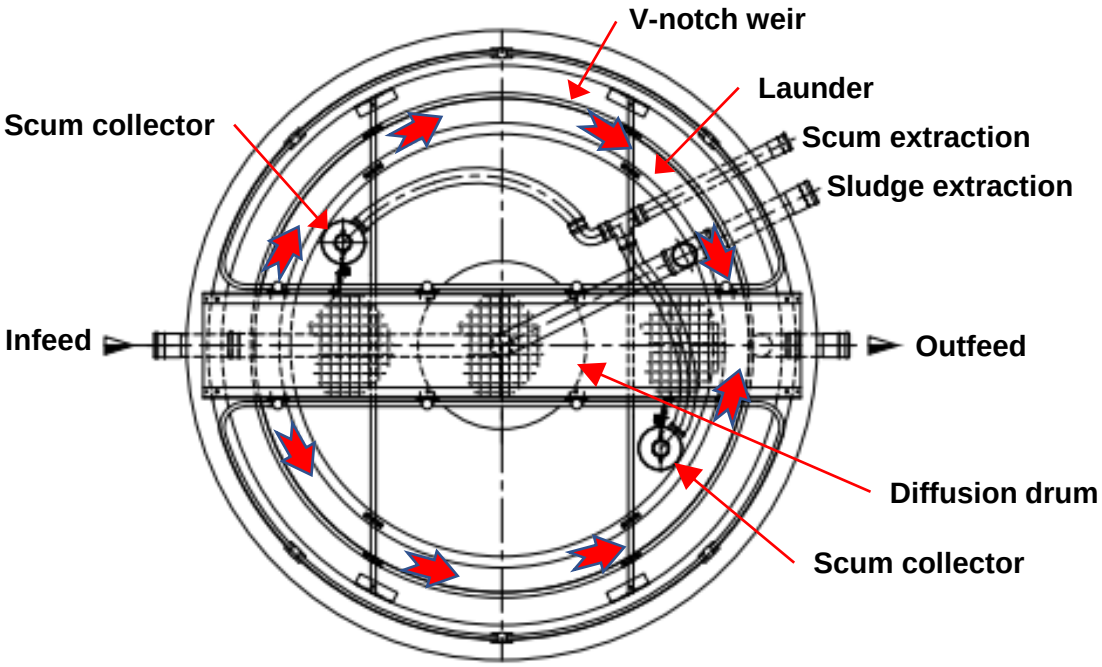
Environmental Wastewater Solutions

EWwS Limited
Unit 12, Acorn Farm Business Centre,
Cubbington Road, Wing,
Leighton Buzzard. LU7 0LB.
Tel.: 07458 306054

Construction of a conical settlement tank with a diameter of 4 m.

PRIMARY AND FINAL SETTLEMENT TANKS



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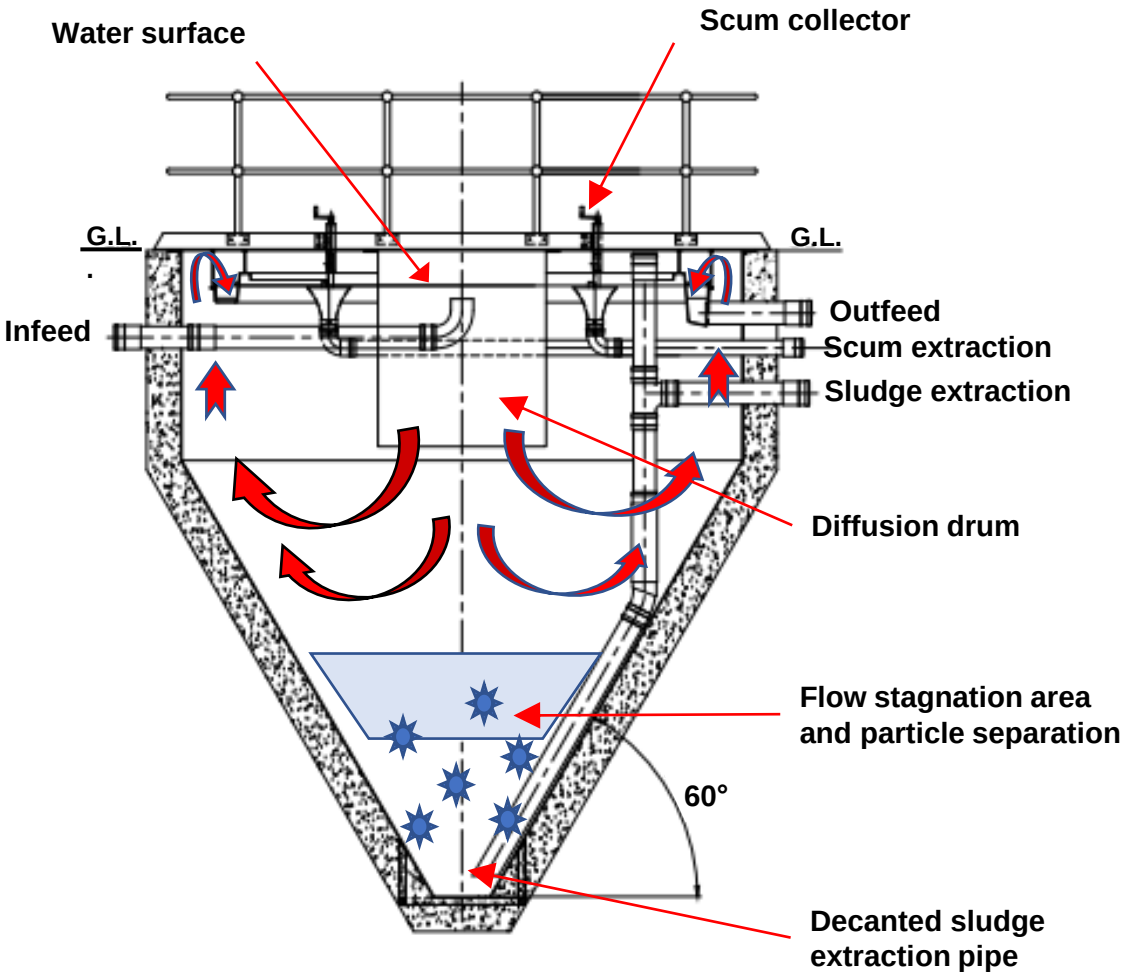

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Concept philosophy

The following explains EWwS Ltd's reasoning for the design of their conical decanters. It will also explain that the concept of maximum ascent speed in order to properly separate suspended particles from wastewater (primary or secondary sludge) depends on the settling characteristics of the sludge, the design of the decanter and the type of upstream biological treatment. of the clarifier.
EWwS Ltd is a manufacturer of BioDisks (RBCs), but also offers activated sludge systems using "Triton 2.0" fine bubble surface aerators and mixers and other fixed film technologies.
The sludge produced by fixed film treatment by RBCs as well as in activated sludge plants is biological in nature and fragile with a particle density in the range of 1.05 to 1.1 g/CC or 1.05-1.1 kg/l (similar to that of water).
The main difference between wastewater treated by RBCs and that by the activated sludge process is the concentration of solids. For RBC wastewater this is 0.2 to 0.3 g/l, while for activated sludge process wastewater it is normally 3 to 4 g/l.
In the majority of cases, activated sludge settling tanks are cylindrical and made of concrete with a bottom slightly inclined by 10°. They are equipped with scrapers to consolidate the sludge in the small diameter central cone at 60° in order to extract the sludge and return it to the aeration tank.
In wastewater from the activated sludge process, the concentration of suspended particles is too high for simple gravity separation, because these particles suffer from "concentration hindered settling" and, therefore, the final sludge clarifier activated must be sized on mass flow theory where the tank solids handling capacity uses critical design parameters based on SSVI 3.5 g/l (stirred sludge volume index at 3.5 g/l of sludge).
With good settling of sludge in wastewater with an SSVI < 80 ml/g, the ascent speed can reach 2.5 m/h. With low settling sludge (high values for SSVI 3.5g/l > 120 ml/g, the rise speed could be less than 0.7m/h. The water is introduced into the center of the clarifier through a diffusion drum whose surface is a fraction of the surface of the tank The circulation of water in this tank can be considered almost laminar and vertical.
When defining the rate of ascent in such a tank, it is sufficient to divide the volume of incoming water by the surface area of the decanter. With a lower concentration of particles in the wastewater from fixed film reactors (RBC or similar), it is possible to achieve separation of suspended solids through terminal settling velocity techniques.
Conical decanters use a complex kinetic flow pattern. The water enters through a fairly large Diffusion drum compared to the water surface area. The reason for this is to quickly reduce the speed of the incoming water. Please keep in mind that speed is a vector and therefore has a value and direction. Inside the diffusion drum the water will be forced downward.

Two final settlement tanks with a diameter of 4 m

Castlemaine WWTP in Ireland

Since the water will follow the path of the least resistance, it will quickly reverse its downward flow direction and flow upward toward the perimeter of the decanter wall where the V-notch weir and launder toward the outlet are located.

In RBCs and most fixed film reactors, the suspended matter content is between 200 and 300 mg/l. At this low solids concentration, separation of water and solids is achieved through the concept of terminal sedimentation velocity for solids moving downward through the stagnation zone. (See graphic explanation)

Reversing flow will create a zero-flow stagnation zone where water velocity (rate of rise) is almost zero, but solids continue to descend at "terminal settling velocity" toward the bottom of the conical section to be consolidated as settled sludge for periodic disposal.
The water flows towards the V-notch weir and launder and will accelerate in the final stages and reach speeds in excess of 0.7 m/h as it passes over the weir. In a decanter with conventional hopper bottom, the V-notch weir must be protected by a scum deflector and the velocities in the space between V-notch weir and the scum deflector could similarly be greater than 0.7 m/ h.
Since the separation of particles took place in the stagnation zone at zero flow, it is useless to talk about a required ascent speed for this type of decanter. Critical features of the decanter are a retention time of up to 2 hours and a design that creates the stagnation zone at zero velocity.
Another feature of the decanter is the 60° angle of the conical wall. This is mandatory for sales of the decanter in the UK and Ireland. The separated and consolidated sludge at the bottom of the cone is extracted by pump-assisted hydrostatic means to avoid resuspension of the settled sludge.
The pumps in the lifting stations are located below the water surface of the decanter. Once the pump is activated by a timer, this creates a difference in water level and the water column above the settled sludge in the tank will in turn help to push the particles through the sludge suction pipe installed in the decanter.
The removal of scum is facilitated by one or more collection devices with an inverted bell located approximately 25 mm below the mirror surface. They are fixed on the walkway and in diagonally opposite positions for a higher rate of scum captivity.
The plant operator can modify the immersion level of the inverted bell collector according to his operational experience in relation to the character of the scum.

Other features of EWwS conical decanters:

The launder is suspended by threaded and adjustable rods. This allows it to be safely adjusted from above and outside the tank without the need for entry. This ability to safely adjust the launder ensures that it will be level all around.
The 90° V-notch weir is made of GRP, fixed to the launder and safely adjustable in height. The decanter tank is made of GRP and is delivered with a galvanized steel walkway with protective guardrail. The decanter is also protected by a guardrail on its galvanized steel perimeter.
The range of decanters can vary from 2.8 meters in diameter to 6 meters in diameter inclusive. The 2.8 meter diameter decanters are delivered in one piece. Decanters from 4 meters to 6 meters in diameter are delivered in kit form for on-site assembly.

The base cones of 3 settlement tanks await assembly of the upper part.
Arthurstown WWTP – Ireland

Handling of a 6m diameter settlement tank before installation

Two 6m diameter settlement tanks under construction