Purpose of Sludge Thickening

Solids from the primary clarifier (primary sludge) and secondary clarifier (secondary sludge) contain large volumes of water.

This increased amount of water increases the overall volume of sludge that must be handled, increasing the size of the equipment, such as digesters, that must be installed.

To decrease this volume, the sludge can be thickened. Essentially this results in an increase in the concentration of solids and a decrease in the total volume that must be handled in subsequent processes.

There are several advantages to sludge thickening, including:

- ✓ Improved digester performance due to a lower volume of sludge
- ✓ Cost savings in the construction of new digestion facilities
- ✓ Reduction in anaerobic digestion heating requirements since less water has to be heated

Thickeners are installed prior to other solids handling processes such as anaerobic and aerobic digestion and dewatering.

Caution should be taken to not thicken sludge to greater than 10% solids because it is difficult to pump sludges to the next treatment unit with a greater than 10% solids concentration.

Gravity Thickeners

Gravity thickening of wastewater sludges uses gravity to separate solids from the sludges being treated.

Solids that are heavier than water settle to the bottom of the thickener and are compacted by the weight of solids that continue to settle.

The design of a gravity thickener is similar to a primary or secondary clarifier and consists primarily of:

- ✓ Inlet and distribution assembly – introduces the sludge into the thickener
- ✓ Sludge rake to move the sludge to a sludge hopper – slowly rotates to move the settled solids to the middle of the tank
- ✓ Pickets or vertical steel members – provide gentle stirring or flocculation of the settled sludge and released trapped gas to prevent rising sludge
- ✓ Effluent or overflow weir – collect and remove effluent or thickener overflow
- ✓ Scum removal equipment – collect and remove floating debris

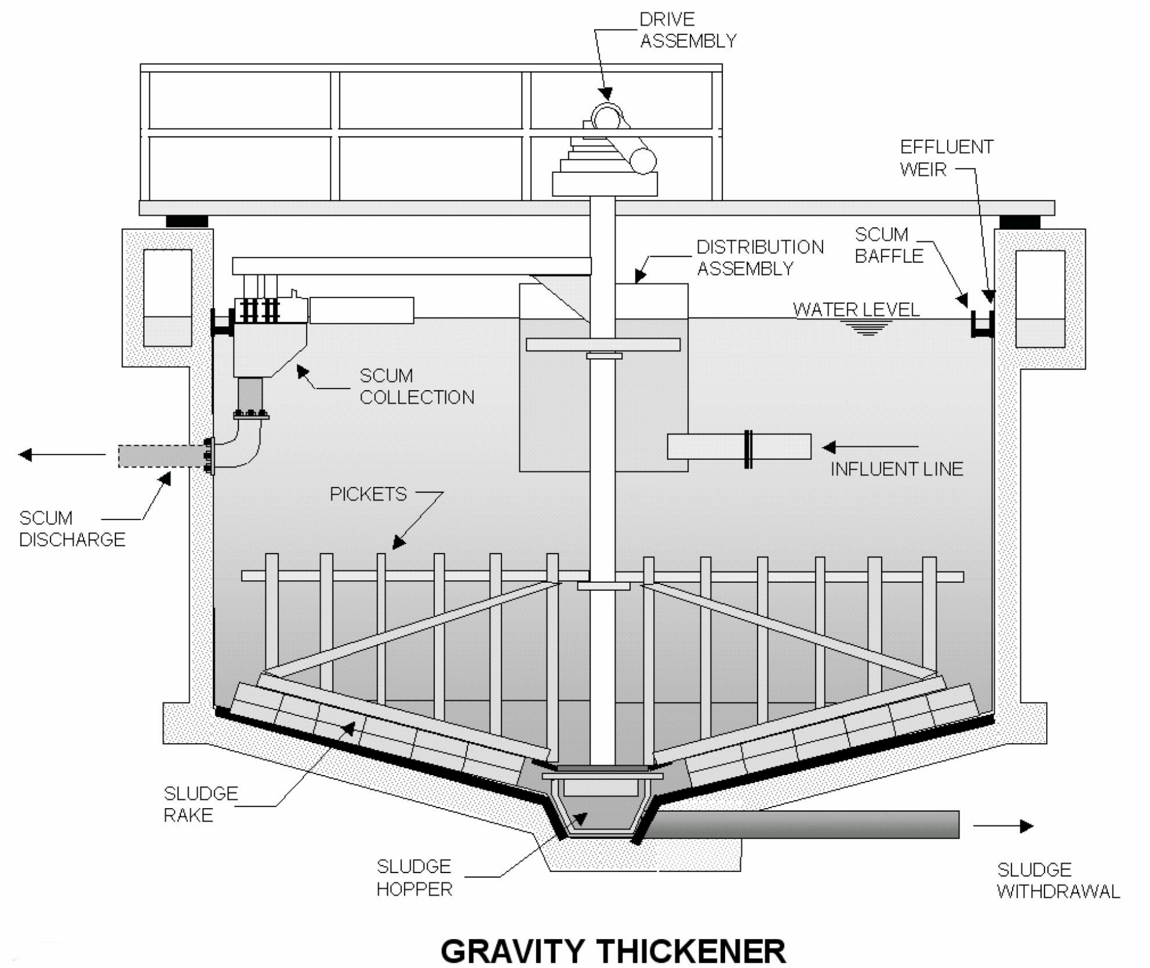

Figure 1.1 Diagram of Gravity Thickener

The operation of gravity thickeners depends on the following factors:

- ✓ Type of sludge
- ✓ Age of the feed sludge
- ✓ Sludge temperature
- ✓ Sludge blanket depth
- ✓ Solids and hydraulic detention times and loadings

Secondary sludges are not as well suited for gravity thickeners as primary sludges due to the large quantities of bound water that makes the sludge less dense than primary sludge solids.

Bound Water is water contained within the cell mass of sludges or strongly held on the surface of colloidal particles, which is one of the causes of bulking sludge in the activated sludge process.

The performance of a gravity thickener is controlled by:

- ✓ The speed of the sludge collection mechanism
- ✓ Adjusting the sludge withdrawal rate
- ✓ Controlling the sludge blanket depth

Typically the flow through a thickener is continuous and should be controlled as consistent as possible.

Under normal operating conditions the surface water and effluent should be clear and free from solids and gas bubbles. The effluent is returned to the headworks of the plant for further treatment.

The sludge blanket depth is usually kept around 5 to 8 feet and the speed of the sludge collectors should be fast enough to allow the settled solids to move toward the sludge collection sump, but not at a speed that will disrupt the settled solids.

Typical loadings and output concentrations vary based on the sludge type and the operation of the thickener.

Sludge Type	Solids Loading lbs/day/sq ft*	Thickened Sludge, %
Separate		
Primary	20 – 30	8 – 10
Activated Sludge	5 – 8	2 – 4
Trickling Filter	8 – 10	7 – 9
Combined		
Primary & Act Sl	6-12	4 – 9
Primary & Trickling Filter	10 – 20	7 – 9

* lbs/day/sq ft X 4.883 = kg / day / sq m

Table 1.1 Operational and Performance Guidelines for Gravity Thickeners[1]

As with any wastewater treatment process, troubleshooting gravity thickeners starts with visual inspections as well as an understanding of the expected results by comparing design values with operating criteria. Performance can typically be determined by observing items such as liquid surface and effluent quality, as well as being aware of such things as uncharacteristic odors.