

# Drinking Water System Basics Treatment and Distribution

Public Service Commission  
Water Personnel Training  
2012



*To Protect and Enhance Kentucky's Environment*

**Kentucky**  
UNBRIDLED SPIRIT™

# Common Words and Phrases



- Chapter 8: State drinking water regulations (401 KAR Chapter 8)
- Operator Certification: Program and regulations covering the certification of operators (401 KAR Chapter 11)
- Plans Review: DOW Engineering Section
- 10 States Standards: Industry standard for designing drinking water facilities
- Regional Offices: Local DOW offices (10 state-wide)
- Technical Assistance: State program for 1-on-1 or group drinking water technical help
- Capacity Development: State program to assess whether a system has managerial/financial/technical to meet SDWA

# Common Words and Phrases



- Source Water: Raw water (surface, ground)
- Producer: Treats raw water
- Purchaser: Buys drinking water from another system (no treatment)
- Coagulation: Mixing of chemicals to begin removing contaminants
- Flocculation: Sticking together of contaminants and coagulants
- Sedimentation: Settling out the contaminants
- Filtration: Removing fine particulates through media
- Disinfection: Inactivating/killing microbes

# Common Words and Phrases



- Clearwell: Finished water storage at plant
- Backwash: Cleaning of filter media
- Lagoon: Means of storing backwash water and other water before discharging
- Discharge: Any water sent back to the “waters of the Commonwealth”
- Storage: Usually refers to distribution tanks
- Booster Stations: Increases pressure/disinfectant in the system
- Master Meter: Flow meter usually associated with buying/selling to another water system

# Drinking Water Classification

- Classified by source water
  - Surface
  - Ground
  - Purchaser
- Classified by # of connections and # of people served
  - Community
  - Non-community
    - Transient
    - Non-Transient
  - Semi-public

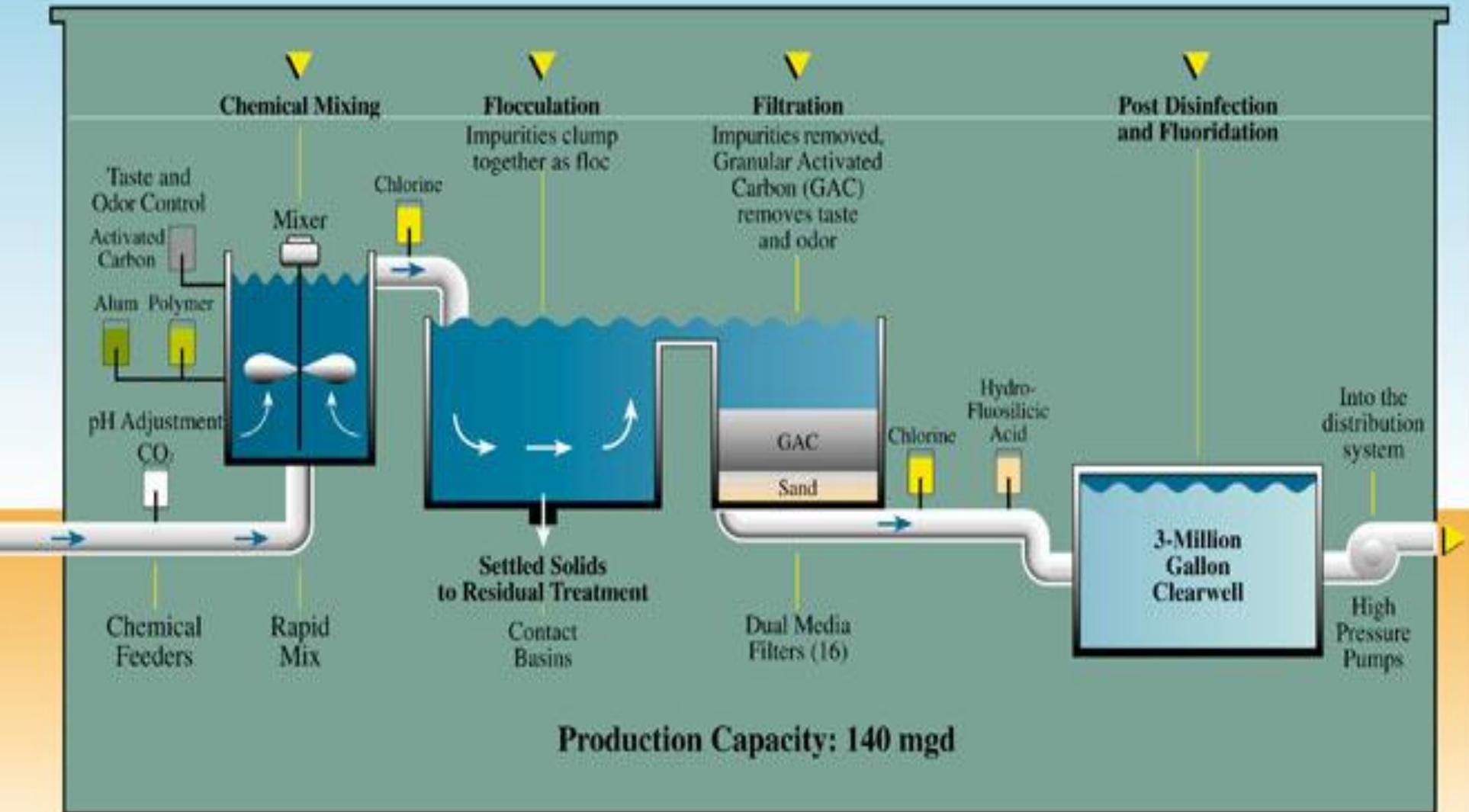
# Drinking Water Classification

- Further classified to determine system staffing and operator certification needs (4 levels)
  - Treatment plants: By MGD capacity
    - “A” plants are all surface and groundwater with conventional filtration
    - “B” plants are groundwater with other types of filters or just chemical treatment
  - Distribution system: By population served

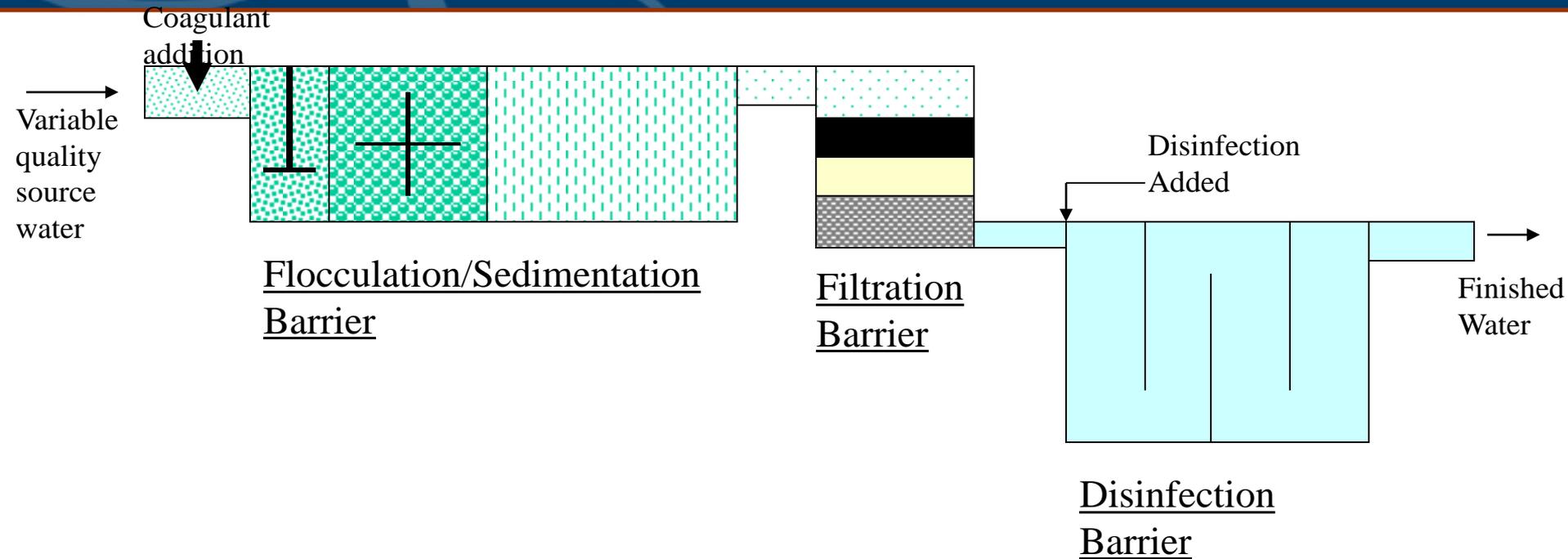
# Drinking Water Treatment



# Basic Water Treatment Processes

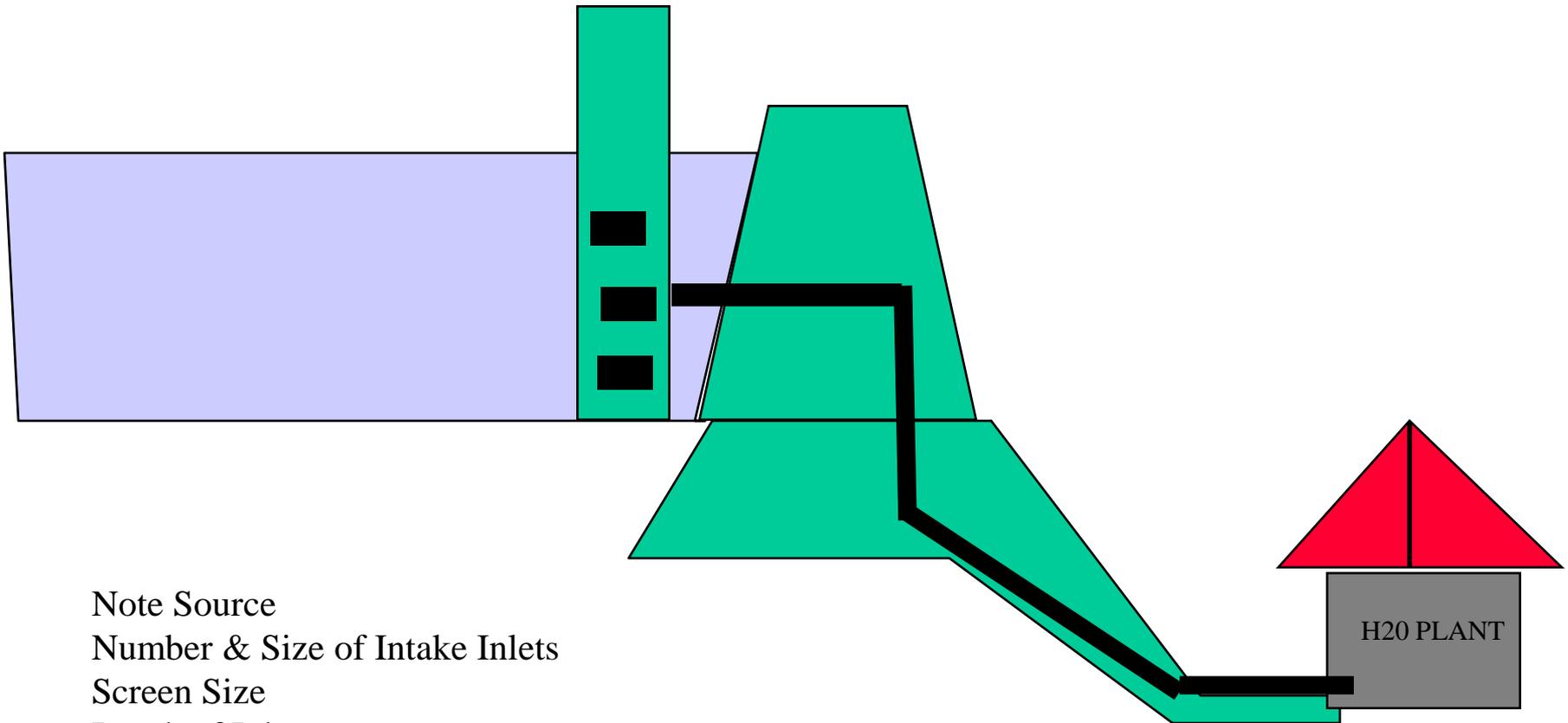


# MULTIPLE BARRIER CONCEPT



- Given a variable quality source water, the treatment objective is to produce a consistent, high quality finished water.
- Protozoan parasites, such as Giardia and Cryptosporidium, are found in most source water; however, it is difficult to quantify their presence and assess their viability.
- Microbial pathogens in the source water, such as protozoan parasites, bacteria and viruses, can be physically removed as particles in treatment processes and inactivated through disinfection.
- Multiple barriers are provided in a treatment plant to remove or inactivate microbial pathogens.
- Key treatment barriers include flocculation/sedimentation, filtration and disinfection.
- Since measurement of protozoan parasites is difficult, surrogate parameters, such as turbidity, particle counting and pathogen inactivation, are used to assess the performance of each barrier.

# Intake Structure Gravity Feed



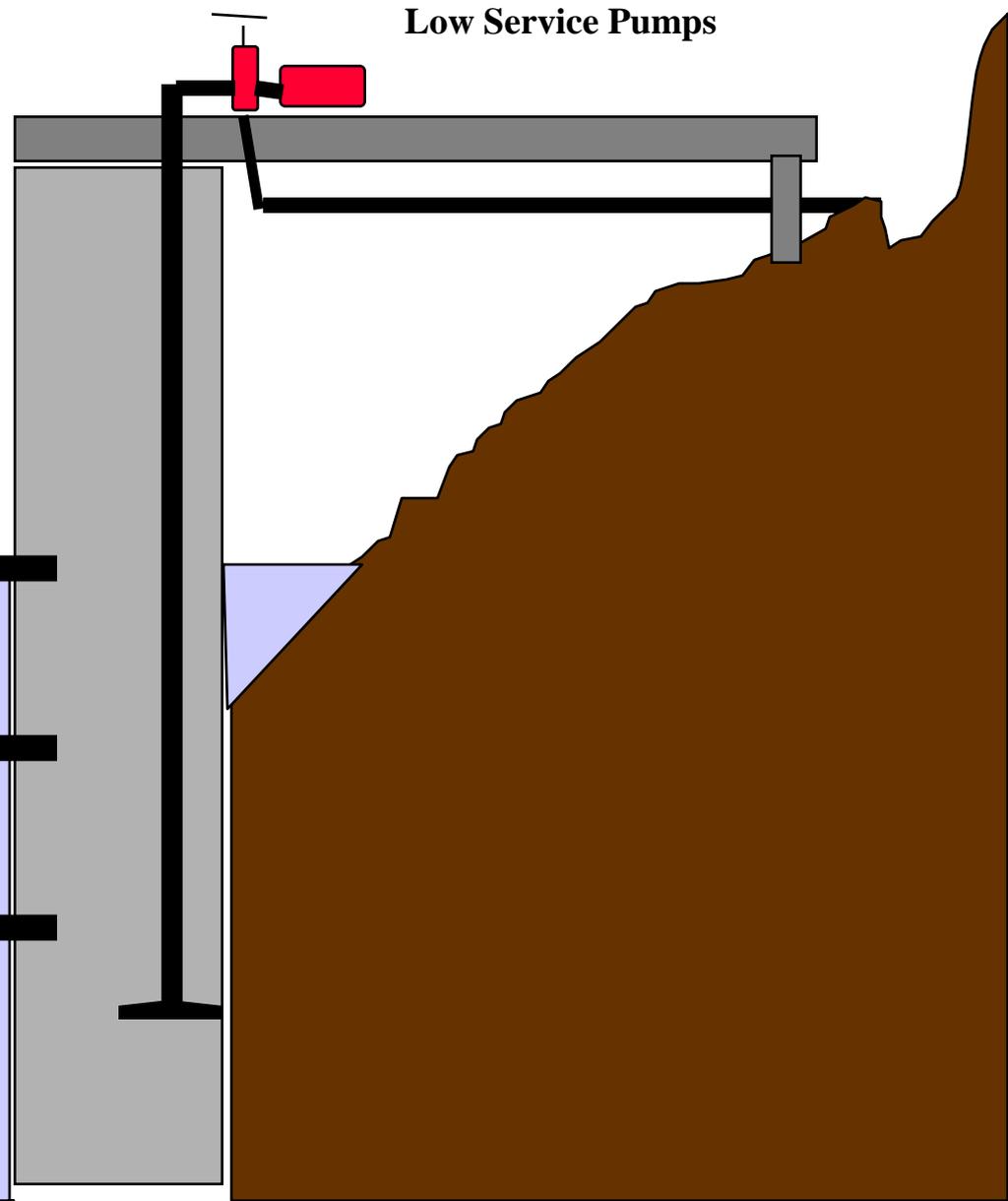
Note Source  
Number & Size of Intake Inlets  
Screen Size  
Depth of Inlets

# Intake--Pumped

Flow measured in gallons / minute

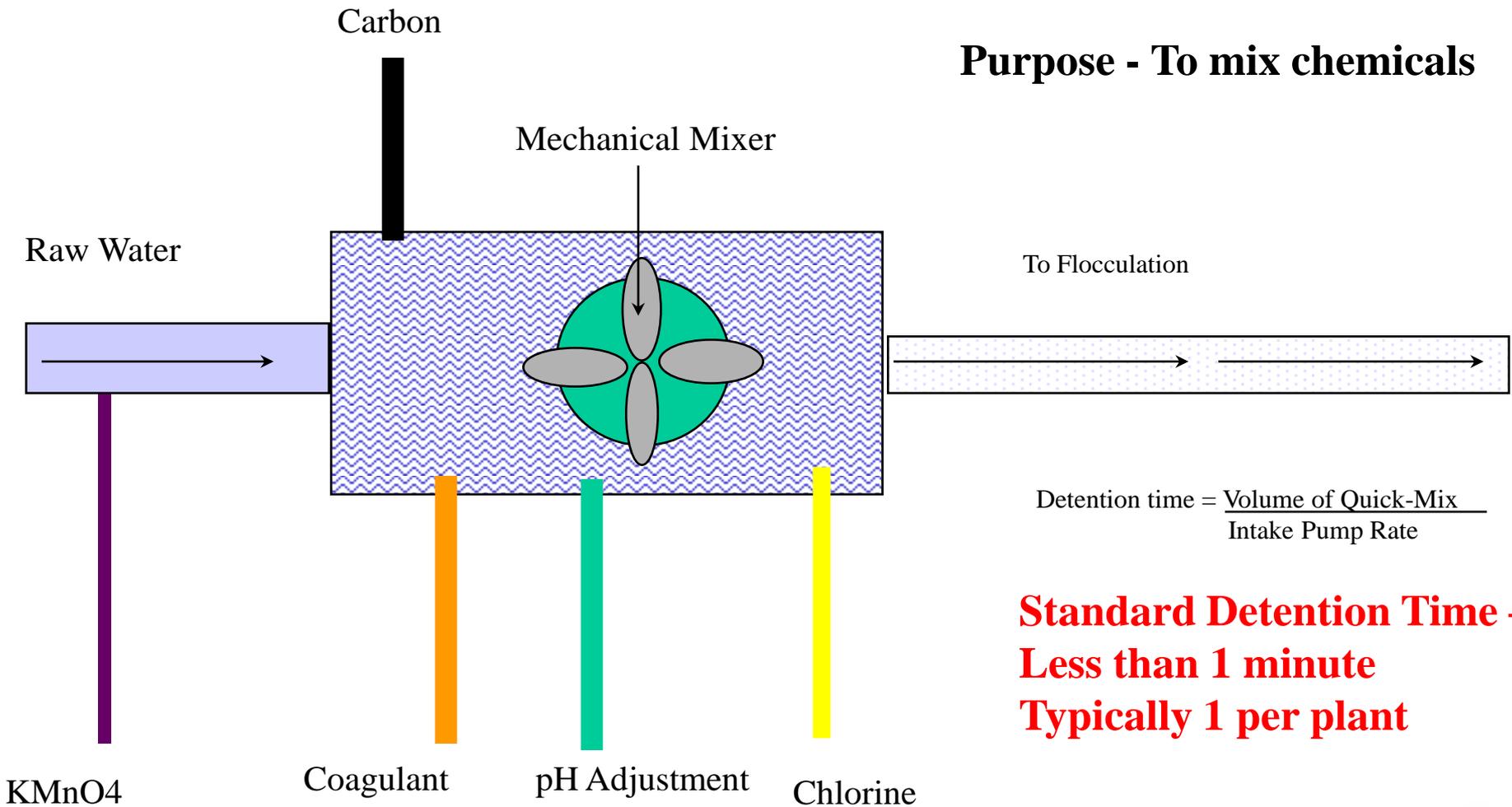
Plant capacity = GPM x 1440 ( gal /day)

Note Source  
Size and depth of inlets  
Screen Size  
Number & Size of Pumps





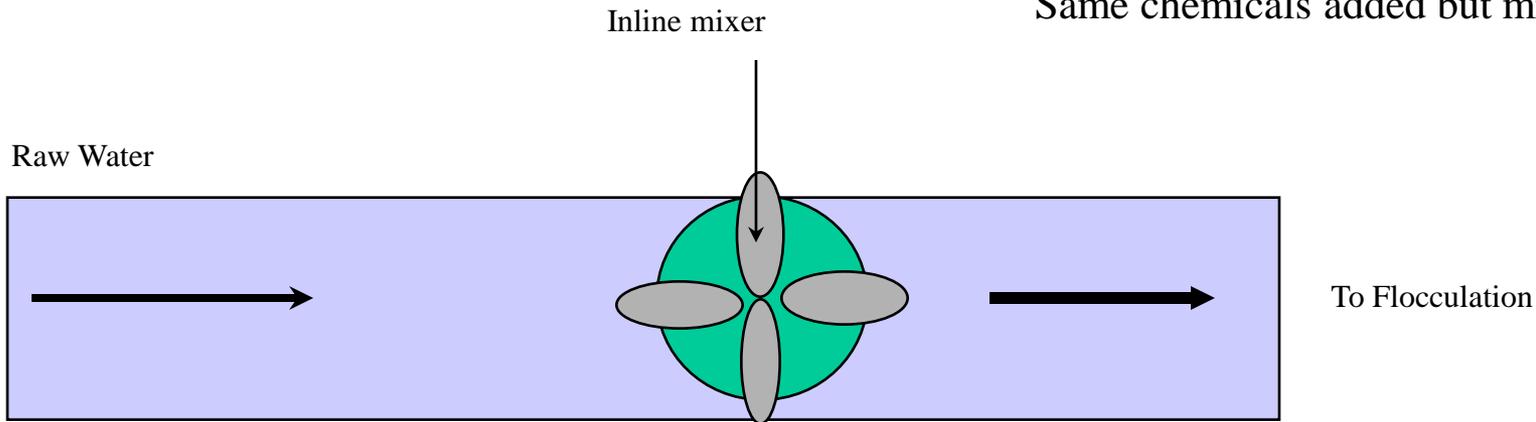
# Rapid Mix (Quick or Flash Mix)



# In-line Rapid Mix

**Purpose - To mix chemicals**

Same chemicals added but mixed in the pipe

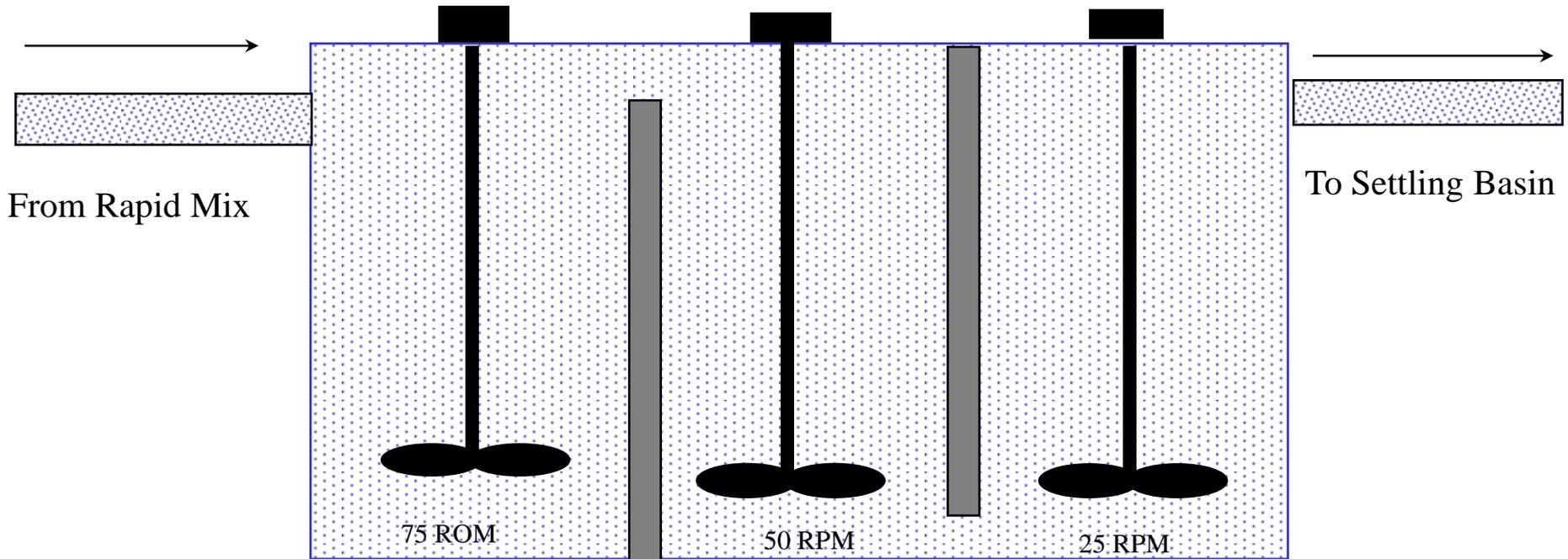


# Chemical Addition



# Flocculation Basin

**Purpose- To provide time & Conditioning for chemicals and contaminants to react and form “Floc”**



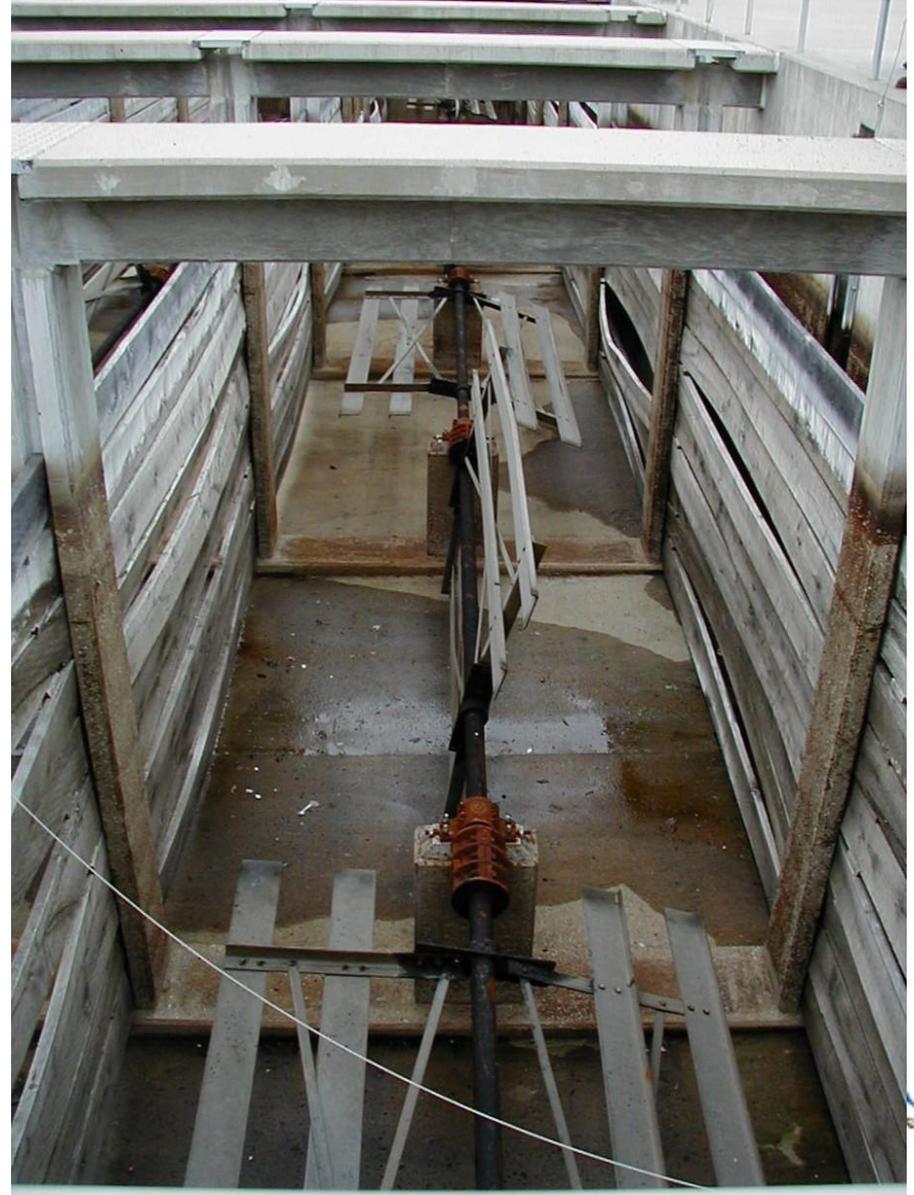
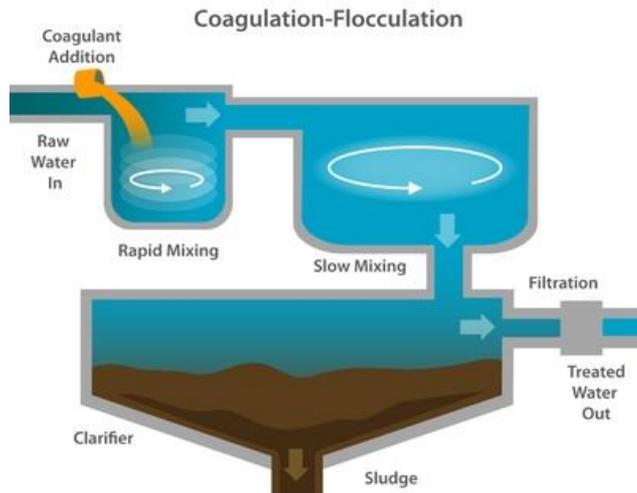
Detention Time = Volume / Intake Pump Rate

Volume = Length X Width X Depth X 7.48 ( Gallons)

**Standard Design Retention Time =  
40 to 60 min.  
Typically 2 trains**

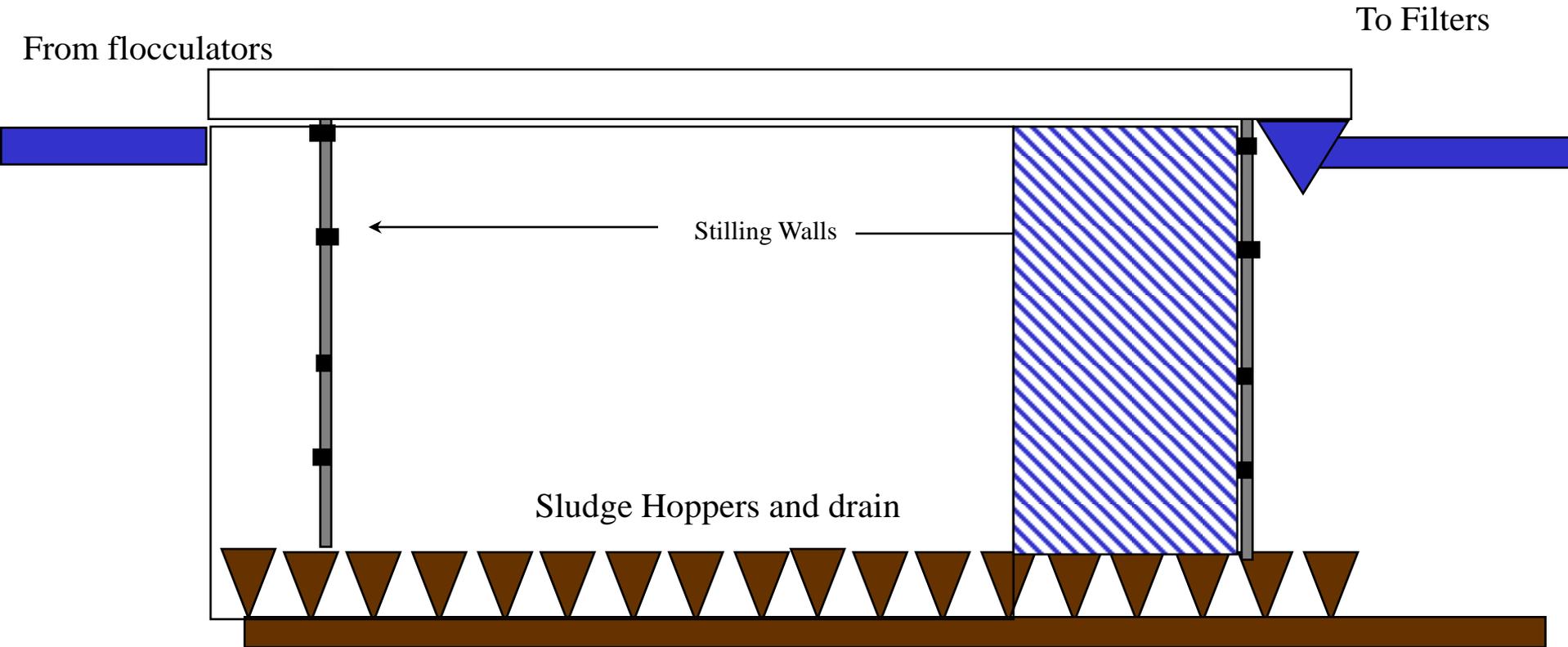


# Flocculators



# Settling Basin

**Purpose - Allow floc to settle to bottom**



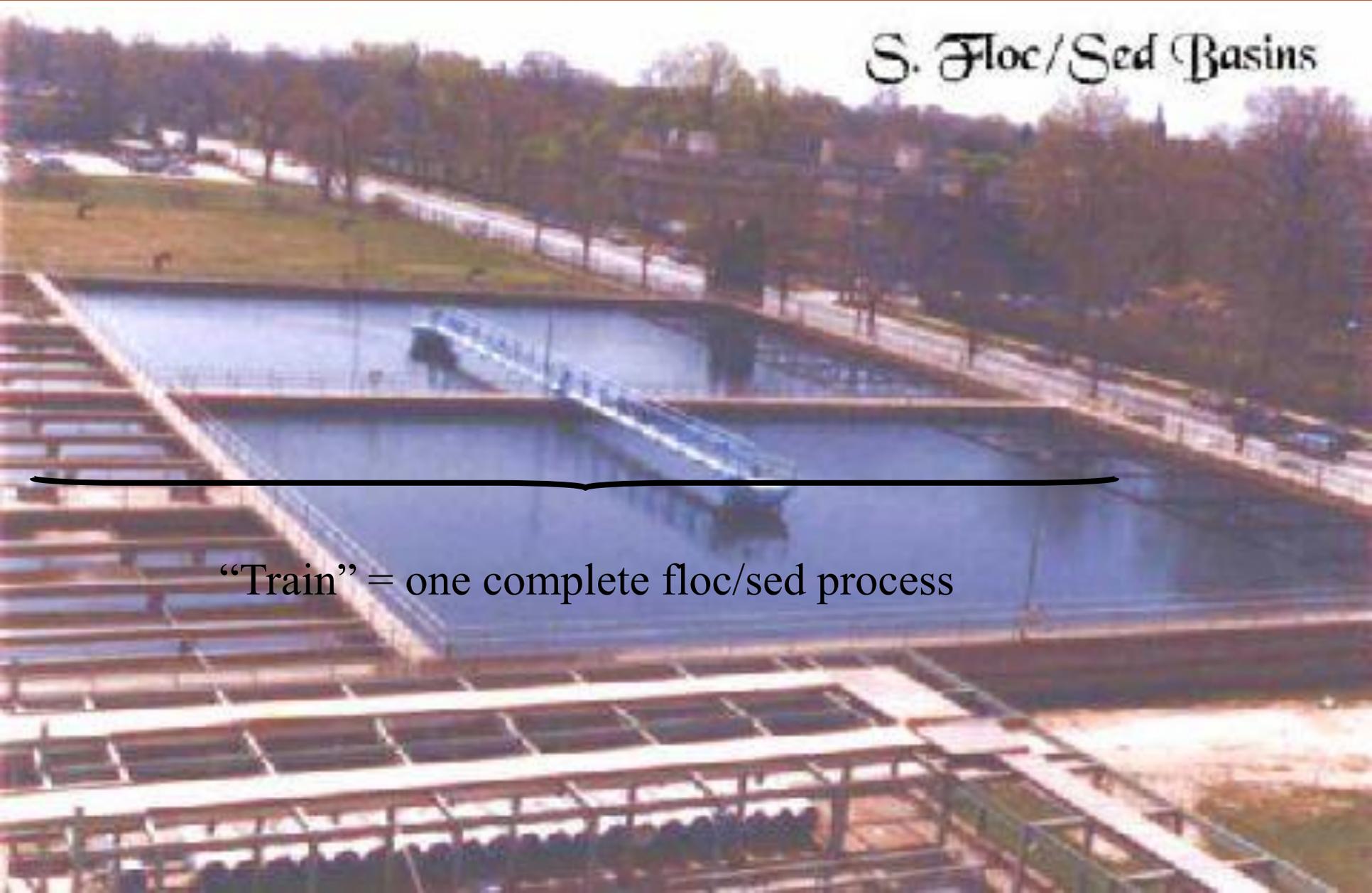
**Standard Detention Time = 4 hours**

**Typically 2 trains**

Detention time = Volume / Intake Pump Rate

# Conventional Sedimentation Basin

*S. Floc/Sed Basins*

An aerial photograph of a large, rectangular sedimentation basin. The basin is filled with water and has a central bridge structure with a walkway. The basin is surrounded by a concrete wall and a grassy area. In the background, there are trees and a building. A black bracket is drawn under the basin, pointing to the text below.

“Train” = one complete floc/sed process

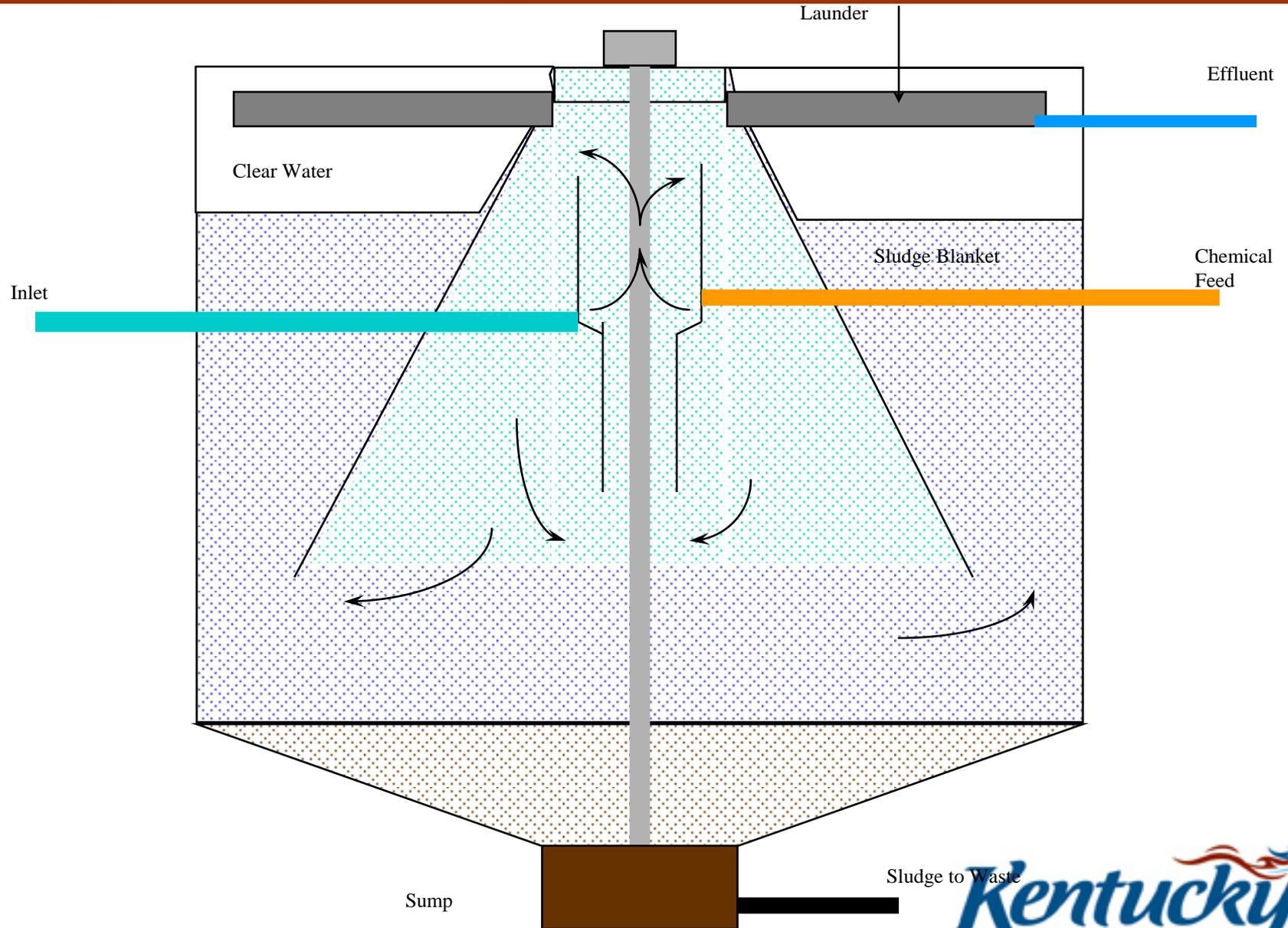
# Conventional Sedimentation Basin



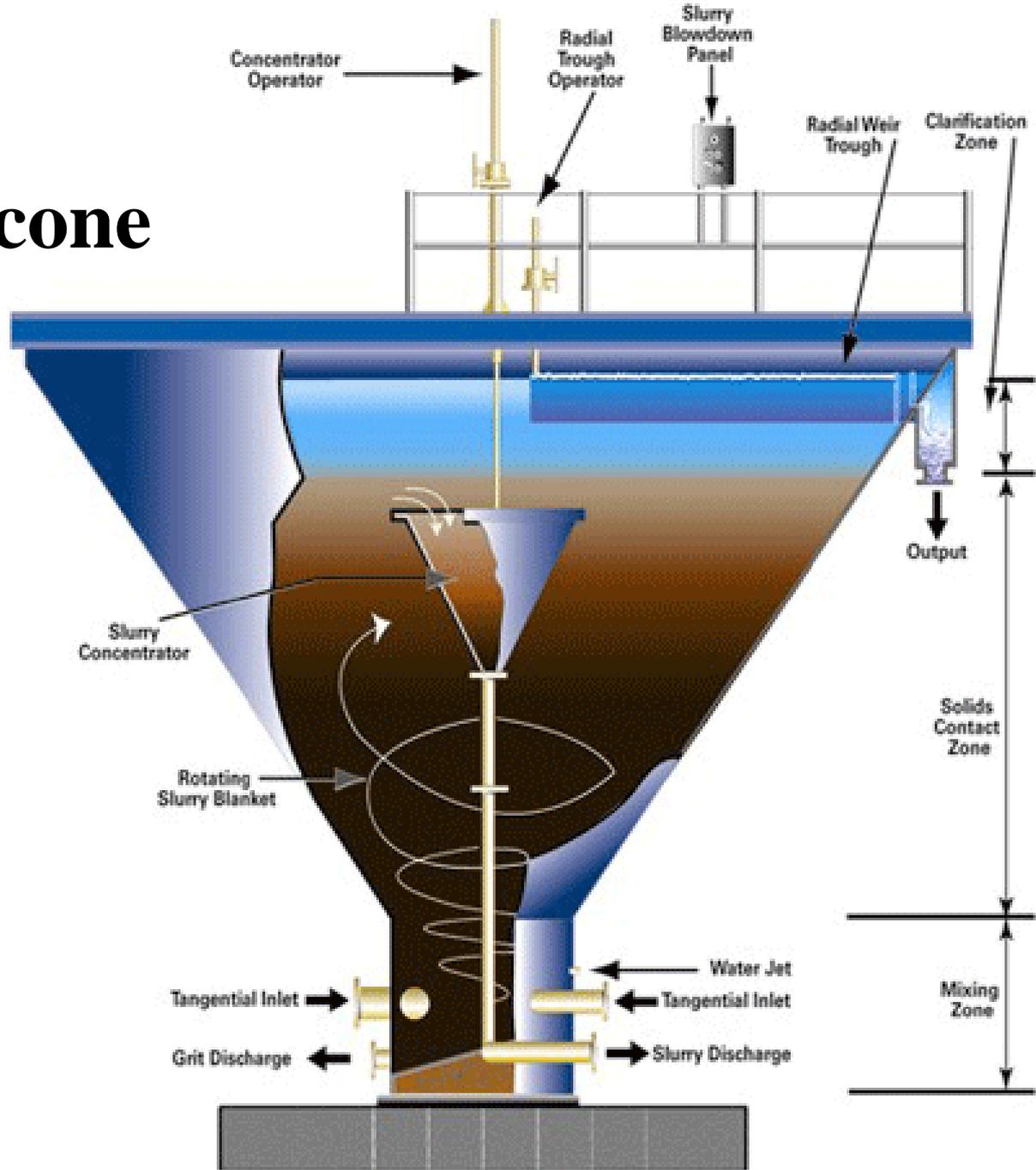
# Up-flow Sedimentation



# Solids Contact Sedimentation Unit



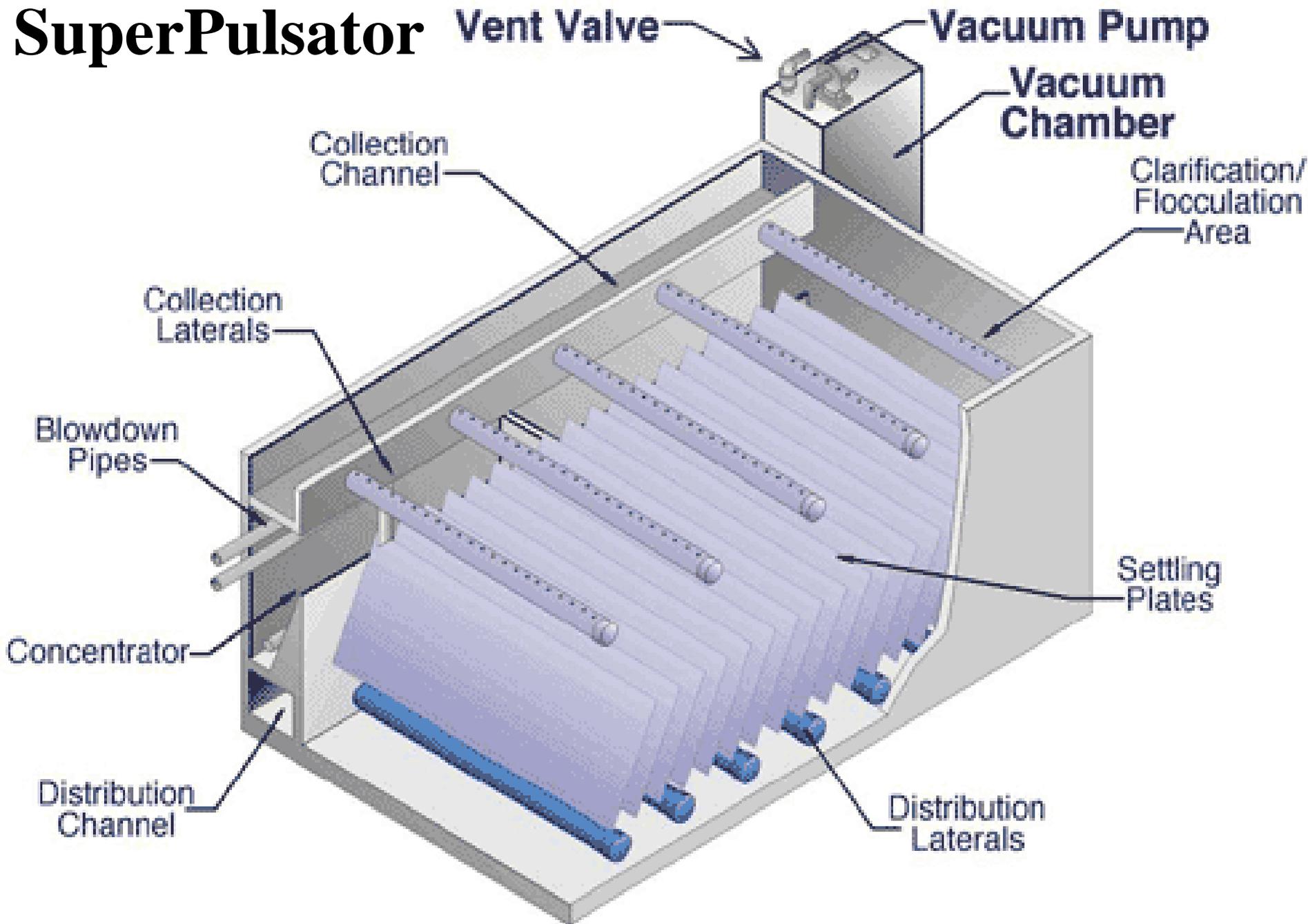
# Claricone

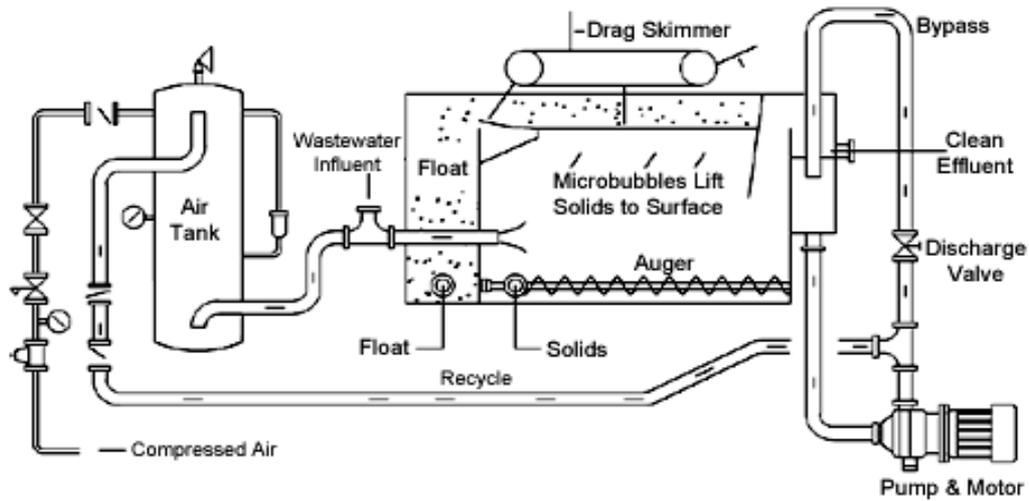


# Claricone



# SuperPulsator

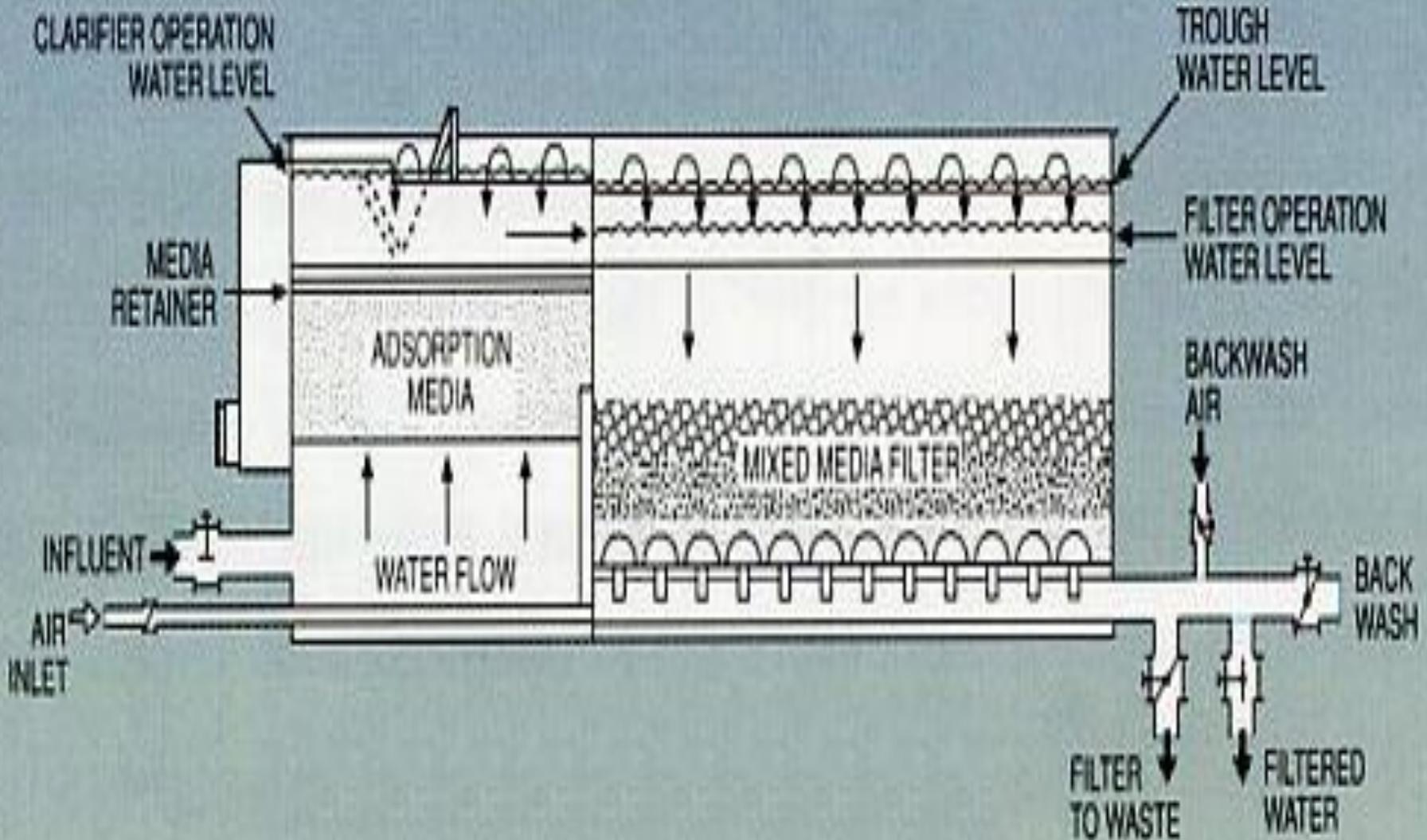




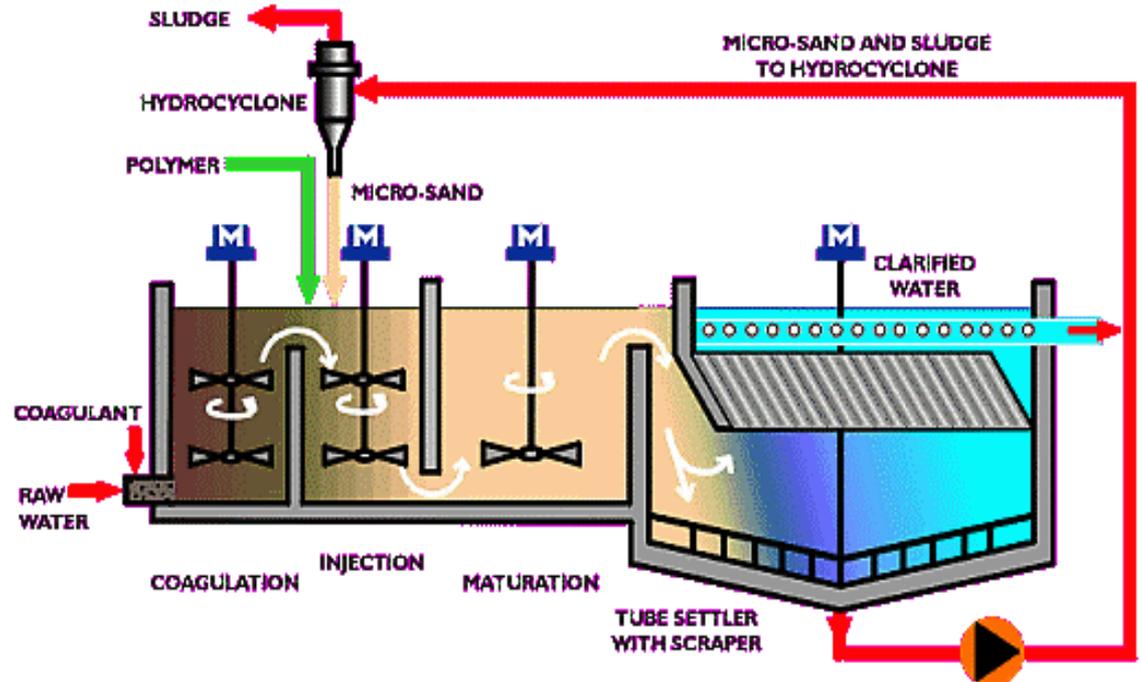
# Dissolved Air Filtration



# Trident Microfloc Package Treatment



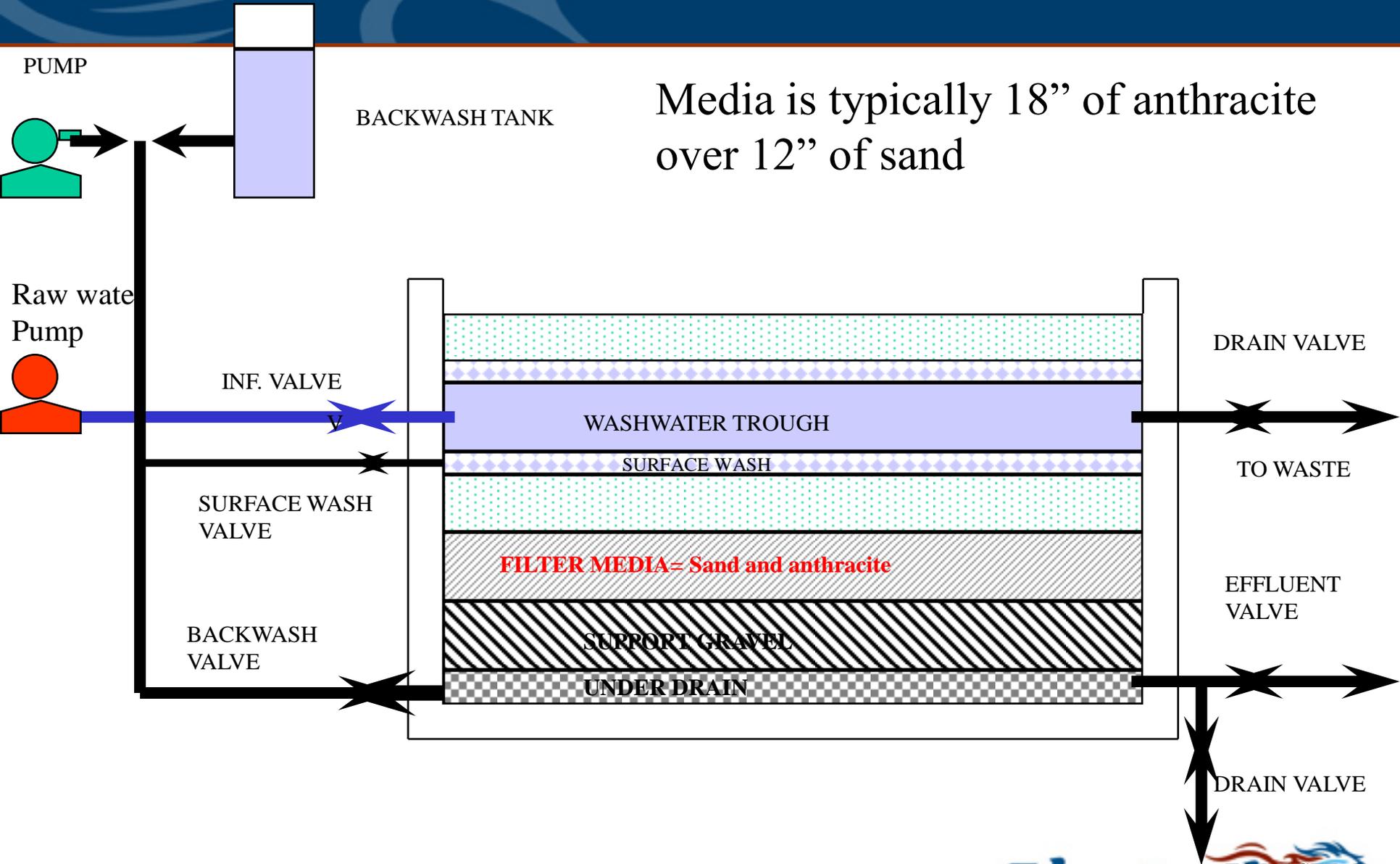
# Actiflo (Ballasted Sand)



# Conventional Filtration



# Conventional Filter



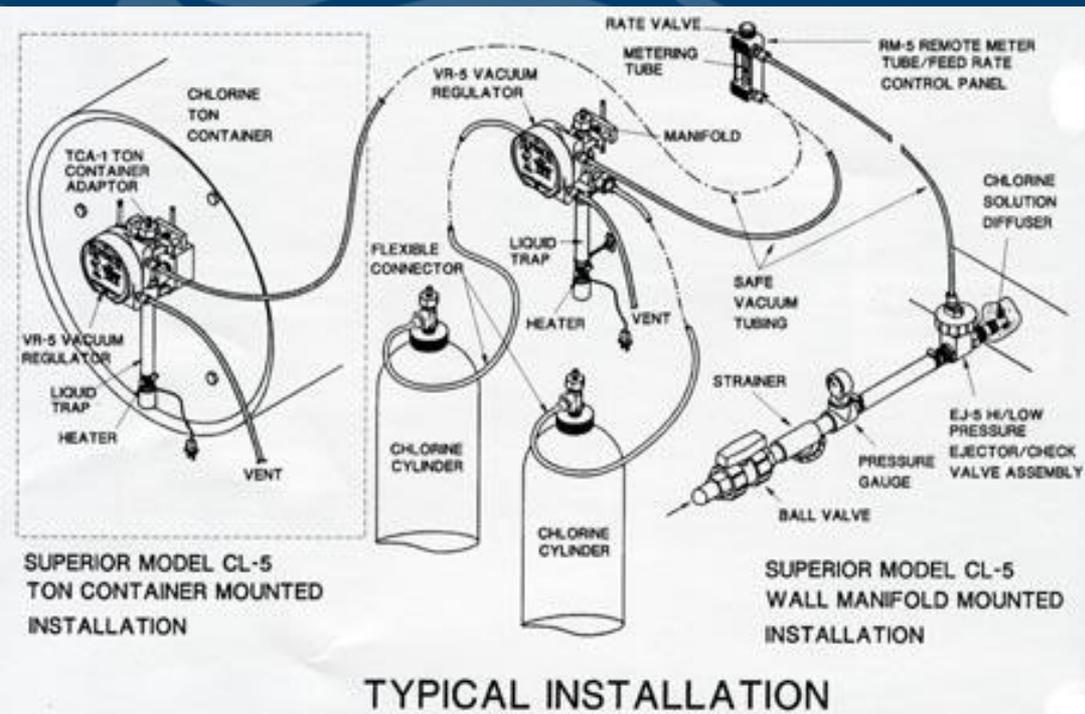
Media is typically 18" of anthracite over 12" of sand



# Membrane Filtration

# 150 pound Chlorine Cylinders



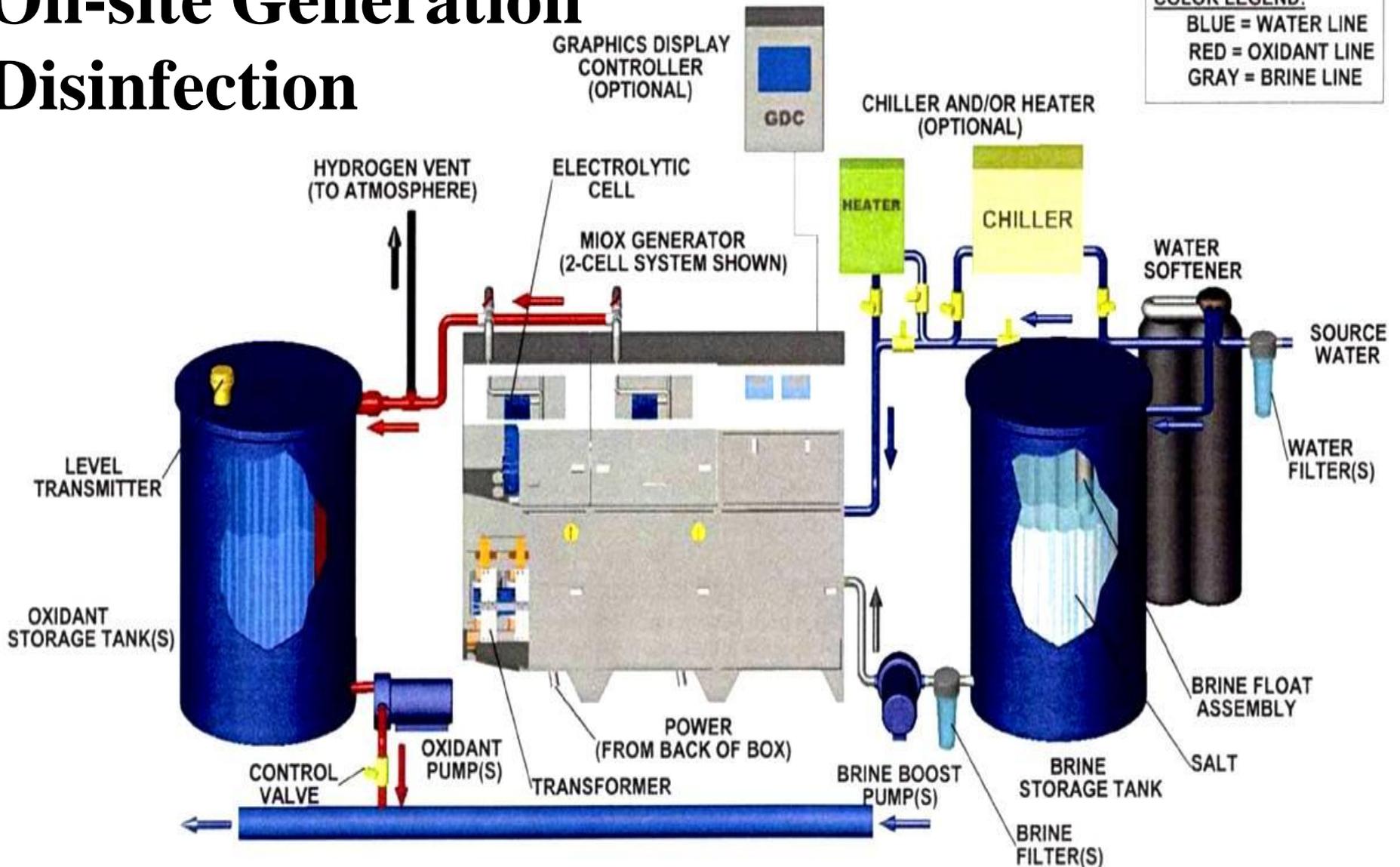


# 1 Ton Chlorine Cylinders

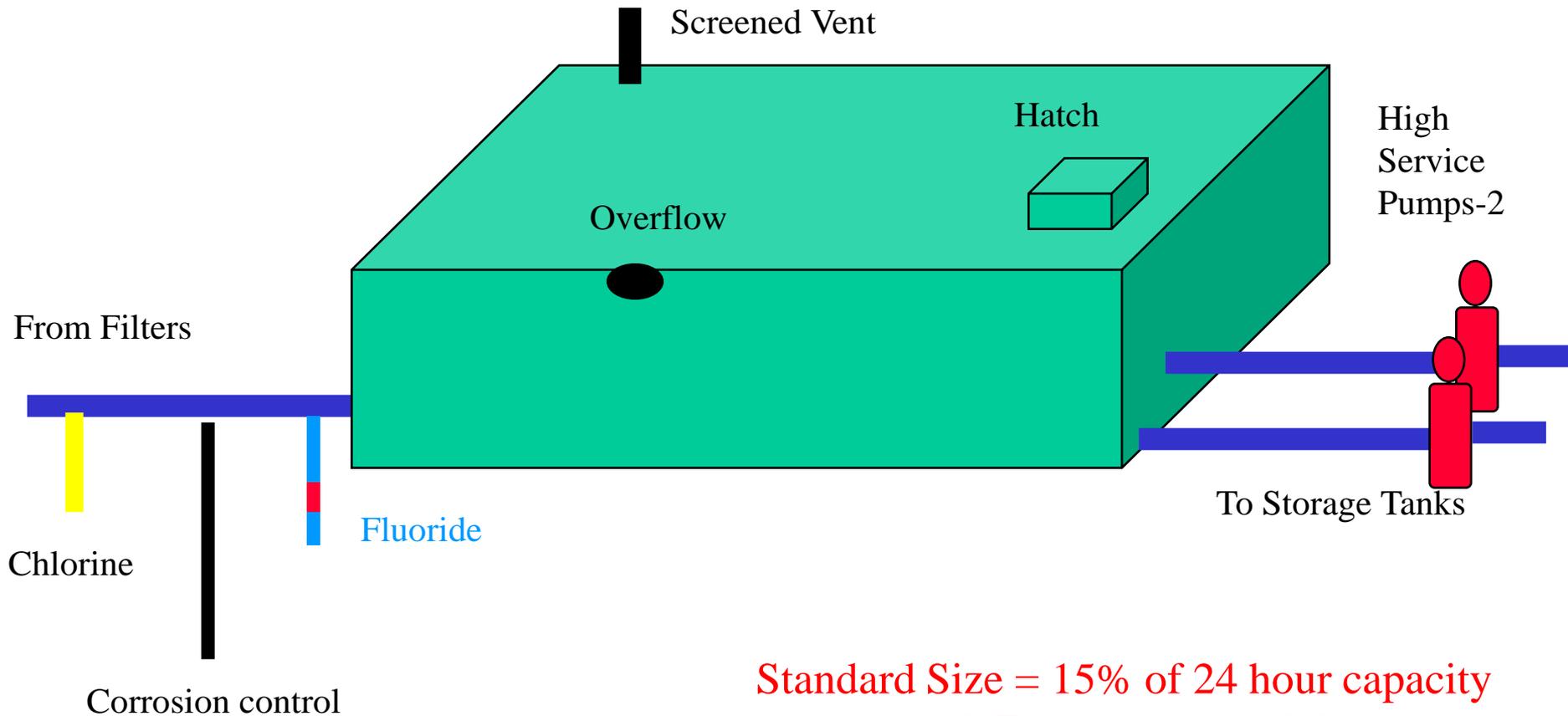


# On-site Generation Disinfection

**COLOR LEGEND:**  
 BLUE = WATER LINE  
 RED = OXIDANT LINE  
 GRAY = BRINE LINE

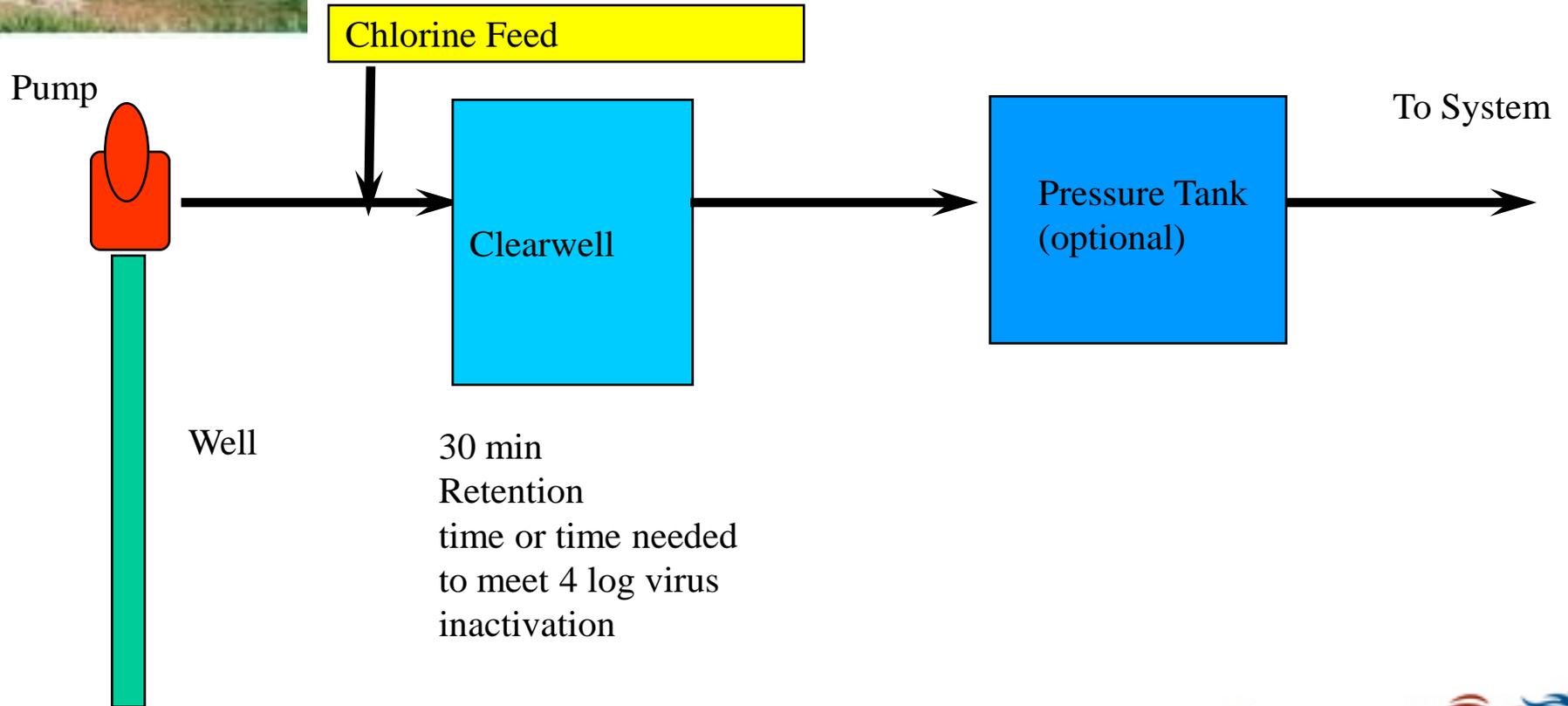


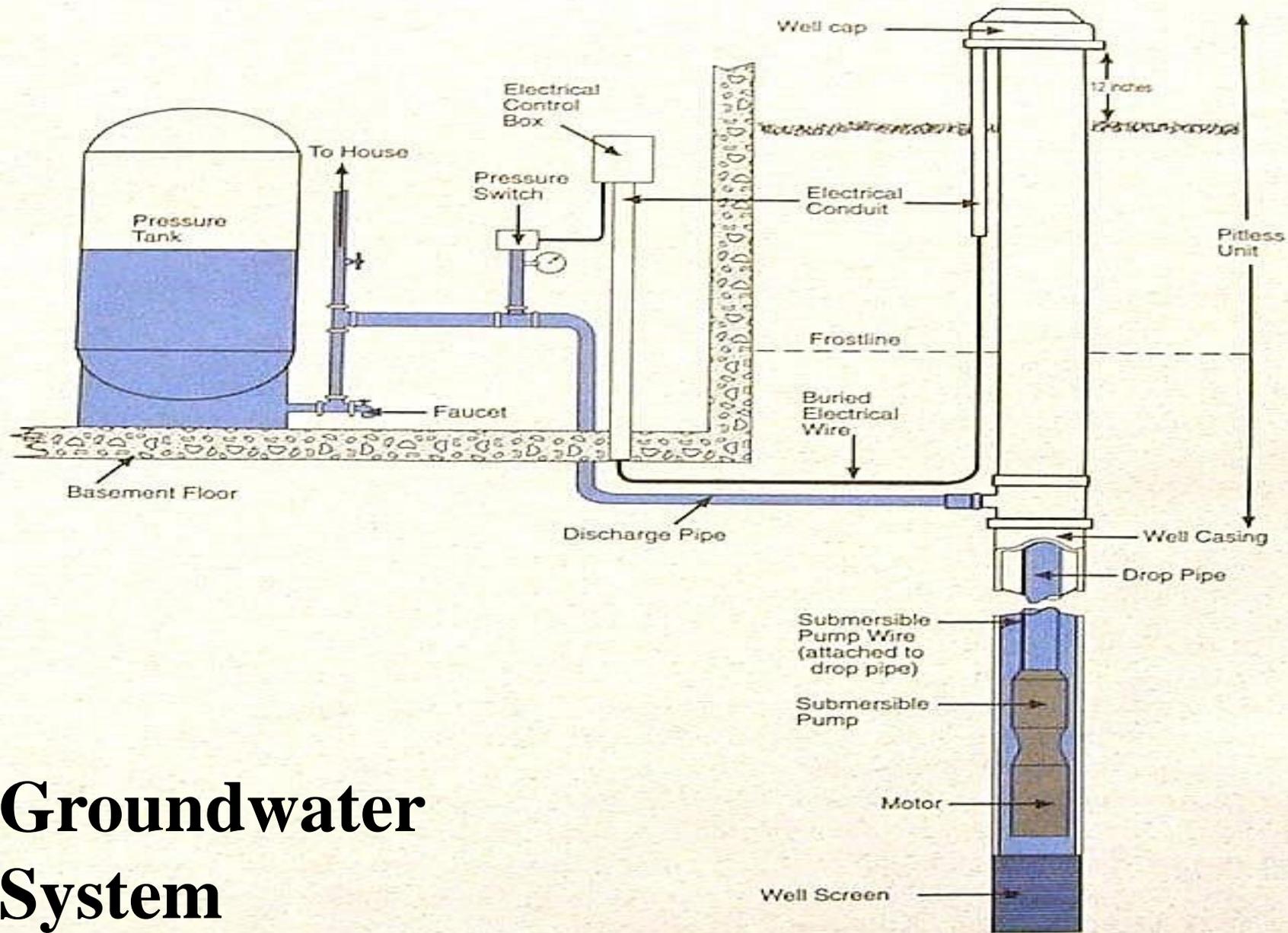
# Clear Well



Standard Size = 15% of 24 hour capacity  
or to meet C-T inactivation of Giardia

# Basic Groundwater System

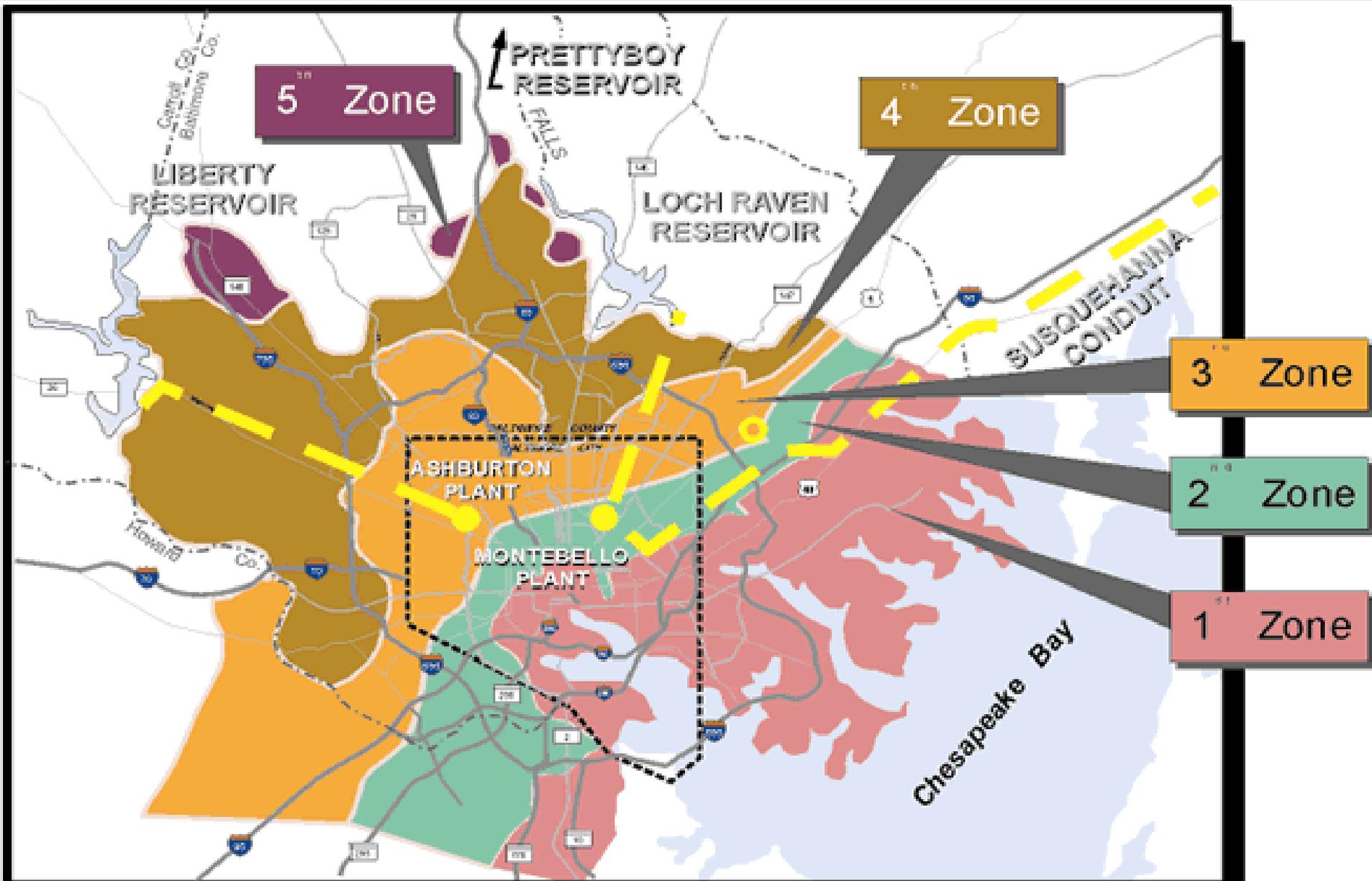




# Groundwater System

Well and Water System.

# Distribution System Map





# Distribution Piping Material

Cast Iron



Concrete



Ductile Iron



PVC





# Water Tanks

**EPA  
Region 4  
2004  
Award  
Winner**

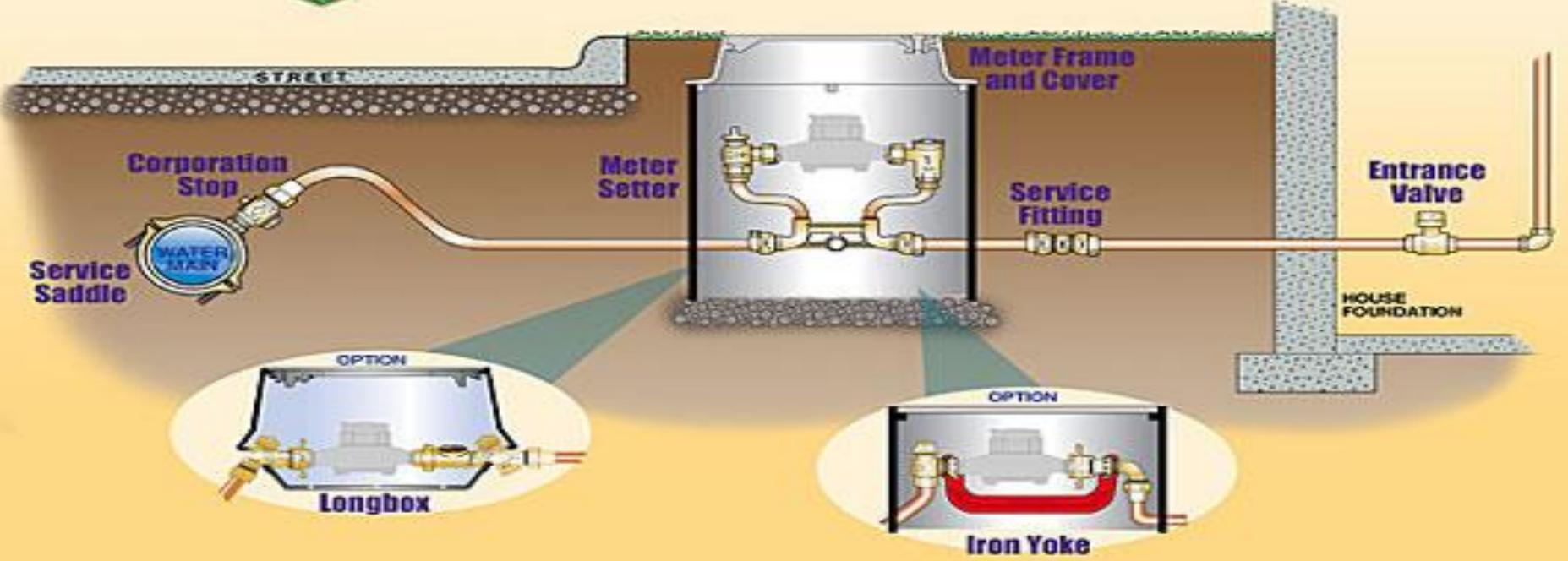


# Meters and Hydrants

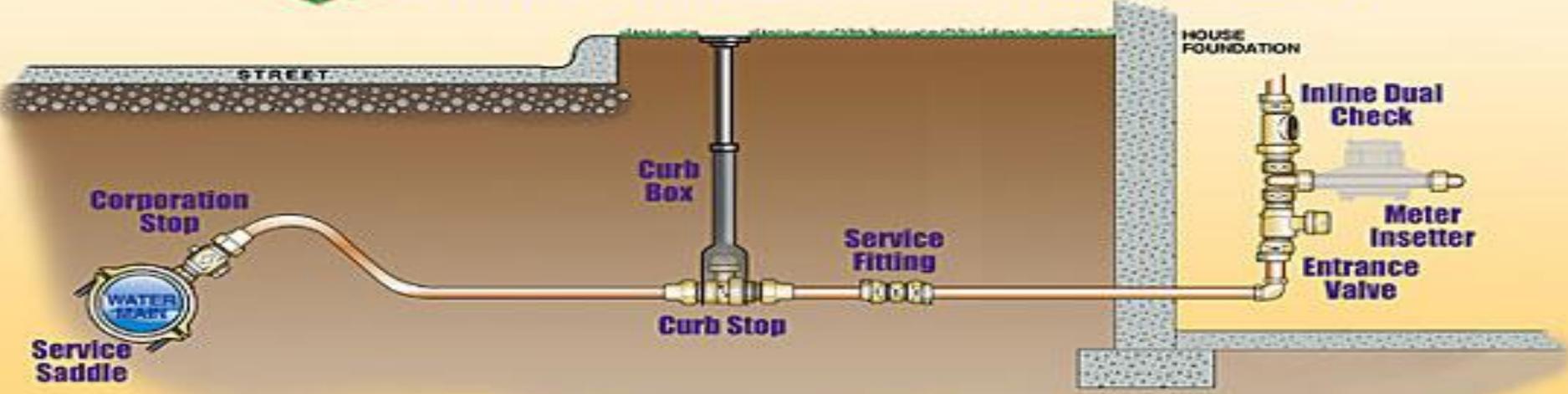




# WATER SERVICE LATERAL Southern Installation



# WATER SERVICE LATERAL Northern Installation



# Questions?? Comments??

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