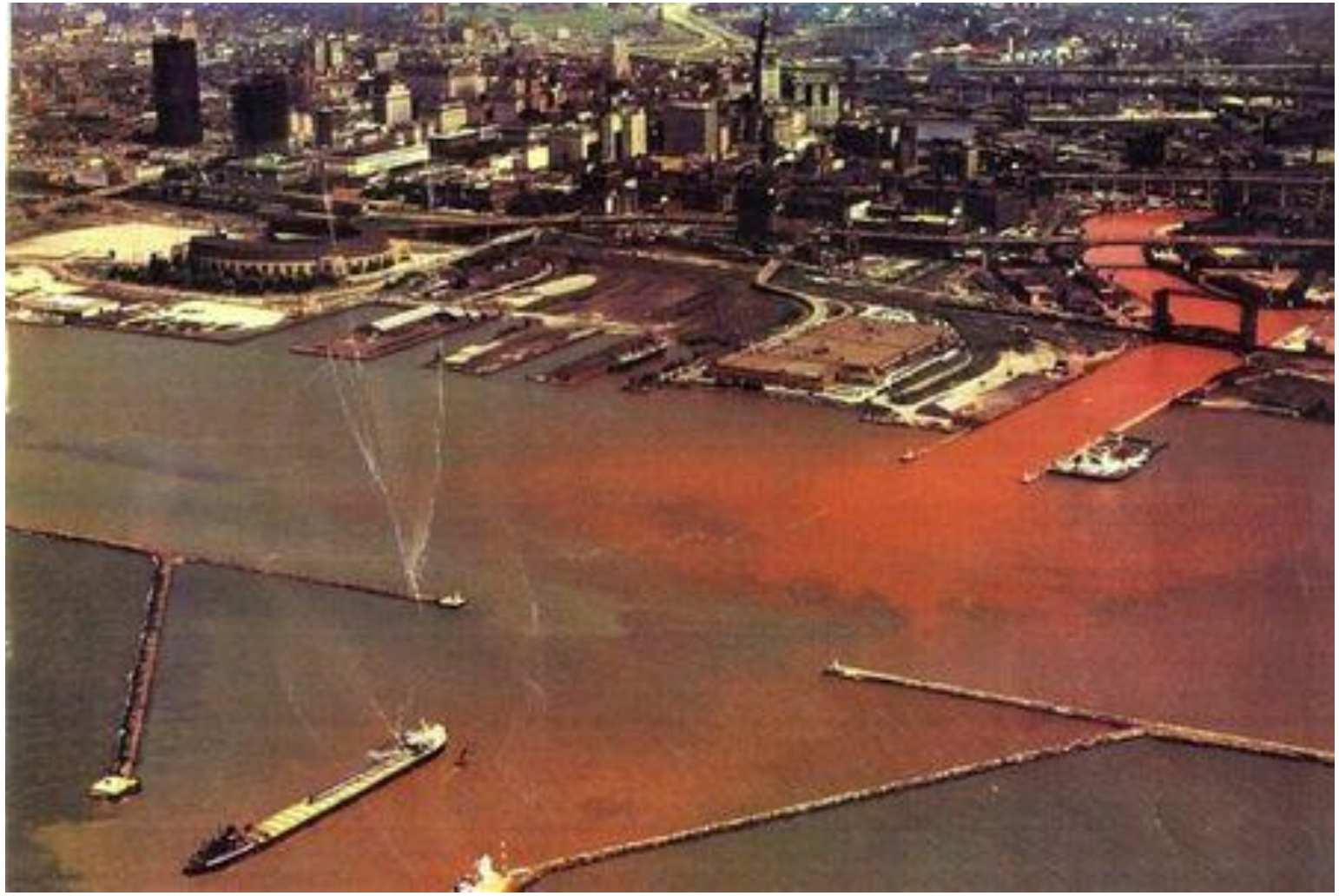
Toilet to Tap, How does water really work?

Ralph Stevens TPC Instructor

TPC

Why get into Water/Wastewater?



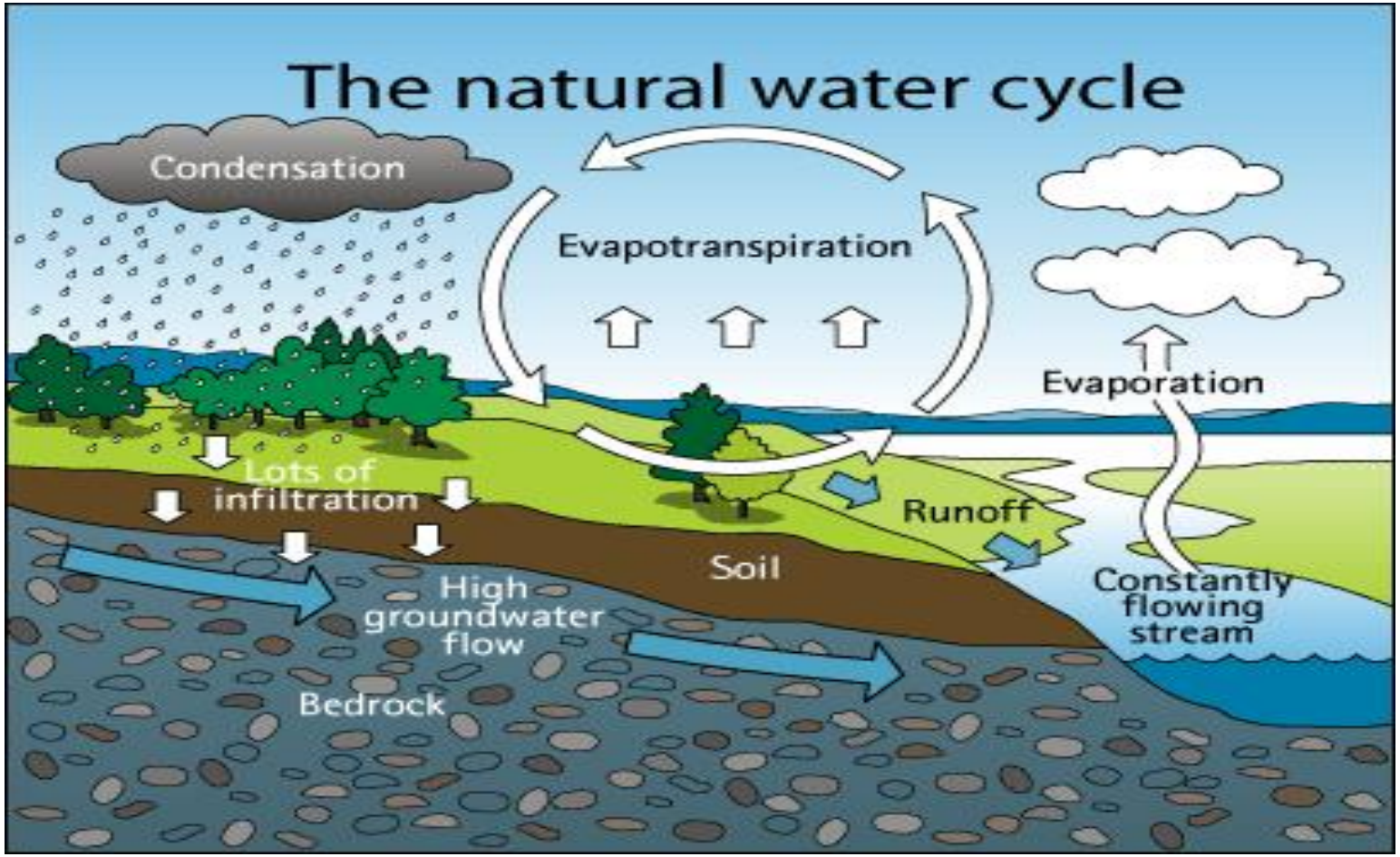
This is Why!!!

This is Why!!!!

Who is affected? – Everyone and Everything!

- Environment
- Living things
- Jobs
- Operations
- Lab
- Electrical
- Mechanical
- Engineering

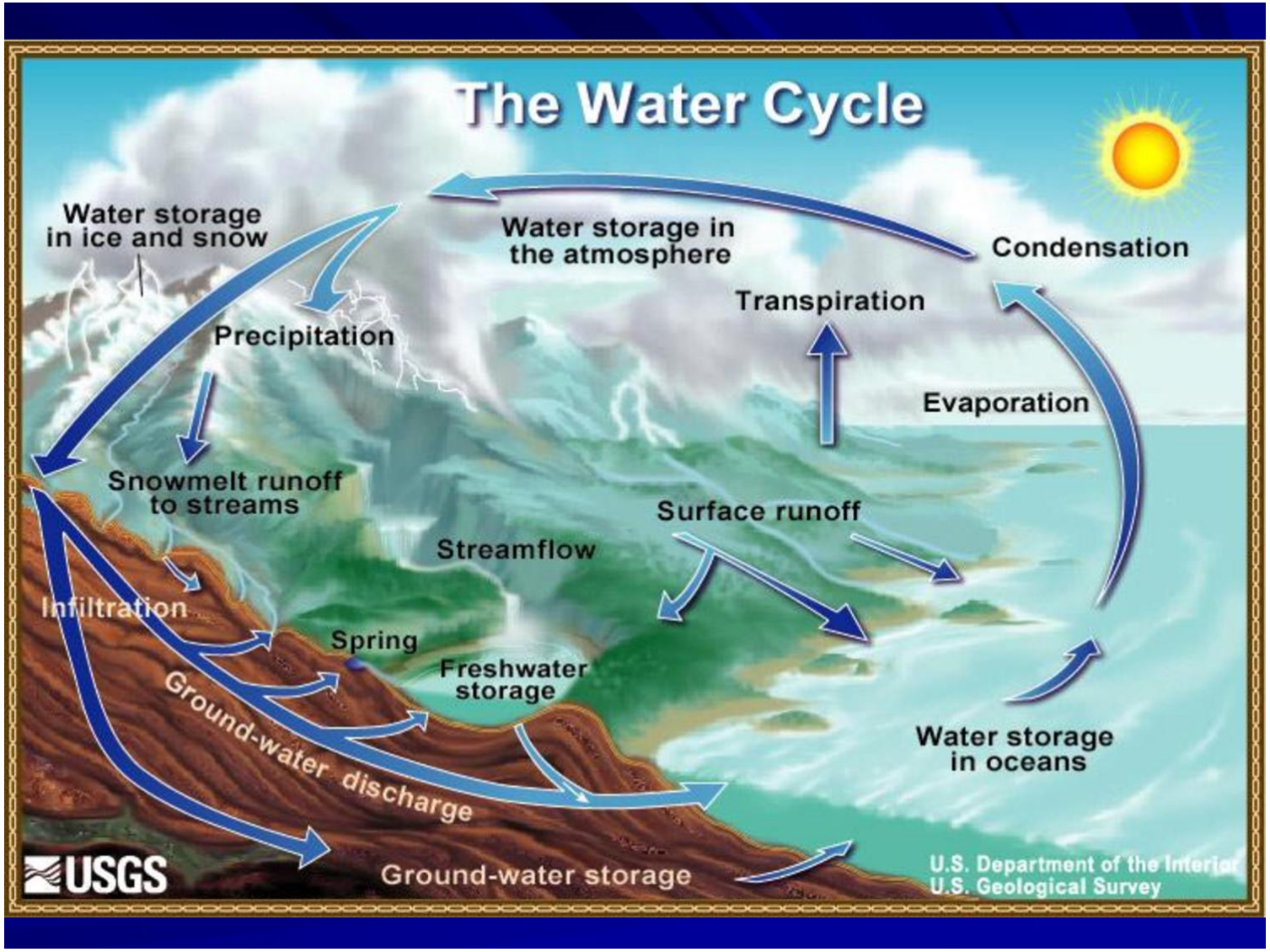
Purpose of Water Treatment



The Water Cycle

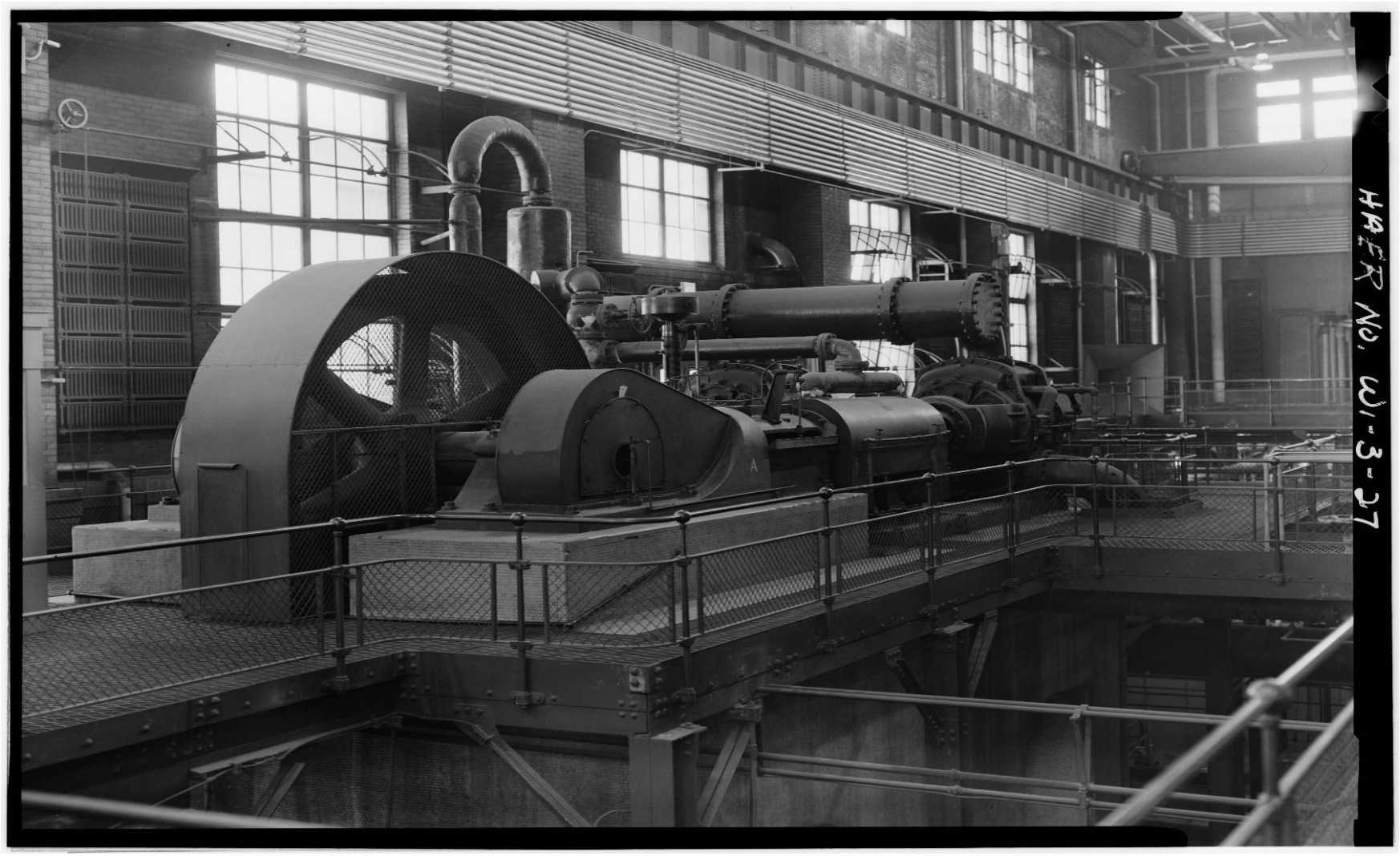
- The sun and gravity are the driving forces of the hydrologic cycle, there is no starting point and no end point. To discuss the water cycle, it is simplest to break into it at some point, then trace its action until we’re back where we started. Let’s start with the atmosphere above the earth.

The Water Cycle

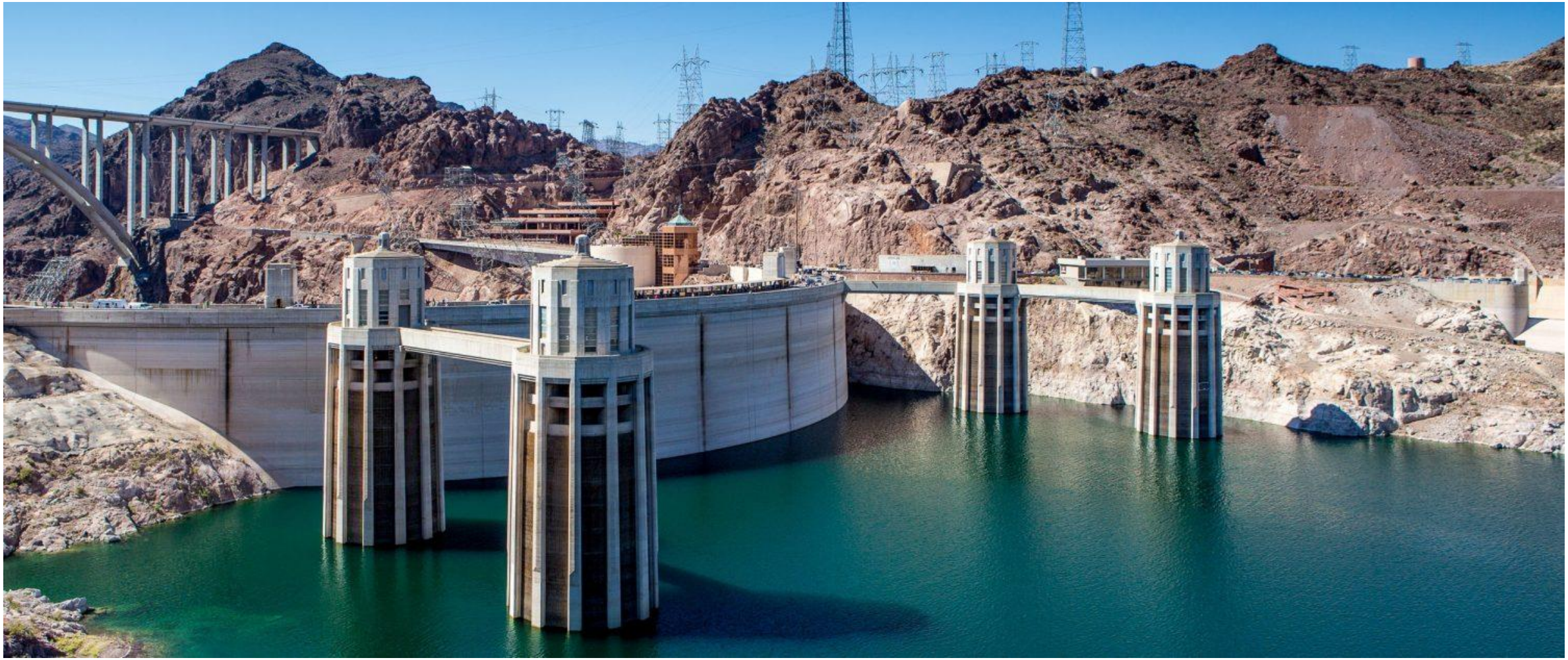


The Beginning of Water Treatment

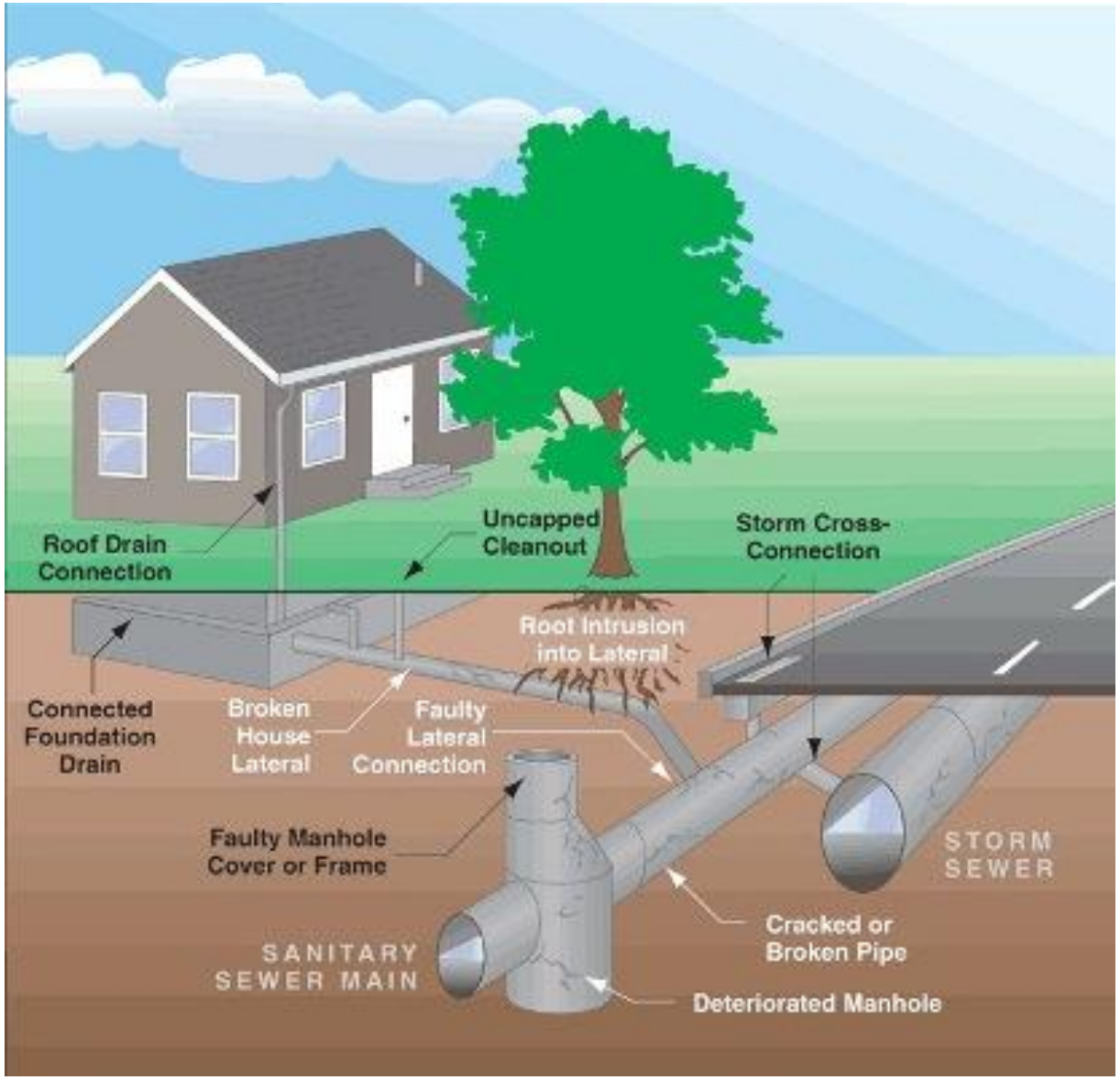
The Beginning of Water Treatment



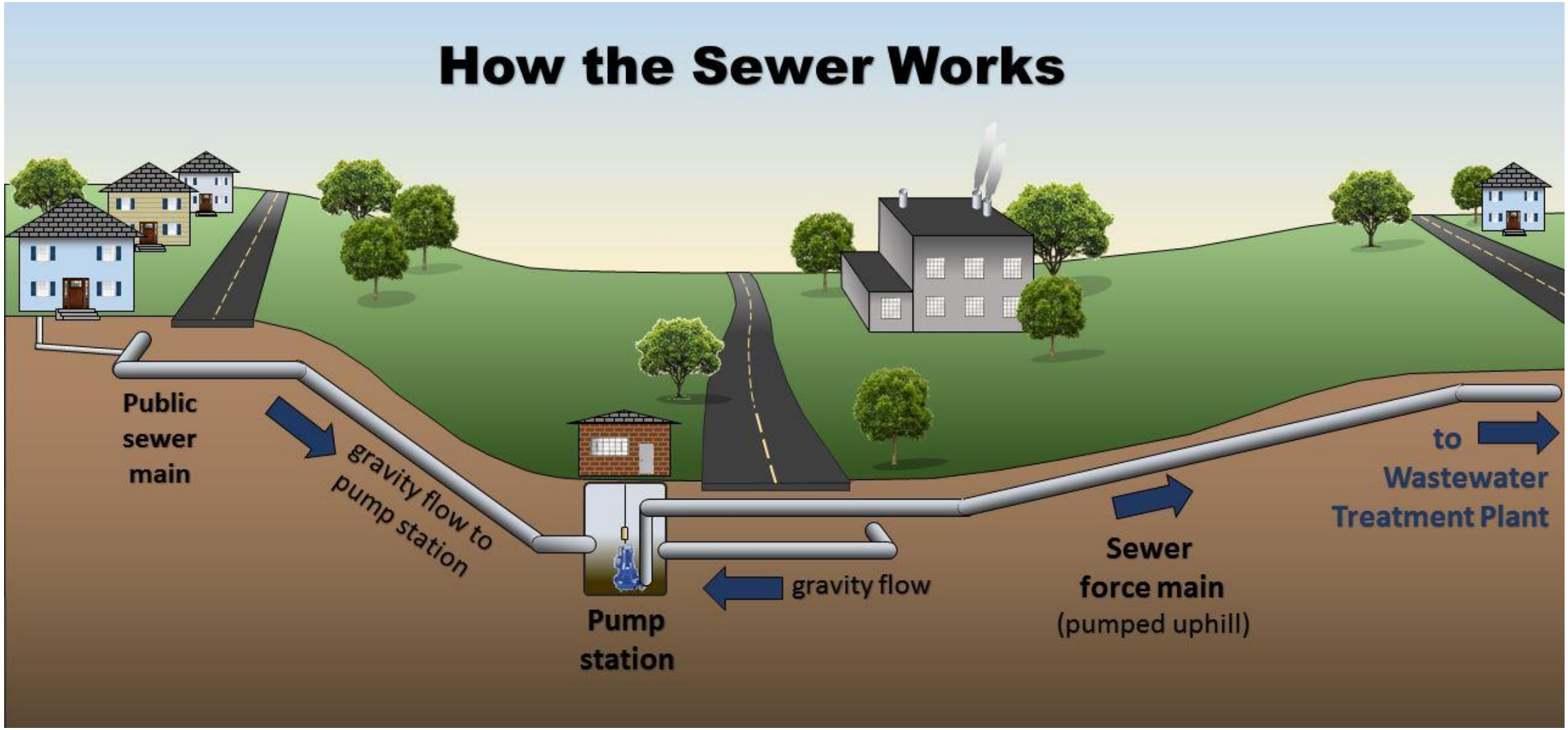
Water Collection



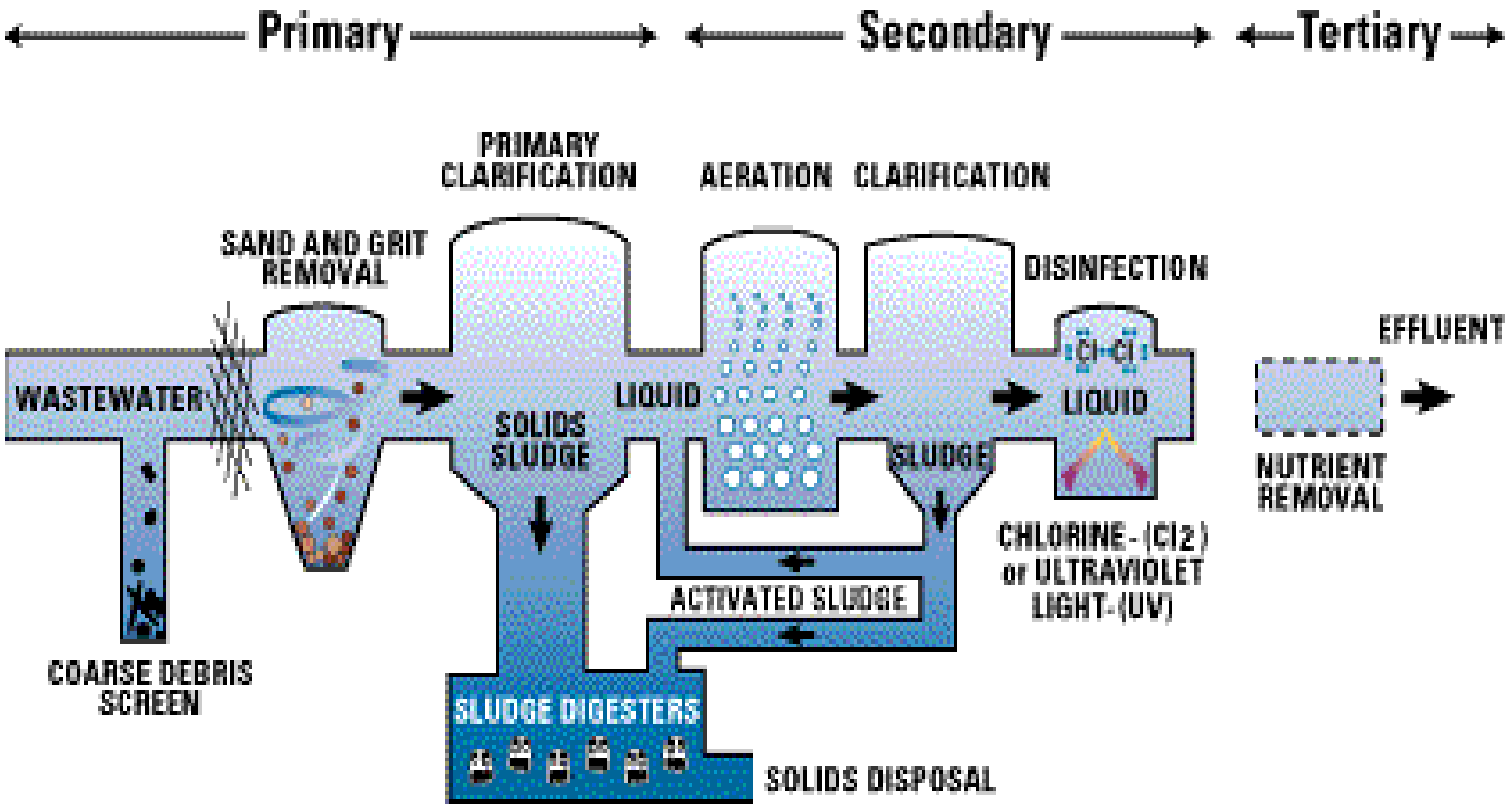
How does it get to the plant



How does it get to the plant



Purpose of WW Treatment



Purpose of WW Treatment

- Disease- causing organisms or pathogens are associated with water containing human wastes.
- These pathogens can cause such diseases as:
- Hepatitis, Polio, cholera and dysentery
- Wastewater treatment helps control these band other diseases effectively

Typical Treatment Facilities

- The general principle in Wastewater treatment is to remove pollutants from the water getting them to either settle or float.
- Treatment facilities are designed in stages. Each stage either removes particles from wastewater or changes dissolved and suspended material to a form that can be removed.

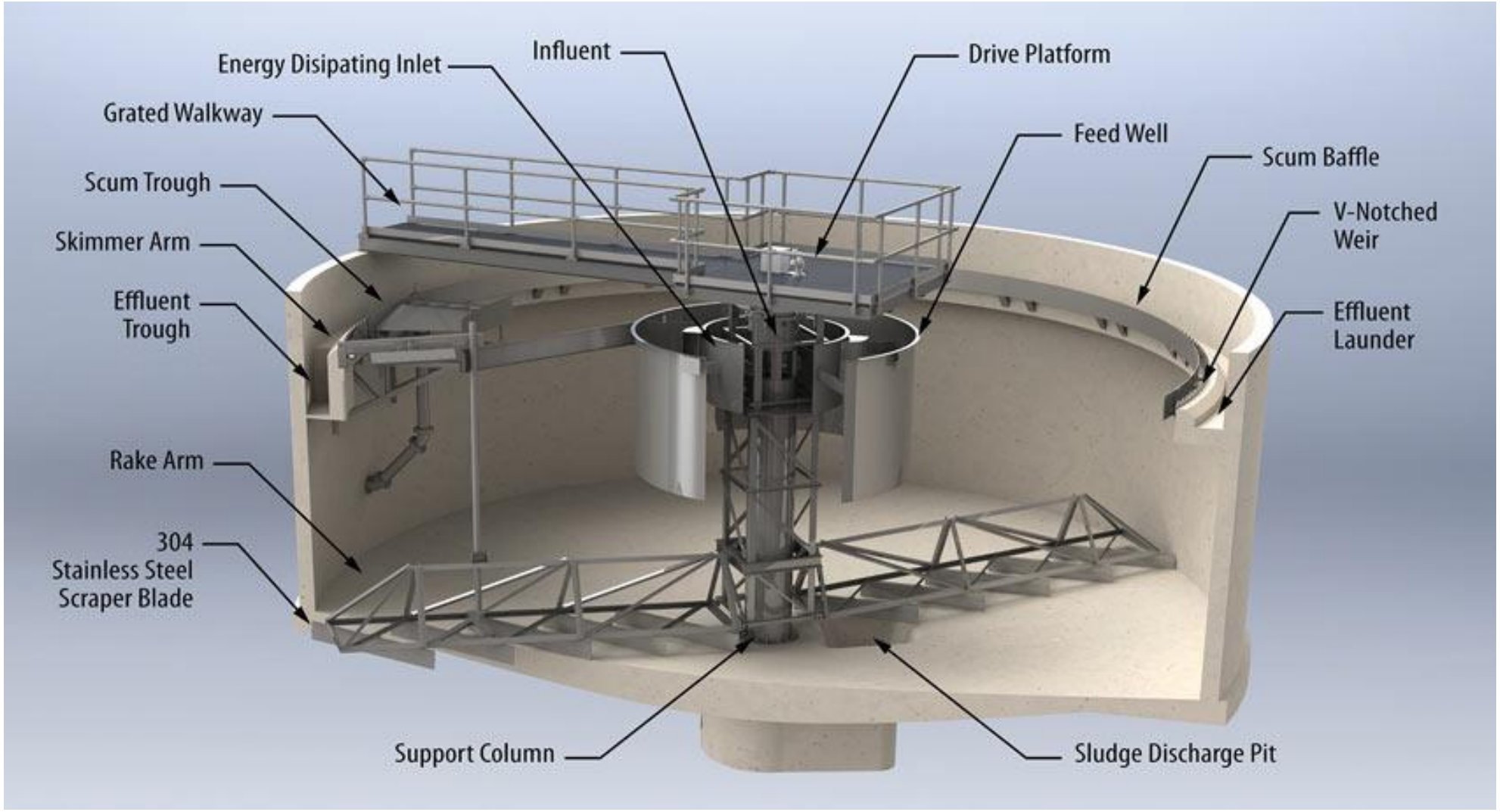
Stages May Include

- Influent
- Preliminary Treatment
- Primary Treatment
- Secondary Treatment
- Tertiary Treatment
- Disinfection and Effluent Discharge
- Solids Handling
- Sidestreams

Stages May Include

Stages May Include

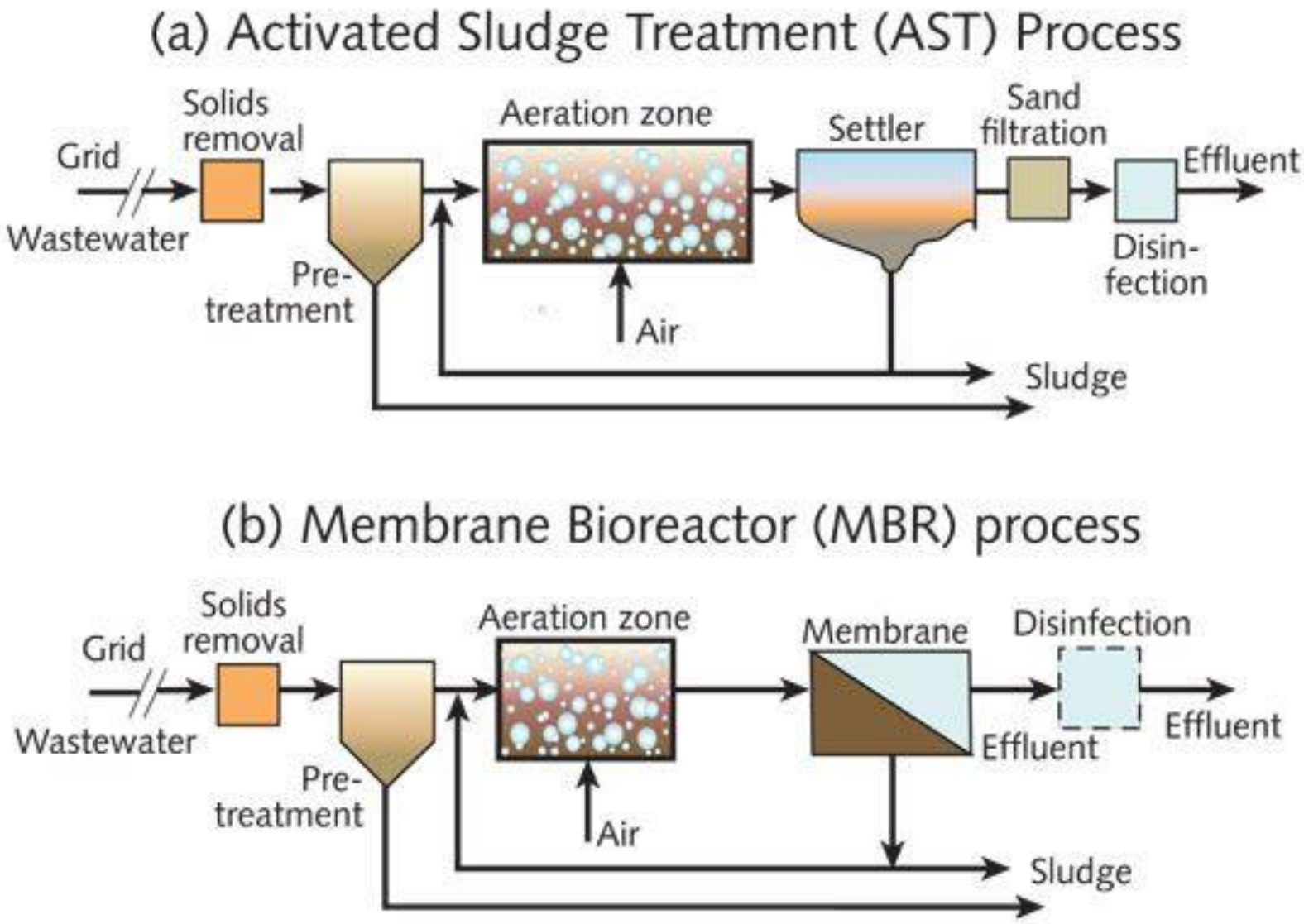
Primary Treatment Systems



Secondary Treatment Systems

Secondary Treatment Systems

Secondary Treatment Systems



Solids Separation

Solids Separation

Chemical Treatment

- Wastewater is classified as strong, medium or weak according to the quantity of physical, chemical and biological impurities found in it.
- Particles as small as 100 microns remain in wastewater even after the processes of settling occur. They are so small gravity has no practical effect on them. They must be either be filtered from the water or be made to combine in masses large enough to settle out in suspension.

Chemical Treatment

- Chemical coagulants are added to wastewater to overcome these obstacles. Coagulants form a gelatinlike substance called floc. It is a positive electrical charge and a sticky quality which's enables it to trap colloidal particles and hold them together. The resulting aggregation continues in a process called flocculation. In this process, the floc gathers into larger masses, which then can settle in a sedimentation tank.

Chemical Treatment

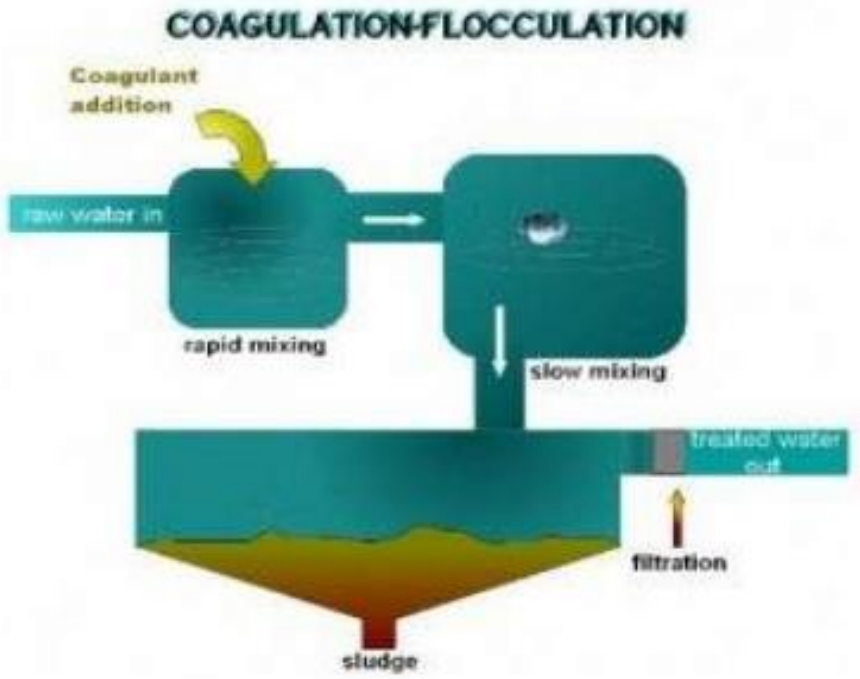
Chemical Formula
Primary Coagulant

Aluminum sulfate (Alum)
$Al_2(SO_4)_3$

Ferrous sulfate
$FeSO_4$

Ferric sulfate
$Fe_2(SO_4)_3$

Ferric chloride
$FeCl_3$



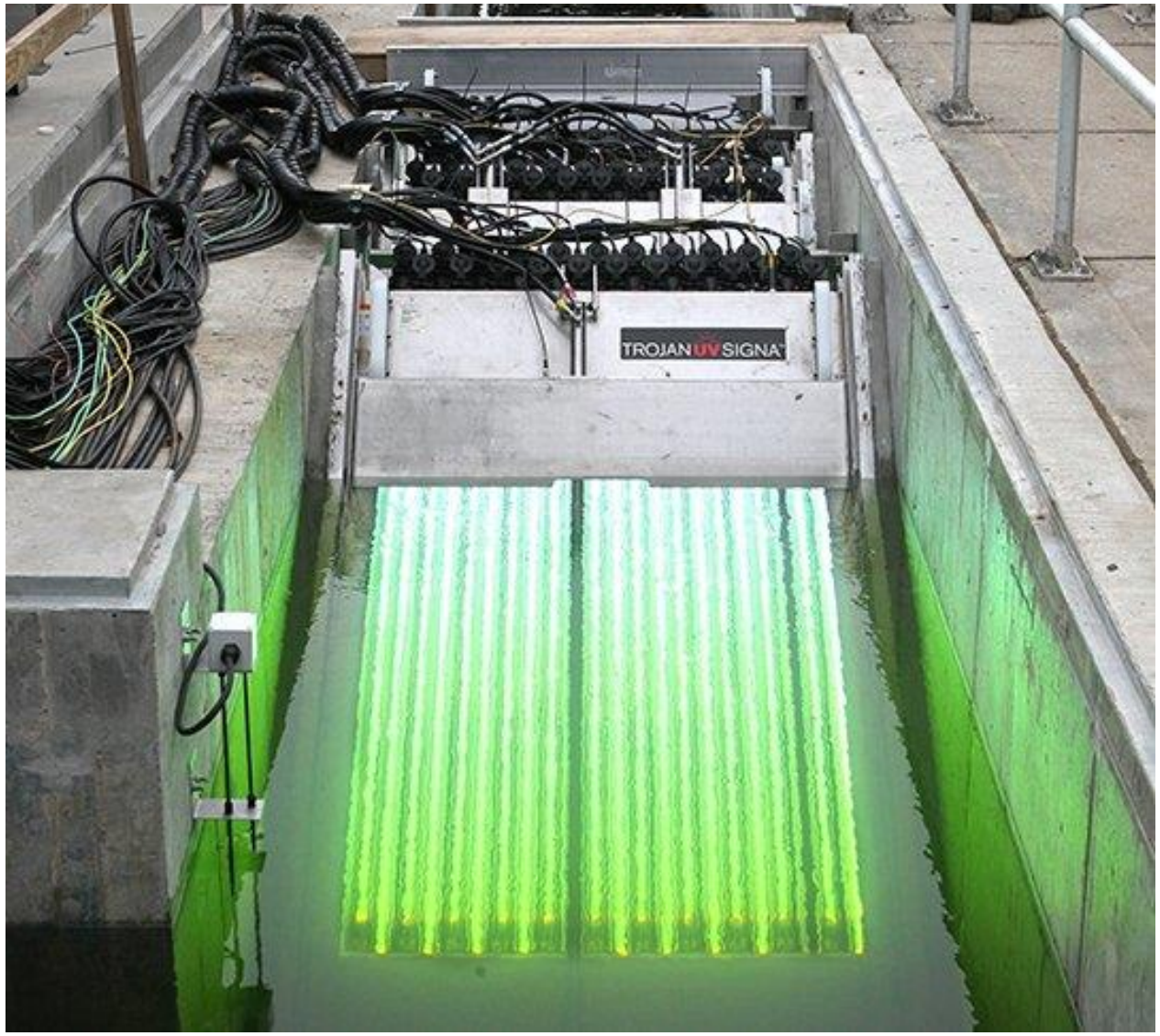
Disinfection

- The three-chief disease-producing organisms found in domestic wastewater are:
- Bacteria
- Viruses
- Protozoa
- Waterborne bacteria cause diseases such as typhoid and dysentery. One of the more common diseases caused by waterborne viruses is infectious hepatitis.
- Disinfection destroys most of theses organisms, but not all, the difference between sterilization.

Disinfection and Effluent Discharge

- Disinfection is one of the last stages of treatment. Its purpose is to prevent the spread of waterborne diseases. A disinfectant is added to the water and held long enough to kill most pathogens that survived earlier treatment steps.
- Chlorine is the most widely used disinfectant. Enough chlorine is applied so that it will be still detectable in the water after a specified holding time. Other methods include; Ozone, UV, Bromine Chloride. Can you name some others?

Disinfection



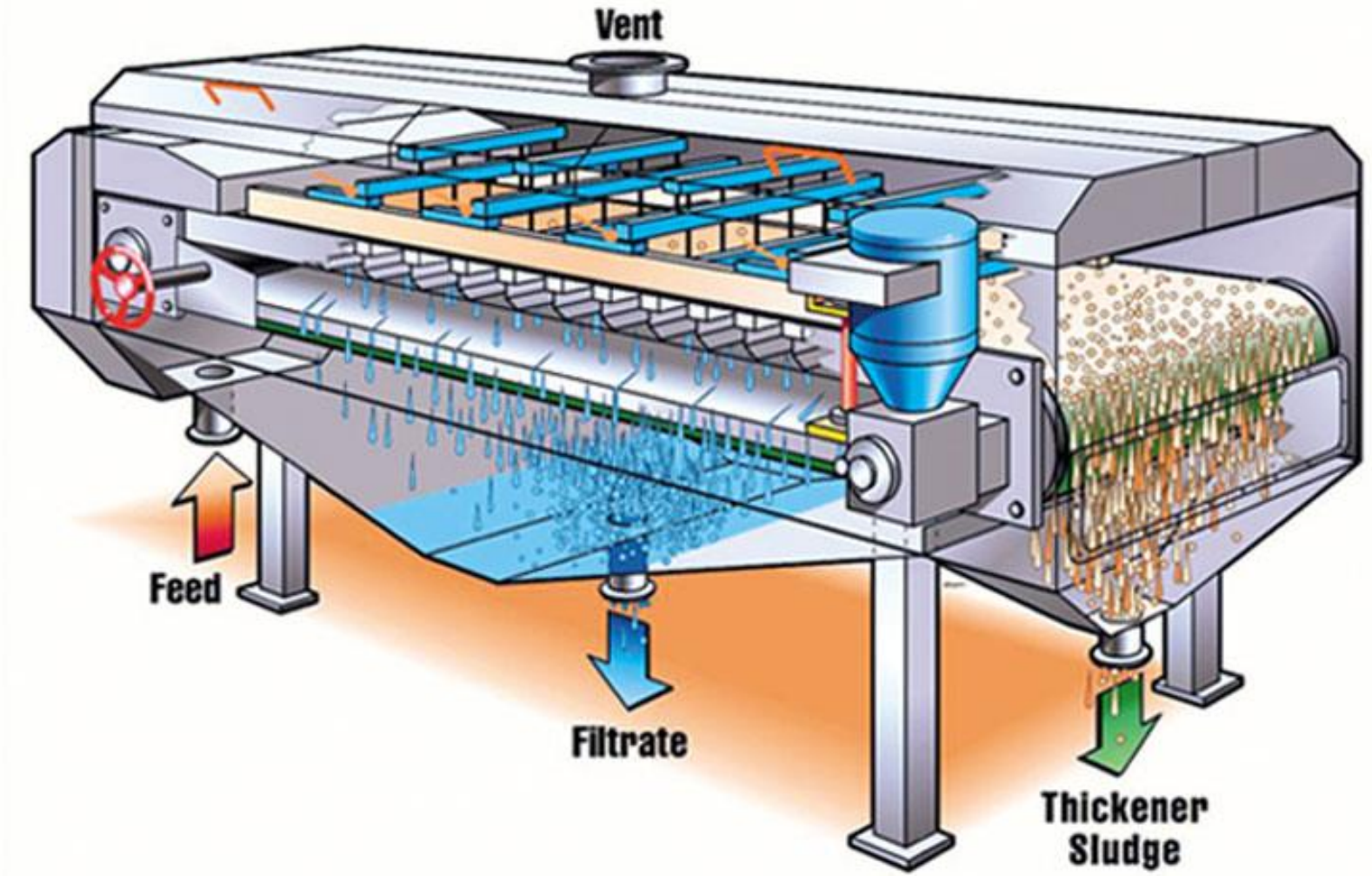
Biological Processes

- **Algae –** grows by taking energy from the sunlight and using carbon dioxide and inorganics released by the bacteria in the pond. The algae in turn releases oxygen into the water, adding to the oxygen introduced by wind action. It is important to make sure that there is enough oxygen in the pond for aerobic bacteria to stabilize organic wastes.
- **There are two types of lagoons:**
- **Unaerated**
- **Aerated**

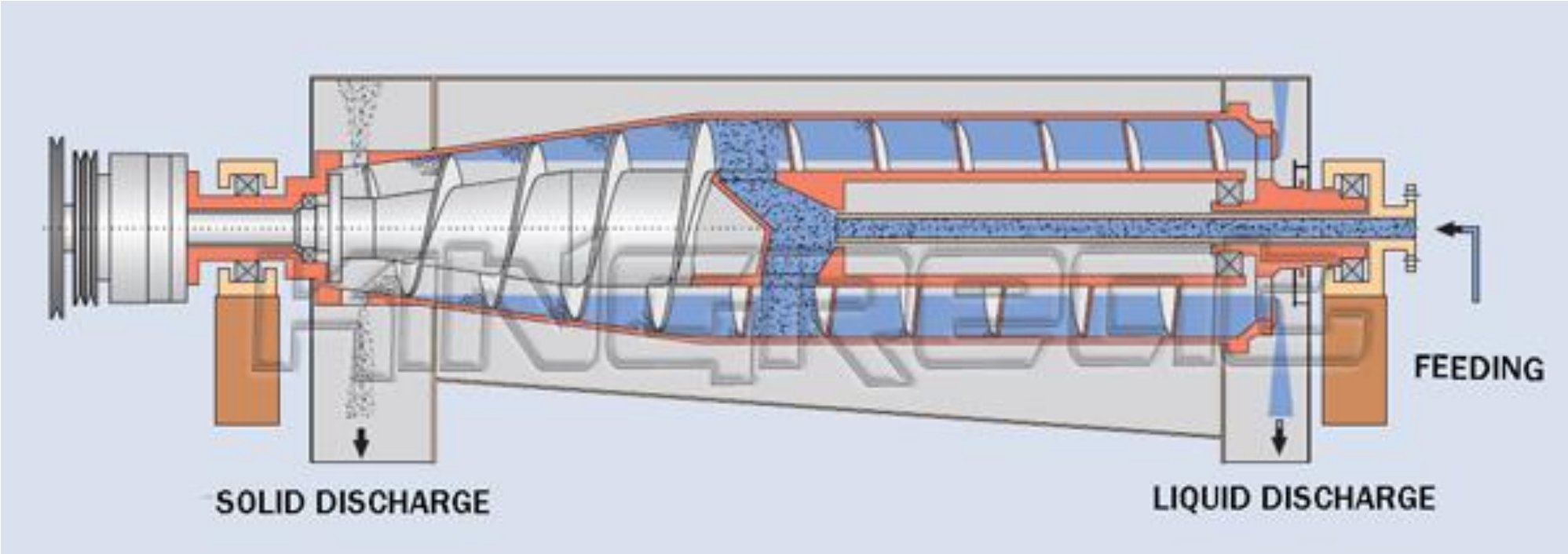
Aeration Tanks

Aeration Types

Solids Treatment and Disposal



Solids Treatment and Disposal



Solids Treatment and Disposal

Solids Treatment and Disposal

Basic Properties of Water

Basic Properties of Water

In the end we need clean water!

Thank You

TPC

Thank You!

- If you'd like to learn more about water and wastewater systems at your facility,

  TPC can help!

Email: sales@tpctraining.com

Phone: (847) 808-4000