Optimisation of local resources for hand-dug wells

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TOWARDS THE MILLENNIUM DEVELOPMENT GOALS

Optimisation of local resources for hand-dug wells

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IN VIEW OF a comprehensive programme planned for implementation in six districts of Sri Lanka to improve the WTSAN facilities in the rural sector, a pilot project was undertaken in one Divisional Secretary's divisions in one of the target districts, Monaragala. The Community Water supply & Sanitation Project Unit, CWSPU of the Ministry of Housing, Construction and Public utilities undertook the implementation of the pilot project under its second WATSAN project funded by ADB. (Loan No: 1235 SRI CSP)

Madulla DS division, one of the most backward areas in the district has been selected for the pilot project. Overall objective of the pilot effort was to develop and test, appropriate methodologies, systems and procedures for a community based RDWSS project, which could be replicated on a wider scale.

Project area

Madulla is the remotest DS area in the district and with an area of around 670 sq kms it becomes one of the largest divisions too. There are altogether 38 Grama Niladhari Divisions (GNDs) – local government divisions at the lowest level, each consisting of 2-3 villages – in Madulla with two commercial centers located at the Southern and Northern ends of the division. The total population recorded at the time of the project was around 25,000 with around 5400 HHs. The main source of income of the population in the area was from agriculture, comprising seasonal paddy crops and other crops such as bananas/ plantains, vegetables and citreous varieties. The division recorded a literacy level far below the national average and a majority of the population has been recorded to be under the poverty level. The population density was low averaging around 300 persons per sq. km.

Implementation methodology adopted

The same methodology adopted in the CWSPU in the ongoing IDA/World Bank funded project implemented in an adjoining district, Badulla was applied to this project too.

Before commencement of a project the communities had to confirm their willingness to contribute all unskilled labour necessary for construction of the facilities and to take full and permanent responsibility for future maintenance and operation. The social, technical assistance and training needed by the communities in the participatory planning and implementation of the project of their preference was arranged through a Partner Organisation (PO) appointed by the CWSPU. A GND was considered as the geographical area covered by each community project. The project implementation cycle was of one-year duration with a project development phase of around 6 months and a construction phase of another 6 months. The POs were expected to monitor and consolidate the implemented projects over a further period of one year following completion of works. The project contribution was limited to a maximum of $ 100 per HH.

The community mobilization process started off with the identification of small groups representing up to about 10 neighborhood households. Each group had a leader elected. A WATSAN, situation mapping was carried out by, these small groups, in their respective areas. In an advanced stage a CBO was formed for each project area (GND) electing office bearers from out of the small group leaders at a general assembly of the entire community. The CBO as a main task produced a WATSAN situation map of the entire project area amalgamating the respective small group maps already prepared. Thereafter, the CBO together with the community planned out the requirements mapping them indicating the respective beneficiary households and prepared a community proposal.

In the meantime, the responsible PO field staff, together with the CBO did an accurate map of the area through a compass survey indicating the location of the houses, existing WATSAN situation and on the same map prepared a technically feasible independent proposal conforming to the project criteria and limitations. Cost estimates were prepared for both proposals indicating clearly the cost distribution between the project and the community together with the O&M implications. The two options were then discussed at a general meeting of the entire community laying emphases on the expected community contribution, project contribution and O&M costs and implications. The focus here was more on dug wells as the strategy for the latrine intervention was more, straight forward.

A compromise was reached at this meeting and a final proposal acceptable and endorsed by the community was decided. The expected contribution of the households, basically locally available material and labour was made clear and the CBO with the community worked out the schedules making sure the respective clusters or individual households, as the case may be, who complete the excavations of their wells up to the water level and harnessed the required quantities of sand were issued with the block moulds, cement etc to proceed with the construction. As the

CBO was issued with funds on a reimbursable base and entrusted with the responsibility of managing the funds the inputs could reach the respective communities without undue delays.

The overall pilot project period was 2 years. For ease of operation and for logistical reasons the GNDs have been split into three groups and implementation planned in 3 rounds. 16 community projects each were covered in rounds 1 and 2 and the balance in round 3, covering in all 36 leaving aside the 2 GNDs with the potential for growth into small towns having referred the latter to the National water authority, NWSDB for their intervention.

Water resources availability within the area

The project area falls within the flat plains in the dry zone of the country in its South Eastern region receiving seasonal rains through the North West monsoons during the last quarter in the year. A number of non-perennial streams meander within the area. These carry water only during the monsoons and a few months thereafter and most of them are totally dry for the rest of the year. The entire area has a impervious rock formation at shallower depths. The soil over burden varies from a few meters to about 10 meters. The ground water table varies very much influenced greatly by a very large man made reservoir not very far from the area. The seasonal fluctuation of the ground water table is therefore very high. The main source of available water in the area was ground water exploitable from shallow dug wells.

Consequently shallow dug wells have been identified as the main option for domestic water supply to the target area with a few borehole wells with hand pumps where the rock formation did not permit excavation of dug wells.

Challenges faced

- The project contribution ceiling was inadequate to cater to an all dug wells project. Shallow dug well is comparatively a costly option.
- Low population density; scattered HHs in the area; demanding higher service level (4 HHs to a water point within 250m haulage distance was the satisfactory service level stipulated by the project)
- Road works, irrigation works and other construction/ development activities in the area consuming bulk of the building materials such as stone products, bricks etc in the area and in the vicinity
- Short supply of skilled labour due mainly to the remoteness of the area.
- Poor access roads posing adverse difficulty in transportation of material.
- Water table fluctuation demanding concentration of the construction activities to a particular period in the entire area.
- Weaker technology know how
- Seasonal agricultural activities and others for sustenance keeping the people engaged most of the time, thus causing difficulty in organizing community contribution.
- Political interferences
- Difficulties in monitoring due to the vast extent of the working area geographically

Venturing into alternative options

It was obvious that the traditional technology/ methods of construction of shallow dug wells using traditional material such as rubble, bricks etc would not be possible in this instant, considering the challenges faced. More appropriate methods optimizing the local resources available had to be given thought. The option to be developed basically had to;

- be cost efficient
- be time efficient
- utilise locally available material
- be manageable by laymen with the minimal skilled labour intervention
- be acceptable to the community
- be acceptable to the project administrators, meaning CWSPU.

Options introduced

It was necessary to take a decision to deviate from the project stipulated service levels by introducing options for wells to serve individual HHs, 2-3 HHs and those serving 4 and over HHs. Accordingly, well diameters were designed for 1 m, 1.2 m and 1.5 m respectively

As a result of the existence of a number of streams in the area, sand happened to be a resource readily available in sufficient quantities and all over the entire project area. Making use of this readily available resource, designs were made for the introduction of curved cement blocks (sandcrete) made to shape for lining of wells. The dimensions were so decided that with a specific number of full blocks and with a 20mm joint width a course would be completed. For the larger diameter wells a wall thickness of 150mm was decided but for the 1 m diameter well the wall thickness was further reduced to 100mm. Since the sandcrete blocks were much stronger in compression this was possible.

A mortar mix of 1:8 (cement: sand) was used in the moulding of the blocks. Based on field trials the numbers of each type of blocks possible per 50 kg bag of cement was indicated to the community members for guidance.

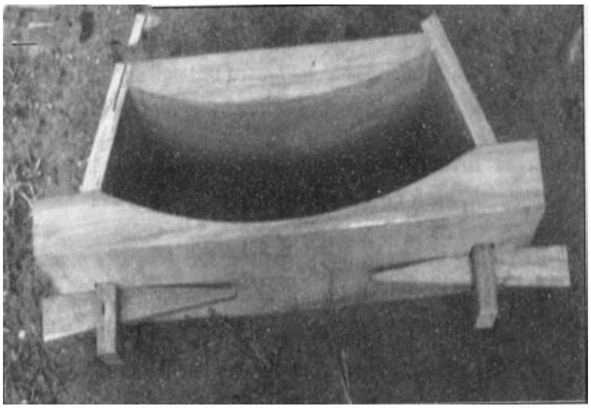

Figure 1. A typical block mould

Table 1. Details of the curved sandcrete block					
Well diameter (m)	Dimensions of the block (mm)		Height of the block (mm)	Width (mm)	Number of blocks per course
	Longer curve	Shorter curve			
1.00	450	370	200	100	8
1.20	300	230	200	150	15
1.50	318	262	200	1`50	17

Well lining with sandcrete blocks moulded to shape

Sandcrete blocks moulded in a curved shape exactly to size to form a course with a specific number with specific vertical joint spaces for a given diameter of a well proved to be a far more advantageous alternative material that could be used for well shaft lining.

Figure 2. Dugwell lined with sandcrete blocks

However, ordinary cement: sand blocks were not suitable for intake construction as it needed plastering which is difficult under wet conditions. Hence, concrete blocks made to shape using 1:3:6 (20) concrete was used

However, special care is needed in moulding the blocks and curing them properly. It acquires its maximum strength with continuous curing during the early days after moulding. This was an aspect that required much effort and convincing to the local community to be apprehended.

Figure 3. Concrete block option for intake area of a well

The relative advantages of using cement blocks for well shaft lining were the following.

- A great reduction was possible in the construction time. Wall linings for wells as deep as 6 m was possible within a matter of 3 days or less.
- It requires very little skills to build with the blocks moulded to shape. For building no skills were required. The householders themselves managed the wall lining depending on a person with some masonry skill for the plastering and finishing works.
- It requires only a thin layer of plastering due to the uniformity of the surface
- It generated more community participation. Block moulding was basically carried out by the women in the households while the men did the excavation and building works, the children sharing in by collecting and transporting sand from the dry stream beds.
- It was cost effective due to all the above factors

Progress achieved

Over 1600 hand dug wells were completed on the project of which more than 80% have been constructed using the sandcrete blocks as the lining material. Technology option proved economical, time saving, manageable without having to utilise excessive skilled labour days and most of all generated more community participation. However due to

Figure 4. Children contributed by collecting and transporting sand from dried up stream-beds

Table 2. Cost comparison per M of lined depth for 1.2M diameter well

Item	Type of lining material used		
	Sandcrete blocks	Rubble 150-225	Burnt clay bricks
Cement (50kg)	04	03	02
Sand (M^3)	0.65	0.45	0.35
Rubble (M^3)	–	1.80	–
Bricks (Nos)	–	–	500
Skilled mason	0.50	03	02
Semi/S mason	01	–	–
U/S labour	04	06	06
Total cost (Rs)	**3250**	**5050**	**4750**

the following constraints mostly administrative lapses and natural phenomena, the project period was prolonged by half a year.

- Inadequate and inconsistent cash flow
- Poor performance of the POs
- Shortage of experienced/qualified technical personnel in PO employment
- Inadequacy of the project staff for monitoring

The success rate of the dug wells were recorded at around 65% during the very dry months, but rest of the year all wells retained sufficient water to meet the domestic demands of the respective households.

The overall quality of construction was above average. Community members have in certain instances on their own resorted to using richer mortar mixes than what was recommended as adequate, in moulding the blocks. Curing of the blocks was a task that was given little importance by the community as such much effort was necessary from the field staff to convince and stress the importance of same. As for the moulding of blocks, there were a good number of household groups who managed to have the total requirement made within a day working late into the night.

Conclusion

The experiences gained on the pilot project of using sandcrete blocks as an alternative material for lining of hand dug wells paved way for its replication in the ADB funded RDWSS project that started its implementation in six districts of Sri Lanka. The technology has already been incorporated into the standard technical manuals on hand dug well construction that are being widely used in the country.

As an alternative material for lining of hand dug wells the use of sandcrete blocks made to shape proved to be a more appropriate option that could be replicated under most conditions anywhere. The skill of making blocks is readily available with most communities in Asia, Africa and Latin America. Where the access to skilled labour resource is a limitive factor in construction trades, especially in the developing countries of the world, here is an option that could easily be handled by an average person.

NEIL HERATH, May 2003