinking, people must dig inside in order to sink the well. Community is trained to do the work.



Making of the cover slab is more or less the same as earlier described. Windlass stand in this case was manufactured in local workshop.



These are the blocks used in lining the wells. From left: wired blocks, normal bricks and the interlocking blocks.

3

WELL CONSTRUCTION SCHEDULE

ACTIVITIES	ACTORS	DAYS																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Digging	Community	█	█	█	█	█	█																								
Technical Inspection	Project			█																											
Establishment of the WPC	Project			█	█	█	█																								
Collection of sand	Community					█	█	█	█	█	█																				
Delivery of materials and two contractors	Project							█																							
Production of bricks/blocks	Contractors and community								█	█	█	█	█	█	█	█															
Production of cover slab + windlass stand	Contractors and community																█														
Lining the well	Contractors and community																	█	█	█	█	█	█	█	█	█	█	█	█	█	
Back filling	Community																	█	█	█	█	█	█	█	█	█	█	█	█	█	
Placing the cover slab + water raising mains	Project																												█		
Construction of the apron	Contractors and community																												█		
Construction of the drainage system	Contractors and community																											█			
Construction of the cattle trough	Contractors and community																												█		
Making of the fence	Community														█																
Levelling	Contractors and community																													█	
Making of the foundation	Contractors and community																	█	█												
Making of the collar	Contractors and community								█																						
Making of cutting ring	Contractors and community								█																						

