11.8 GRIT CHAMBERS

Grit chambers are sedimentation basins placed at the front of wastewater treatment plants to remove sand, egg shells, coffee grounds, and other nonputrescible materials that may clog channels or cause abrasive wear of pumps and other devices. Because the grit material is nonputrescible no further treatment is required before disposal at the ultimate site. The grit is collected in containers or directly in truck beds and hauled away at required intervals.

Grit is defined as sand, gravel, or other mineral matter that has a nominal diameter of 0.15–0.20 mm or larger. Actually, grit will also include smaller mineral particles that may settle as well as nonputrescible organic matter such as rags, coffee grounds, vegetable cuttings, ash, clinker, wood pieces, and tea leaves. Even though some of the grit components such as coffee grounds are organic, they are essentially nonbiodegradable over time spans for grit collection and disposal. The quality and quantity of grit in the sewage determine the design factors and choice of grit removal method.

The amount of grit collected is a function of the removal device, its operation, and the quantity of grit in the sewage and therefore varies over a wide range. Table 11.8 gives typical values for grit quantities. Grit solids content varies from 35 to 80% and volatile content from 1 to 55% (USEPA, 1979). Grit that is washed should achieve a solids content of 70–80%, with a minimum of putrescible matter. The bulk density of grit is from 1 450 to 1 750 kg/m^3 (90–110 lb/ft^3).

Generally grit chambers are designed to remove all particles with a nominal diameter of 0.20 mm (particles retained on a 65-mesh screen) or larger and with a s.g. of 2.65 (sand) (Camp, 1942). The settling velocity of these particles at 10°C is usually taken to be 2.3 cm/s (4.5 ft/min) based on curves of sewage grit settling velocities given by Camp (1942). Using Eq. (11.10) the settling velocity of a particle with these characteristics can be calculated to be near 2.3 cm/s (4.5 ft/min) but the angularity of typical grit particles causes a small deviation from the calculated value. Sometimes grit removal devices are designed to remove 0.15-mm sand particles (retained on a 100-mesh screen) with a settling velocity of 1.30 cm/s (2.6 ft/min) taken from Camp's curve.

It is not desirable to remove any organic matter in grit chambers because no further treatment of the grit is necessary or provided. The chamber must be designed to scour the lighter organic particles while the heavier grit particles remain settled. Different types of devices can accomplish this: (1) constant velocity horizontal flow channels, (2) rectangular grit chambers with a grit washing device, and (3) aerated grit chambers.

TABLE 11.8 Estimated Grit Quantities[a]

Type of system	Average quantity of grit (typical range), m^3/1 000 m^3 or ft^3/1 000 ft^3	Ratios of maximum day to average day
Separate	0.004–0.037	1.5 to 3.0:1
Combined	0.004–0.18	3.0 to 15.0:1

[a]From WEF and ASCE (1992), *Design of Municipal Wastewater Treatment Plants,* vol. 1, WEF, © WEF 1992.