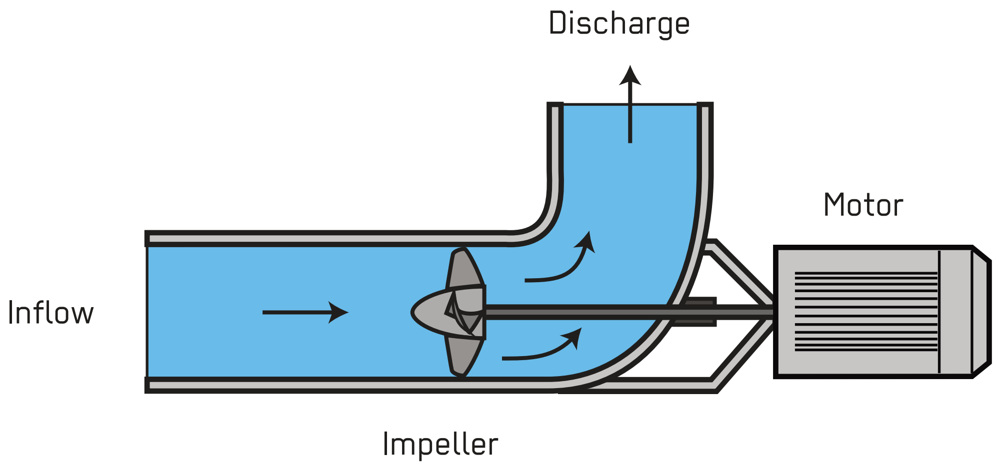
Axial Flow Pump

Response Phase	Application Level	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	Household * Neighbourhood ** City	Household * Shared ** Public	Velocity pump, moves high volumes of water at low pressure
Local Availability	**Technical Complexity**	**Maturity Level**	
** Medium	*** High	*** High	



An Axial Flow Pump is a large diesel or electric motor-driven pump capable of moving large volumes of water at relatively low heads. The most common uses for Axial Flow Pumps are for clearing water from flooded areas, lifting large amounts of flow within a treatment plant or water system, or for agricultural purposes, but they tend not to be used in the acute phase of an emergency.

An Axial Flow Pump is a velocity pump that increases flow velocity or pressure at the pump impeller to impart energy to the pumped fluid. The volume of liquid pumped is relative to the impeller size and rotational speed. Within this category, Axial Flow Pumps are distinguishable in that they push water in the same direction as the axis/shaft and not radially at right angles to the shaft, as with radial flow pumps **(see A.8)**. Axial Flow Pump impellers are shaped similarly to a boat propeller and are designed to push water along instead of creating high pressures. Vertically oriented Axial Flow Pumps are used to move very large volumes of water with minimal vertical lift (e.g. over a river berm). Pumps may also be oriented horizontally and generally offer ease of access to the rotating parts during dry periods.

Design Considerations: Centrifugal pumps can produce flow over a wide range of pressures and flow rates. Where high flow rates and very low head (less than 5–10 metres of head) is needed, Axial Flow Pumps should be considered. Generally, these pumps are installed in a single-stage arrangement. Where additional flow is needed, pumps are installed in parallel rather than in series. Axial Flow pumps do not produce significant pressure to push fluid to a height, and the maximum head is generally 5 metres or less. Axial Flow Pumps are an established and well-tested technology available from many commercial and industrial manufacturers. They should not be used in applications where a valve would be closed during pump operation. When siphons are used, Axial Flow Pumps should be designed carefully for priming considerations. As they are normally used to pump large volumes at high flow rates, these pumps are physically large with special spatial requirements. Engine-driven vertical pumping units require right angle gear drives and additional space for the maintenance of engines, drives and pumps. Axial Flow Pumps are typically a low-speed application requiring special motor designs. Synchronous motors should be considered, where applicable, to reduce the impact on the electrical system.

Materials: Most normal sizes of Axial Flow Pumps are shipped assembled. For very large applications, these pumps may need to be assembled on site. Depending on the size, additional equipment and materials may be needed (locally and/or brought in). This could be skids, valves, buildings or weather covers, construction materials and equipment. Consumables include general lubricants for bearings, such as oil and grease.

Applicability: Axial Flow Pumps are not capable of providing high pressures at discharge and are therefore not useful for supplying water to large distribution systems or elevated storage tanks. However, where high flow rates and very low pressures are needed, Axial Flow Pumps can be considered. Large Axial Flow Pumps are generally permanent installations, though tractor-driven Axial Flow Pumps do exist that are smaller and easy to use. They are useful for flood control but are most effective when designed and installed prior to a flood event. Geotechnical and structural design should be carefully evaluated, as these pumps are usually very large and heavy. Where water depths are shallow on the suction side, these pumps do not perform well, as they need several metres of submergence to prevent the impact of damaging vortices. In an emergency, Axial Flow Pumps are mainly used during the stabilisation and recovery phases.

Operation and Maintenance: Typical preventative maintenance includes the periodic inspection of gaskets, seals and lubricant levels. Replacement of worn parts is required at regular intervals as determined by the manufacturer.

Health and Safety: Safety precautions should be exercised around any electro-mechanical equipment. Hazards associated with pump stations include risk of electric shock, rotating equipment, open water, and pressurised flow. If engine-driven pumps are employed, potential health risks with engine emissions should be evaluated.

Costs: Costs for complete pump stations are high and are closely tied to capacity and construction materials. Costs also depend on elements such as the prime mover (motor/engine driver), and capital costs include fuel storage tanks for fuel and any large, dedicated power lines needed for special motors.

Social and Environmental Considerations: The end users of a water supply system typically do not interact with these pumps. The complexity of O&M of the system should be considered, and trained and capable staff are a requirement. For motor-driven pumps, environmental considerations concern the use of consumables (lubrication, oil, chemicals) and power sources. A plan for appropriate containment and disposal related to consumables should be in place. For smaller pumping systems, solar power **(see S.10)** or hybrid power systems with solar panels are feasible and often have a lower environmental impact and short payback period.

Strengths and Weaknesses:

(+) Can pump large flow rates
(+) Typically run at low speed, so less wear

(−) Not possible to pump to high pressures
(−) Better performance with individual discharge headers than combined discharge headers
(−) Should not be used with a closed discharge valve
(−) Need large depths of water in the suction pit to meet submergence requirements

→ **References and further reading material for this technology can be found on page 217**