



pennsylvania

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Office of Water Management



Module 1: Introduction to Wastewater Treatment

Wastewater Treatment Plant Operator Certification Training

Unit 1 – Roles of the Treatment Plant Operator

Learning Objectives

- List the roles of the Treatment Plant Operator
- Describe the operator responsibilities

▶ Roles of the Treatment Plant Operator

- Planning, design and construction of new facilities
- Administration
- Public Relations
- Operation and Maintenance
- Safety
- Continuing Education

Planning, design and construction

- Offer input about the design and how the plant should be operated efficiently.
- Offer important information regarding the limitations of the current facility.
- Offer input on issues such as maintainability, security, operability, and safety.
- During construction, the Treatment Plant Operator should become familiar with the plant

Administration

Workbook Page 1-2

- Supervision
 - Scheduling and supervision activities of other operators, mechanics, and laborers.
- Record Keeping
 - Maintaining accurate records.
- Financial Administration
 - Identify and manage plant needs, including equipment and personnel.
 - Create and manage an operating budget.

Operation and Maintenance

- **Process Control Decisions**
 - Any action to maintain or change quality/quantity of water being treated
- **Laboratory Procedures**
 - Process control depends on reliable laboratory data.
- **Mechanical Principles**
 - Should have a general knowledge of pumps, hydraulics, electric motors, and circuitry.

Public Relations

- Plant Tours
 - Appearance is important.
 - Annual “open house”
- Downstream User Interests
 - Treatment plants protect water for downstream users, so establish role as protector, not polluter.

Safety

- What types of safety issues might there be at a sewage treatment plant?
 - Open water tanks
 - Disease (proper hygiene)
 - Icing of walkways
 - Chemical use
 - Electrical contact

Safety

- Safety Program Planning
 - Treatment plants should be a safe place to work and visit.
 - Ensure safety by planning programs and training the operators.

Continuing Education

- Keep up with new technology
- Maintain sufficient con. ed. to maintain license
- Learn advanced concepts like troubleshooting

Key Points

- Key Points on 1-5

Unit 1 Exercise

1. True
2. Quality or Quantity
3. “c” Upgrading the electrical service panel

▶ Unit 2—Characteristics of Wastewater

Learning Objectives

- Describe the typical composition of raw wastewater.
- Explain the effects of wastewater discharges on the receiving stream.
- Identify how treatment plant discharge impacts natural cycles.

Untreated Wastewater

Contaminants in untreated wastewater

- Organic contaminants;
 - Inorganic contaminants;
 - Pathogens; and
 - Other contaminants.
-
- Table 2-1 and 2-2 in workbook

Organic Contaminants

- Derived from animals and plants, or may be manufactured chemical compounds.
- All organics contain carbon.
- Measured as BOD
- Untreated influent BOD is 200 to 250 mg/L

Contaminants Cont'd

Inorganic Contaminants

- Not biodegradable
- Include nutrients like phosphorous and nitrogen
- Include heavy metals

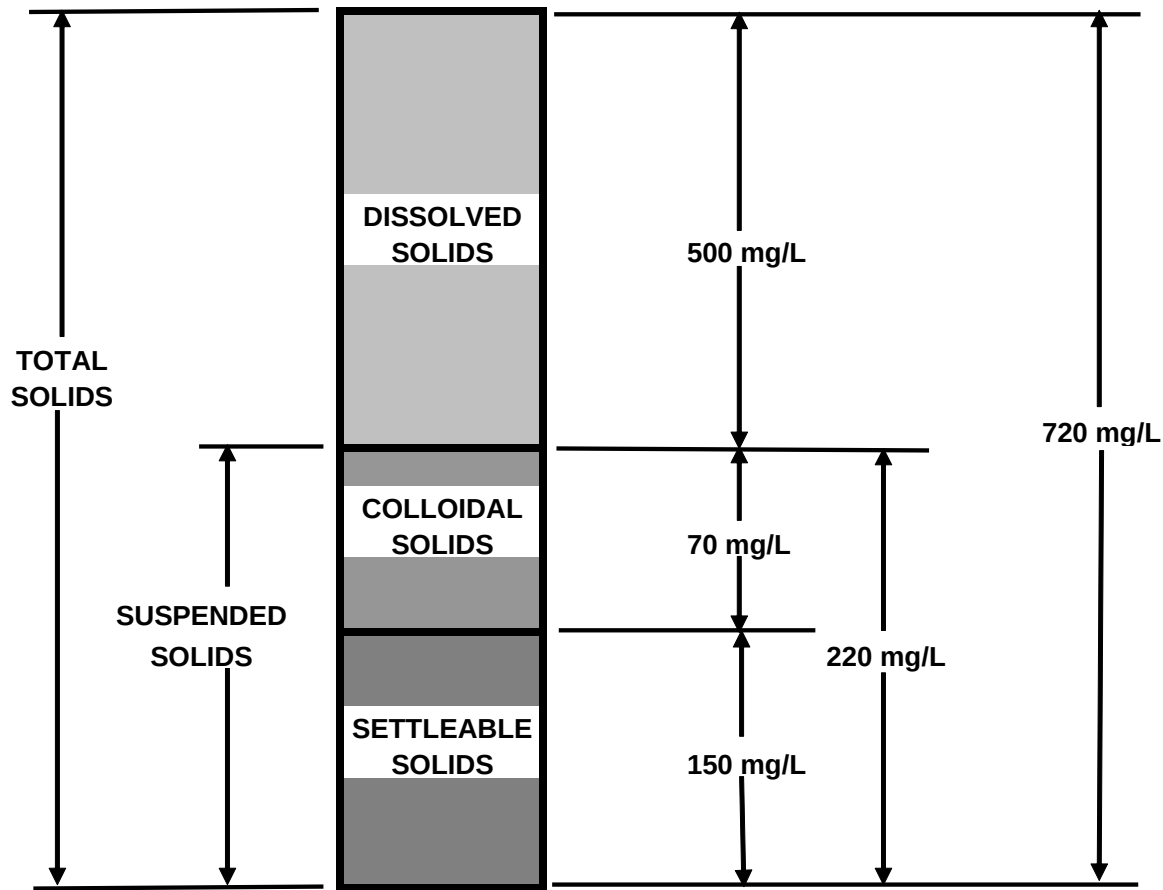
Pathogens

Thermal waste

Question

- A stream used for trout stocking is one example of a thermal sensitive stream where the stream temperature needs to be regulated. Can anyone think of any other reasons to regulate the temperature of discharges to the receiving stream?

Typical Composition of Solids in Raw Wastewater



Effects of Wastewater Discharges

Workbook Page 2-10

- Oxygen depletion and odor in stream
- Negative human health effects
- Sludge and scum accumulations

Dissolved Oxygen for Aquatic Life

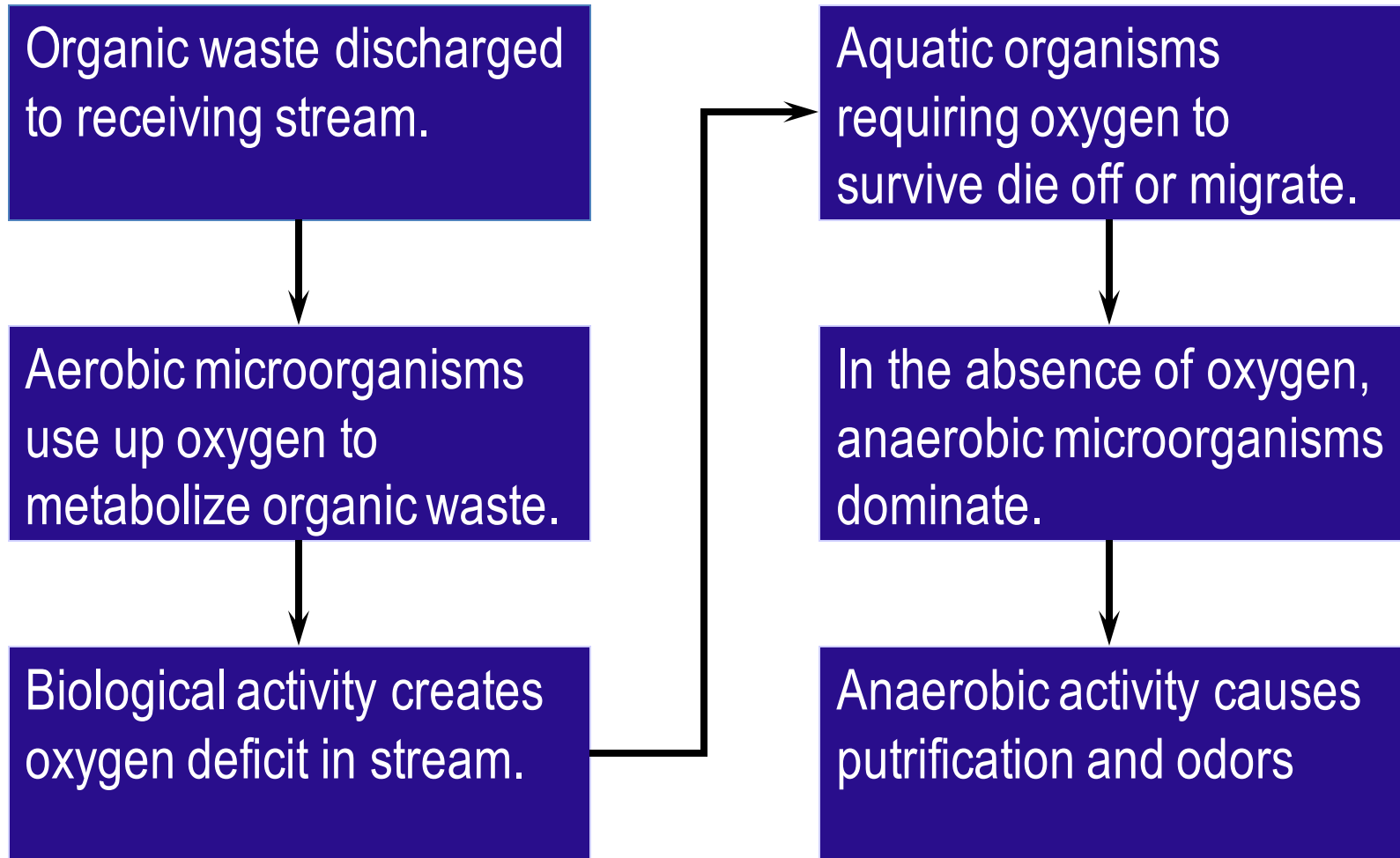
DO depends on temperature and flow

- Cold water can retain MORE dissolved oxygen
- Warm water can retain LESS
- Turbulent flow adds more oxygen
- For aquatic life, DO should be at least 5 mg/L

Effects of Organic Waste Discharge

- Oxygen utilization by aerobic bacteria
- Odor production by anaerobic bacteria

Oxygen Utilization by Aerobic Microbes



Human Health

- Untreated wastewater may contain **pathogens**
- **Treatment Objectives:**
 - Stabilization
 - Disinfection

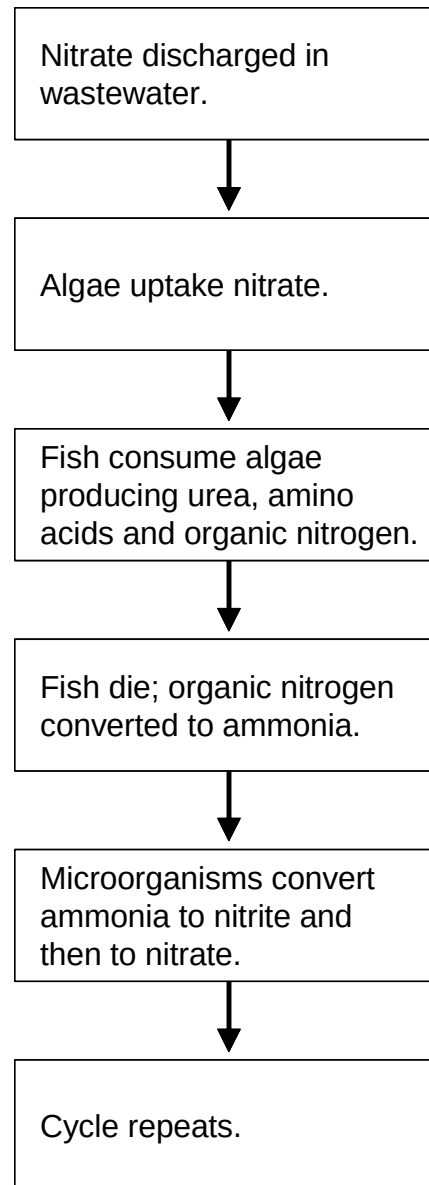
Other Effects of WW Discharge

- Workbook Page 2-13

Natural Cycles

- Workbook Page 2-14

Nutrient Cycles



Key Points and Exercise

- Key Point on 2-16
- Unit 2 Exercise

Unit 2 Exercise

1. A, C, and D
2. “C” Organic contaminant
3. BOD
4. “C” 200 to 250 mg/L
5. “B” 30 to 50 mg/L
6. True
7. “C” Industrial waste discharges

Unit 2 Exercise con't

8. B and C

9. “B” Excessive nutrient availability...

10. Stabilization

11. True

12. Carbon, hydrogen, oxygen, sulfur,
phosphorous, nitrogen

▶ Unit 3—Basic Wastewater Treatment Processes

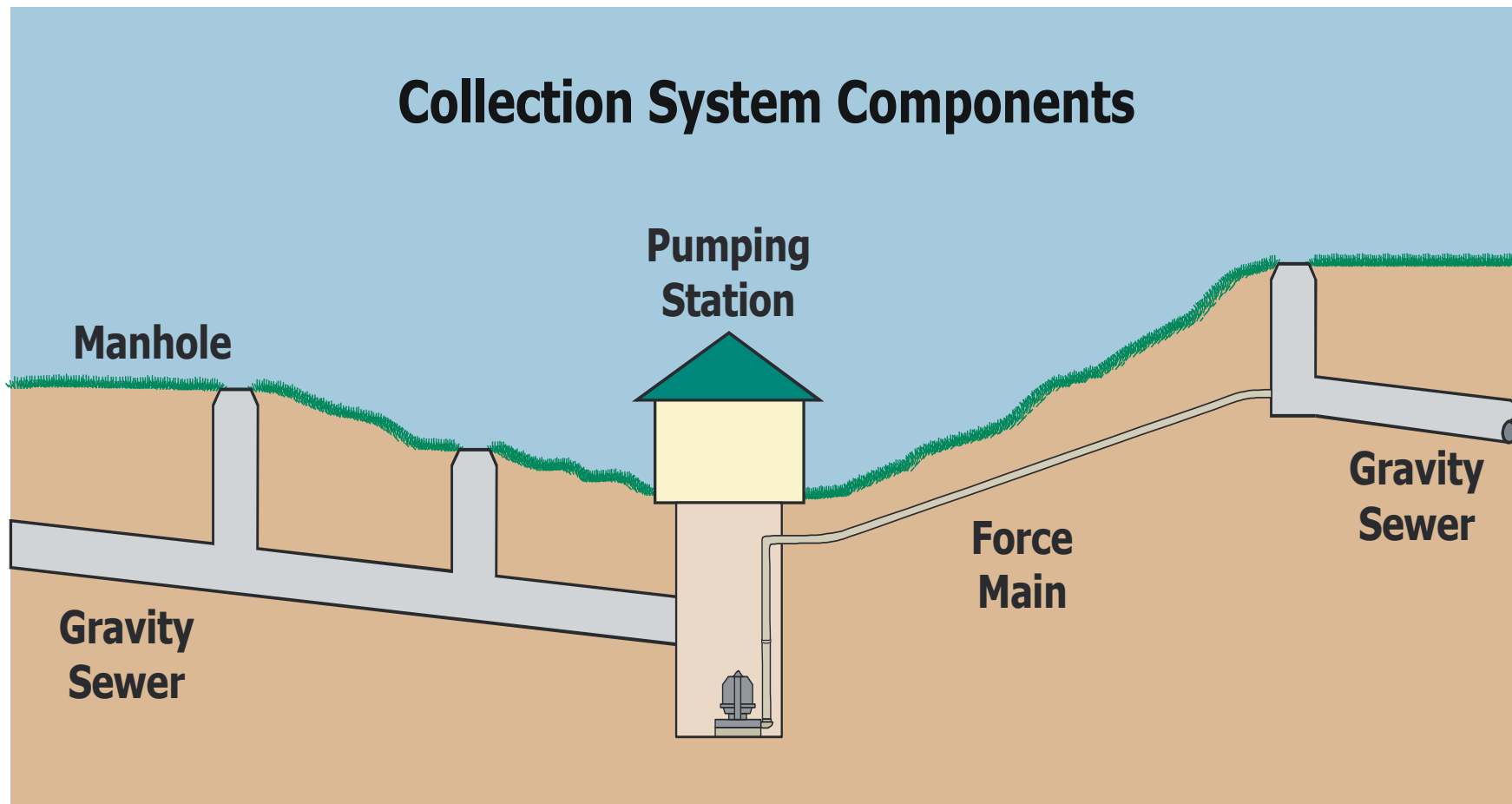
Learning Objectives

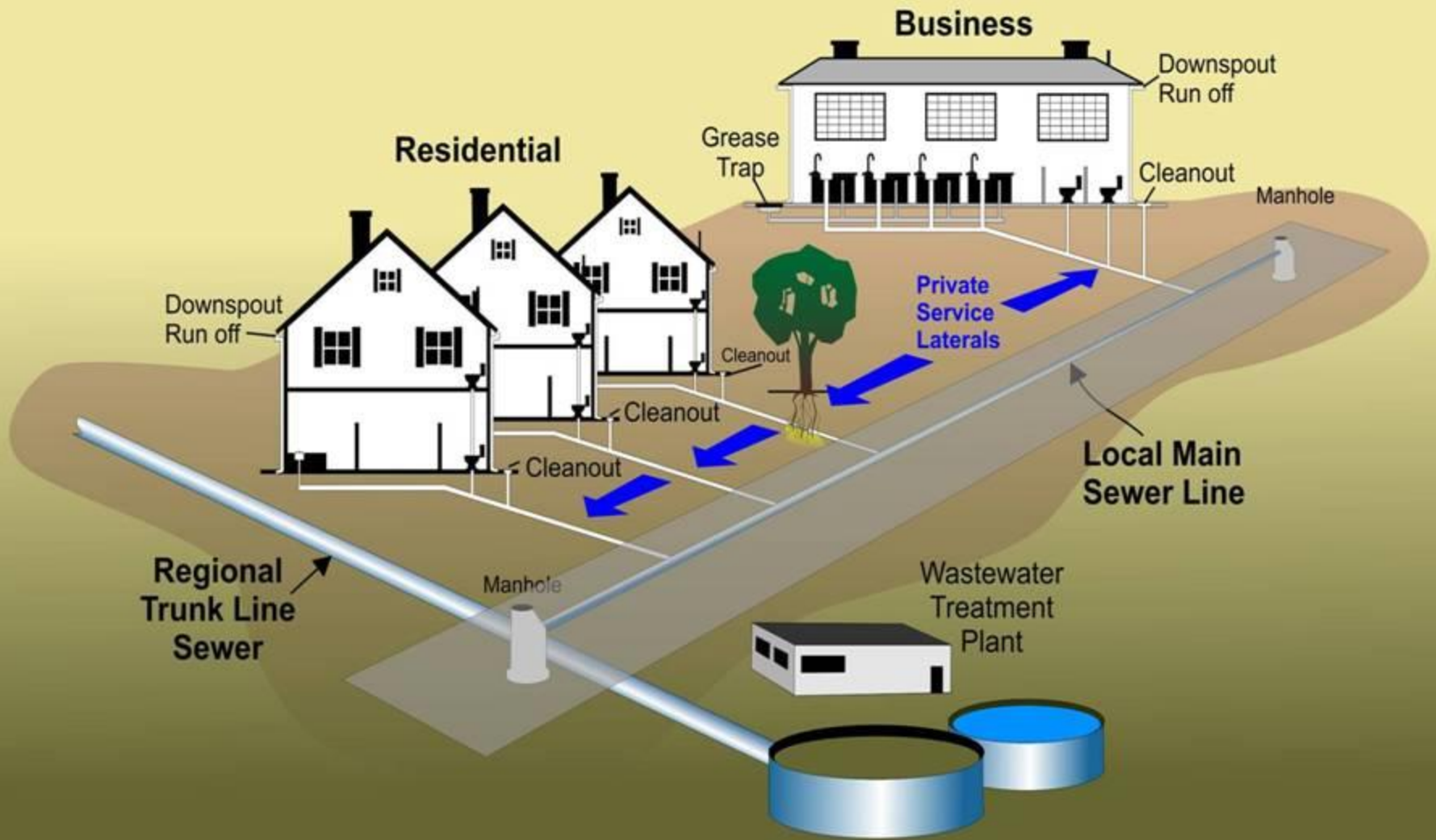
- Describe how wastewater is collected and transported to a treatment plant.
- Indicate the function of each treatment process.
- Describe two methods of effluent disposal.

Collection Systems

- Septicity definition (page 3-2)
- 3 Types:
 - Sanitary Sewer
 - Storm Sewer
 - Combine Sewer

Wastewater Collection and Conveyance System





Wastewater Treatment Processes

Preliminary Treatment

- Screening
- Grit removal
- Pre-Aeration
- Flow Metering and Sampling

Primary Treatment

- Sedimentation and Flotation

Secondary Treatment

- Biological Treatment
- Sedimentation

Tertiary (Advanced) Treatment

- Chemical Phosphorous Removal
- Biological Nutrient Removal
- Multimedia Filtration

Disinfection

Solids Treatment

- Digestion
- Disposal

Wastewater Treatment Processes

Preliminary Treatment

- Screening
- Grit removal
- Pre-Aeration
- Flow Metering and Sampling

Primary Treatment

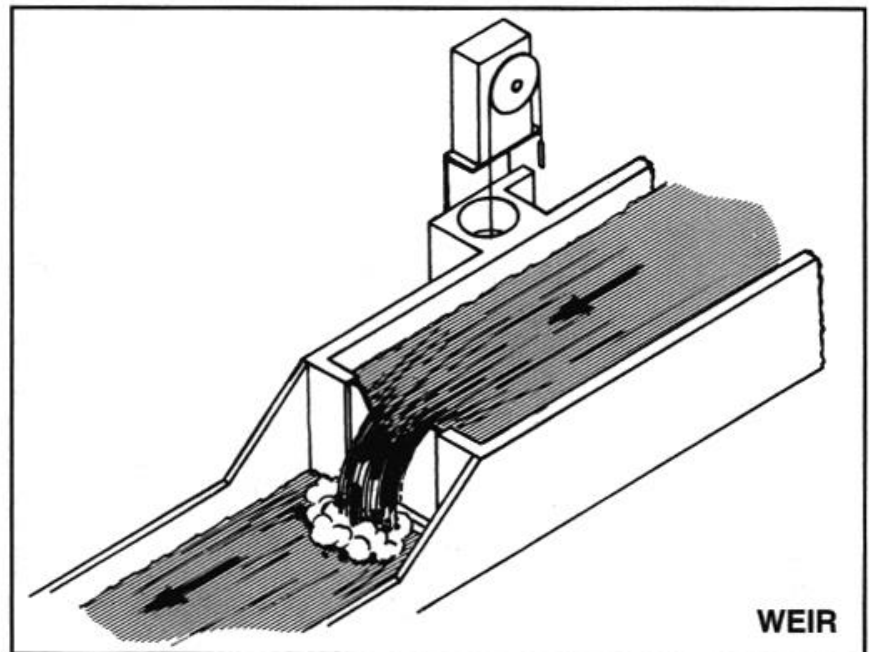
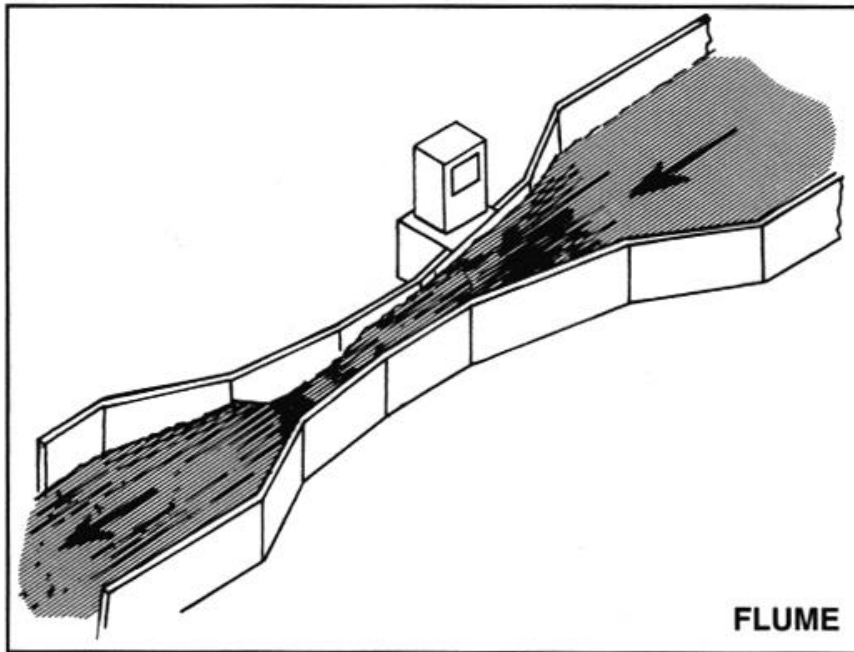
Secondary Treatment

Tertiary (Advanced) Treatment

Disinfection

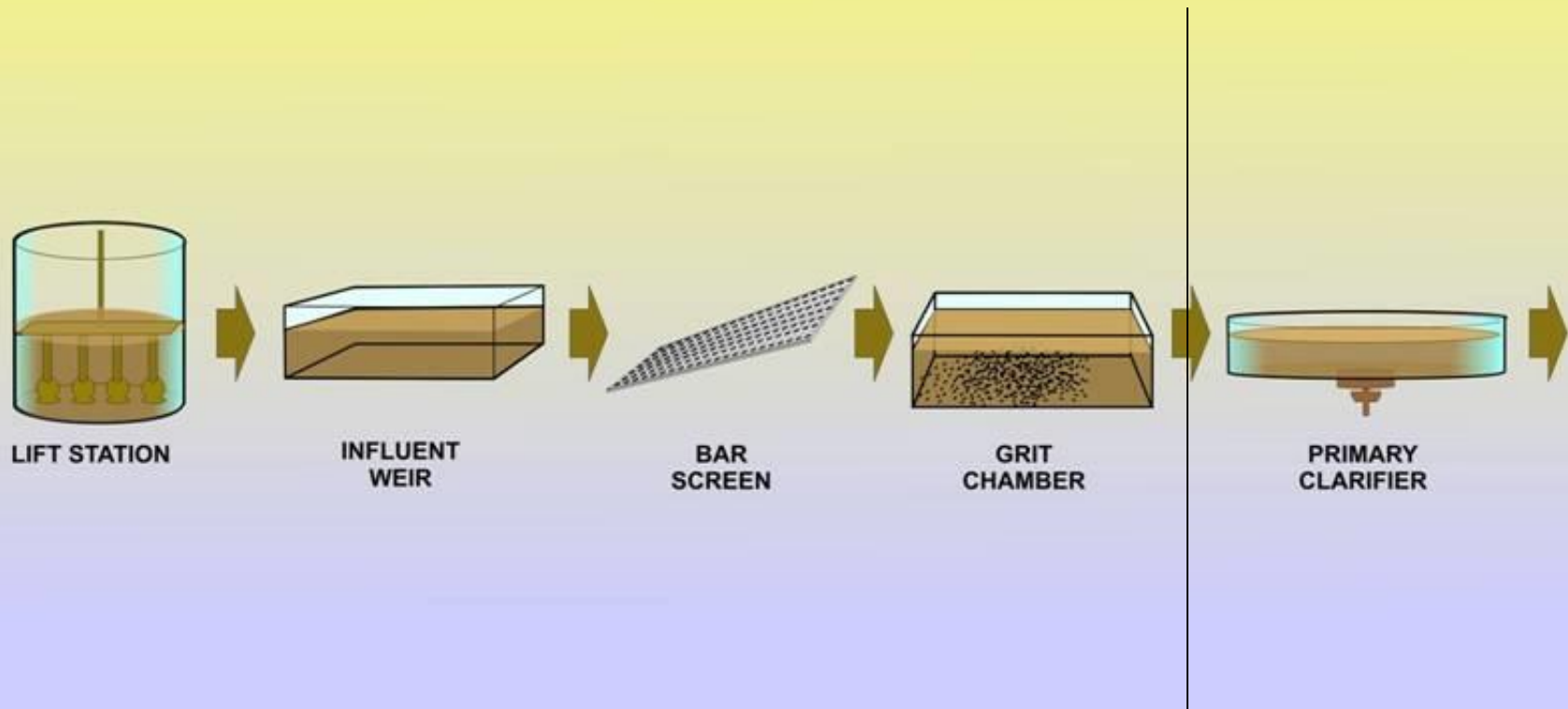
Solids Treatment

Flow Metering



Flow metering is important as discharge quality limits are based on flow ratio to stream flow.

▶ Preliminary and Primary Treatment



Wastewater Treatment Processes

Preliminary
Treatment



**Primary
Treatment**



Secondary
Treatment

- Sedimentation and Flotation



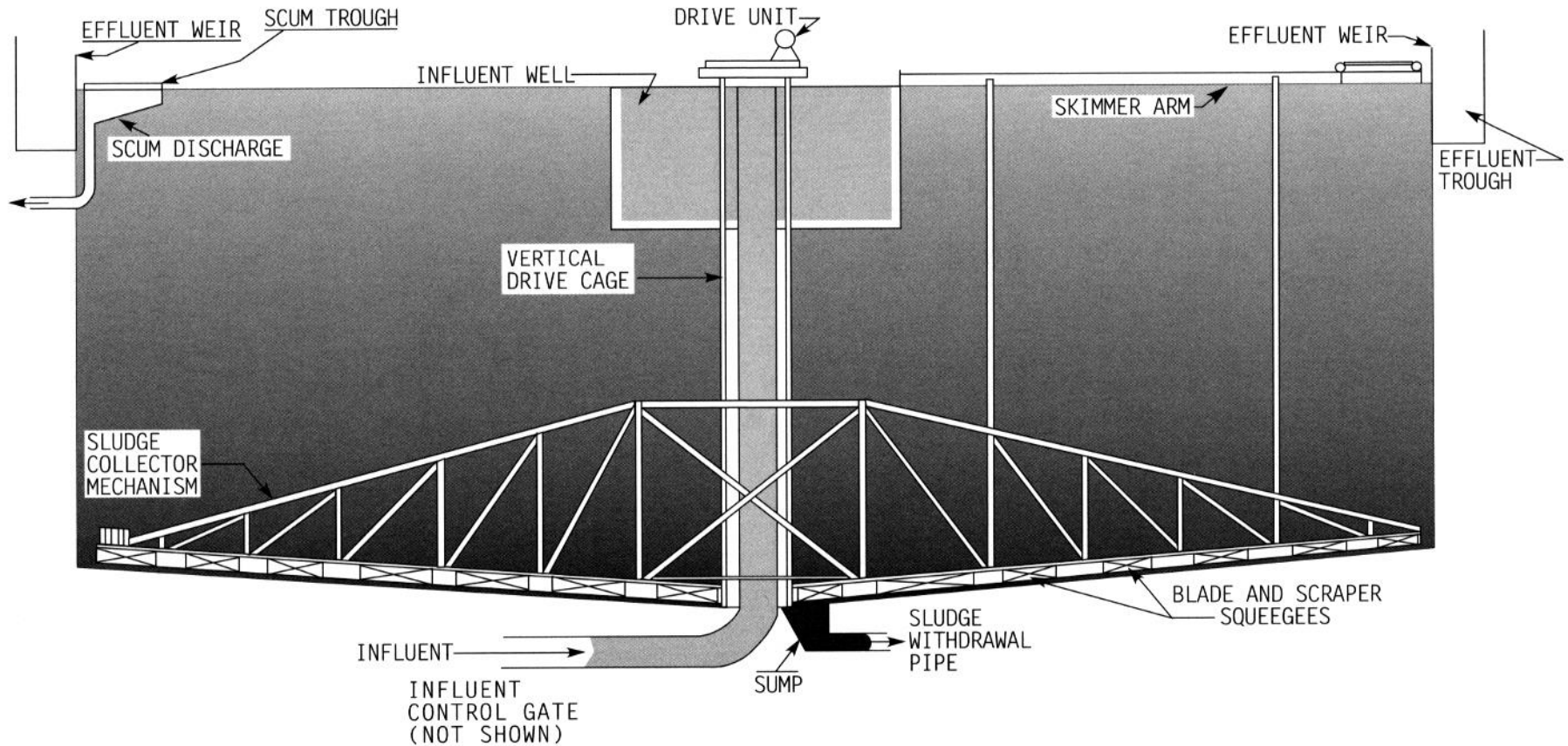
Tertiary (Advanced)
Treatment



Disinfection

Solids
Treatment

Primary Clarifier



Wastewater Treatment Processes

Preliminary
Treatment



Primary
Treatment



**Secondary
Treatment**

- Biological Treatment
- Sedimentation



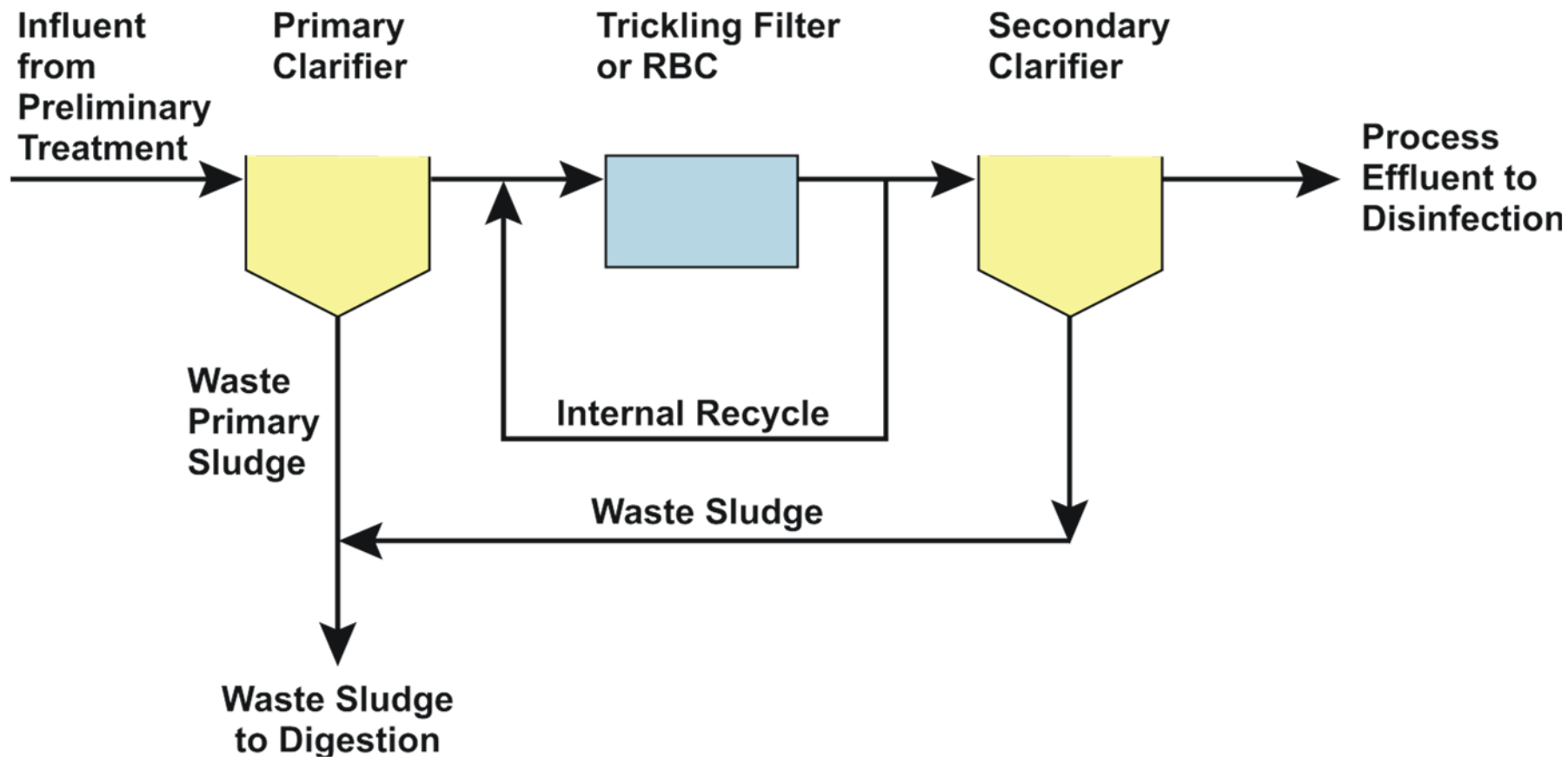
Tertiary (Advanced)
Treatment



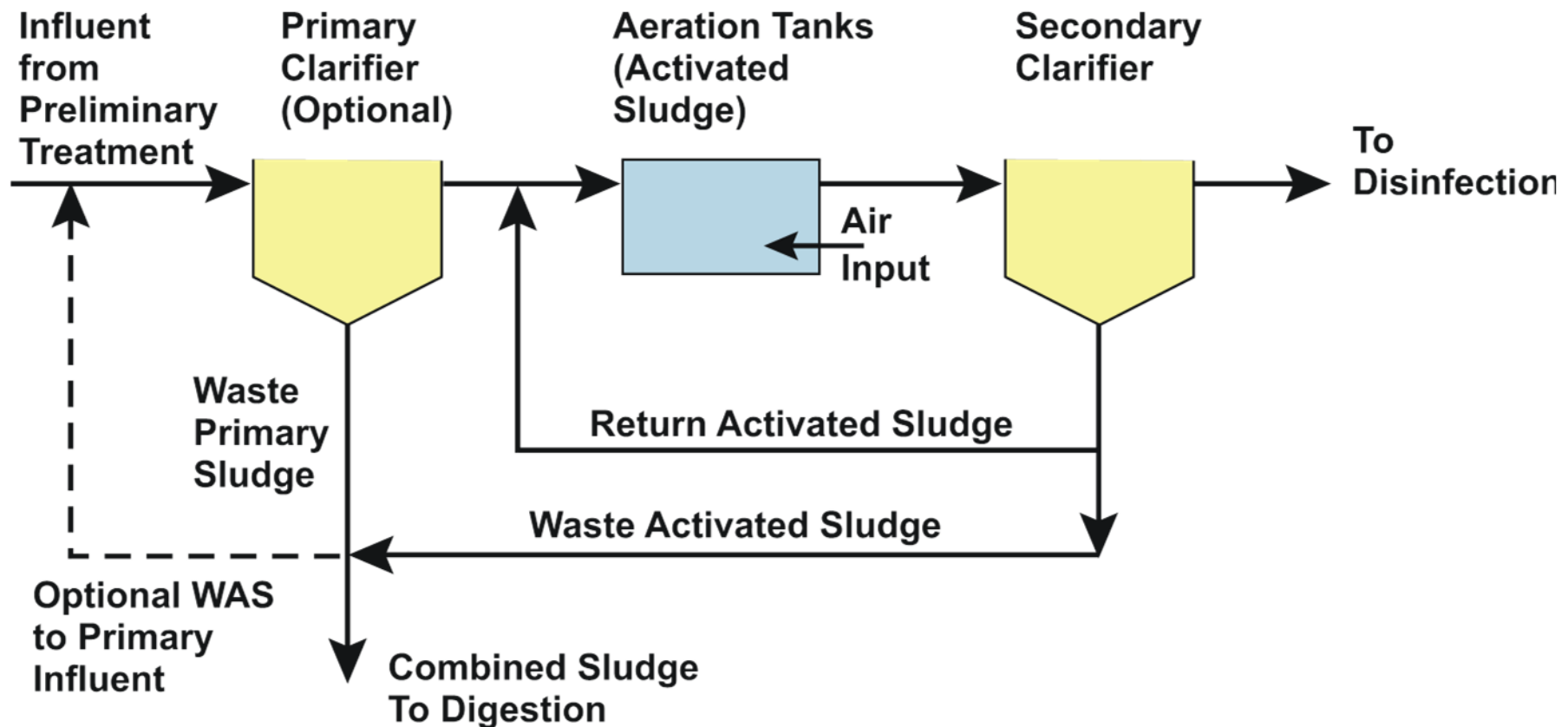
Disinfection

Solids
Treatment

➤ Fixed Film Biological Treatment Process



➤ Suspended Growth Process Schematic



Wastewater Treatment Processes

Preliminary
Treatment



Primary
Treatment



Secondary
Treatment



**Tertiary (Advanced)
Treatment**

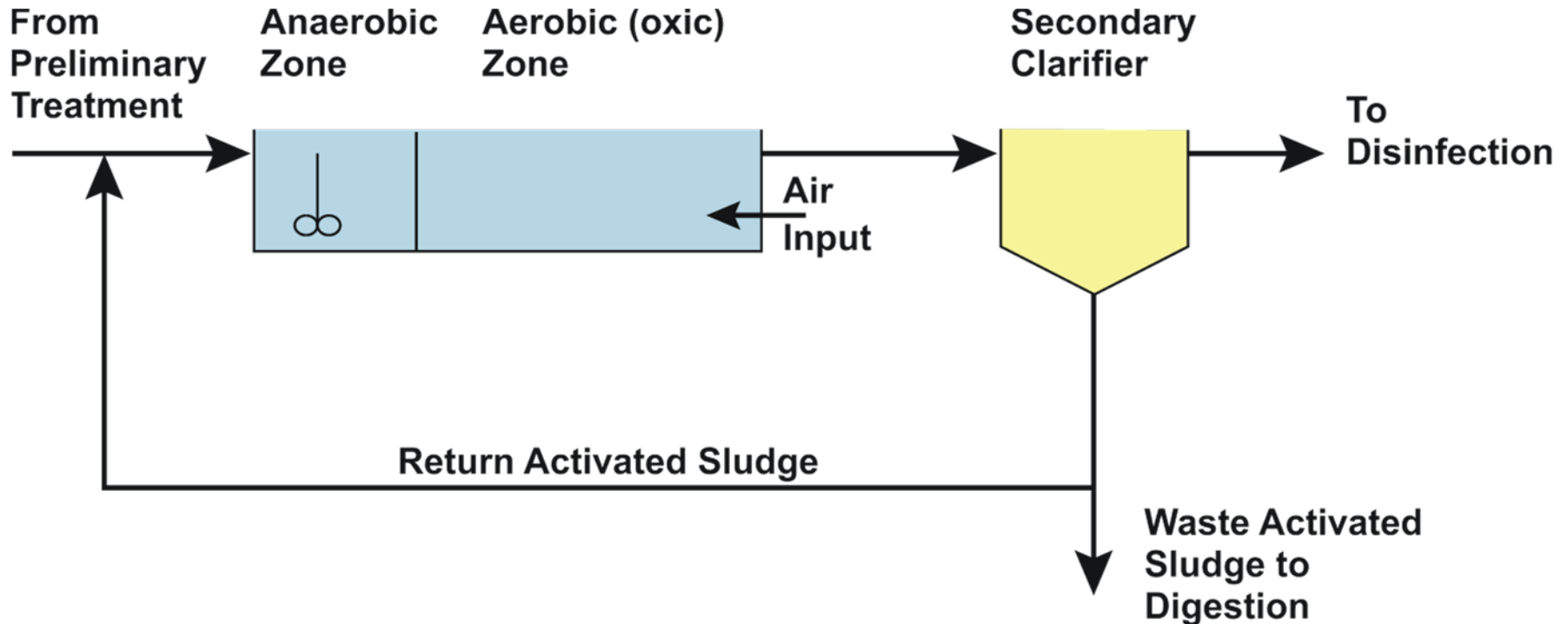


Disinfection

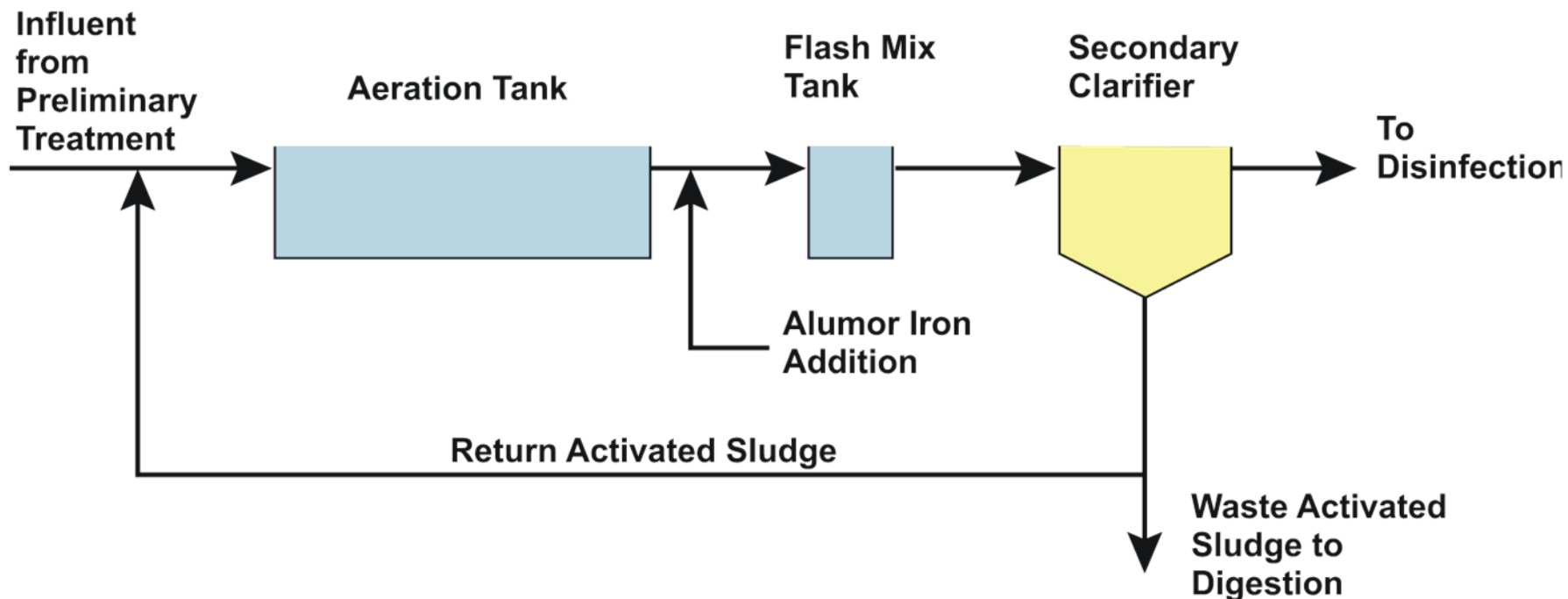
Solids
Treatment

- Chemical Phosphorous Removal
- Biological Nutrient Removal
- Multimedia Filtration

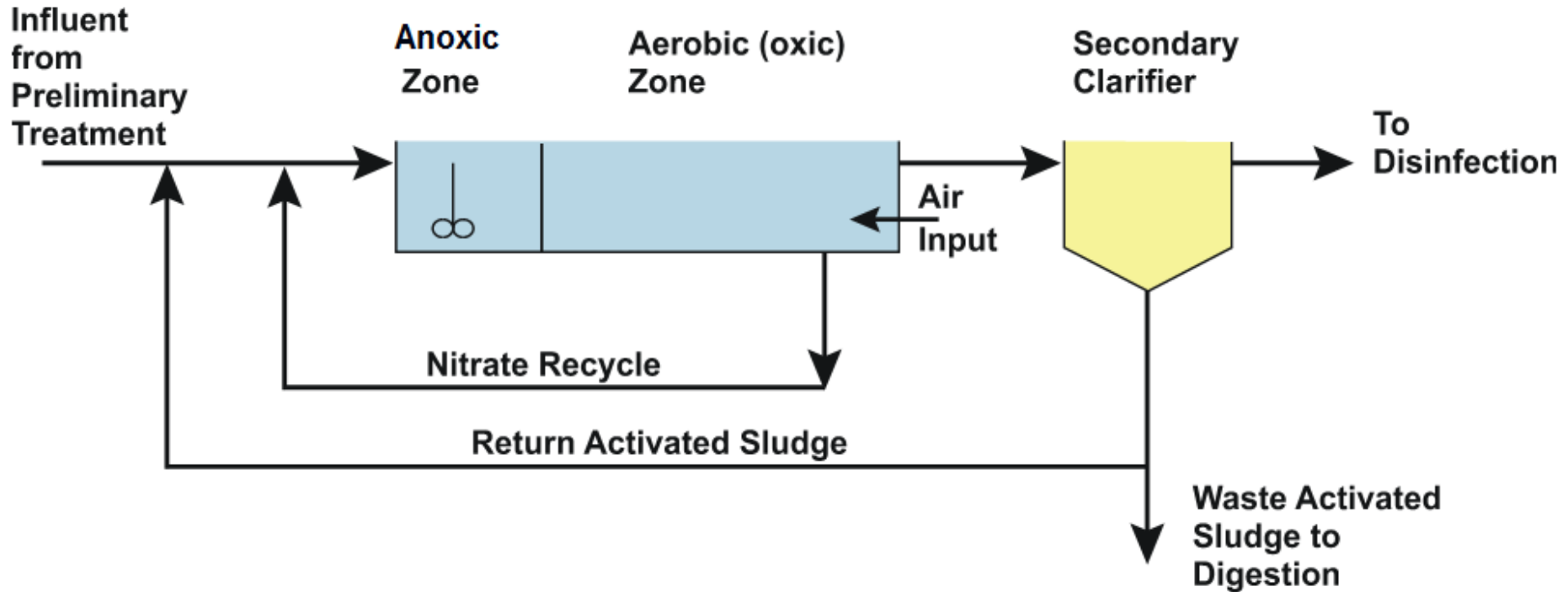
➤ Biological Phosphorus Removal Schematic



Chemical Precipitation Schematic



Denitrification Process Schematic



Wastewater Treatment Processes

Preliminary
Treatment



Primary
Treatment



Secondary
Treatment



Tertiary (Advanced)
Treatment



Disinfection

Solids
Treatment

Disinfection

- Necessary to reduce disease causing pathogens
- Majority of plants use some form of chlorination
- Ultra-violet light disinfection becoming more popular due to security and safety issues with chlorine

Solids Treatment

Primary
Treatment

Secondary
Treatment

**Solids
Treatment**

- Digestion
- Disposal

► Solids Management - STABILIZATION

- Digestion
 - Aerobic and anaerobic treatment
- Incineration
- Wet Oxidation
- Lime Stabilization
- Post Lime Stabilization
- Dewatering

Disposal

- Stream discharge
- Land disposal

Unit 3 Exercise

1. Collection and conveyance, treatment, disposal
2. Sanitary sewer, storm, combined
3. C, F, D, A, B, G, E
4. 2 ft/sec
5. Septic
6. True

Unit 3 Exercise

7. Weir, Parshall flume, Kennison
8. “C” Sludge blanket
9. “B” Secondary clarifier
10. True
11. Nitrogen, Phosphorous
12. Stream discharge, land disposal

▶ Unit 4–State and Federal Regulations

Learning Objectives

- List the purpose of the Drinking Water and Wastewater Systems Operators' Certification Program
- Identify the classification and sub-classifications for wastewater operator licenses
- List the responsibilities of a licensed plant operator under Chapter 302.
- Identify and locate state and federal regulations that govern wastewater treatment.

Certification Program

- Chapter 302
- Exam requirements
- Classes and subclasses

Operator

- O&M planning
- Report to system owner
- MAKE PROCESS CONTROL DECISIONS
- SOPs for non-certified operators

State Board for Certification

- Page 4-8 in the workbook
 - Duties of the Board

Unit 4 Exercise

1. A, C, and D
2. True
3. B, C, and D
4. NPDES
5. A and B
6. False
7. “D” State Board