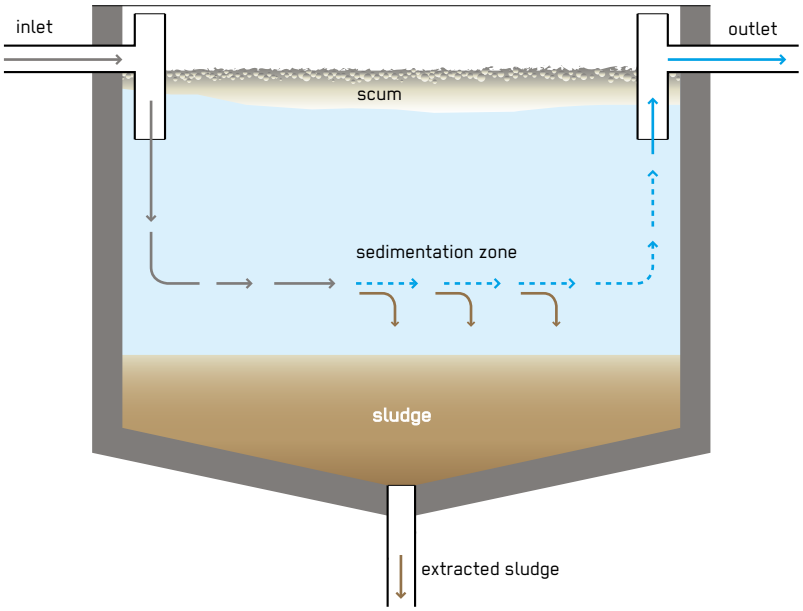
Settler

Phase of Emergency	Application Level / Scale	Management Level	Objectives / Key Features
Acute Response * Stabilisation ** Recovery	Household ** Neighbourhood ** City	Household * Shared ** Public	Solid / liquid separation, BOD reduction
Space Required	**Technical Complexity**	**Inputs**	**Outputs**
** Medium	** Medium	● Blackwater, ● Greywater	● Effluent, ● Sludge



A Settler is a primary treatment technology for blackwater and greywater. It is designed to remove suspended solids by sedimentation. It may also be referred to as a sedimentation or settling basin/tank, or clarifier. The low flow velocity in a Settler allows settleable particles to sink to the bottom, while constituents lighter than water float to the surface.

Settlers are often used as primary clarifiers, and are typically sequenced after Pre-Treatment Technologies **(PRE)**. Settlers can achieve a significant initial reduction in suspended solids (50–70 % removal) and organic material (20–40 % Biochemical Oxygen Demand (BOD) removal) and ensure that these constituents do not impair subsequent treatment processes. Settlers may take a variety of forms, sometimes fulfilling additional functions. They can be independent tanks or integrated into combined treatment units. Several other technologies in this Compendium have a primary sedimentation function or include a compartment for primary settling: ABR **(T.2)**, Biogas Reactor **(T.4)**, Waste Stabilisation Ponds **(T.5)**, Sedimentation and Thickening Ponds **(T.8)**.

Design Considerations: The main purpose of a Settler is to ensure sedimentation by reducing the velocity and turbulence of the wastewater stream. Settlers are typically designed for a hydraulic retention time of 1.5–2.5 hours. Less time is needed if the BOD level should not be too low for the following biological step. The tank should be designed to ensure satisfactory performance at peak flow. In order to prevent eddy currents and short-circuiting, as well as to retain scum inside the basin, a good inlet and outlet construction with an efficient distribution and collection system (baffles, weirs or T-shaped pipes) is important. Depending on design and location, desludging can be done using Manual Emptying and Transport **(C.1)**, Motorised Emptying and Transport **(C.2)** or by gravity using a bottom outlet. Clarifiers are settling tanks built

with mechanical means for continuous removal of solids being deposited by sedimentation and are equipped with mechanical collectors that continually scrape the settled solids towards a sludge hopper in the base of the tank, from where it is pumped to sludge treatment facilities. A sufficiently sloped tank bottom facilitates sludge removal. Efficiency of the primary Settler depends on wastewater characteristics, retention time and sludge withdrawal rate. It may be reduced by wind-induced circulation, thermal convection and density currents due to temperature differentials and in hot climates, thermal stratification. These phenomena can lead to short-circuiting. To enhance the performance of Settlers inclined plates (lamellae) and tubes can be installed which increase the settling area, or chemical coagulants can be used.

Materials: A Settler can be made of concrete, sand, gravel, cement, steel, as well as fibreglass, PVC or plastic, and are available as prefabricated units.

Applicability: The choice of a technology to settle solids is governed by the wastewater characteristics, management capacities and desirability of an anaerobic process, with or without biogas production. Technologies that already include some type of primary sedimentation (listed above) do not need a separate Settler. Many treatment technologies, however, require preliminary removal of solids in order to function properly. A primary sedimentation tank is particularly important for technologies that use a filter material (e.g. Anaerobic Filter **(T.3)**) but is often omitted in small Activated Sludge plants **(T.13)**. Settlers can also be installed as stormwater retention tanks to remove a portion of the organic solids that otherwise would be directly discharged into the environment.

Operation and Maintenance: In Settlers that are not designed for anaerobic processes, regular sludge removal is necessary to prevent septic conditions and the build-up and release of gas which can hamper the sedimentation process by re-suspending part of the settled solids. Sludge transported to the surface by gas bubbles is difficult to remove and may pass to the next treatment stage. Frequent scum removal is important and sludge should be disposed of appropriately in a treatment system or buried.

Health and Safety: To prevent the release of odorous gases, frequent sludge removal is necessary. Sludge and scum must be handled with care as they contain high levels of pathogenic organisms; they require further treatment and adequate disposal. Appropriate personal protective equipment is necessary for workers who may come in contact with the effluent. Equipment and hands should be disinfected after sludge removal work.

Costs: The capital costs of a Settler are medium and operational costs are low. Costs depend on the conveyance and treatment technology it is to be combined with, and also on the local availability and thus costs of materials (sand, gravel, cement, steel) or prefabricated modules and labor costs. The main operation and maintenance costs are related to the removal of primary sludge and the cost of electricity if pumps are required for discharge (in absence of a gravity flow option).

Social Considerations: Usually, Settlers are a well-accepted technology. The wearing of adequate personal protective equipment should be addressed and trainings for involved staff might be needed.

Strengths and Weaknesses:

⊕ Simple and robust technology
⊕ Efficient removal of suspended solids
⊕ Relatively low capital and operating costs

⊖ Frequent removal of sludge required
⊖ Effluent, sludge and scum require further treatment
⊖ Sophisticated hydraulic and structural design

→ **References and further reading material for this technology can be found on page 193**