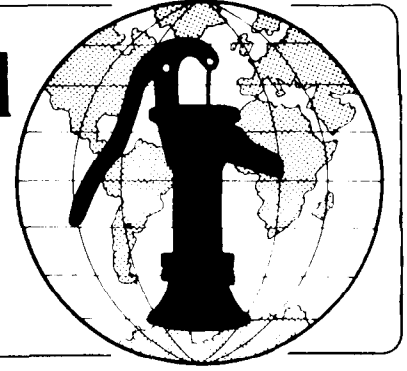


Water for the World



Selecting a Method of Well Construction Technical Note No. RWS. 2.P.2

Water wells can be classified by their method of construction: hand dug, driven, jetted, bored, and cable tool. Selecting the most suitable construction method is important to ensure that the family's or the community's water needs are met and to ensure that the method is best in terms of overall cost, available materials, and geological conditions. See "Planning How to Use Sources of Ground Water," RWS.2.P.1.

This technical note compares five methods of well construction and discusses the advantages and disadvantages of each. Read the entire technical note before selecting a method.

Useful Definitions

AQUIFER - A water-saturated geologic zone that will yield water to springs and wells.

POROSITY - A soil's ability to store water.

WATER TABLE - The top, or upper limit, of an aquifer.

General Information

In many communities, a method of extracting ground water will already exist. If so, the selection of a method should follow these priorities:

- (1) improve the present source, such as deepening a hand dug well;
- (2) duplicate the present method, such as digging more wells; and
- (3) select a new method.

This technical note should be used when the third priority has been reached, or if the community has no present method of extracting ground water.

When selecting a method of well construction, there are non-technical factors that should be considered. These may be called community factors, and they include the social acceptability of the method, the willingness of the community members to assist in construction, and so on. These factors are discussed in "Planning How to Use Sources of Ground Water," RWS.2.P.1, and "Community Participation in Planning Water Supply and Sanitation Programs," HR.2.I. For more information on all the methods of well construction discussed in this technical note, refer to "Methods of Developing Sources of Ground Water," RWS.2.M.

Hand-Dug Wells

The materials used to construct these wells--picks, shovels, concrete, reinforcing material--are available in many villages. The construction methods used are common and no special skills are required. See Figure 1. But constructing a hand dug well is hard work and may take several weeks, compared with the other methods which take only several days. This extra construction time raises the labor cost.

Hand dug wells can be constructed in almost any type of soil, except hard rock or where there are large boulders. Their practical depth is limited to about 10m. Because hand dug wells cannot be sunk far into an aquifer, their yield is affected by changes in the water table. The large diameter, from 1.0-1.5m, of these wells allows them to act as reservoirs for water. This is particularly useful in aquifers with low porosity, since the well can accumulate water for later use. Also, a hand dug well's large diameter can accommodate a variety of water lifting devices.

Advantages:

- readily available materials
- common construction techniques
- can act as a reservoir
- can use a variety of water lifting devices

Disadvantages:

- hard work to construct
- limited depth
- affected by water table changes
- not suitable for formations with hard rock or large boulders

Driven Wells

These wells require a specially built, but inexpensive, well point which must be purchased. The well point is made of hard steel. With the necessary equipment, the construction method is easy and fast and no special skills are required. See Figure 2.

Driven wells are not suitable for hard rock or heavy beds of clay, nor where there are boulders or coarse gravel which can damage the well screen. Their practical depth is limited to about 8m but where driven wells can be sunk fairly deep into the aquifer, they are not affected by fluctuations in the water table.

Advantages

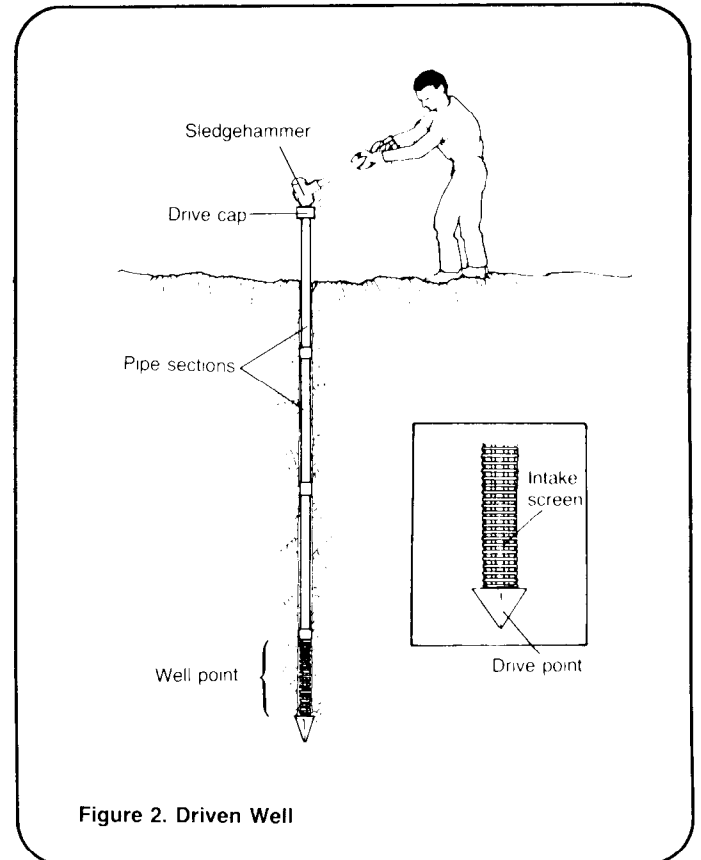
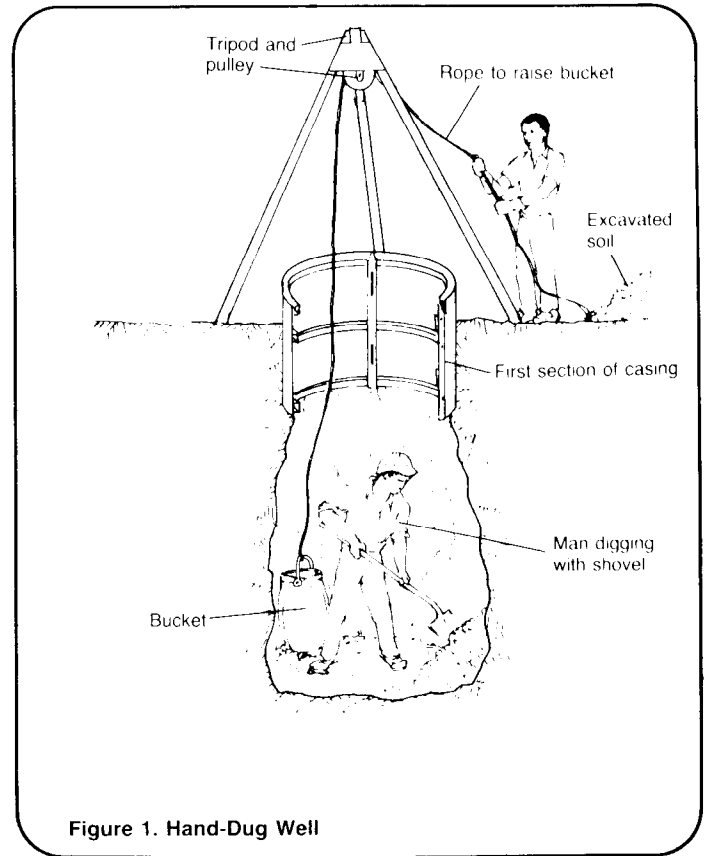
- easy to construct
- not affected by water table fluctuations

Disadvantages

- require special well point
- limited depth
- not suitable for hard rock, heavy clay, boulders, or coarse gravel

Jetted Wells

Constructing these wells requires a water pump and hoses, a raised platform or tripod, and special jetting drill bits--all of which raise the cost. The method is fast, but a certain amount of skill is required. See Figure 3.



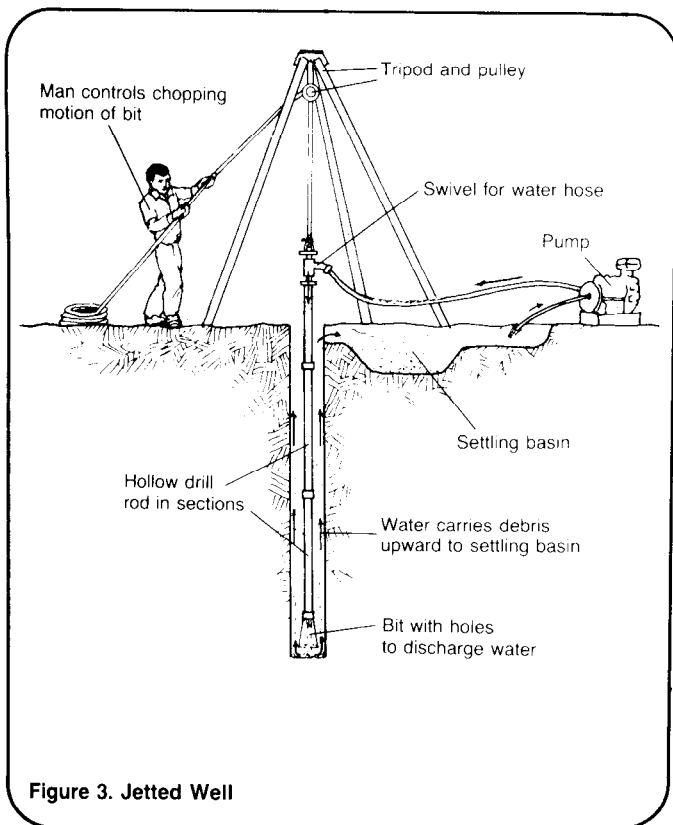


Figure 3. Jetted Well

Jetted wells can be carried to depths of 60m, increasing the chances of reaching a groundwater source. They are not seriously affected by water table changes. These wells cannot be constructed in hard rock or where there are large boulders.

Advantages:

- deep construction
- increased chance of finding ground water
- not affected by water table fluctuations

Disadvantages:

- moderate to high cost
- specialized equipment
- special skills
- not suitable for hard rock or boulders

Bored Wells

Constructing these wells requires special augering bits, sections of drill, pipe or rod, and a raised platform. When these are available, bored wells are a good choice. Bored wells are relatively easy to construct, and the techniques used are quickly learned. See Figure 4.

These wells are not suitable for hard rock or where there are boulders larger than the diameter of the augering bit (50-200mm). Their practical depth is limited to about 15m, but they are not affected by changes in the water table.

Advantages:

- easy to construct with the proper equipment and experience
- not affected by water table changes

Disadvantages

- some special tools and skills are required
- not suited for hard rock or boulders larger than auger

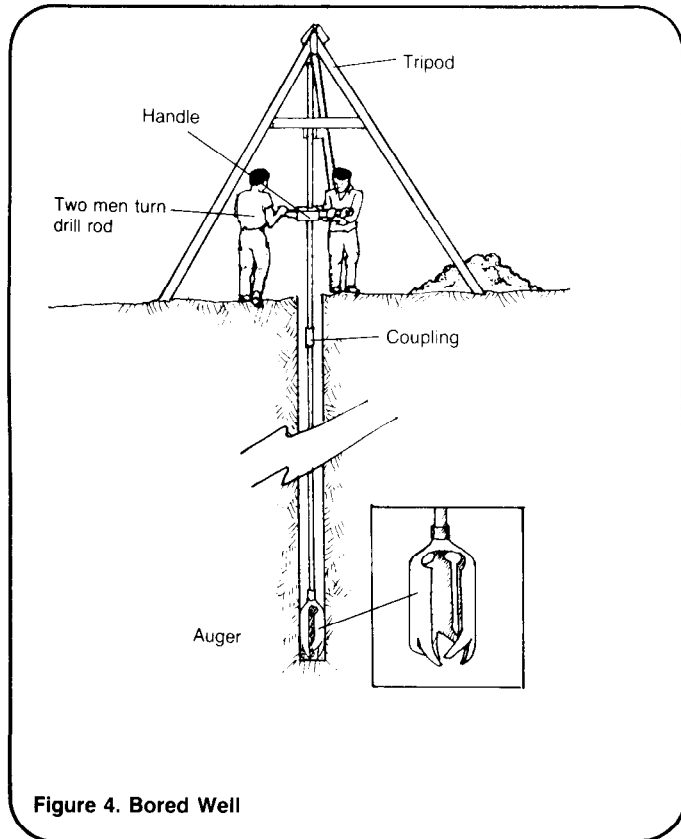
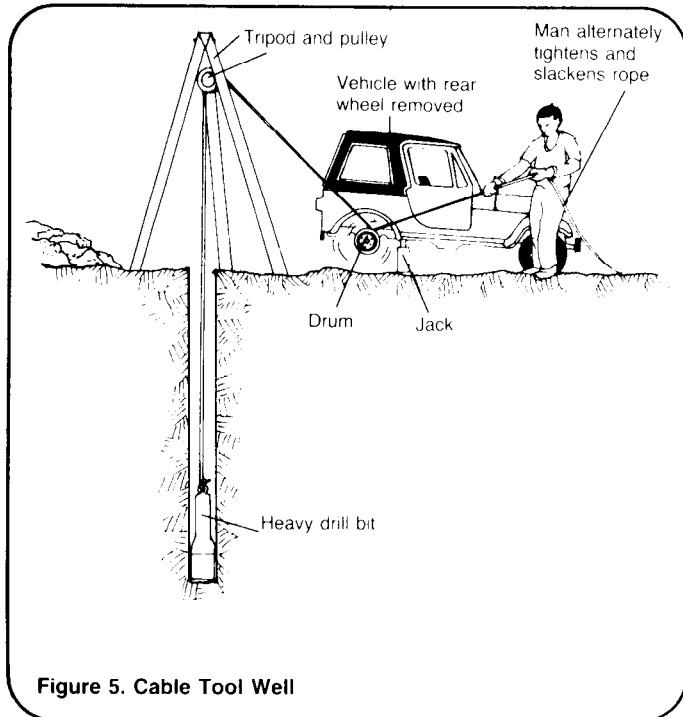


Figure 4. Bored Well

Cable Tool Wells

These wells require expensive equipment including a motorized power source, heavy drill bits, a tripod and pulleys, a bailer, and a suction pump. Special skills are required to operate this equipment, and the equipment may be difficult to transport into remote areas. See Figure 5.



These wells can be sunk in nearly every type of soil, even hard rock. They can be sunk to depths of 75m or more. This increases the chances of finding reliable groundwater sources. They are not affected by changes in the water table.

Advantages:

- suitable for all types of soil
- deep construction
- increased chance of finding groundwater
- not affected by water table fluctuations

Disadvantages:

- high cost of equipment
- requires experienced operators
- difficult to carry equipment to remote areas

Comparison of Methods

Table 1 summarizes some of the features of each method of well construction. It can be used as an aid in selecting a method. For further help in making a selection, see "Methods of Developing Sources of Ground Water," RWS.2.M. If more details are needed on any method, consult the "designing" technical note on that method.

Table 1. Comparison of Types of Wells

FACTOR	WELL TYPE				
	Hand Dug	Driven	Jetted	Bored	Cable Tool
Cost	Moderate	Low	Low to moderate	Moderate to high	High
	No	No	Yes	No	Yes
Special Construction Skills	No	No	Yes	No	Yes
Sophisticated Equipment	No	No	Yes	No	Yes
Act as Reservoir	Yes	No	No	No	No
Variety of Water Lifting Devices	Yes	No	No	No	No
Affected by Water Table Fluctuations	Yes	No	No	No	No
Unsuitable Soil Conditions	Hard rock, large boulders	Hard rock, heavy clay, boulders, coarse gravel	Hard rock, boulders	Hard rock, boulders larger than auger	None