COMMUNITY BASED OPERATION AND MAINTENANCE MANAGMENT GUIDELINE HAS 8 PARTS

Community Based Operation and Maintenance Management Manual for Rural Point Water Supply Schemes: Part – B: Water Sources and Technology Options

Final Manual

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2. DESCRIPTION OF WATER SOURCE AND TECHNOLOGIES

2.1 Background

A number of global technology options are available for improved rural water supply systems. However, not all can be applied everywhere. In most rural parts of Ethiopia, the common choices are boreholes equipped with hand pumps or motorized pumps; hand dug wells (with hand pumps), shallow wells (with hand pump), and developed springs. This operation and maintenance management guideline focuses on these three types of technological options.

2.2 Hand Dug Well

The traditional method of obtaining groundwater in rural areas is still the most common by means of hand-dug wells. However, because they are dug by hand their use is restricted to suitable types of ground, such as clays, sands, gravels and mixed soils where only small boulders are encountered.

Hand-dug wells provide a cheap, low-technology solution to the challenges of rural water supply. It is excavated and lined by human labor, generally by entering the well with a variety of hand tools. Depths of hand-dug wells range from 5 meters deep, to over 20 meters. It is impractical to excavate a well which is less than a meter in diameter; an excavation of about 1.5 meters in diameter provides adequate working space for the diggers and will allow a final internal diameter of about 1.2 meters after the well has been lined.

Hand Dug Wells can be lined, unlined or a combination. In all wells, however, at least the top 3 metres should be lined to prevent (potentially dirty) surface water seeping in.

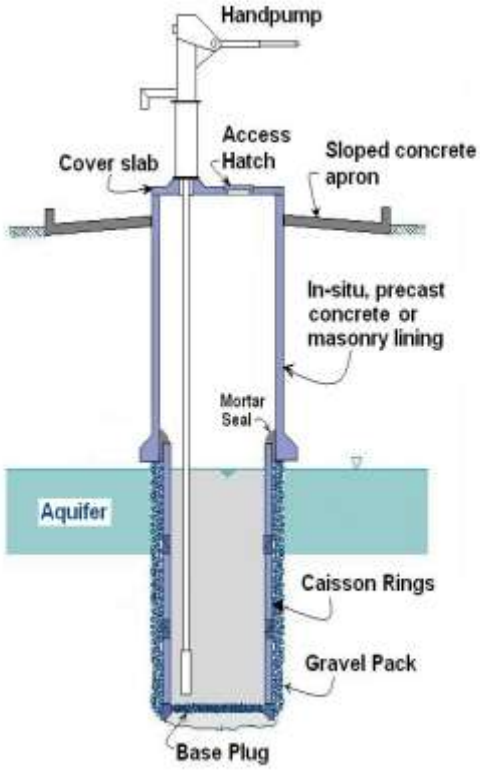
There are several options available for lining a well shaft. These are: 1) Precast concrete ring (caisson), 2), in-situ concrete,3) Masonry lining, 4) ferro-cement lining.

With suitable design, windlass, bucket pumps, or a variety of other low technology pumps can be used in place of a commercial hand pump (Afridev, Indian Mark-II, Rope Pump etc).

This water supply technology is recommended where there are no spring resources, and where the water table is close to the surface. Hand dug wells can serve up to 350 people.

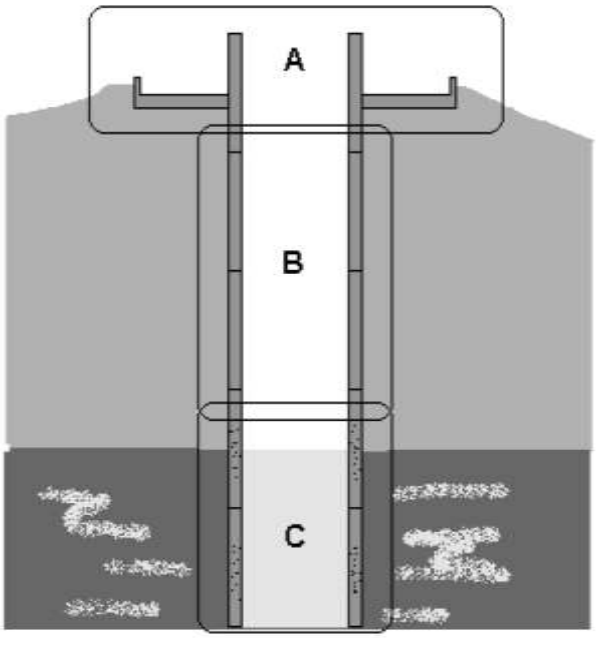
For rural households in Ethiopia, the single most popular water supply model is still the traditional hand dug well: nationwide 37% of the rural population still relies upon wide diameter hand dug wells. In regional situation, Oromia lead, Tigray and Amhara followed in the use of HDW in the provision of water for rural people.

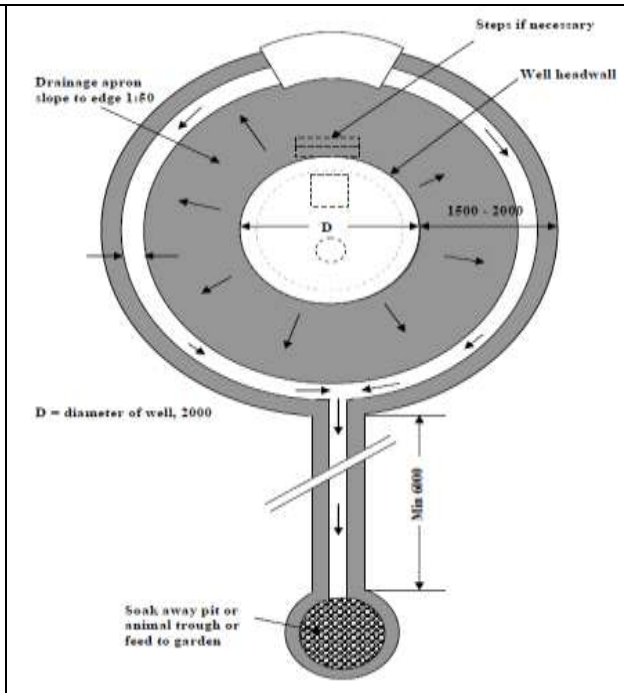
Figure 2-1: Hand Dug Well fitted with Hand and Rope Pumps



The elements of hand dug well are A) The Well Head, B) The well shaft and C) The intake as illustrated in Figure below.

Figure 2-2: Elements and Layout of Hand Dug Well





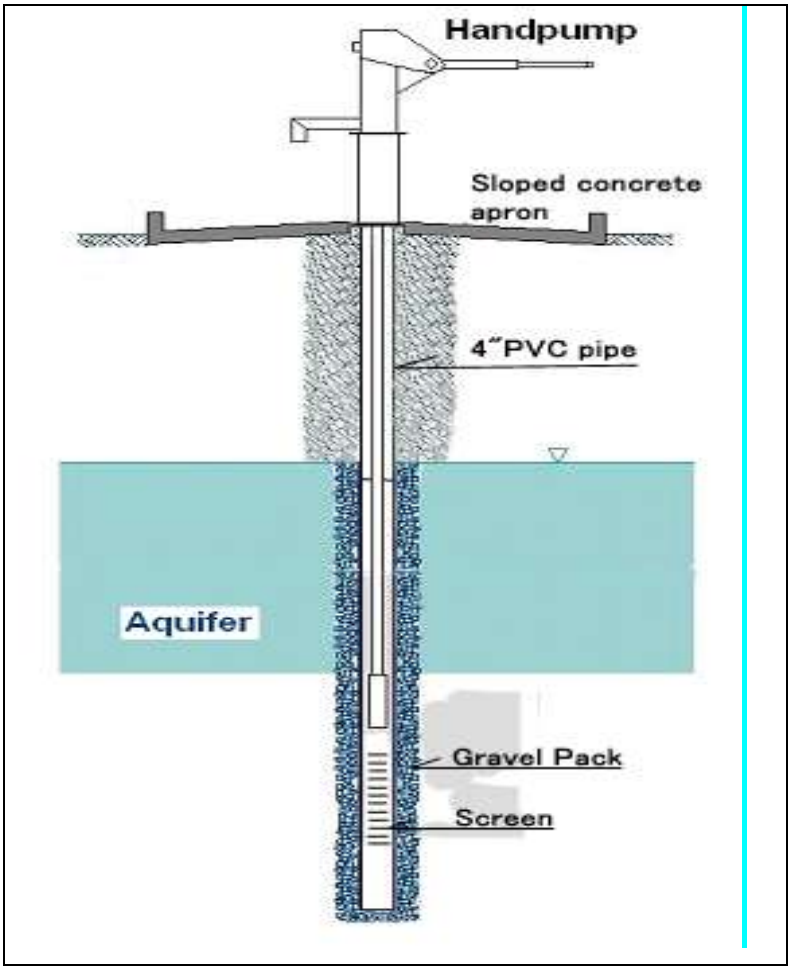
2.3 Shallow Well

This system is an advanced type of hand-dug well which is constructed in accessible area by a medium drilling rig which can reach greater depth than hand-digging. The major advantage of using shallow wells over hand-dug wells is: 1) they can be reaching up to 60 meters depth, 2) they are not risky during the dry season, and 3) they cannot be polluted easily.

Shallow drilled wells are wells which have been drilled with drilling machine and lined with uPVC or steel casing. This type of wells could be fitted with Village Level Operation and Maintenance (VLOM) type hand pumps and the diameter of the wells is usually 4 to 6 inch.

Cleaning of such well is not done manually but with the use of pumps, surging and or bailing. Thus it requires drilling machine, pumps and accessories and trained personnel. To this effect cleaning and developing of such well is done by drilling company or by the Regional Water Bureaus. Therefore, when there is a need to do such work the Water Sanitation and Hygiene Committee (WASHCO) should contact the WWO. Regarding the maintenance of the well head and the hand pump it is identical with the hand dug well. However, if the well is fitted with pumps such as Indian Mark II a tripod, chain block and pipe clamp is required for maintenance of the pump as one should remove all the riser pipes. Hence, it should only be done by qualified technician. A typical shallow well is presented in Figure 2-3.

Figure 2-3: Typical Shallow well fitted with Hand Pump



About 8.7% of the rural population nation-wide is serviced by shallow well fitted with hand pumps.

2.4 Spring Development

Springs are outcrops of groundwater that often appear as small water holes or wet spots at the foot of hills or along river banks.

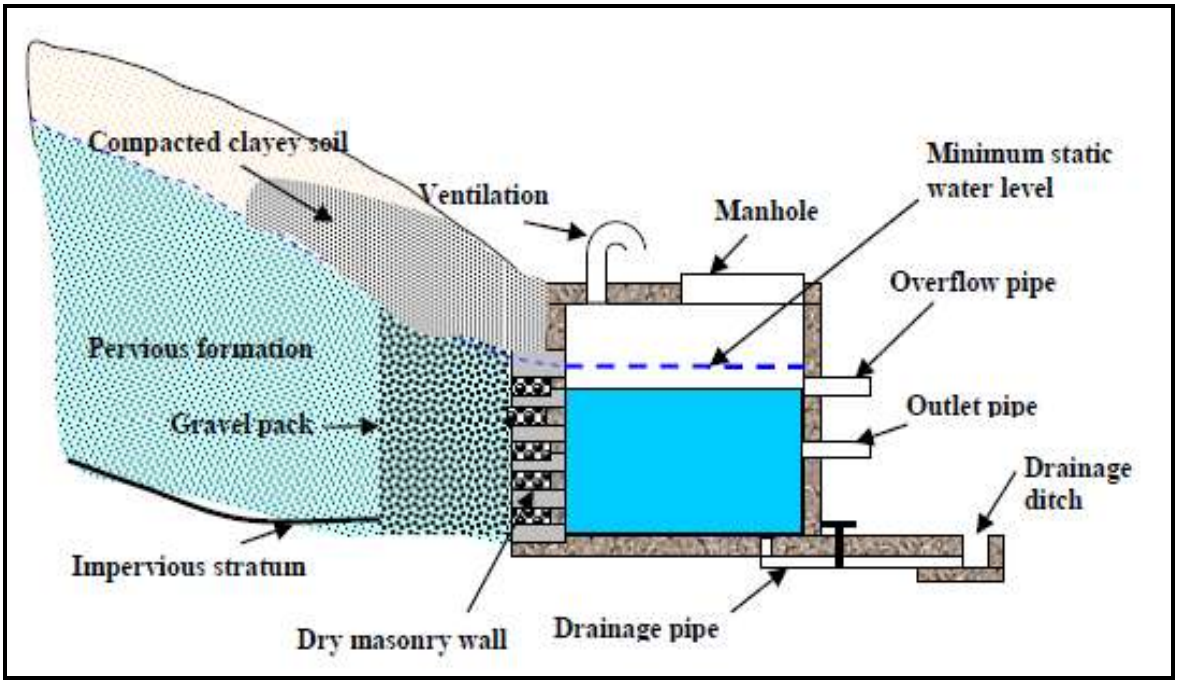
Springs are classified according to the conditions under which water flows to them. 1) gravity depression spring, 2) gravity overflow spring, 3) Artesian depression spring, 4) Artesian fissure spring, 5) Artesian overflow spring. All these types of springs require different types of development structures.

The main parts of a spring protection are a drain under the lowest natural water level, a protective structure providing stability and a seal to protect surface water leakage. The drain usually is placed in a gravel packed and covered with sand & may lead to a conduit or a reservoir as can be seen in the figure below.

A spring source can be used either to supply a gravity scheme or just to provide a single outlet, running continuously. To prevent waste, any flow which is surplus to that required for domestic use can be used to irrigate kitchen gardens.

2.4.1 On- spot Spring Development

This involves protecting the spring and then guiding the water to a collection chamber. This is then connected to a water point or on-spot uses, and if needed a cattle trough. Each spring capping can serve up to 1000 beneficiaries.



If the flow from the spring is not sufficient to meet peak demands during the day, a storage tank can be incorporated into the structure of the spring protection. This enables the flow from the spring over the full 24 hours to be stored, and then used throughout the day to meet intermittent demands by means of a tap in the structure.

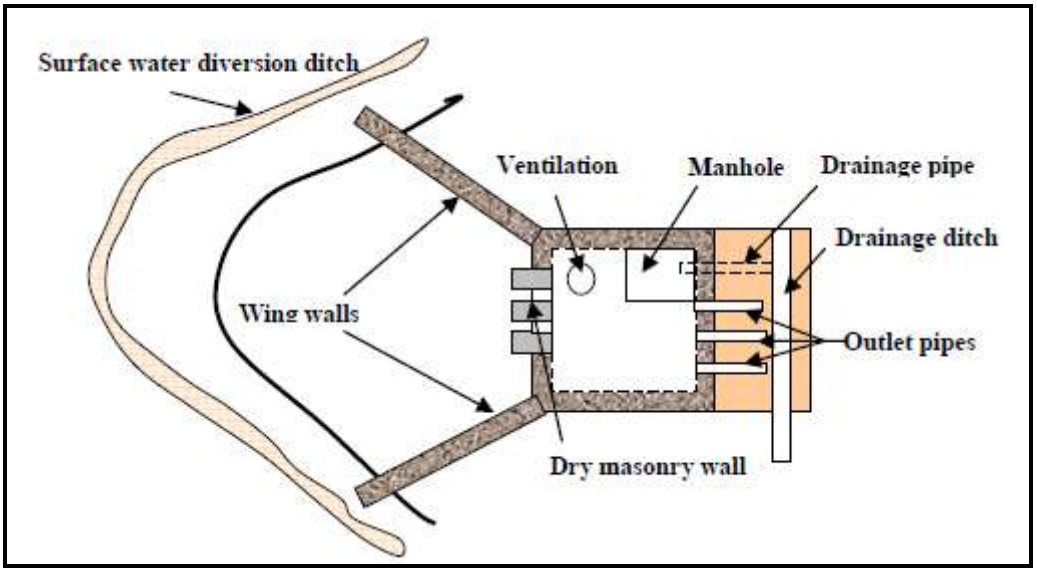
A flow in excess of 0.1 liters per second is sufficient to fill a 20 liter container in just over 3 minutes, which is an acceptable waiting time. From such a spring a daily useful yield of about 3000 liters can be expected, which is enough water for about 150 people.

If the flow were to be only 0.05 liters per second it could still can be made to supply the same population by incorporating a storage tank of one cubic meter capacity.

If the flow were to be 0.5 liters per second or more the source would be suitable to supply multiple outlets or a piped gravity scheme.

In all cases, a spring should be protected from surface-water pollution by the construction of a deep diverting ditch or equivalent above and around it. The spring and the collecting basin should have a watertight top, preferably concrete, and water obtained by gravity flow. Covers for inspection manholes, when provided, should be tightly fitted and kept locked.

Figure 2-4: typical spring development plan and section



2.4.2 Pumping and Gravity Feed System

This part is not the scope of the assignment.

2.5 Technology Options

As per the TOR, this guideline focuses on low technology options such as handpumps. Among many types of handpumps, the adaptation of handpumps in Ethiopia is specific. These are Afridev, Indian Mark-II and Rope pumps. Standardization of handpumps is required based on site specific. Details of the selected options of technologies are presented in part-c of this guideline.