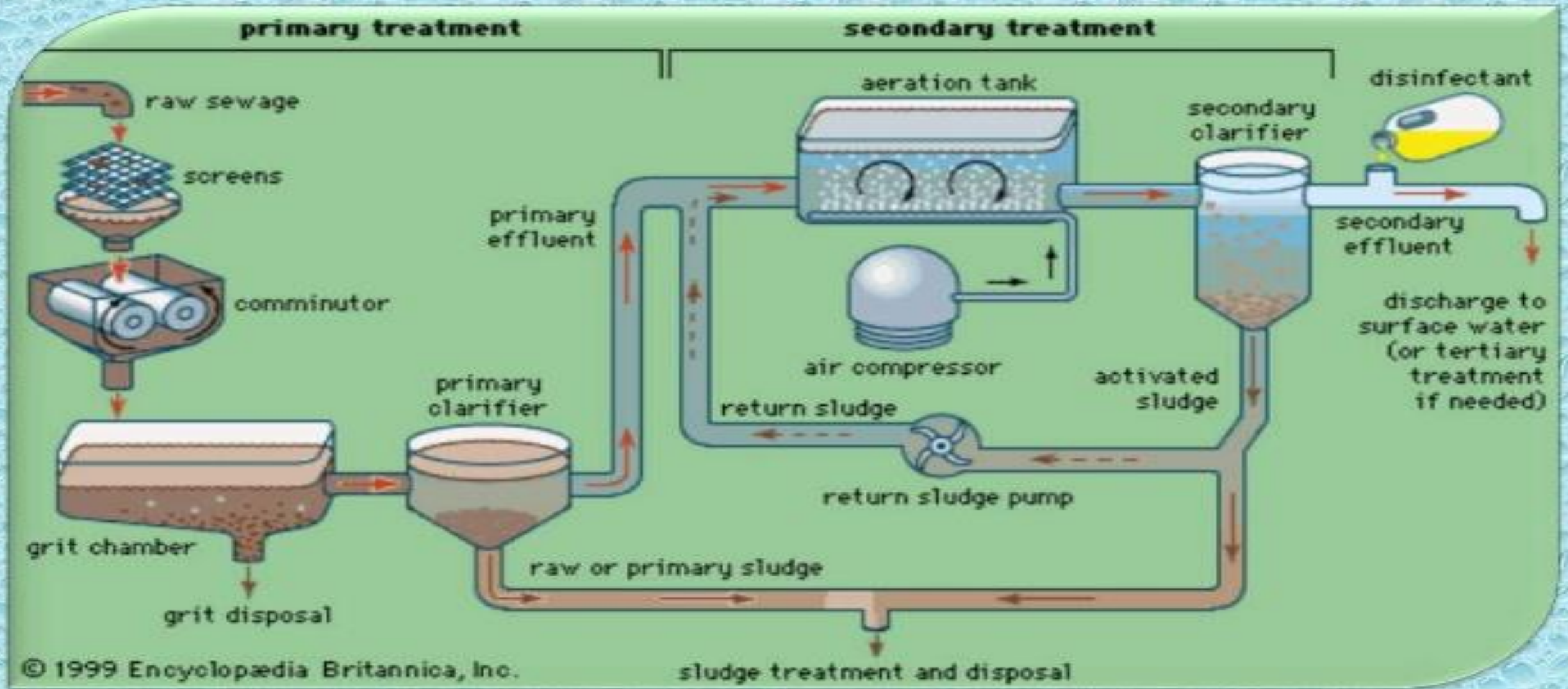




WATER SUPPLY AND WASTE WATER MANAGEMENT

Lecture - 04

Waste Water Treatment Process



Preliminary, Primary, Secondary, and Tertiary Treatments of Wastewater

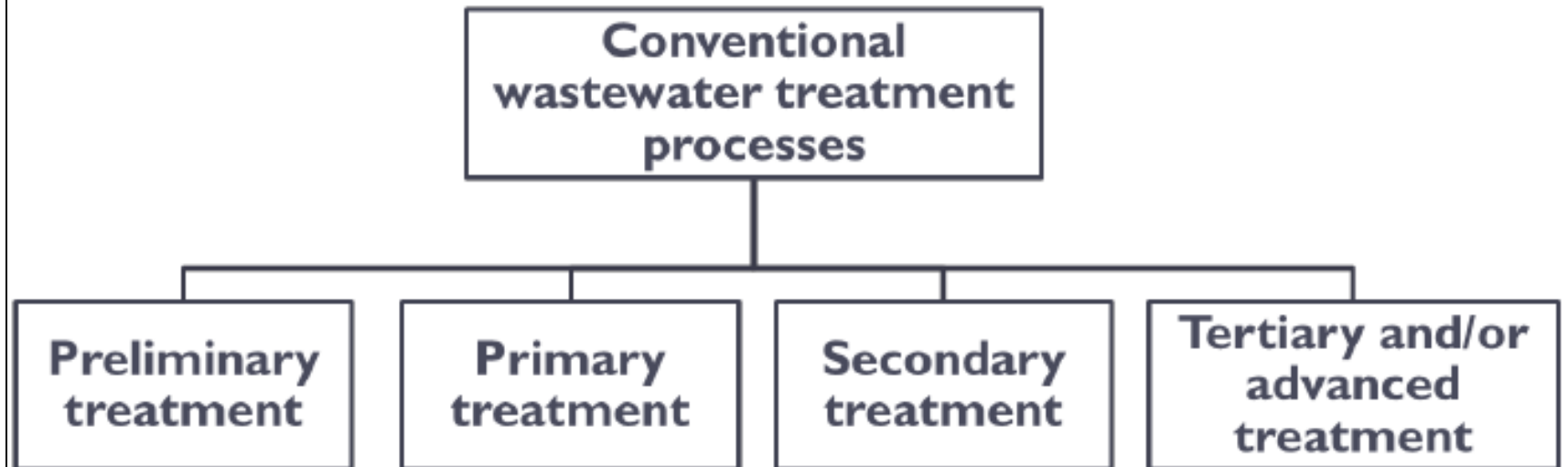
Wastewater: *Intorduction*

- Wastewater treatment consists of applying known technology to improve or upgrade the quality of a wastewater.
- Wastewater treatment involves collecting the wastewater in a central, segregated location (the Wastewater Treatment Plant) and subjecting the wastewater to various treatment processes.
- The principal objective of wastewater treatment is generally to allow human and industrial effluents to be disposed off without danger to human health or unacceptable damage to the natural environment.
- With the current emphasis on environmental health and water pollution issues, there is an increasing awareness of the need to dispose of these wastewaters safely and beneficially

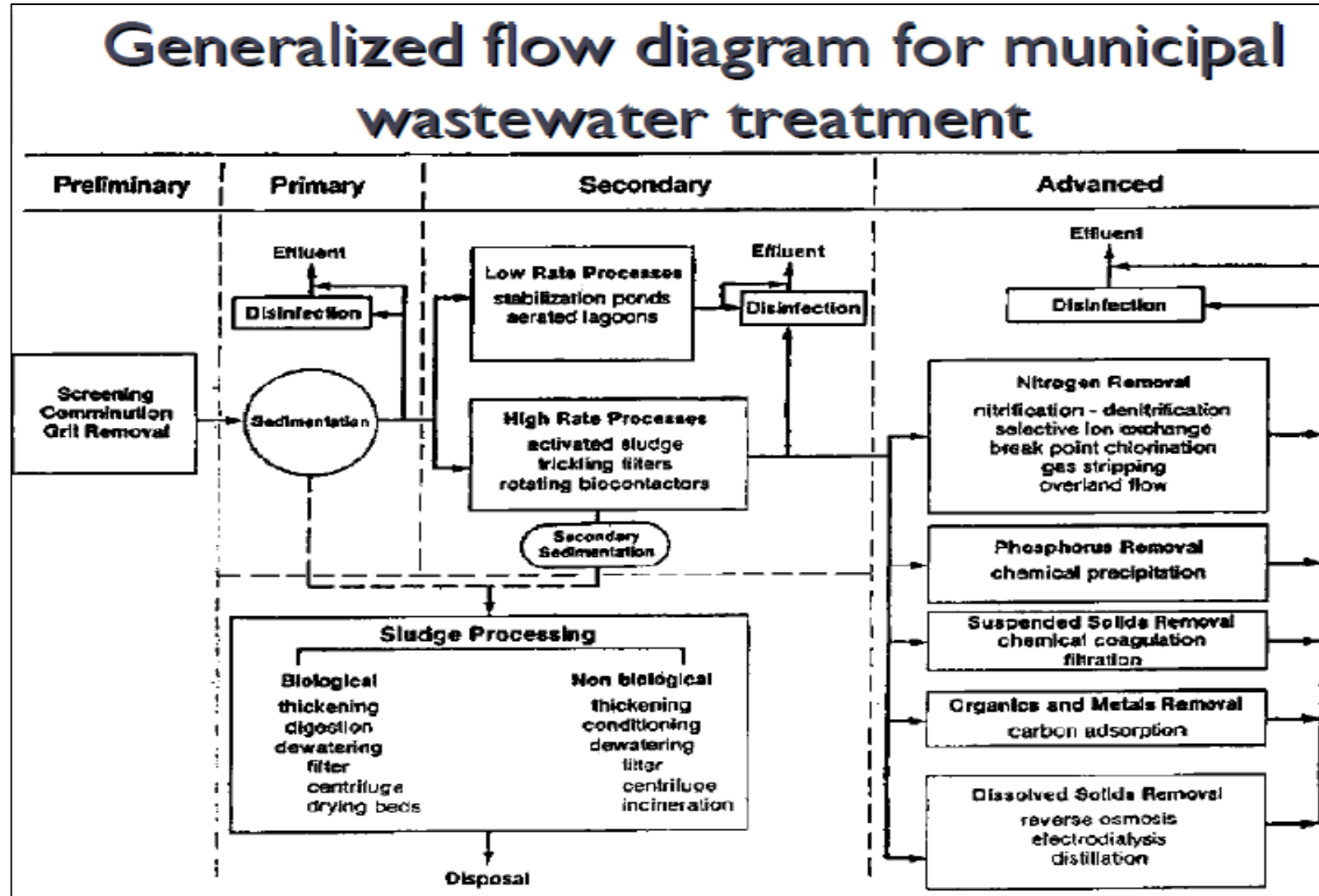


Water Pollution: *Effects*

Conventional wastewater treatment processes



Water Pollution: *Effects*





Water Pollution: *Effects*

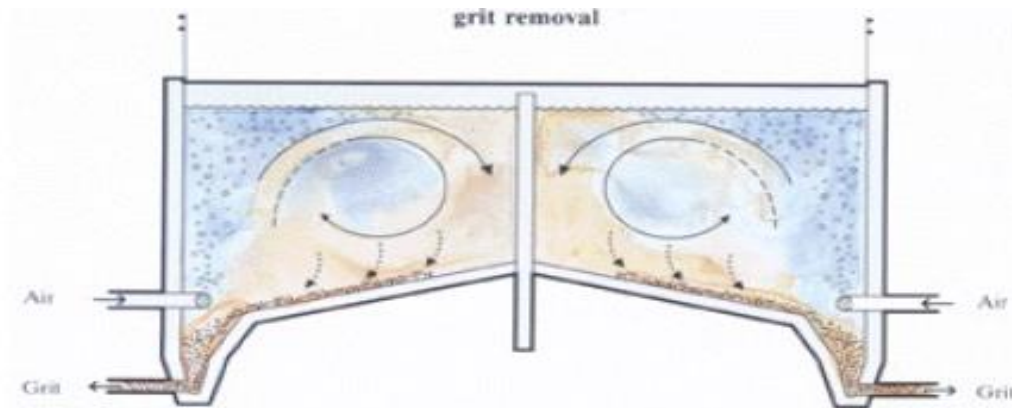
- Conventional wastewater treatment consists of a combination of physical, chemical and biological processes and operations to remove solids, organic matter and sometimes, nutrients from wastewater.
- General terms used to describe different degrees of treatment, in order of increasing treatment level, are preliminary, primary, secondary, and tertiary and/or advanced wastewater treatment.
- In some countries, disinfection to remove pathogens sometimes follows the last treatment step



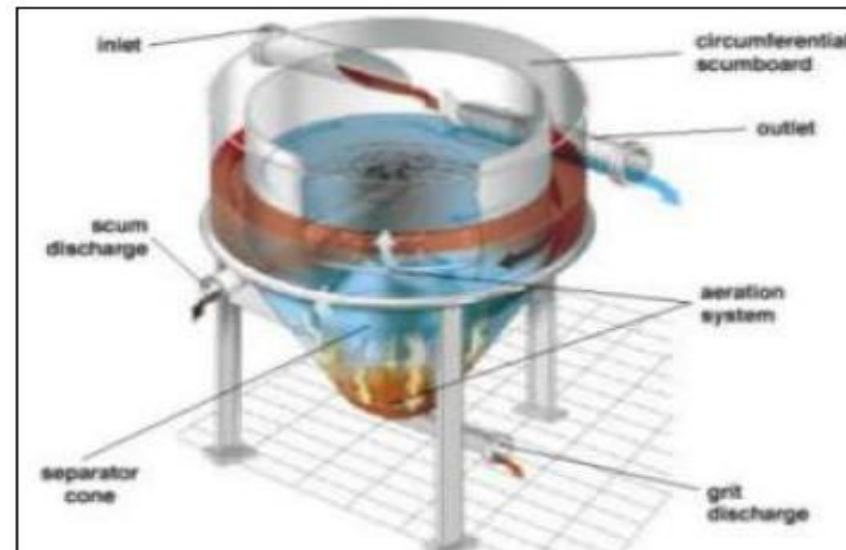
Wastewater Treatment: *Preliminary*

- The objective of preliminary treatment is the removal of coarse solids and other large materials often found in raw wastewater
- Preliminary treatment operations typically include coarse screening, grit removal and, in some cases, comminution of large objects
- In grit chambers, the velocity of the water through the chamber is maintained sufficiently high, or air is used, so as to prevent the settling of most organic solids
- Comminutors are sometimes adopted to supplement coarse screening and serve to reduce the size of large particles so that they will be removed in the form of a sludge in subsequent treatment processes

Preliminary: *Grit Chamber*

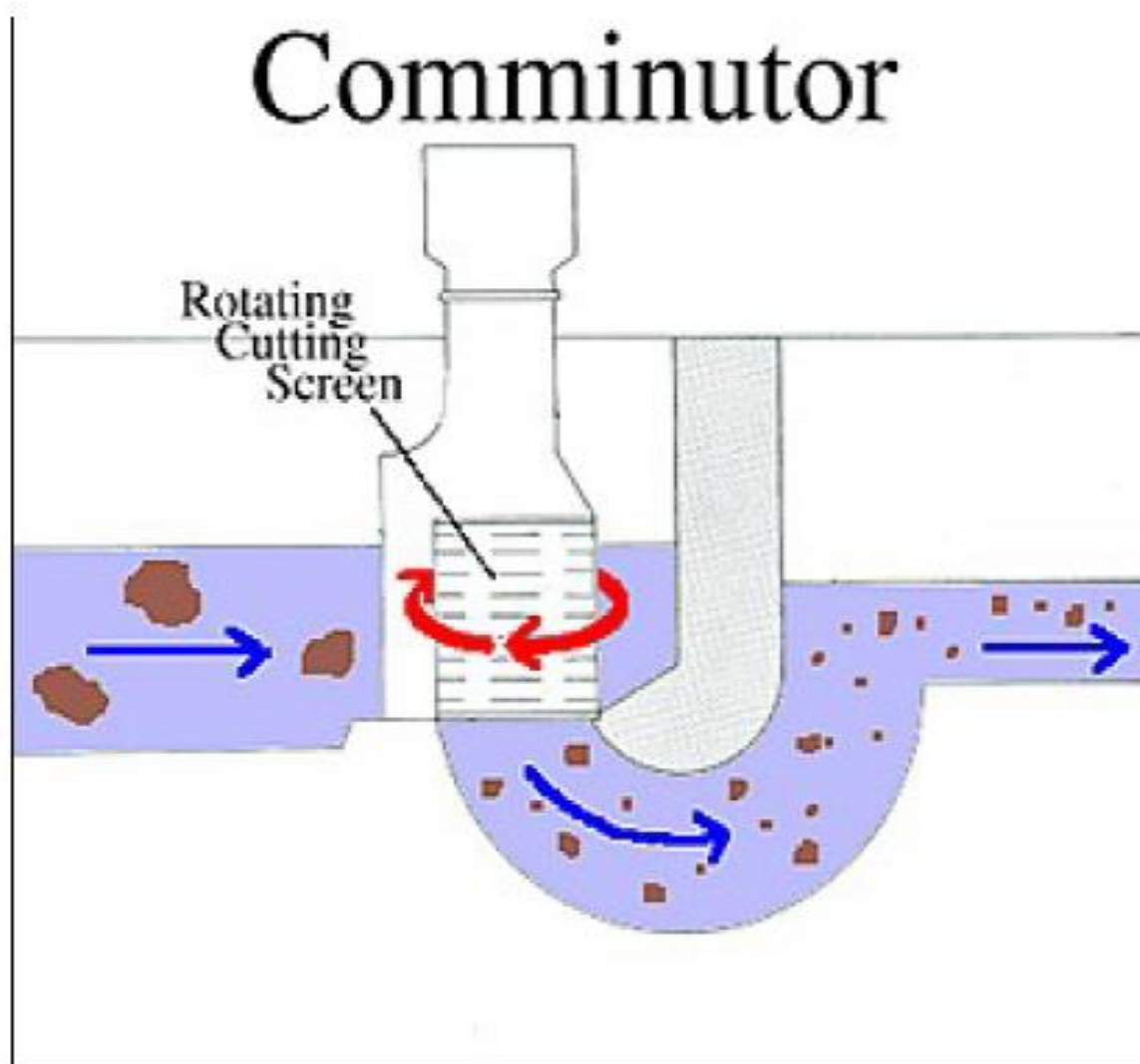


Aerated grit chamber :
diffused air keeps organic solids in suspension as grit settles



Vortex - Type Grit Chambers
Vortex is created
-Grit move to the outside of the unit and gets collected

Preliminary: *Comminutor*



- In this device all of the wa flow passes through the grinder assembly

- The grinder consists of a screen or slotted basket, a rotating or oscillating cutter and a stationary cutter

- Solids pass through the screen and are chopped or shredded between the two cutters



Wastewater Treatment: *Primary*

- The objective of primary treatment is the removal of settle-able organic and inorganic solids by sedimentation, and the removal of materials that will float (scum) by skimming
- Approximately 25 to 50% of the incoming biochemical oxygen demand (BOD_5), 50 to 70% of the total suspended solids (SS), and 65% of the oil and grease are removed during primary treatment
- Some organic nitrogen, organic phosphorus, and heavy metals associated with solids are also removed during primary sedimentation
- In many industrialized countries, primary treatment is the minimum level of pre-application treatment required for wastewater irrigation
- It may be considered sufficient treatment if the wastewater is used to irrigate crops that are not consumed by humans or to irrigate orchards, vineyards, and some processed food crops



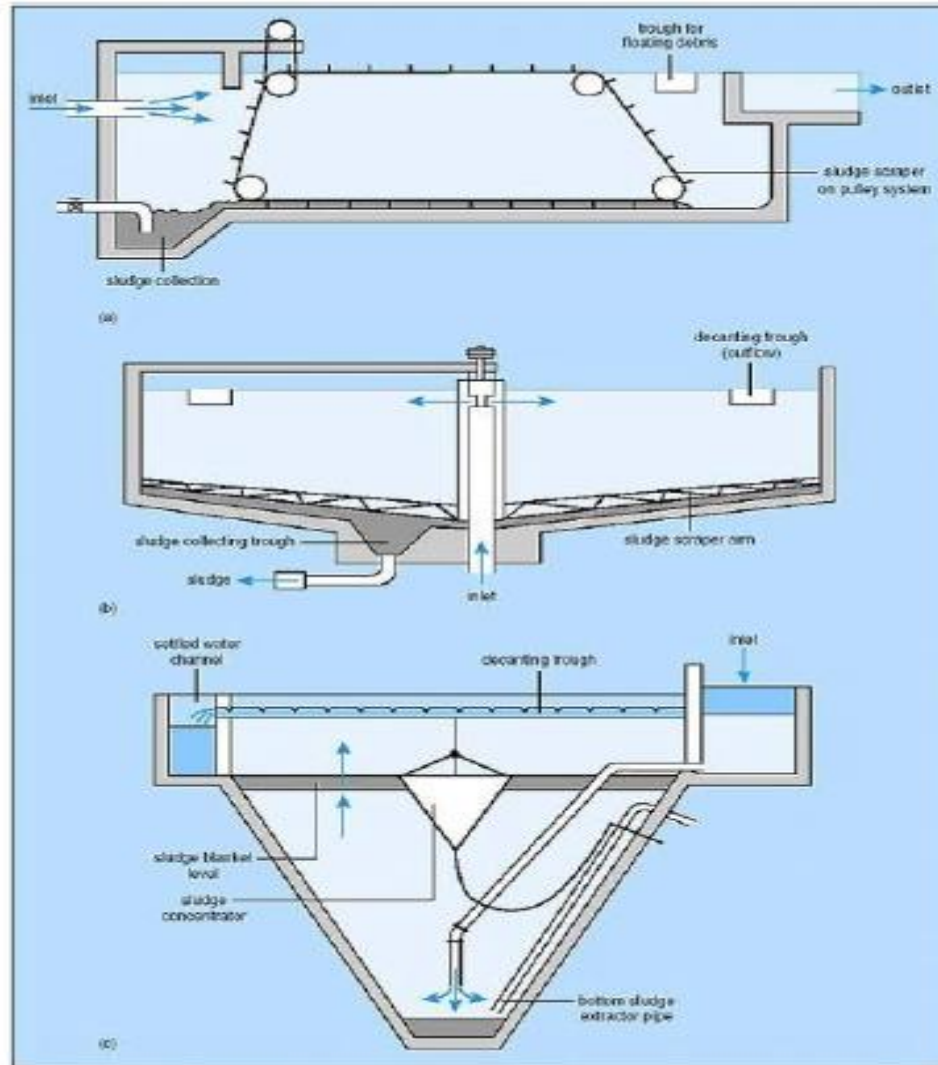
Wastewater Treatment: *Primary*

Contd...

- Primary sedimentation tanks or clarifiers may be round or rectangular basins, typically 3 to 5 m deep, with hydraulic retention time between 2 and 3 hours
- Settled solids (primary sludge) are normally removed from the bottom of tanks by sludge rakes that scrape the sludge to a central well from which it is pumped to sludge processing units
- Scum is swept across the tank surface by water jets or mechanical means from which it is also pumped to sludge processing units

Primary Treatment:

Sedimentation Tank & Clarifier



Typical sedimentation tanks:

(a) rectangular horizontal flow tank;

(b) circular, radial-flow tank;

(c) hopper-bottomed, upward flow tank

Primary Treatment:

Sedimentation Tank & Clarifier



- In large sewage treatment plants ($> 7600 \text{ m}^3/\text{d}$), primary sludge is most commonly processed biologically by anaerobic digestion
- In the digestion process, anaerobic and facultative bacteria metabolize the organic material in sludge, thereby reducing the volume requiring ultimate disposal, making the sludge stable (nonputrescible) and improving its dewatering characteristics
- Digestion is carried out in covered tanks (anaerobic digesters), typically 7 to 14 m deep
- The residence time in a digester may vary from a minimum of about 10 days for high-rate digesters (well-mixed and heated) to 60 days or more in standard-rate digesters
- Gas containing about 60 to 65% methane is produced during digestion and can be recovered as an energy source
- In small sewage treatment plants, sludge is processed in a variety of ways including: aerobic digestion, storage in sludge lagoons, direct application to sludge drying beds, in-process storage (as in stabilization ponds), and land application.

THANK YOU