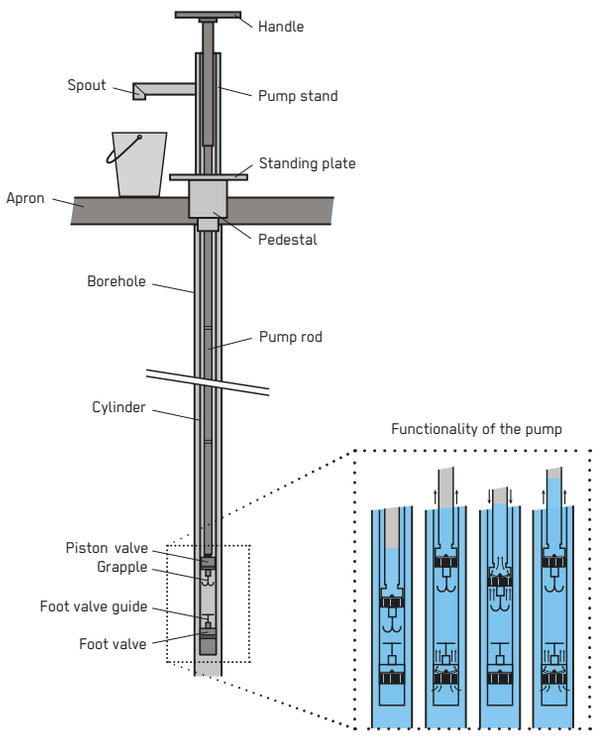
Direct Action Pump

Response Phase	Application Level	Management Level	Objectives / Key Features
Acute Response * Stabilisation * Recovery	** Household * Neighbourhood City	** Household ** Shared * Public	Positive displacement pump, medium lift pump, water column lifted directly
Local Availability	**Technical Complexity**	**Maturity Level**	
** Medium	* Low	*** High	



A Direct Action Pump is a positive displacement pump that displaces a fixed amount of water per cycle. Water is lifted or displaced directly by the user without additional levers or bearings. The pump is mostly unsuitable for emergencies and should be reserved for long-term water supply in rural areas.

Direct Action Pumps are manually operated. They work through directly lifting and displacing the water column in a reciprocating manner, causing the water to move into the pump head on both the up and down stroke due to two non-return valves, one at the bottom of the outer pipe and the other at the bottom of the inner pipe. Maintenance requirements are low, and underground components are made mostly from plastic, so they are corrosion resistant and easier to handle.

Design Considerations: Direct Action Pumps can generally lift water to around 15 metres. As the water column is lifted directly, pumping water from greater depth is usually not feasible. The only way this can be achieved is by reducing the weight of water in the pipes through a modified pipe design (e.g. with the Canzee pump, this would require a 40 mm outer and 32 mm inner pipe, rather than the usual 50 mm/40 mm configuration). Flow rates are generally between 2,500–3,000 L/hour at 5 metres in depth, which is slightly less than suction pumps but still better than deeper well pumps.

There are two main types of Direct Action Pump in use, the Tara and Canzee pump, which differ slightly from each other. Both of them use two non-return valves, and both require the water column to be lifted directly on the upstroke (during which water is held in place by the non-return valve of the inner pipe). However, they differ in two ways. The Tara pump has an inner pipe that is hollow and sealed which makes it buoyant, whereas the inner pipe of the Canzee fills with water that is lifted. Also, the hollow

inner pipe of the Tara pump has a piston at the base (with integrated non-return valve) that seals against an outer pipe, above which water is lifted within the outer pipe on the upstroke. In this way, the outer pipe in the Tara acts like a cylinder, in contrast to the Canzee pump which allows water to enter both the inner and outer pipes on alternate strokes, and there is no piston or cylinder.

Materials: The materials needed include the pump head, outer pipe with valve, inner pipe with valve, the connection from the inner pipe to the handle (usually made from metal) and the handle (made from metal, plastic or wood). In many cases, this type of pump is produced locally. Availability will depend on country context.

Applicability: Direct Action Pumps are used mainly for drinking water supply. As the pump works by directly lifting or displacing a water column, the depth to which users can easily operate it is limited to water tables at up to around 15 metres in depth, and the pump must be set directly over the well or borehole. These pumps are more often viable at household level and in the context of rural communities with fewer users per pump, rather than in emergencies and/or urban settings where there are dense populations and where manual water extraction from a single shared source may not meet the volume demand **(see S.8)**. This type of pump is suited to lower numbers of users (e.g. up to 150), as the plastic materials are not as robust as deep well pumps, though more intensive use is possible but will require more maintenance.

Operation and Maintenance: O & M is easier for Direct Action Pumps than deeper well pumps, as they lift water directly using no levers or bearings, resulting in fewer maintenance issues in comparison. Plastic pipes and fittings are lighter, which makes extracting the pipes easier and more straightforward than for metal pipes. In addition, for the Tara pump the foot valve can be removed without actually removing the outer pipe. Some of the parts can also be locally manufactured (e.g. valve washers can be made from inner tubes for the Canzee pump), which can theoretically contribute to sustainability. Another factor reducing maintenance is that the pump rods and rising mains are made from plastic, making them resistant to corrosion by groundwater with a low pH such that less repair and replacement is needed. However, certain parts will eventually need replacement, either more frequently (e.g. valve washers) or less frequently (e.g. pump handle and rod connecting to rising main). While the design lends itself to easy maintenance, the reality is that even such simple pumps are often not maintained as required. There are various reasons for this that are separate from the pump technical design **(see S.8)**.

Health and Safety: Since most of the below-ground components are made of plastic, there are no concerns with the solubility of metals in lower pH water, meaning also less exacerbation of the effect of iron-related bacteria on water quality. One issue with Direct Action Pumps is physical over-exertion, as the water must be lifted directly. This could cause back issues for adults, and long pumping times are not suitable.

Costs: Costs for Direct Action Pumps are usually within a range of 150–500 USD. Ongoing costs are low since there are fewer moving parts, and for some pumps, the parts can be fabricated locally.

Social and Environmental Considerations: Generally, these types of pumps are well accepted. As they are manually operated, they represent an environmentally friendly way of extracting water, with limited risk for over-exploiting the water source used for pumping.

Strengths and Weaknesses:

⊕ Requires less O & M than deep well pumps due to fewer working parts and plastic components
⊕ Relatively easy access to pipes and valves below ground
⊕ Relatively cheap and easy to manufacture

⊖ Relatively limited water lift
⊖ Not suitable for too many users
⊖ Can be physically hard work to operate, especially for children or the elderly

→ **References and further reading material for this technology can be found on page 216**