

# 13

## Chapter

# Wastewater Story

We'll cover the following key points:

- Sewage
- Wastewater Treatment Plant (WWTP)
- Better Housekeeping Practices, Sanitation and Diseases



Hi, I'm EeeBee

Do you Remember:

Fundamental concept in previous class.

In class 5<sup>th</sup> we learnt

- Waste Management
- Diseases caused due to lack of cleanliness

Still curious?

Talk to me by scanning the QR code.



## Learning Outcomes

By the end of this chapter, students will be able to:

- Understand the process of wastewater management.
- Recognize the impurities present in sewage.
- Describe the stages involved in treating wastewater.
- Explore hygienic practices for effective waste disposal.
- Explain different methods for sewage disposal.

## Guidelines for Teachers

The teacher can begin the chapter by defining sewage and explaining its sources from both domestic and industrial origins. They can depict the movement of wastewater through sewage systems, emphasizing the role of pipelines and pumps in transporting it to treatment plants, supported by visuals and videos. The teacher can explain the functioning of a wastewater treatment plant (WWTP), covering each stage from initial screening to the final disinfection process. They may also highlight better practices for waste management and showcase how small actions at home can reduce contamination. Additionally, the connection between hygiene and health can be emphasized with case studies, illustrating how inadequate sanitation can lead to illnesses.

## NCF Curricular Goals and Competencies

This chapter aligns with the following curricular objective and competency:

**CG-5 (C 5.1):** Developing an understanding of the interplay between science, technology, and society.



## Mind Map

# WASTE WATER STORY

## Water, Our lifeline

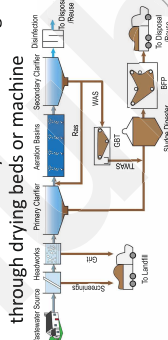
- The increasing scarcity of fresh - water due to population growth, pollution etc.
- Realising the urgency of the situation on the World Water Day, on 22 March 2005, the General Assembly of the United Nations proclaimed the period 2005–2015 as the International Decade for action on “Water for life”.
- Cleaning of water is a process of removing pollutants before it enters a water body or is reused. This process of wastewater treatment is commonly known as “Sewage Treatment”.

## Sewage

We know that sewage is a complex mixture containing suspended solids, organic and inorganic impurities, nutrients, saprophytes and disease causing bacteria and other microbes.

## Wastewater treatment plant (WWTP)

- ✓ Water in Bar Screen
- ✓ Water in Grit and Sand Removal Tank
- ✓ Sludge transferred to separate tanks
- ✓ Water removed by activated sludge through drying beds or machine



## Sanitation and disease

- ✓ Poor sanitation and contaminated drinking water is the cause of a large number of diseases.
- ✓ Untreated human excreta is a health hazard.
- ✓ It becomes the most common route for water borne diseases. They include cholera, typhoid, polio, meningitis, hepatitis and dysentery.

## Sanitation in public places

The government has laid down certain standards of sanitation but, unfortunately, they are not strictly enforced.

## Water freshens up — an Eventful journey

The network of big and small pipes of wastewater called sewers, forming the sewerage.

### ❖ Treatment of polluted water

- ✓ Aeration
- ✓ Filtered
- ✓ Chlorination
- ✓ Removing pollutants

## Better housekeeping practices

- ✓ Cooking oil should not to be thrown into drains.
- ✓ Use Chemicals to kill microbes.
- ✓ Do not throw waste in drains.

## Alternative arrangement for sewage disposal

Septic tanks, chemical toilets, composting pits etc.

## Sewage

The teacher stands in front of the classroom, holding a poster of a sewage treatment plant.



All living organisms generate waste. Nature manages this waste efficiently and wisely. Nature uses trees to clean air, and soil organisms to recycle waste and keep the soil fertile. Nature keeps the waters clean by letting aquatic organisms recycle waste. For centuries, nature managed the waste generated by us, too. Human populations have been generating so much waste that nature's agents cannot handle it anymore. But a large amount of waste we generate now is non-biodegradable. It means it cannot be broken down by natural decomposers. This is why it has become important for us to find efficient ways to manage the waste we generate.

We celebrate **22nd March as World Water Day** to bring awareness amongst people for safe water, fit for human consumption. On the World Water Day, i.e. 22 March 2005, the

General Assembly of the United Nations proclaimed the period 2005-2015 as the International Decade for action on Water for Life. All efforts made during this decade aim to reduce by half the number of people who do not have access to safe drinking water.

### In History...

- The earliest known sewage systems date back to **3000 BCE** in the Indus Valley Civilization (modern-day India and Pakistan). Cities like Mohenjo-Daro and Harappa had covered drains and a centralized sewage system.
- The ancient **Babylonian and Mesopotamian civilizations** also built rudimentary drainage systems to handle wastewater from households.
- In the mid-19th century, London built an extensive underground sewer network under the guidance of **Joseph Bazalgette** to combat the "Great Stink" of **1858**, which was caused by untreated human waste in the Thames River.

Sewage refers to wastewater generated from homes, industries, agricultural fields, and various human activities. It also includes rainwater that runs off streets during storms or heavy rainfall. Essentially, sewage is liquid waste, with a significant portion of its water containing dissolved and suspended impurities known as contaminants.

## Composition of Sewage

Sewage comprises several components that can be broadly categorized into organic impurities, inorganic impurities, nutrients, and microorganisms:

### 1. Organic Impurities:

- **Animal Waste:** Includes animal manure and urine, often from agricultural or livestock areas, which can carry harmful microorganisms.
- **Oil and Grease:** Sourced from industrial facilities, road runoff, and household kitchens, these contaminants impact water quality.
- **Fruit and Vegetable Waste:** The kitchen waste decomposes in water, increasing its biological oxygen demand (BOD) and affecting aquatic life.
- **Pesticides and Herbicides:** These agricultural chemicals run off into water bodies, disrupting ecosystems and accumulating in the food chain.

### 2. Inorganic Impurities:

- **Phosphates:** Found in detergents and fertilizers, they promote algae growth, reducing oxygen levels in water and harming aquatic organisms.
- **Nitrates:** These compounds, primarily from agricultural runoff, can contaminate drinking water and pose health risks, such as causing "blue baby syndrome."
- **Metals:** Heavy metals like lead, mercury, and cadmium from industrial waste are highly toxic and can accumulate in living organisms, leading to long-term environmental and health hazards.

### 3. Nutrients:

- **Nitrogen and Phosphorus:** These essential nutrients often appear in sewage due to agricultural runoff and domestic waste. While beneficial in small amounts, their excessive presence can disrupt aquatic ecosystems.

### 4. Microorganisms:

- **Bacteria:** Sewage contains various bacteria, some of which are harmful and cause waterborne diseases like cholera and typhoid.
- **Protozoa:** These microorganisms, such as those causing dysentery, are also present in sewage and contribute to the spread of diseases.



## The Sewage System

An effective sewage system is essential for the safe management of wastewater. It consists of an intricate network of pipes designed to transport wastewater from its sources to treatment facilities. These pipes, called sewers, are typically made of materials like PVC (Polyvinyl Chloride) or cast iron, known for their durability and resistance to corrosion.

### 1. How It Works:

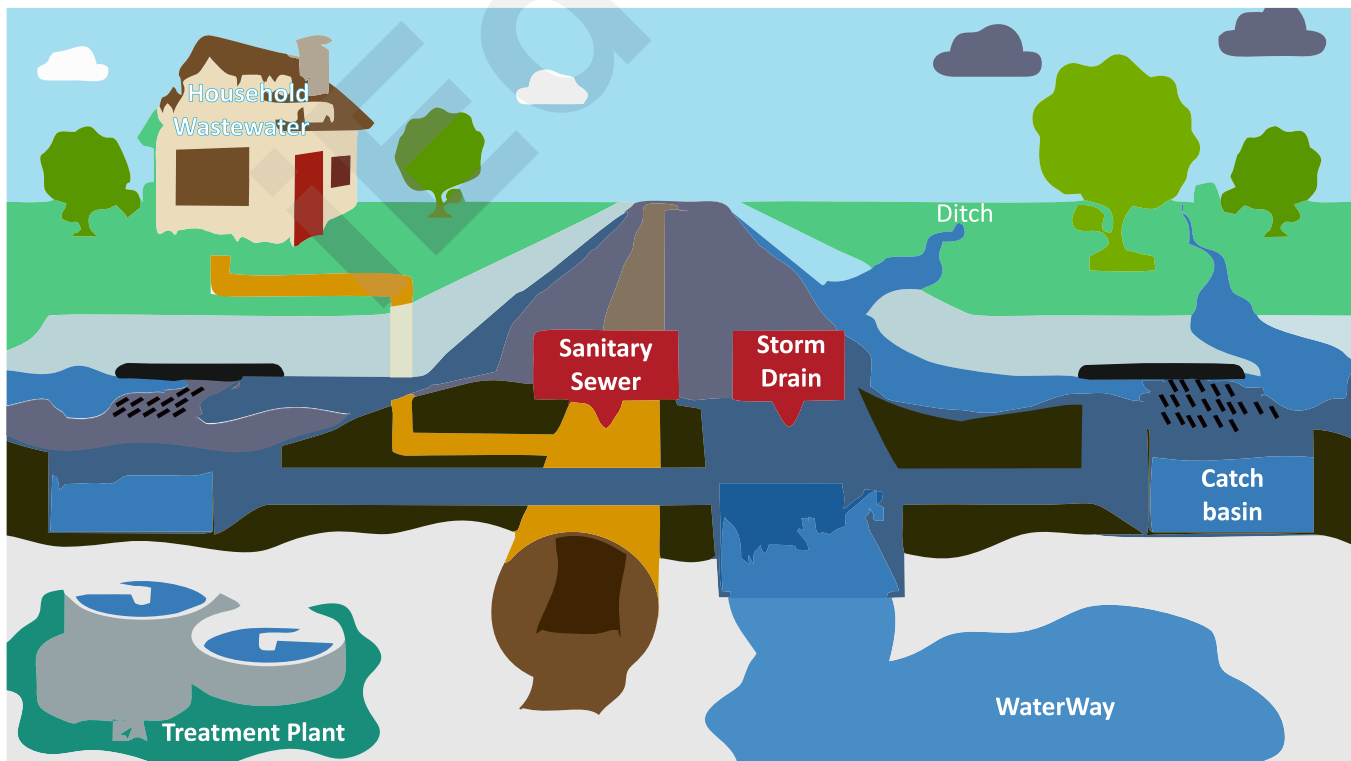
- Wastewater from toilets, sinks, and washing machines flows through household drains.
- These household drains connect to larger sewer mains, which are covered by manhole covers for maintenance and inspection.
- The sewer mains gradually transport wastewater through progressively larger pipes to a wastewater treatment plant (WWTP).

### 2. Location and Flow Design:

- Wastewater treatment plants are often located in low-lying areas to utilize gravity for the smooth flow of sewage.
- Sewer mains are strategically designed to follow natural streambeds, ensuring efficient transportation.

### 3. Treatment Process:

- Once the sewage reaches the treatment plant, it undergoes multiple stages of purification.
- After treatment, the cleaned water is discharged into rivers, seas, or other water bodies, ensuring minimal harm to the environment.



## Infrastructure of Sewage Systems

Modern sewage systems consist of various components working together to ensure efficient wastewater management:

### 1. Household Drains:

These collect wastewater directly from homes and buildings, serving as the starting point of the sewage system.

### 2. Sewers:

Underground pipelines that carry wastewater to the treatment plants. These pipes vary in size, from small household sewers to large tunnels transporting massive volumes of wastewater.

### 3. Pumping Stations:

In areas where gravity is insufficient, pumping stations are used to move wastewater to higher elevations, ensuring an uninterrupted flow to treatment facilities.

### 4. Manholes:

- A manhole is a vertical opening in the ground, road, or pavement that provides access to underground sewer pipes for cleaning, inspection, and maintenance.
- They are installed at regular intervals (50-60 meters) in the sewer network and at points where multiple sewer lines meet or change direction.



## Let's recall what we know

### Apply Concept in Context

Apply

- How does treating sewage benefit both human health and the environment? Provide examples of pollutants removed during the treatment process, such as organic impurities, inorganic impurities, and microorganisms.
- If untreated sewage were released into rivers, how might it affect aquatic life and drinking water supplies?

**Skills Covered:** Critical thinking, Applicative thinking, Brainstorming

### Examine Further

Analyse

- What would happen if sewage pipes were not properly maintained? Explain with reference to blockages, overflows, and environmental consequences.
- How might the improper disposal of heavy metals in sewage impact the food chain and human health?

**Skills Covered:** Critical thinking, Analytical thinking, Brainstorming, Research, Investigation

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## Self-Assessment Questions

Evaluate

- What is sewage, and why is its treatment essential?
- Name three main components of sewage (e.g., organic impurities, inorganic impurities, microorganisms) and give examples of each.
- How does a sewage system use gravity to transport wastewater?
- What are the advantages of having a well-maintained sewage system for public health and the environment?

**Skills Covered:** Research, Observation, Recall

## Bloom's Taxonomy

## Creative Insight

Create

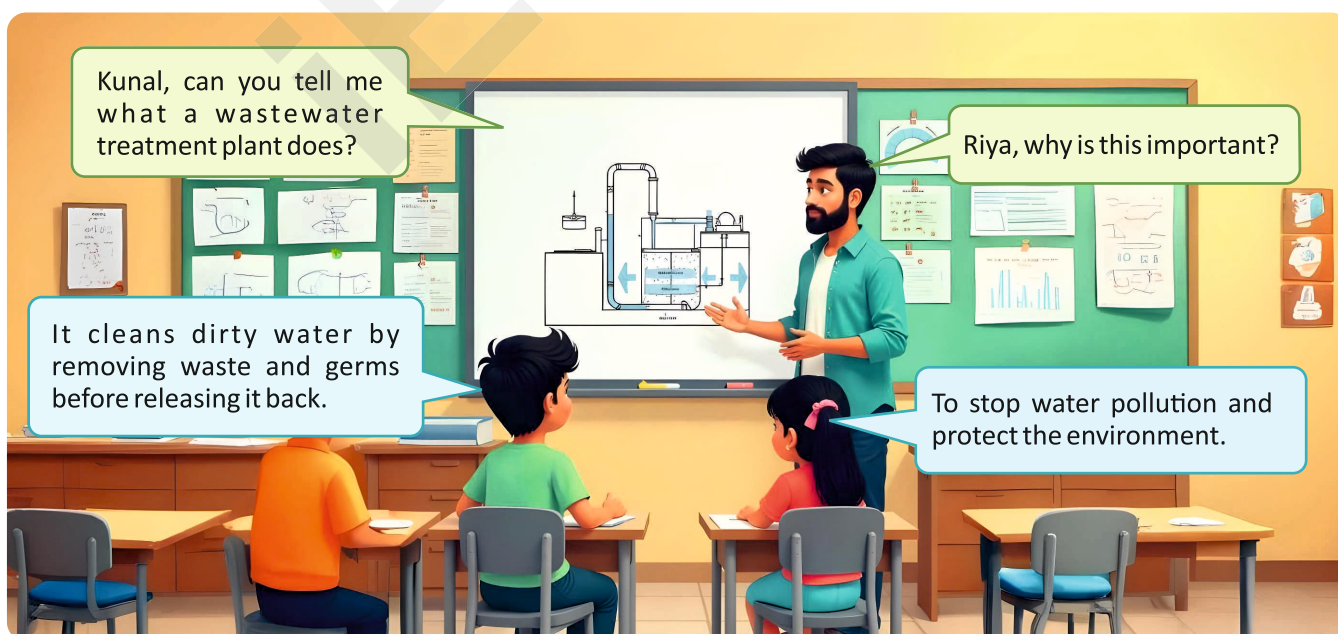
Sewage treatment ensures wastewater is safely managed, reducing health risks and environmental harm. Components like pipes, manholes, and pumping stations work together to transport wastewater to treatment plants.

**Task:** Create a diagram illustrating the journey of wastewater from household drains to a treatment plant. Label key components like sewers, manholes, pumping stations, and treatment stages, and explain the role of each part in sewage management.

**Skills Covered:** Research, Creativity, Observation, Brainstorming

## Wastewater Treatment Plant (WWTP)

The teacher stands by a simple diagram of a wastewater treatment plant on the board. Riya and Kunal, sitting in the front row, look at the diagram attentively.



## Definition of Wastewater

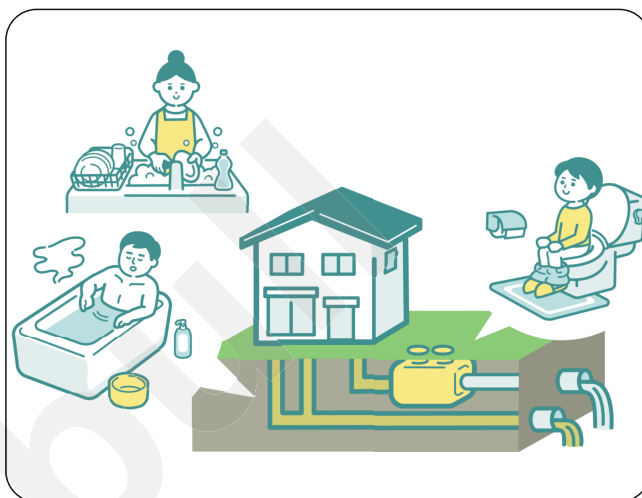
Wastewater refers to water that has been previously utilized and contaminated through various human activities. It encompasses a broad spectrum of water sources that have interacted with pollutants, rendering it unsuitable for direct consumption or reuse without proper treatment. The contaminants in wastewater may vary depending on its origin but generally include a mixture of organic, chemical, and biological pollutants that pose risks to human health and the environment.

## Types of Wastewater

### 1. Household Wastewater

Household wastewater, often referred to as domestic wastewater, originates from residential areas. It comprises water discarded from everyday activities such as washing, bathing, cooking, and sanitation. Common sources of household wastewater include sinks, showers, toilets, washing machines, and dishwashers. This type of wastewater typically contains:

- Soap and detergent residues from cleaning and washing.
- Food particles and grease from cooking or dishwashing.
- Human waste and associated contaminants from toilets.



Despite appearing less harmful compared to industrial wastewater, untreated household wastewater can lead to significant environmental degradation, including water pollution and the spread of waterborne diseases.

### 2. Industrial Wastewater





Industrial wastewater is produced as a byproduct of various manufacturing and industrial processes. The characteristics of this wastewater depend heavily on the type of industry involved. For example:

- Chemical plants may release water contaminated with harmful chemicals or toxic substances.
- Metal processing industries might generate wastewater containing heavy metals like lead, mercury, or chromium.
- Oil refineries often discharge wastewater containing hydrocarbons and other oily residues.

Industrial wastewater is particularly concerning due to the presence of non-biodegradable pollutants that can persist in the environment for extended periods, making its treatment and proper disposal essential to protect ecosystems and public health.

### 3. Agricultural Wastewater

Agricultural wastewater stems from farming and livestock-related activities. The primary contributors include runoff water from irrigation fields, livestock pens, and agricultural operations. This type of wastewater often carries:

- Excess nutrients such as nitrogen and phosphorus from fertilizers.
- Pesticide residues from crop protection chemicals.
- Organic waste from animal farms, including manure and urine.

Agricultural wastewater poses a significant threat to aquatic ecosystems. High nutrient levels can cause eutrophication, a process that leads to the excessive growth of algae, reducing oxygen levels in water bodies and harming aquatic life. Additionally, pesticide residues and pathogens can further degrade water quality, impacting biodiversity and human health.



### Wastewater Treatment Plant

Wastewater, or sewage water, contains harmful contaminants that must be treated before it is released into natural water bodies, such as rivers or seas. To ensure that the water is safe for the environment and public health, it is processed in a **Wastewater Treatment Plant (WWTP)**.

The treatment of sewage involves a systematic approach comprising three main stages: **Primary Treatment**, **Secondary Treatment**, and **Tertiary Treatment**. Each of these steps plays a crucial role in transforming harmful wastewater into a safer resource.



## 1. Primary Treatment: Removing Solid Waste

The primary treatment stage focuses on removing physical impurities and solid waste materials from the sewage. This process is divided into three sub-stages:

**(i) Screening:** The first step, screening, involves removing large objects and materials that can damage or clog the machinery in subsequent treatment stages. Sewage is passed through screens of vertical bars designed to filter out items such as:

- Coins
- Rags
- Sticks
- Plastic packets

These objects are collected and disposed of, often in landfills. The type of screen used can vary, ranging from bar screens to mesh screens with different sizes, to effectively capture and remove solids. This step ensures that only smaller particles move forward in the treatment process.

**(ii) Grit Removal:** After screening, the wastewater enters the grit chamber, where the flow rate is carefully adjusted. The aim is to slow down the water enough to allow heavier materials, such as:

- Sand
- Grit
- Stones
- Broken glass to settle at the bottom.

These particles are removed because they can cause severe damage to the pumps and other machinery. This stage ensures the safety and efficiency of the treatment plant's equipment.

**(iii) Sedimentation:** In this step, the wastewater flows into large sedimentation tanks, where solids settle due to gravity. The heavier, solid waste material at the bottom is referred to as sludge, while lighter impurities such as oil and grease, collectively known as scum, float on the surface.

- **Sludge** is collected and removed using pumps from the bottom of the tank.
- **Scum** is skimmed off the surface for proper disposal.

This process effectively separates solid impurities from the liquid, preparing the wastewater for further biological treatment.

## 2. Secondary Treatment: Biological Decomposition

The secondary treatment stage focuses on decomposing the organic, biological content of sewage. This process primarily relies on the activity of aerobic bacteria that break down organic matter in the presence of oxygen.

- The wastewater is transferred to aeration tanks, where air is continuously blown to maintain oxygen levels. This speeds up the activity of bacteria, allowing them to digest and decompose organic waste effectively.

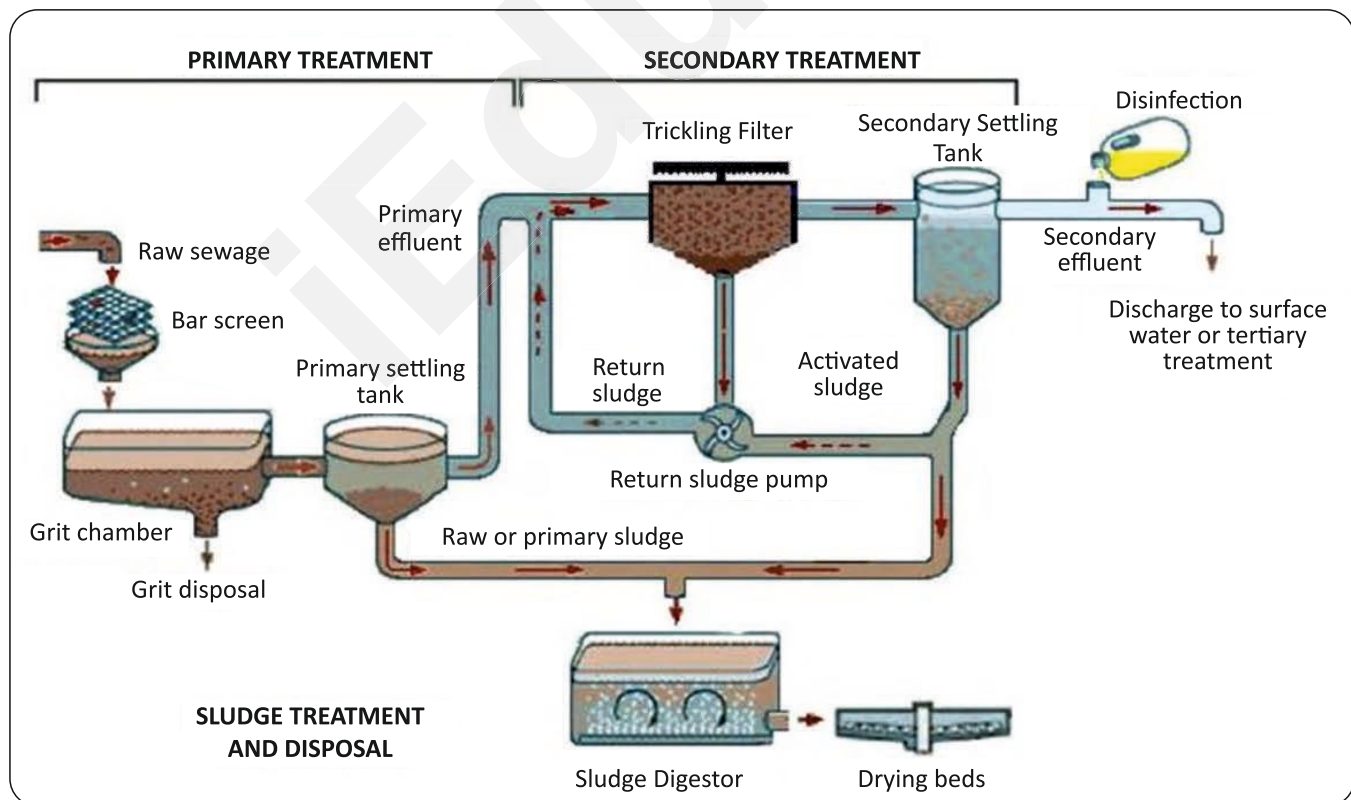
- This process, known as digestion, produces biogas as a byproduct. Biogas is a renewable energy source that can be harnessed as a fuel, contributing to the energy efficiency of the treatment plant.

This stage ensures that most of the harmful biological contaminants are neutralized, making the water significantly safer.

### 3. Tertiary Treatment: Chemical and Disinfection Processes

In the final stage of treatment, water undergoes chemical disinfection to remove any remaining microorganisms or chemical pollutants. The specific treatments applied depend on the composition of water after secondary treatment.

- Water is disinfected using chlorine, a powerful chemical that kills bacteria, viruses, and other pathogens. Alternatively, the water may be exposed to ultraviolet (UV) rays, which effectively eliminate disease-causing microorganisms without adding chemical residues.
- After disinfection, the treated water is ready to be released into natural water bodies, such as rivers, lakes, or seas. In some cases, it can be reused for agricultural or industrial purposes, depending on the treatment quality.



## Uses of Treated Water and Sludge

Treated water and sludge derived from wastewater treatment processes have immense utility and can contribute significantly to various sectors. On the other hand, sludge, which is the residual byproduct of chemical, biological, and physical treatment of municipal and industrial wastewater, is a valuable resource due to its rich composition. The following are the key uses of treated water and sludge:

### 1. Fertilizer and Landfill Applications

- Sludge is rich in nutrients and organic content, making it highly suitable for use as fertilizer in agriculture. It enhances soil fertility and improves crop yields by supplying essential nutrients.
- In addition to fertilization, treated sludge can also be used as landfill material. It helps in land reclamation projects and aids in restoring degraded or barren lands.

### 2. Improvement of Soil Quality

- Sewage sludge and wastewater effluents serve as an excellent source of organic matter, which is critical for soil health. The organic content in sludge enhances the physical structure of the soil, making it more porous and better able to retain moisture and nutrients.
- The nutrients present in treated sludge, including nitrogen and phosphorus, are essential for plant growth and contribute to sustainable farming practices.

### 3. Biogas Production and Energy Generation

- Treated sludge can be used as a raw material for biogas production. The anaerobic digestion of sludge generates biogas, which is a renewable energy source.
- Biogas can serve as a clean-burning fuel for cooking, heating, and industrial applications. Additionally, it can be converted into electricity, providing an eco-friendly energy solution that helps reduce dependence on fossil fuels.

## Let's recall what we know

### Apply Concept in Context

Apply

- How does a wastewater treatment plant help in reducing water pollution? Provide examples of how untreated water affects rivers, lakes, and marine life.
- If wastewater is not treated before being released into the environment, how might it affect public health and ecosystems?

**Skills Covered:** Critical thinking, Applicative thinking, Brainstorming

### Examine Further

Analyse

What will happen if untreated wastewater is discharged into a river near a community?

Provide your answer in relation to waterborne diseases, aquatic life, and contamination of drinking water sources.

**Skills Covered:** Critical thinking, Analytical thinking, Brainstorming, Research, Investigation

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## Self-Assessment Questions

Evaluate

- What is a wastewater treatment plant, and why is it important for managing water pollution?
- Name the primary stages of wastewater treatment and describe their purpose.
- How does the removal of solid waste differ from the removal of harmful chemicals in wastewater treatment?

What are the advantages of treating wastewater before releasing it into the environment?

**Skills Covered:** Research, Observation, Recall

**Bloom's  
Taxonomy**

## Creative Insight

Create

Wastewater treatment ensures that harmful contaminants are removed before the water is released back into the environment, protecting ecosystems and public health. The treatment process involves various stages, such as preliminary screening, sedimentation, and disinfection.

**Task:** Create a flowchart showing the stages of wastewater treatment with brief descriptions of each stage (e.g., screening, primary treatment, secondary treatment, tertiary treatment) and their importance.

**Skills Covered:** Research, Creativity, Observation, Brainstorming

## Better Housekeeping Practices, Sanitation and Diseases

The teacher stands at the front of the classroom with a broom in one hand and a poster showing clean and dirty neighborhoods.





## Ensuring Proper Disposal of Household Waste

Proper waste disposal at home is crucial for maintaining clean water systems and preventing environmental pollution. Below are some detailed guidelines on how to responsibly manage household waste to avoid damaging sewage systems and ecosystems:

### 1. Disposal of Cooking Oils and Fats

- Cooking oil, grease, and other fats should never be poured down the drains, as they tend to solidify and clog the pipes, leading to severe blockages in the plumbing system.
- Instead, these substances should be carefully collected and discarded in waste bins. Pouring them into open drains is also harmful, as it blocks soil pores, which are essential for filtering water naturally. This can lead to reduced soil filtration capacity and contribute to waterlogging and contamination.

### 2. Handling Solid Waste

- Solid waste such as used tea leaves, food scraps, and other organic material should not be thrown into drains. These items can accumulate and cause blockages in the drainage system, leading to overflow and unhygienic conditions.
- Such waste should be segregated and composted if possible, or disposed of in designated trash bins to ensure it does not interfere with water flow.

### 3. Safe Disposal of Chemicals and Hazardous Substances

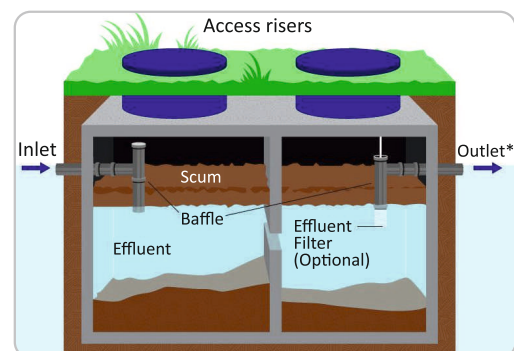
- Household chemicals, including cleaners, grease, paints, beauty products, and unused medicines, should never be poured down the drains. These substances can destroy beneficial microorganisms in the water treatment process, which play a vital role in purifying water naturally.
- Instead, they should be taken to hazardous waste collection centers or disposed of according to the guidelines provided for chemical waste, ensuring minimal environmental impact.

## Alternative Methods of Sewage Disposal

To maintain hygiene and prevent exposure to harmful waste, every community must adopt a reliable method to dispose of sewage safely. Onsite sewage systems are an effective solution, ensuring that sewage is managed in a way that it cannot come into contact with people, animals, or pests. Some common methods of sewage disposal include:

### 1. Septic Tank:

A septic tank is a simple yet effective structure made of concrete or steel. It acts as a container where wastewater flows in from one side. Inside the tank, the solid waste settles at the bottom, and the lighter waste floats to the top. Natural bacterial processes treat the waste in the tank. The treated water is then released through an outlet at the other end, often into a drainage field or soak pit. Septic tanks are commonly used in rural areas or places without access to centralized sewage systems.





## 2. Vermicomposting:

Vermicomposting is a natural and eco-friendly method of disposing of organic waste. This process involves using specific types of worms, such as red wigglers, white worms, and earthworms, to decompose organic materials like vegetable peels, fruit waste, and garden clippings. The worms produce vermicast, also known as worm humus or worm manure, which is rich in water-soluble nutrients. This organic fertilizer can be used to enhance soil quality in farms or gardens. However, items like meat, dairy products, fats, and oils should not be included in vermicomposting.



## 3. Landfill:

Landfills are large pits or unused voids where waste is buried. In these oxygen-free environments, bacteria break down the organic waste. This process generates gases, primarily methane, which can either be burned off or collected and used to produce electricity in gas engines. Properly managed landfills are a sustainable way to dispose of waste while also generating renewable energy. However, poorly managed landfills can lead to groundwater contamination and release harmful gases into the atmosphere.



## Sanitation and Its Impact on Health

### Effects of Poor Sanitation

1. **Spread of Diseases:** Inadequate sanitation facilities lead to water contamination by human waste, directly contributing to the spread of infectious diseases.
2. **Health Risks:** Open defecation and improper waste disposal introduce harmful microbes into the environment, causing waterborne illnesses.

### Common Diseases Linked to Poor Sanitation:

1. **Waterborne Illnesses:** Contaminated water often leads to diseases like cholera, typhoid, hepatitis, polio, and diarrhoea.
2. **Vector-Borne Diseases:** Poor sanitation creates breeding grounds for mosquitoes and other vectors, increasing the prevalence of diseases like malaria and dengue.

### The Role of Clean Water:

1. **Disease Prevention:** Access to clean water is essential for reducing the risk of waterborne diseases and maintaining overall health.
2. **Hygiene and Sanitation:** Clean water is vital not only for drinking but also for hygiene, cooking, and cleaning. It ensures a healthier environment and supports community well-being.

## Let's recall what we know

### Apply Concept in Context

Apply

- How do proper waste disposal and cleanliness reduce the spread of diseases? Provide examples of practices like segregation of waste, regular cleaning, and use of dustbins.
- If a community fails to maintain proper sanitation, how might it affect the health and well-being of its residents?

**Skills Covered:** Critical thinking, Applicative thinking, Brainstorming

### Examine Further

Analyse

What happens if waste is not properly segregated or disposed of? Discuss in relation to environmental pollution, breeding of disease-causing vectors, and contamination of water sources.

**Skills Covered:** Critical thinking, Analytical thinking, Brainstorming, Research, Investigation

### Self-Assessment Questions

Evaluate

- What are better housekeeping practices, and why are they essential for maintaining hygiene?
- Name three ways to improve sanitation and provide examples of how they help prevent diseases.
- How does improper waste management contribute to diseases like dengue and cholera?
- What are the benefits of maintaining clean surroundings compared to living in unhygienic conditions?

**Skills Covered:** Research, Observation, Recall

### Creative Insight

Create

Better housekeeping practices and sanitation ensure a clean and safe environment, reducing the spread of diseases like malaria, cholera, and typhoid. Proper sanitation methods, such as waste segregation, regular cleaning, and preventing open defecation, are essential for community health.

**Task:** Create a poster illustrating the link between poor sanitation and diseases, with practical tips for better housekeeping practices to improve public health.

**Skills Covered:** Research, Creativity, Observation, Brainstorming

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**Bloom's  
Taxonomy**

# SUMMARY



## Sewage

Sewage is wastewater from homes, industries, and agriculture, containing impurities like organic matter, chemicals, nutrients, and microorganisms.

### Key Characteristics

- **Sources:** Toilets, kitchens, and industries.
- **Types of Contaminants:**
- **Organic Impurities:** Animal waste, kitchen waste, oil, and grease.
- **Inorganic Impurities:** Metals, phosphates, and nitrates.
- **Nutrients:** Nitrogen and phosphorus compounds.
- **Microorganisms:** Bacteria, protozoa, and viruses that cause diseases.
- **Examples of Sewage Composition:**
- **Animal Waste:** Can spread diseases like cholera.
- **Kitchen Waste:** Increases biological oxygen demand (BOD), affecting aquatic life.
- **Heavy Metals:** Toxic elements like lead and mercury from industrial waste.

## Wastewater Treatment Plant (WWTP)

A facility that cleans sewage by removing contaminants before releasing it into the environment.

### Key Stages of Treatment

- **Preliminary Treatment:** Removal of large debris (plastic, grit).
- **Primary Treatment:** Sedimentation tanks separate solids from liquid sewage.
- **Secondary Treatment:** Microorganisms decompose organic impurities in aeration tanks.
- **Tertiary Treatment:** Advanced filtration and chemical processes remove Microorganisms and pathogens.

## Location and Design

- Built in low-lying areas to utilize gravity for sewage flow.
- Designed to ensure treated water is safe for reuse or discharge.

### Outcomes:

- Cleaned water is released into rivers or oceans.
- Solid waste (sludge) is treated further or used as compost/fuel.

## Better Housekeeping Practices, Sanitation, and Diseases

### Better Housekeeping Practices:

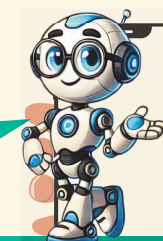
- Proper disposal of kitchen waste, grease, and chemicals prevents blockages in sewer systems.
- Avoiding littering and using dustbins reduces pollution and keeps surroundings clean.
- Sanitation and Its Role in Health:
- Inadequate sanitation leads to the spread of diseases like cholera, typhoid, and dysentery.
- Maintaining clean toilets and wastewater systems prevents contamination of water sources.

### EeeBee: Your AI Buddy

Explore! **Wastewater Story**  
with EeeBee AI Buddy.

Hi Friend! Use prompts to ask me questions about the chapter we just finished! eeee, lets go!

Start by  
Scanning this  
QR Code:





Gap Analyzer™  
Take a Test



# EXERCISE

That turn curiosity into confidence—let's begin!



## A. Choose the correct answer.

- What is the main purpose of a wastewater treatment plant?  
(a) Generate electricity ☐ (b) Remove impurities from sewage ☐  
(c) Increase water flow ☐ (d) Produce heavy metals ☐
- Which of the following is an example of an organic impurity in sewage?  
(a) Nitrate ☐ (b) Oil and grease ☐  
(c) Heavy metals ☐ (d) Phosphates ☐
- What is the first step in a wastewater treatment process?  
(a) Tertiary treatment ☐ (b) Aeration ☐  
(c) Preliminary treatment ☐ (d) Sedimentation ☐
- What disease is commonly caused by drinking untreated water?  
(a) Typhoid ☐ (b) Diabetes ☐  
(c) Malaria ☐ (d) Hypertension ☐
- Which practice helps reduce blockages in sewage systems?  
(a) Disposing of grease in sinks ☐ (b) Proper waste segregation and disposal ☐  
(c) Leaving litter in open drains ☐ (d) Dumping plastics into toilets ☐

## B. Fill in the blanks.

- Sewage is a mixture of wastewater from \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ sources.
- In wastewater treatment plants, \_\_\_\_\_ treatment involves the removal of large debris.
- The spread of diseases like cholera and typhoid can be prevented by maintaining good \_\_\_\_\_.
- The presence of nitrates in water can cause \_\_\_\_\_ in infants.
- A \_\_\_\_\_ helps in accessing underground sewers for cleaning and maintenance.

## C. Write True or False.

- Sewage includes only water from households.
- Bacteria in sewage can cause waterborne diseases.
- Untreated wastewater improves the quality of rivers and lakes.
- Proper sanitation prevents vector-borne diseases like dengue.

#### D. Define the following terms.

1. Sewage
2. Wastewater Treatment Plant (WWTP)
3. Organic Impurities
4. Sanitation
5. Manhole

#### E. Match the columns.

##### Column A

1. Sewage
2. Preliminary Treatment
3. Secondary Treatment
4. Tertiary Treatment
5. Better Housekeeping Practices

##### Column B

- (a) Includes bacteria, viruses, and protozoa
- (b) Removal of large debris
- (c) Breakdown of organic impurities
- (d) Advanced filtration and pathogen removal
- (e) Reduces blockages in sewers

#### F. Give reasons for the following statements.

1. Proper wastewater treatment reduces the spread of waterborne diseases.
2. Regular maintenance of sewage systems prevents environmental pollution.
3. Manholes are necessary for inspecting underground sewers.
4. Poor sanitation increases the risk of vector-borne diseases.
5. Nitrates in sewage can contaminate drinking water, causing health risks.

#### G. Answer in brief.

1. What are the main components of sewage?
2. How does a wastewater treatment plant clean sewage?
3. Why is it important to maintain a clean and functional sewage system?
4. What is the role of better housekeeping practices in sanitation?
5. How does untreated sewage affect aquatic life?

#### H. Answer in detail.

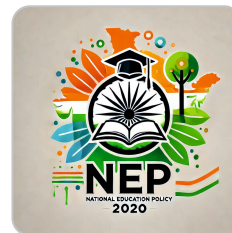
1. Describe the stages of a wastewater treatment plant, from preliminary to tertiary treatment.
2. Explain the role of better housekeeping practices in reducing sewage-related issues.
3. Discuss the health hazards caused by poor sanitation and how to prevent them.
4. Describe the composition of sewage and explain how each component impacts the environment.





**21st Century Skills!**

The policy focuses on coding, data science, AI, robotics, and entrepreneurship, ensuring you are future-ready.



## Skill-based Activity



### Explore Wastewater and Treatment Process

**STEM**

Perform the given activity at your home to understand how wastewater is treated to remove impurities.

You will need a jar, sand, gravel, cotton, and muddy water.

- Take a clear jar and layer it with cotton at the bottom, followed by gravel and sand.
- Pour muddy water through this setup to mimic basic filtration.
- Observe how the sand and gravel filter out impurities from the water.
- Compare this simple filtration process to the stages of treatment in a Wastewater Treatment Plant (WWTP).

Now, answer the following questions:

- What is sewage, and how is it different from wastewater?
- Why are multiple stages needed in a wastewater treatment process?
- How does wastewater treatment contribute to environmental health?

**Skills Covered:** Observation, Analytical thinking, Logical thinking, Brainstorming

### Components of a Sewage System Model

**Art**

Create a 3D model of a sewage system using craft materials:

- Include key components such as household drains, sewers, manholes, pumping stations, and a wastewater treatment plant (WWTP).
- Use additional materials to show impurities like organic and inorganic waste.
- Label each part clearly and write a description of its function in your notebook.

**Skills Covered:** Creativity, Analytical thinking, Organization, Brainstorming

## Sewage Management in Action!

### Group Activity

Students can explore how sewage is managed in their community.

- Collect information on the sewage infrastructure, such as drains and manholes.
- Experiment with a small setup that mimics sewage flow, using water pipes and gravity flow systems.

**Skills Covered:** Critical thinking, Logical thinking, Brainstorming, Collaboration, Social skills, Networking

## Factors Influencing Wastewater Flow

### Case to Investigate

Investigate how the following factors affect the flow and treatment of wastewater. Work with your teacher to collect data based on observations or experiments.

Factors	Data Collected
Type of impurities	Organic, inorganic, or microorganisms
Pipe design and gradient	Smooth or blocked flow
Maintenance of sewers	Frequency and methods
Environmental conditions	Heavy rains or blockages

Compile your findings and present them as a report.

**Skills Covered:** Critical and analytical thinking, Research, Brainstorming, Investigation, Communication

## Sustainable Sewage Practices

### Aligning with SDGs

Discuss how modern techniques like decentralized wastewater treatment systems, eco-friendly bioreactors, and water recycling contribute to sustainable sewage management. Reflect on how these practices address challenges like water pollution, disease spread, and resource scarcity.

**Aligned with SDG 6: Clean Water and Sanitation**

**Skills Covered:** Global awareness, Critical thinking, Research, Analytical thinking, Problem-based thinking

## Personalized Sanitation Improvement Plan

### Integrated Learning

Using your knowledge of wastewater management, design a sanitation improvement plan for a local community.

- Suggest better housekeeping practices to reduce contamination.
- Include methods for managing wastewater and promoting hygiene.
- Consider community-specific factors such as population size, available infrastructure, and resources.

**Skills Covered:** Applicative thinking, Critical thinking, Research, Brainstorming, Empathy, Emotional intelligence