COMMON GROUNDWATER SUPPLY SYSTEMS

Sources of Drinking Water

(1) Ground Water

- the main source of water supply in urban and rural areas
- Free from Pathogens and requires no treatment

- **Urban Area**: power driven production wells, access to safe drinking water-99%, Public water supply-47%
- **Rural Area**: Hand pumps, 90% have access to tubewell within 150 m

(2) Surface Water: Pond sand filter (suitable for coastal belt)

(3) Rain Water: Rain water harvesting (suitable for arsenic affected areas)

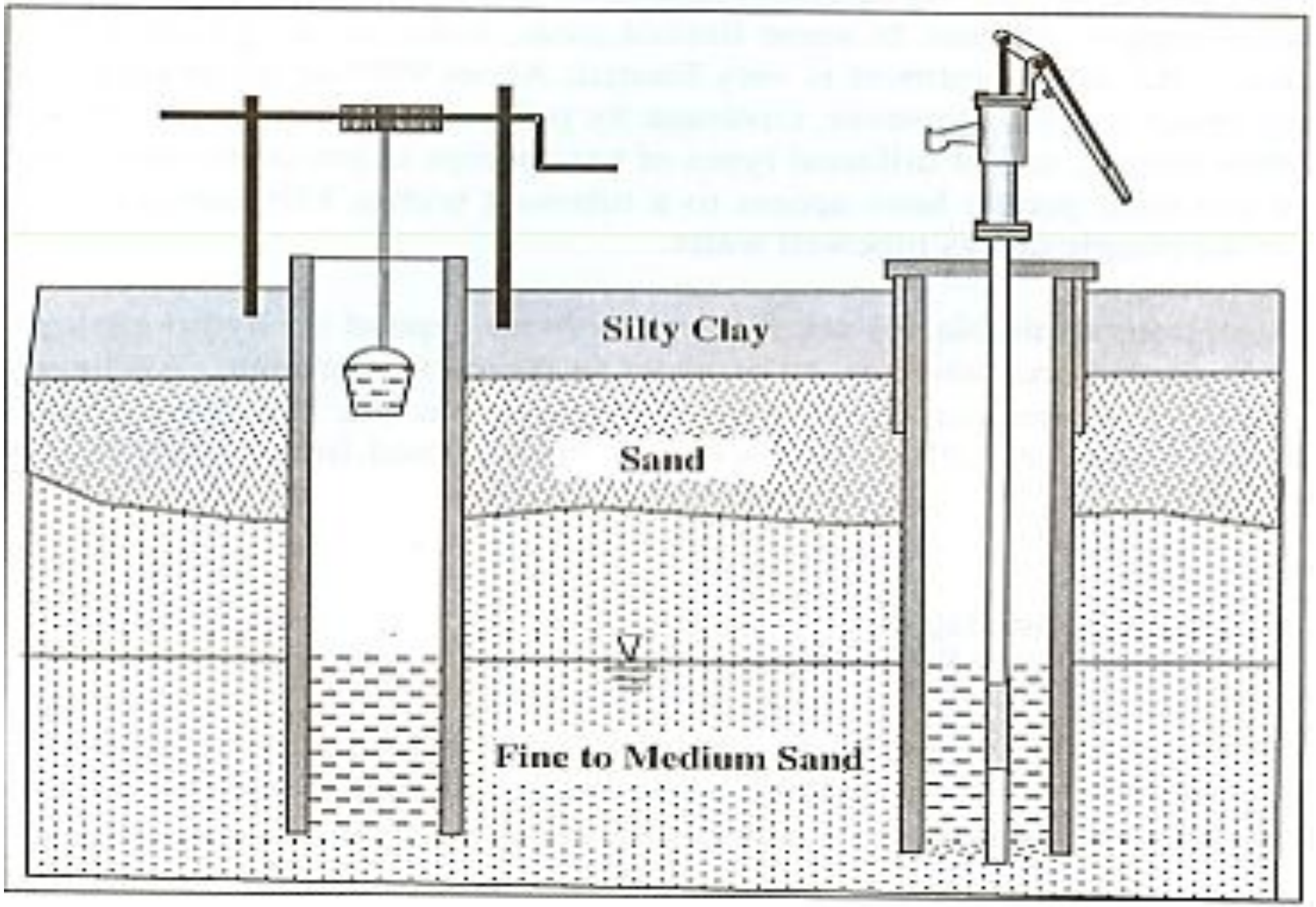
Water Supply Technologies

- **Dug well** (h<10m)
- **Tubewell**
  - Shallow Tubewell (h<7.5m)
  - Deep-set Intermediate Tech (h<30m)
  - Deep tubewell (h>75m)
- **Alternative technologies**
  - Pond sand filter
  - Rain water harvesting etc.

Open Well/Dug well

- Oldest method, low cost, no special equipment or skill necessary.
- A hole is dug to a depth below the GWT(<10m) and dia >1.2m
- Depth of Community dug well: 20~30 m
- Walls are lined to prevent water seeping, prevent caving and collapse of soil during construction

Open Well/Dug well



Open Well/Dug well



Open Dug well



Closed Dug well by tubewell

Bacterial contamination of well water

Can be Protected by sealing the well top with water tight concrete slab

Application areas:

In acute Arsenic and Iron problem areas, because Dug well water is free from Arsenic and Iron.

Tubewell Technology

- Shallow Tubewell
- Deep-set Intermediate Technology
- Deep tubewell

Shallow Tubewell

- Draw water from shallow depth by creating vacuum in the suction pipe
- Extract water from a depth of 7.5m

Category

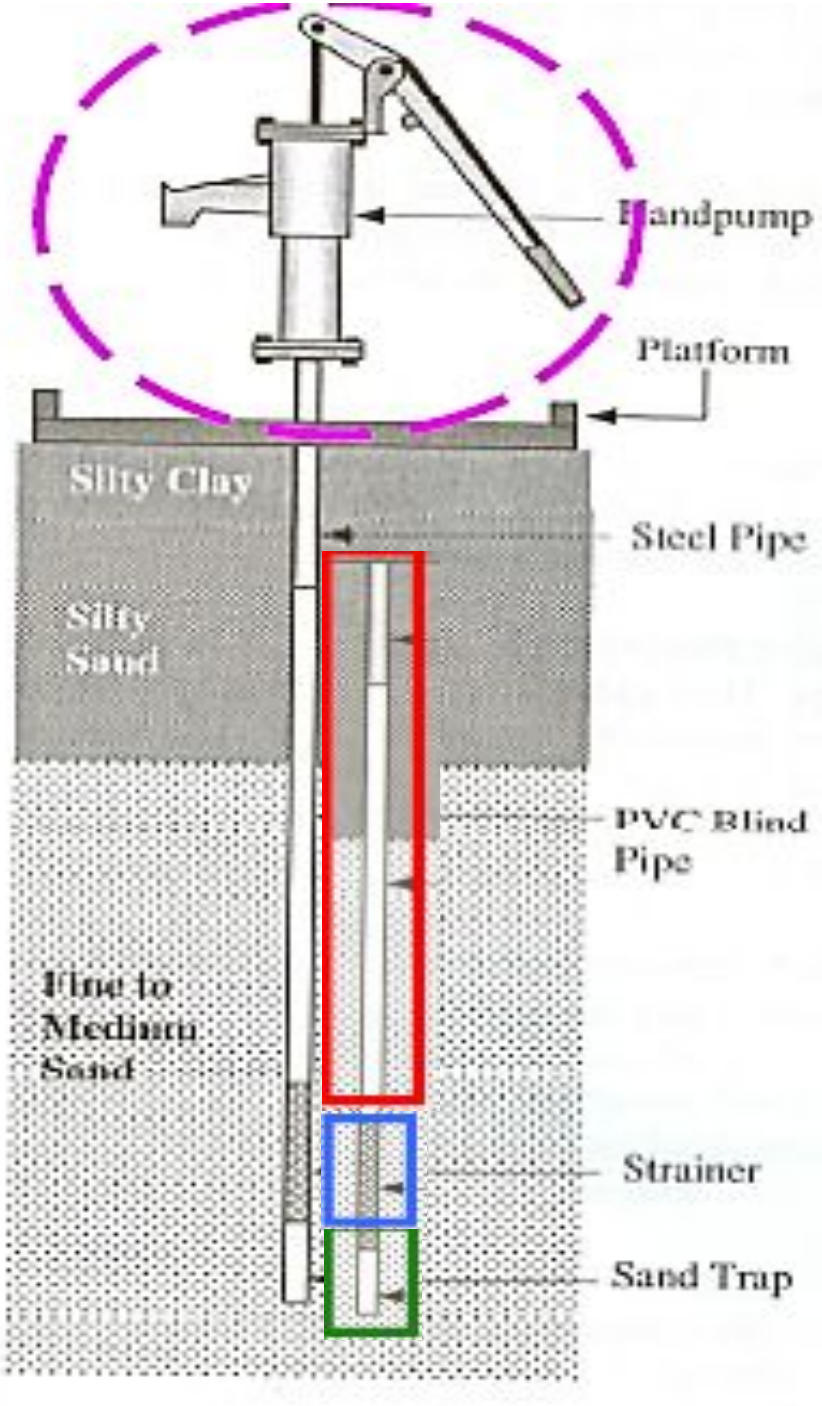
1. No. 6 handpump tubewell
2. Rower pump tubewell
3. Disco pump tubewell

No. 6 Handpump Tubewell

- Barrel diameter is 6 inch
- Theoretical lifting capacity 32.8 ft
- Average Discharge 30~40 liters /min
- Design Life: 15 ~20 years or more

Components:

- Handpump
- Blind pipe (rising pipe)
- Strainer/screen: 38mm dia PVC
- Sand trap



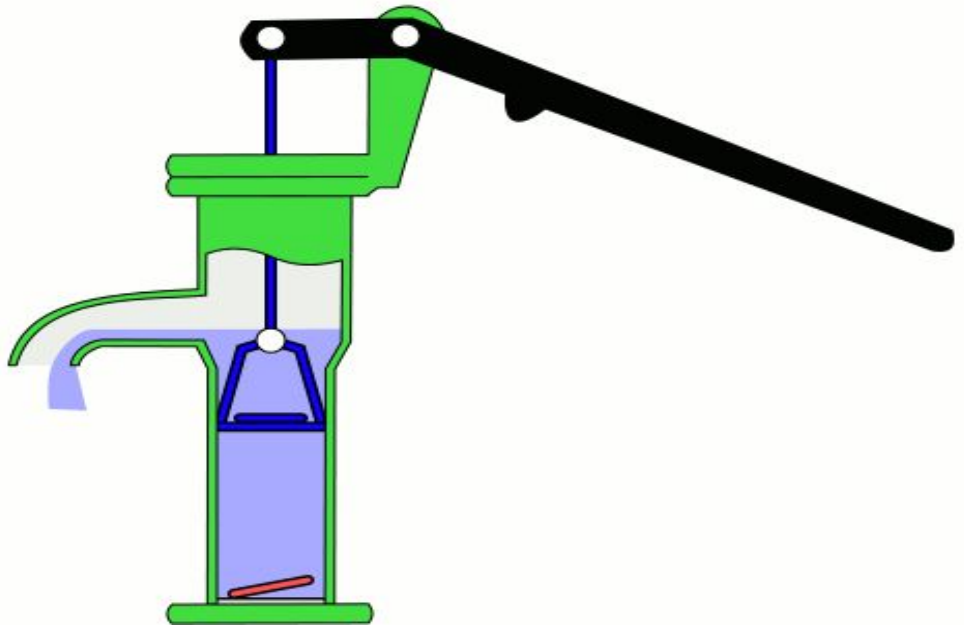
No. 6 Handpump Tubewell

- Components
  - **Handpump**: base, barrel, head cover, handle, piston rod, plunger, valve weight, bolts and nuts are component parts which are made of cast iron. Bucket and seat valve are made of leather or PVC.
  - **Blind pipe**: pipe between screen and the handpump. 38 mm diameter pipes are the most common and top five feet GI and remaining are PVC.
  - **Strainer (screen):** 38 mm diameter strainers are used, 2 m long and made of PVC. Openings used are 0.008 inch (slot no. 8), 0.010 inch (slot no. 10 and 0.012 inch (slot no. 12).
  - **Sand trap:** about 4 to 6 ft long an extension of a blank pipe, fixed at the bottom of the filter. Open end is sealed with a cap and generally PVC sand traps are used. It prevents blocking of the strainer.

No. 6 Handpump Tubewell

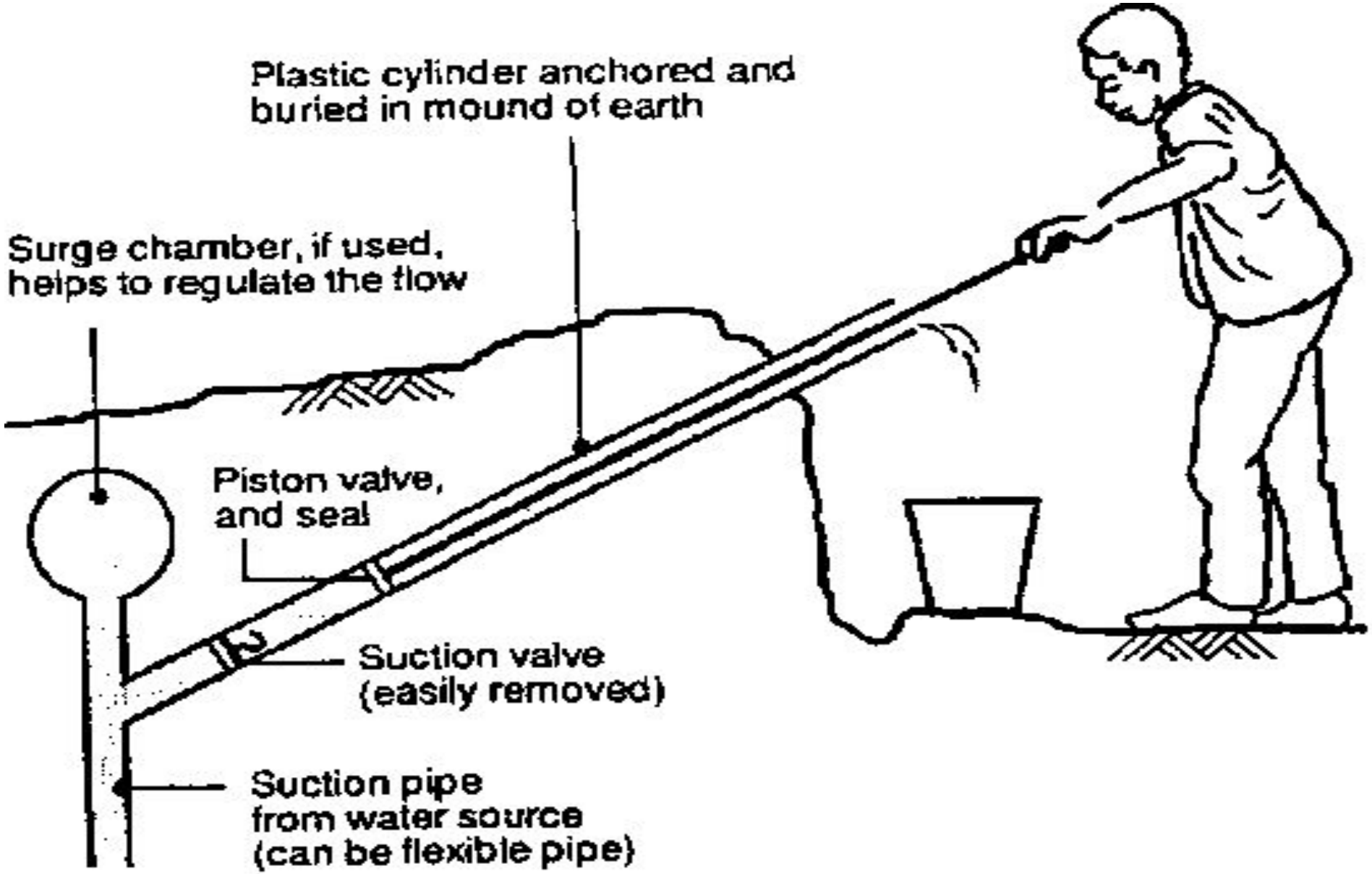
Working principle:

- In the first stroke vacuum is created within the cylinder of the pump by raising the piston and water entered into it.
- In the second stroke piston is lowered down and water enters in the upper chamber and comes out of the spout when the piston is raised to create vacuum again.



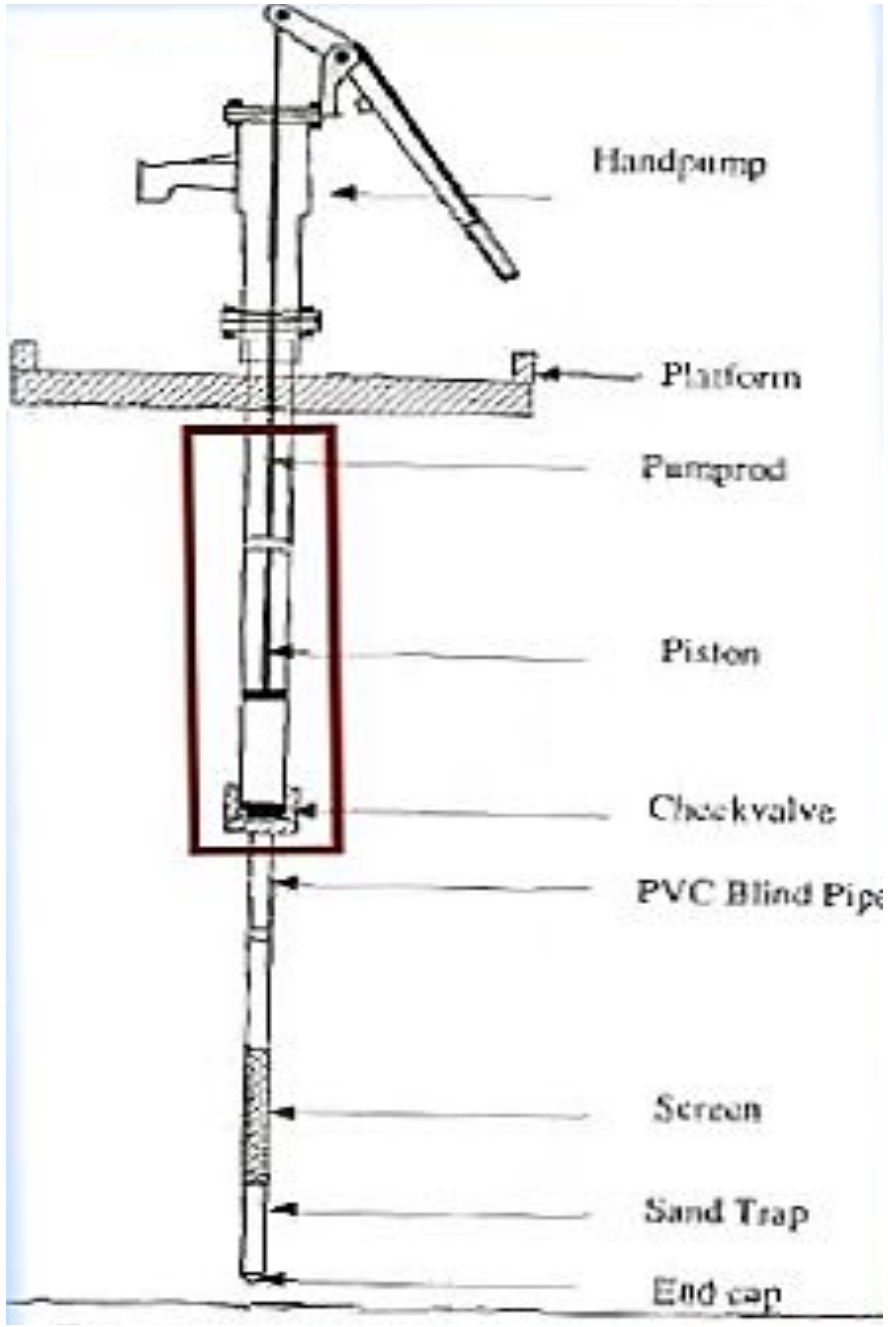
Rower Pump Tubewell

- A simple manually operated pump for small scale irrigation.
- A suction pump in which the piston is directly activated.
- A surge chamber (an air vessel just downstream of the foot valve, makes the pumping operation smoother).
- Simple and reliable with a very few moving parts thus wear is reduced.
- Limited use for drinking water as the spout is relatively low.
- Typically, pumps are installed in collapsible tubewells with the screen extending to the coarse sand aquifer.
- Average Discharge 75 liters /min

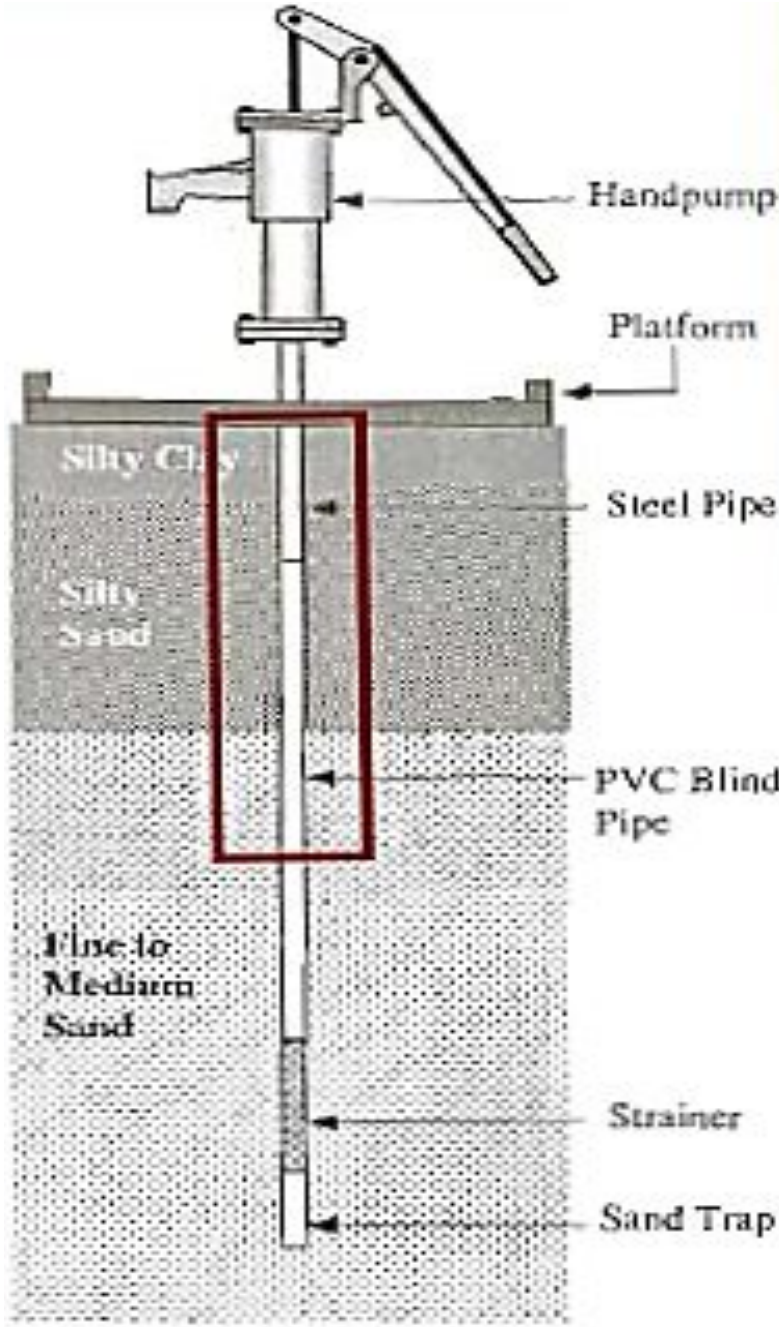

Plastic cylinder anchored and buried in mound of earth
Surge chamber, if used, helps to regulate the flow
Piston valve, and seal
Suction valve (easily removed)
Suction pipe from water source (can be flexible pipe)

Disco Pump Tubewell

- Modified No.6 hand pump
- Suction action is extended by extending the suction rod about 1-3 m.
- About 75 mm diameter GI pipe is used as casing.
- h = 7-10m



Disco Pump Well



No. 6 Handpump Well

Deep-set Intermediate Technology

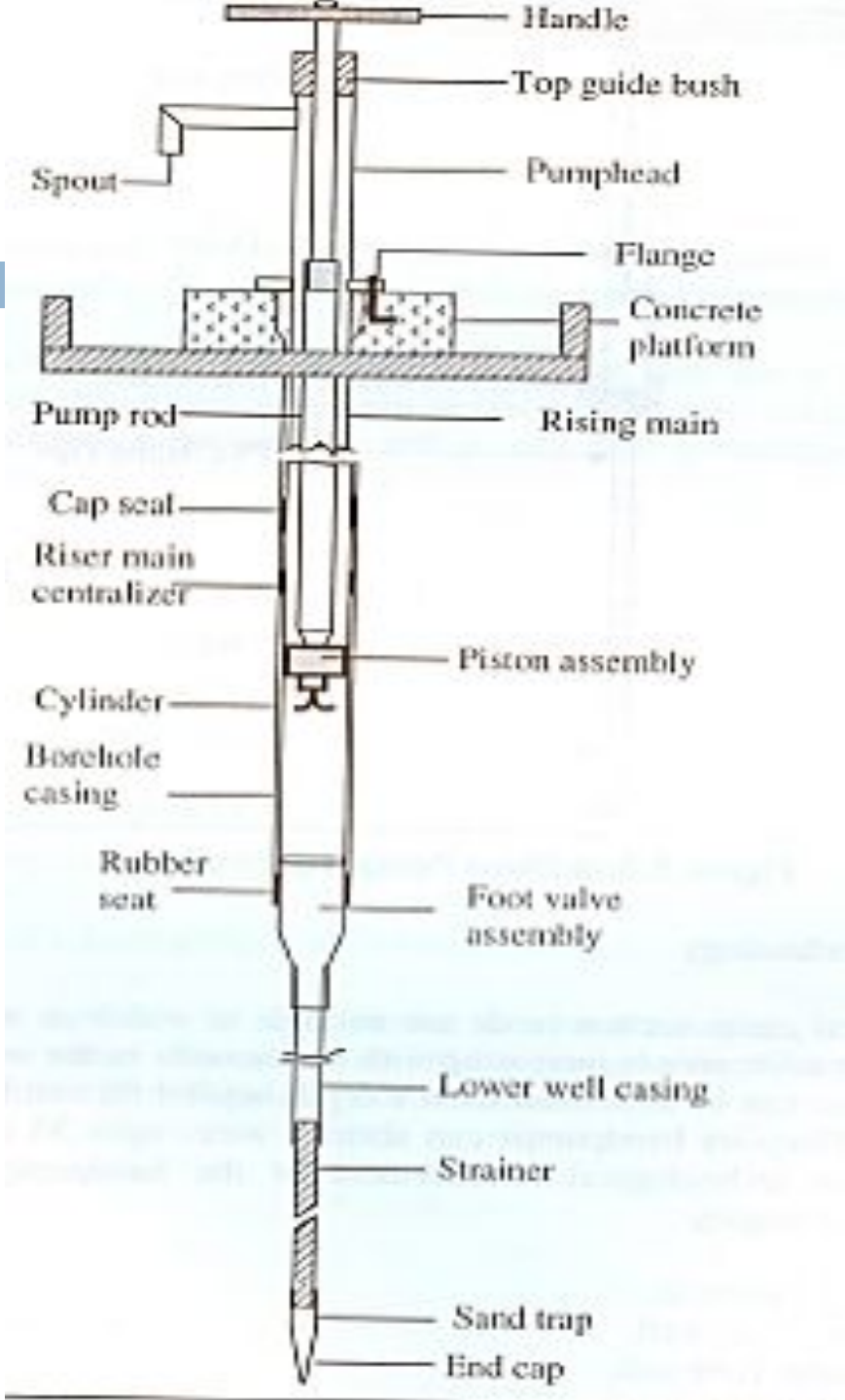
- Due to irrigation in dry season WT goes down
- No. 6 hand pumps go out of operation
- h = 15 - 30m

Category

- **Tara** Handpump tubewell
- **Moon** Handpump tubewell
- **Bangla** Handpump tubewell
- **Mark-II** Handpump tubewell

Tara Hand Pump Tubewell

- h = 15 m
- expected life 3 to 5 years
- Average discharge 24 litres /min
- Main components: pump head, handle, pump rod, piston assembly, foot valve assembly and cylinder.
- The lower part is similar to No. 6 hand pump.

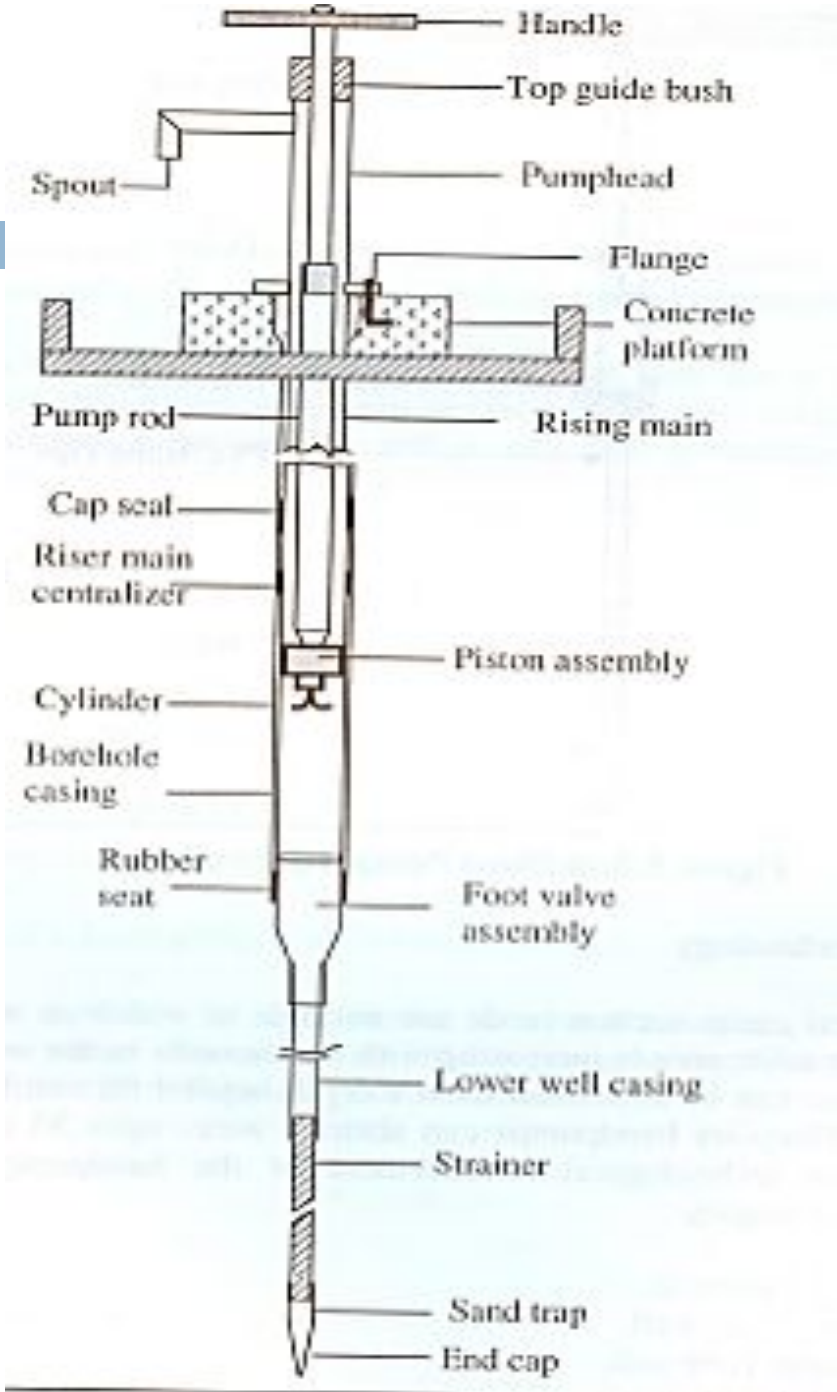


Tara Hand Pump Tubewell

This pump does not proved to be user friendly.

Problems:

- Because of direct actions, more force is required even at low head
- Buoyancy forces is not always available due to leakage
- Moderate output for 7m lift and very low output for 12m lift.
- Repairing is inconvenient



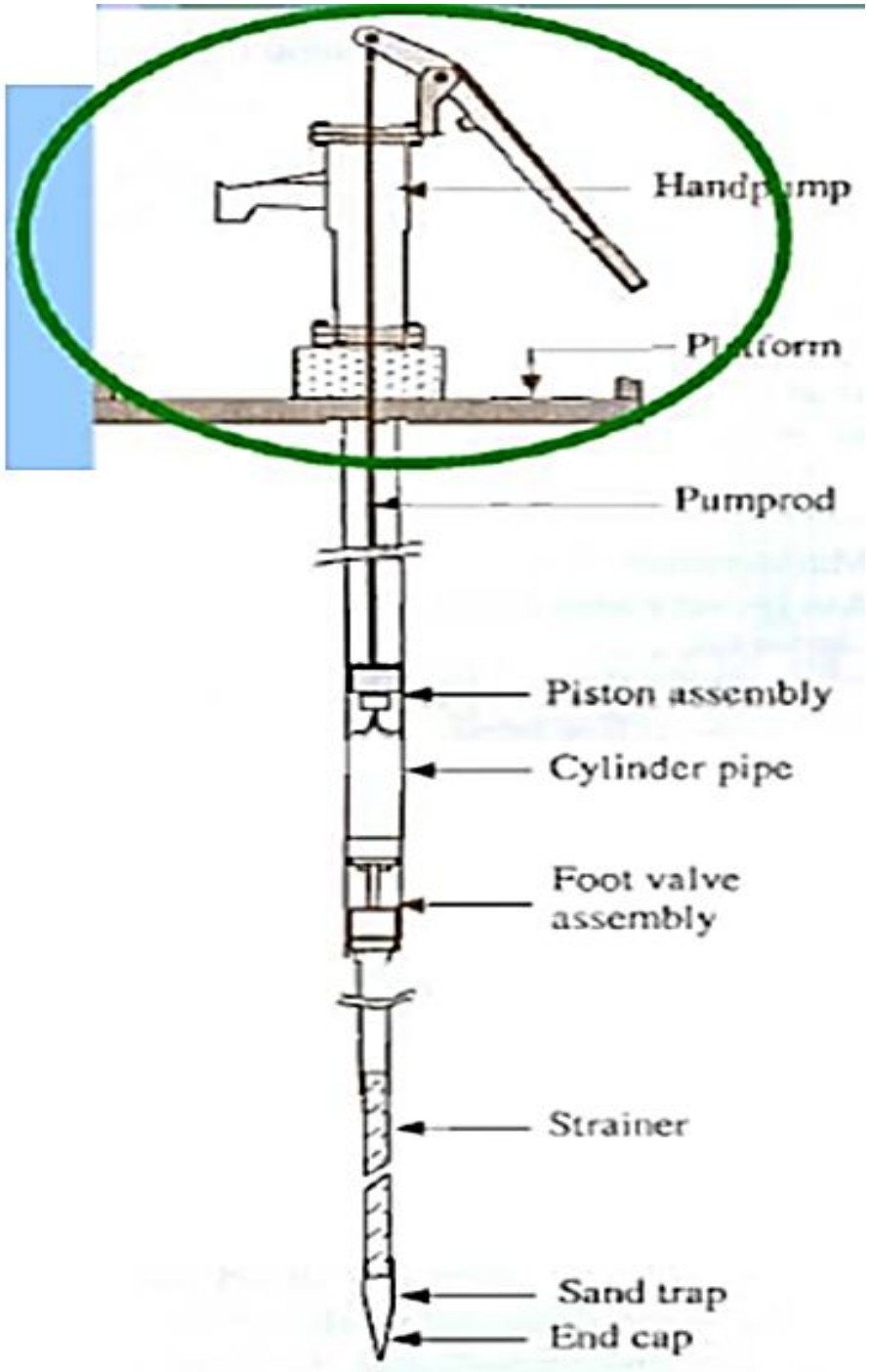
Tara Hand Pump Tubewell

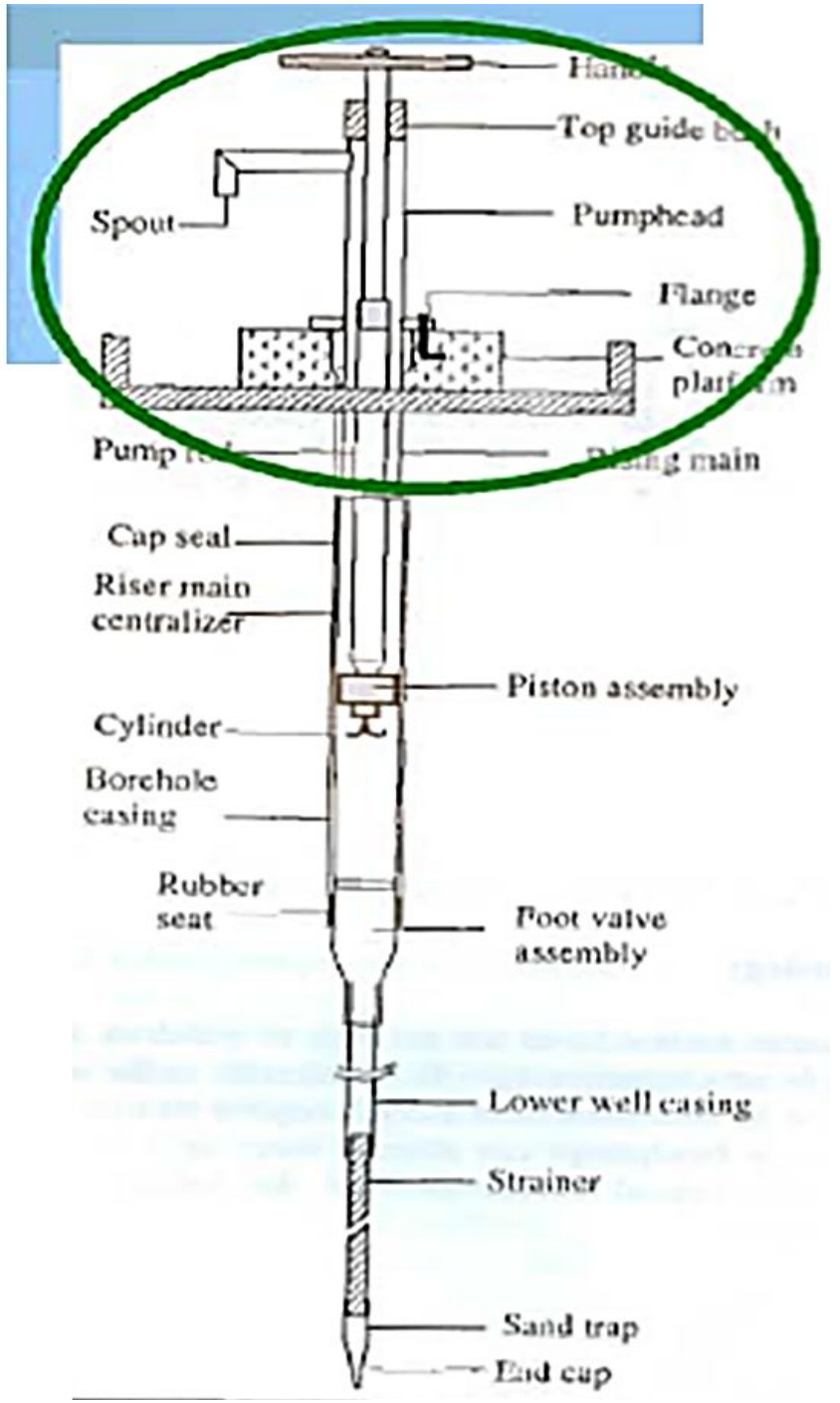
Working principle:

- The term ‘ Direct Action ‘ for Tara hand pump refers to a vertical pumping action using a ‘ T ‘ bar handle connected to a buoyant PVC pump rod.
- The load is transmitted directly from the user to the pump rod and piston during operation.
- The buoyant pump rod, of a relatively large diameter, displaces water in both the upward and downward stroke and the buoyancy of the pump rod makes pumping operation easy.

Moon Hand pump Tubewell

- Moon hand pump tubewell is a modified Tara HP
- The direct action of Tara HP is uncomfortable.
- The head of Tara HP is replaced by the head of No.6 hand pump to get the advantage of lever action.
- PVC pump rod is replaced by steel rod
- Suitable for lifting water up to 25 m
- Maximum discharge 36 litres /min


Handpump
Platform
Pumprod
Piston assembly
Cylinder pipe
Foot valve assembly
Strainer
Sand trap
End cap

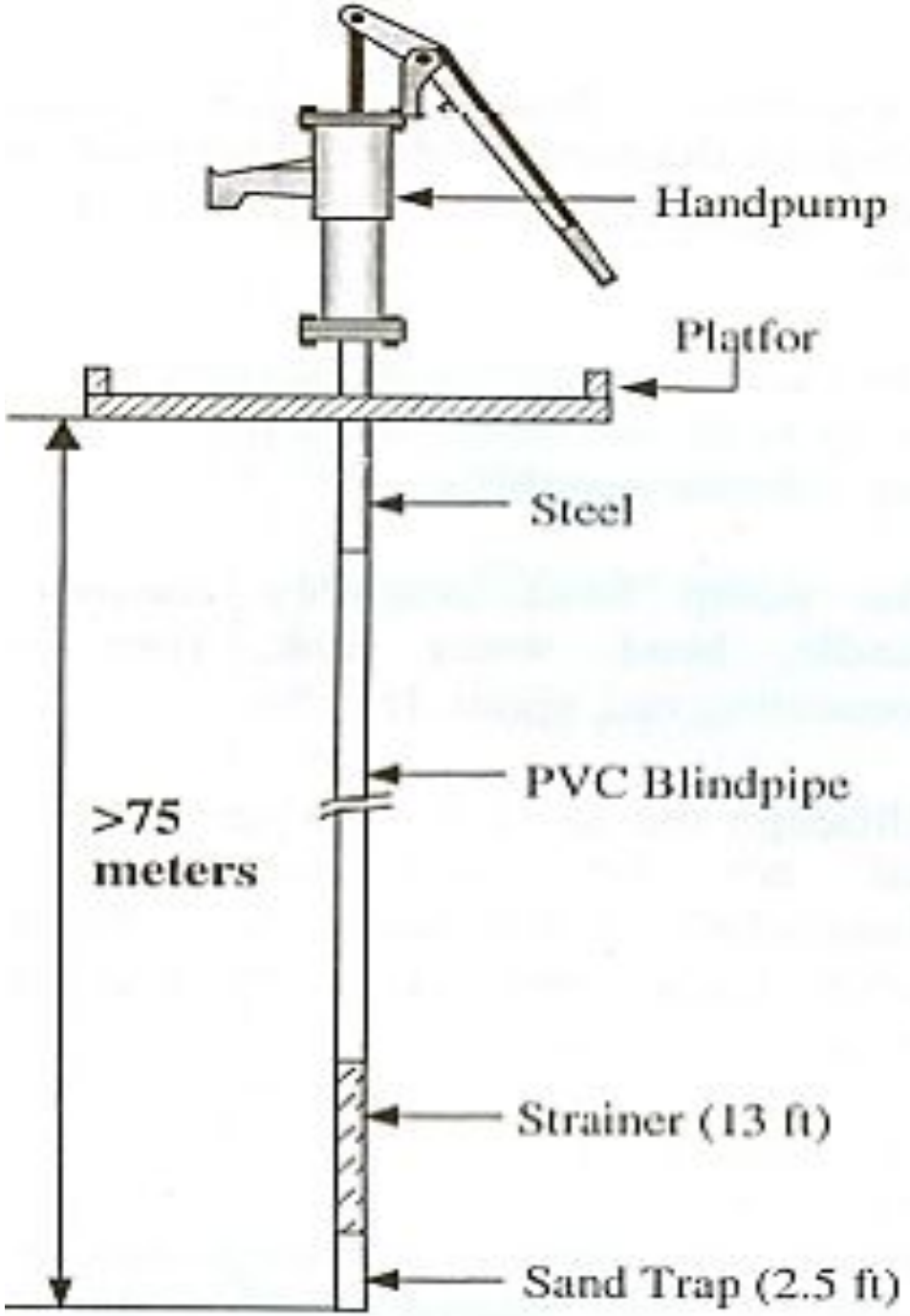

Top guide
Spout
Pumphead
Flange
Concrete platform
Rising main
Cap seal
Riser main centralizer
Piston assembly
Cylinder
Borehole casing
Rubber seat
Foot valve assembly
Lower well casing
Strainer
Sand trap
End cap

Deep Tubewell

- A tubewell penetrating at least one impervious layer
- H >75m
- In coastal belt, it can be as deep as 300m

Components:

- Same as No. 6 hand pump tubewell with the addition of more blind pipes
- Installation cost is high


Handpump
Platfor
Steel
PVC Blindpipe
>75
meters
Strainer (13 ft)
Sand Trap (2.5 ft)

Site Selection Criteria

Dug well:

- At least **10 m** away from latrines, abandoned ditch or marshy land.
- Should not be installed near **pond, canal or river.**
- Should not be installed **under any tree**, near any bush, by the side of road or any disposal site of industries.
- Users **accessibility, Safety factor and comfort** for lifting water.

Site Selection Criteria

Hand Pump Tube well:

- At least **10 m** away from latrines.
- Should be installed at a **place with higher elevation**, which is not usually flooded.
- Should be accessible to **users and caretakers**.

Technology	Inst. Cost (TK.)	Adv.	Disadv.
Dugwell	Low	Low cost	Sanitary protection is difficult
No. 6 Handpump	2000 - 4000	Suitable for shallow WT	May produce high As content
Tara Handpump	13000-15000	Suitable for LWT zone	More force is required
Deep tubewell	50000-70000	Usable in coastal/saline areas	High installation cost