

PRACTICAL 3

STUDY OF DRINKING WATER TREATMENT

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- **WHAT IS MEANT BY WATER TREATMENT ?**
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INTRODUCTION

- **Water is one of the basic needs for all living beings to survive on earth.**
- **It is equally important to get pure form of water for drinking, washing and other basic means related to water use.**
- **Thus with the aim of supplying more acceptable form of water for a specific end use the water treatment plants were set up.**
- **This water treatment plants removes the contaminants & unacceptable components or reduce their concentration in water to acceptable limits through various water cleaning process.**

NEED OF WATER TREATMENT

- **Water treatment is any process that improves the quality of water to make it more acceptable for a specific end-use.**
- **The end use may be drinking, industrial water supply, irrigation, river flow maintenance, water recreation or many other uses, including being safely returned to the environment.**
- **This treatment is crucial to human health and allows humans to benefit from both drinking and irrigation use.**

WHAT IS MEANT BY WATER TREATMENT

- Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids, and gases from water.
- The goal is to produce water fit for specific purposes.
- Most water is purified and disinfected for human consumption (drinking water), but water purification may also be carried out for a variety of other purposes, including medical, pharmacological, chemical, and industrial applications.
- The methods used include physical processes , chemical processes and biological processes .

WHAT IS MEANT BY WATER TREATMENT

- In the water treatment process the contaminants are removed by,
UNIT OPERATION : contaminant removal by the physical forces
UNIT PROCESS : contaminant removal by the chemical or biological process
- Before and after the water treatment, the water quality has to be checked.
- Water quality : physical, chemical and biological characteristics.
- Why because whether the treatment meets the standards or not.

WHAT IS MEANT BY WATER TREATMENT

SOURCES OF WATER

Surface sources.

**Ponds and lakes
Streams and rivers
Storage reservoirs
Oceans**

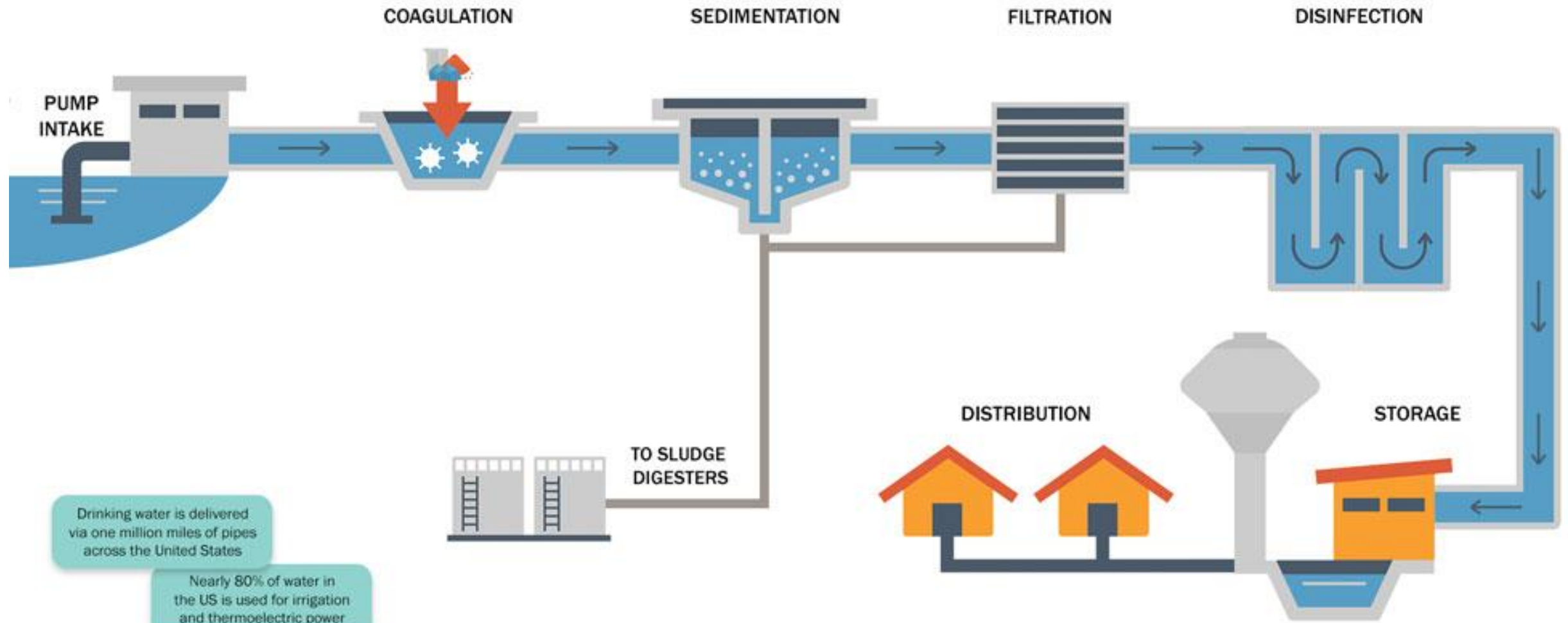
Subsurface / underground sources

**Springs
Infiltration galleries
Infiltration wells
Open wells and tube wells**

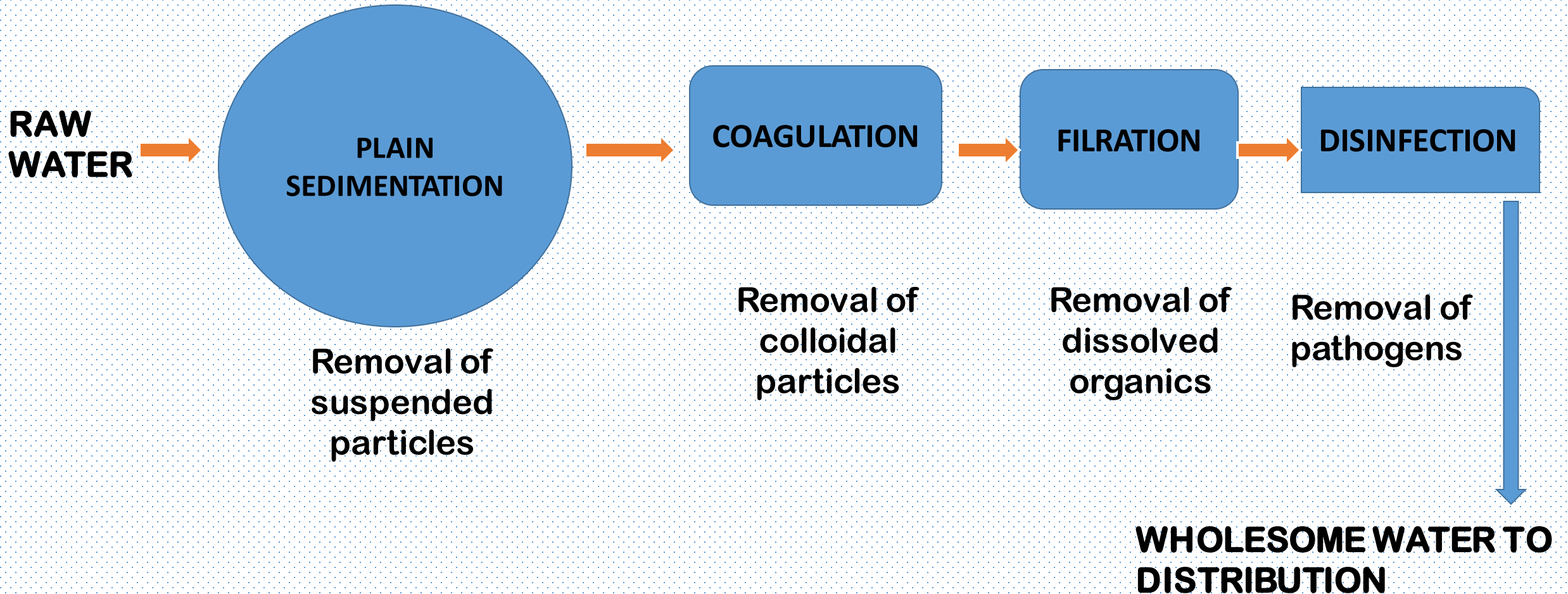
WHAT IS MEANT BY WATER TREATMENT

- The available raw water must be treated and purified before supplied to general public use.
- The extend of purification depends on quality of water.
- The various methods are adopted for purifying public water supply are:
 - Screening
 - Plain sedimentation
 - Sedimentation aided with coagulation
 - Filtration
 - Disinfection
 - Aeration
 - Softening
 - distribution
 - Miscellaneous treatment –
 - Fluoridation
 - Liming
 - Recarbonation
 - Desalination

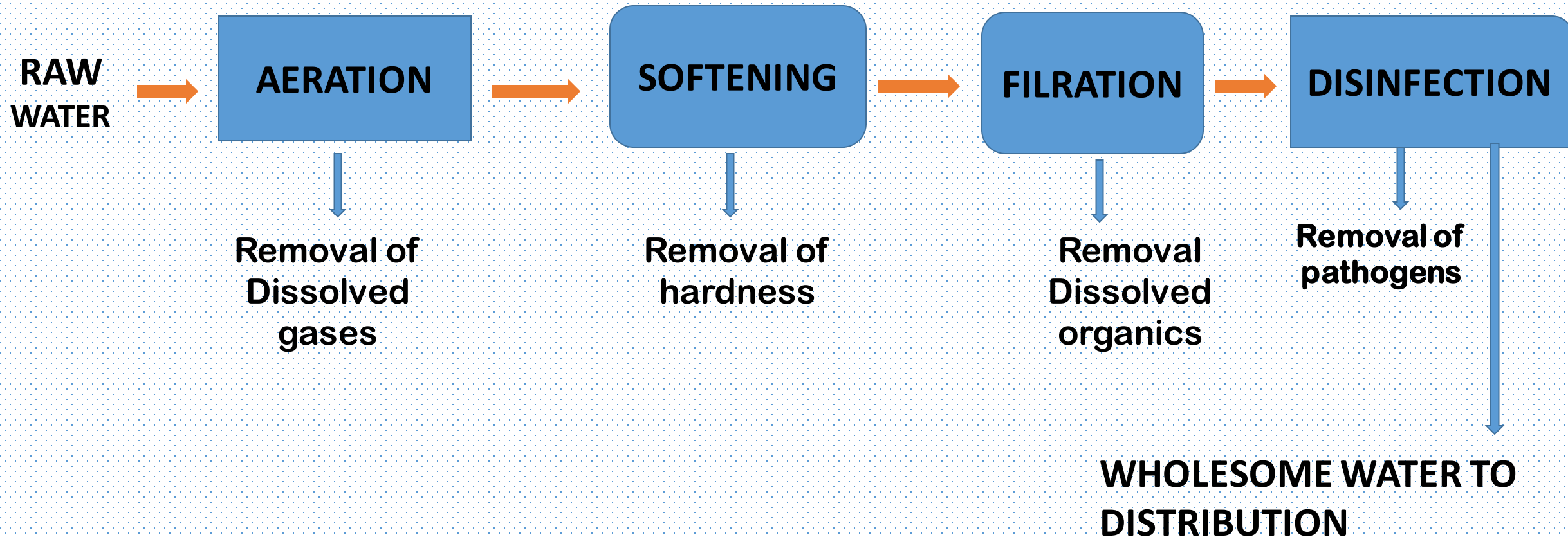
WATER TREATMENT PROCESS



SURFACE WATER TREATMENT



GROUND WATER TREATMENT



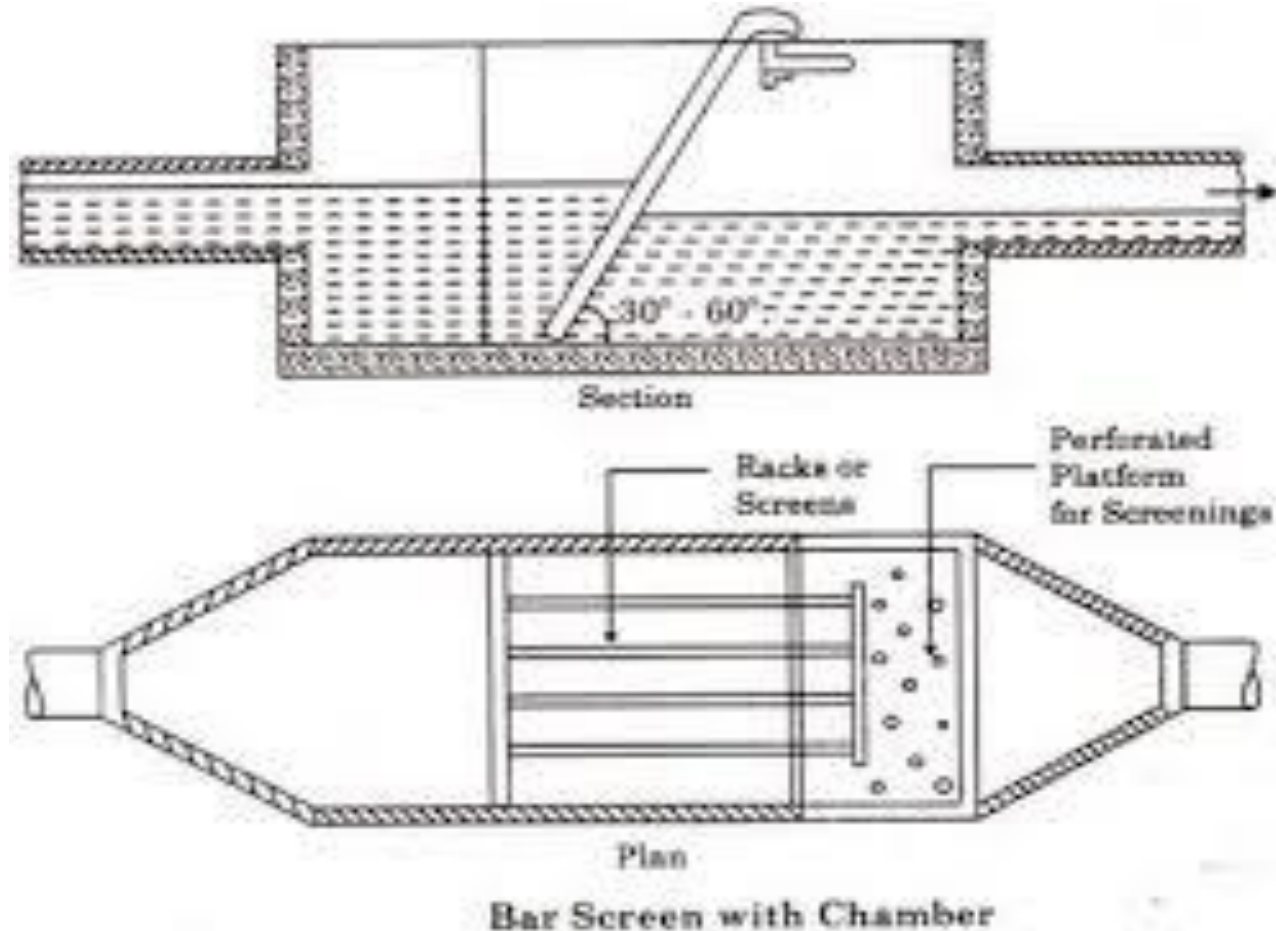
COMPONENTS OF WATER TREATMENT PLANT

SCREENING

- **To protect the main units of a treatment plant and to aid in their efficient operation.**
- **Remove any large floating and suspended solids that are present in the inflow.**
- **These materials include leaves, twigs, paper, rags and other debris that could obstruct flow through the plant or damage equipment.**
- **There are coarse and fine screens**
- **Coarse screens are steel bars spaced 5–15 cm apart, which are employed to exclude large materials (such as logs and fish) from entering the treatment plant, as these can damage the mechanical equipment.**

COMPONENTS OF WATER TREATMENT PLANT

BAR SCREEN



COMPONENTS OF WATER TREATMENT PLANT

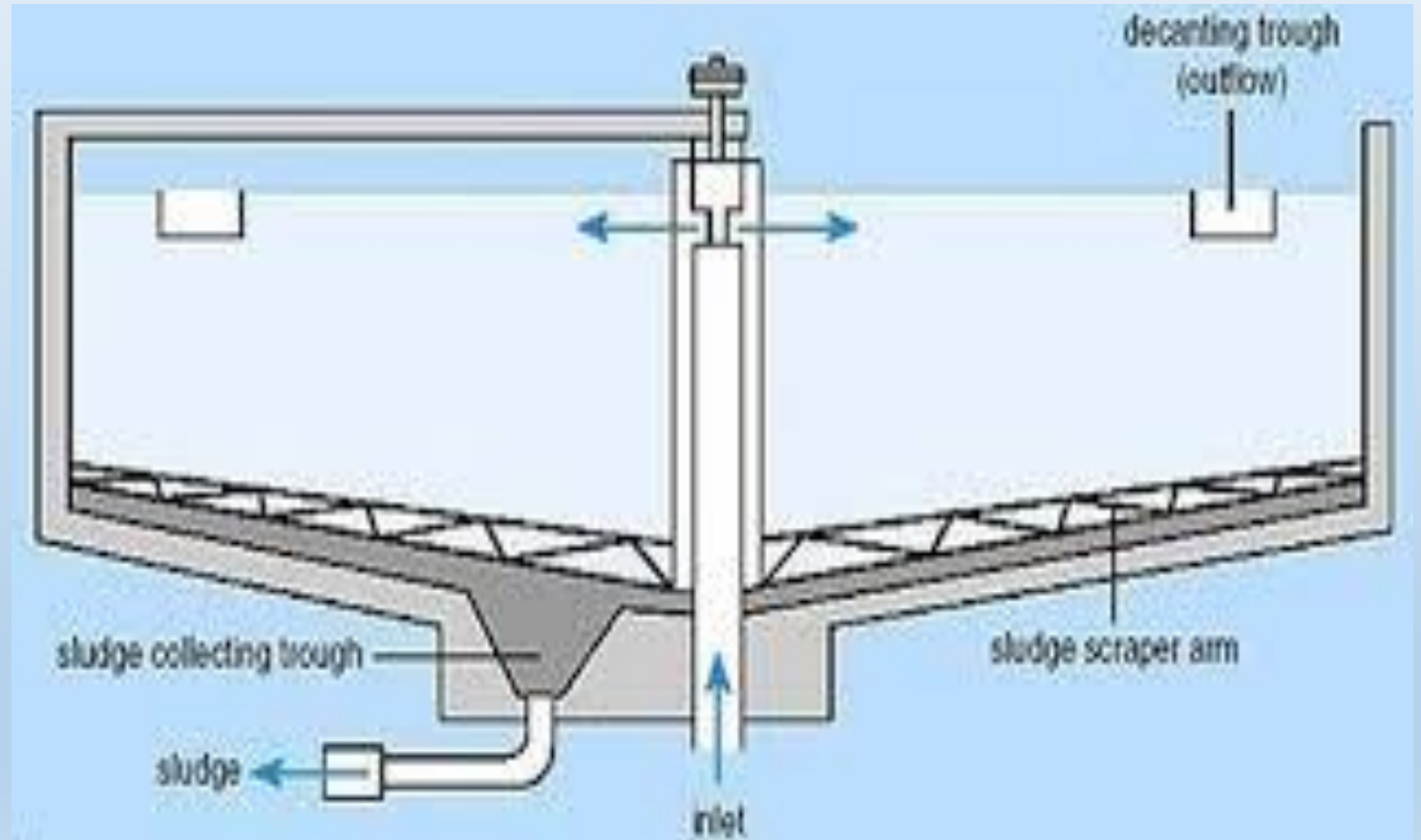
SEDIMENTATION TANK

Plain sedimentation

- To remove suspended particles
- It is the first unit operation
- All the particles whose specific gravity greater than 1 will have a tendency to settle, but turbulence and flow velocity do not allow the particles to settle
- Plain sedimentation - method of removing particles by controlling the turbulence and flow velocity .
- Sedimentation is done by using sedimentation tanks
 - a. horizontal flow rectangular settling tanks
 - b. Radial flow circular settling tanks.

COMPONENTS OF WATER TREATMENT PLANT

CIRCULAR SEDIMENTATION TANK



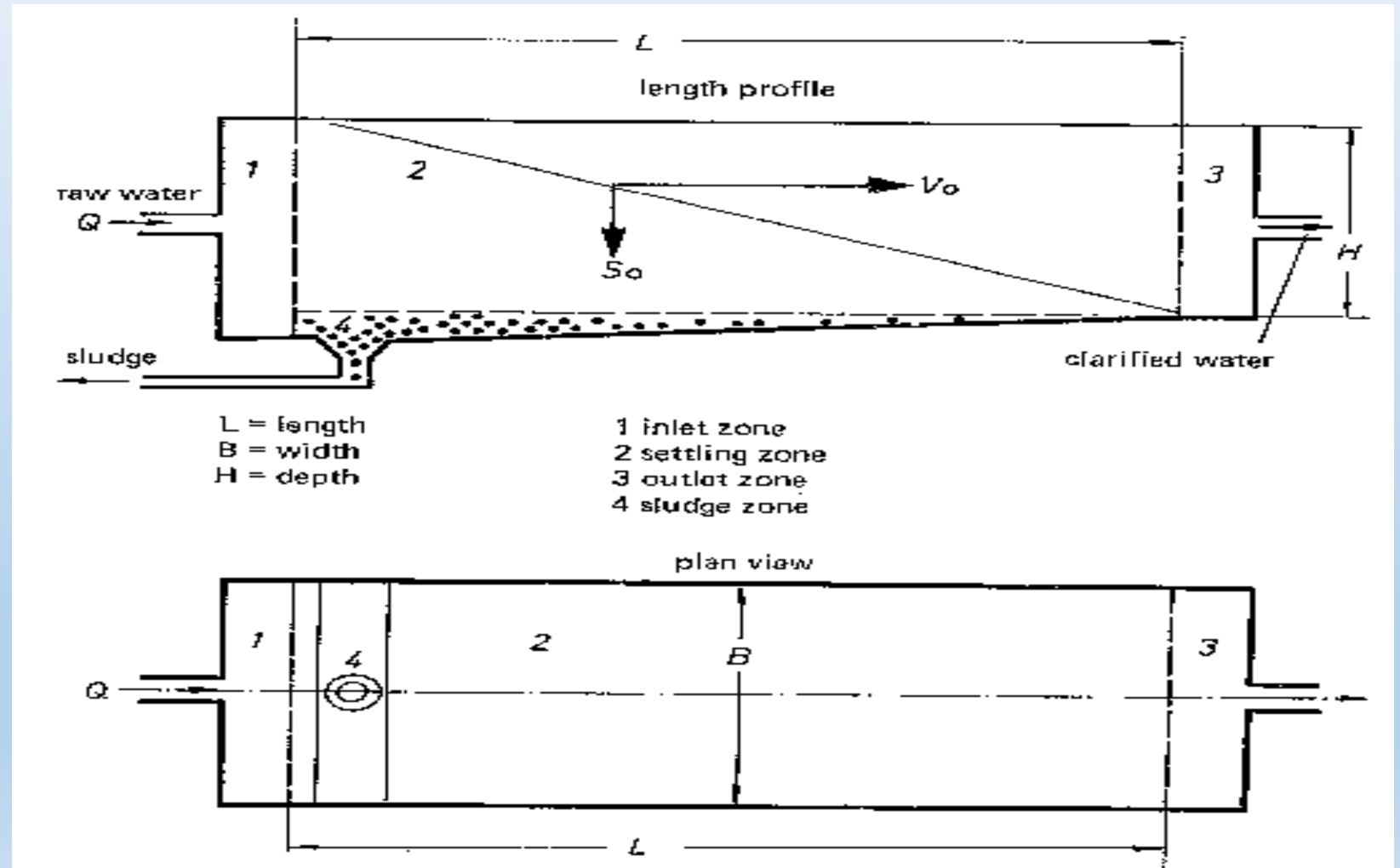
COMPONENTS OF WATER TREATMENT PLANT

CIRCULAR SEDIMENTATION TANK



COMPONENTS OF WATER TREATMENT PLANT

RECTANGULAR SEDIMENTATION TANK



COMPONENTS OF WATER TREATMENT PLANT

**RECTANGULAR
SEDIMENTATION TANK**



COMPONENTS OF WATER TREATMENT PLANT

SEDIMENTATION AIDED WITH COAGULATION

- It is an accelerated sedimentation process.
- Capture of colloidal particles which is escaped during the plain sedimentation.
- Colloidal particles are negatively charged particles , can be removed by coagulation.
- Coagulants are chemical compounds, positively charged- capture colloidal particles by charge neutralization .
- Popular coagulants are
 - > Aluminium sulphate (Alum)
 - > Ferrous sulphate
 - > Chlorinated copperas

COMPONENTS OF WATER TREATMENT PLANT

SEDIMENTATION AIDED WITH COAGULATION

Clariflocculators

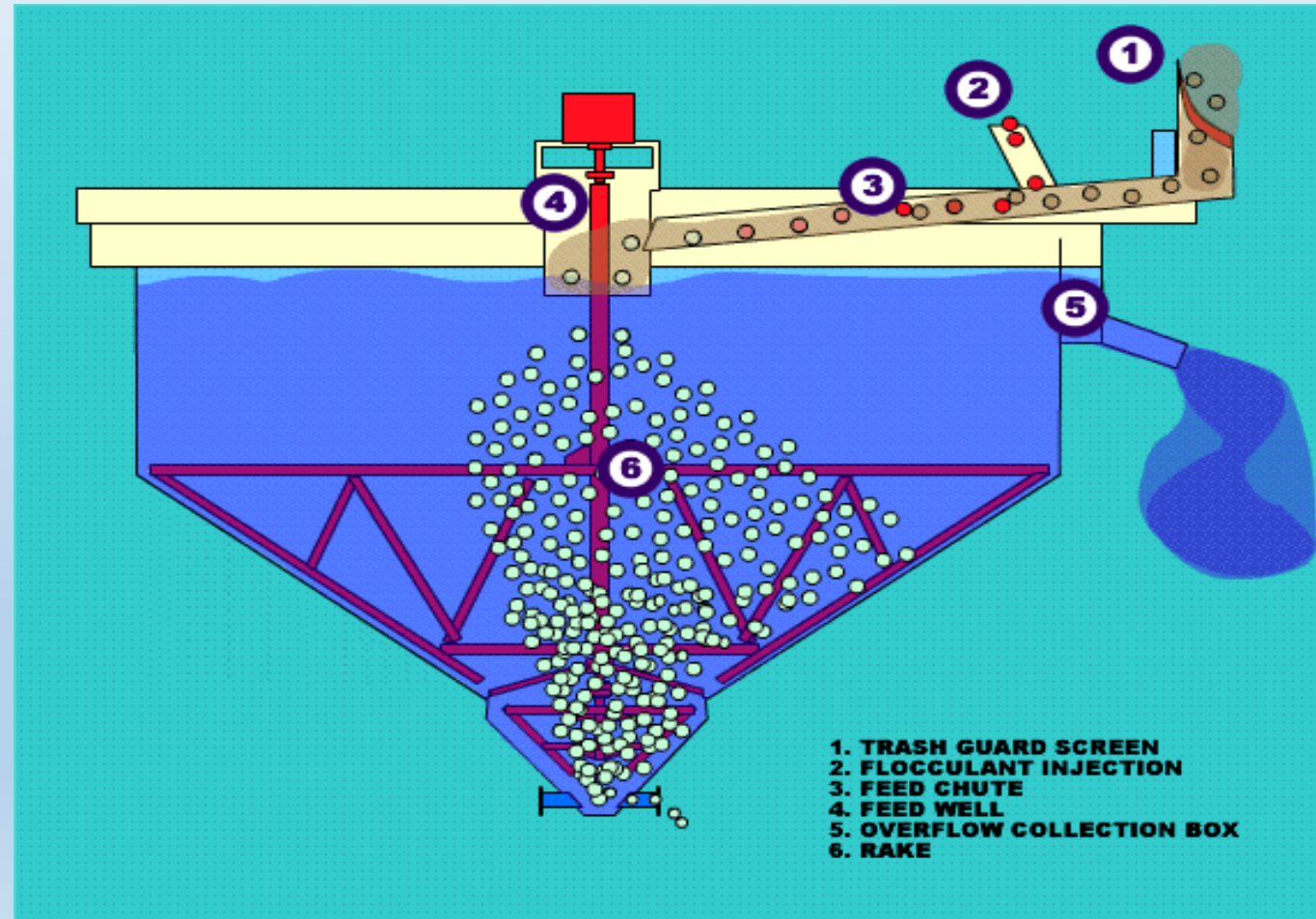
**It is a unit where the coagulation , flocculation and sedimentation takes place.
It consists of:**

- a. Rapid mixing unit (flash mixing unit) : Used for blending coagulant uniformly with water.**
- b. Flocculator (slow mixing unit) : They are used to produce floc.**
- c. Sedimentation tank: Used to capture floc.**

COMPONENTS OF WATER TREATMENT PLANT

SEDIMENTATION AIDED WITH COAGULATION

Clariflocculators



COMPONENTS OF WATER TREATMENT PLANT

FILTER UNIT

Filtration:

It is a method of passing water through a stationary bed of granular media.

Media react and retain the impurities in water and yield impurity free water.

Media such as

- a. Anthracite coal**
- b. Silica sand**
- c. Garnet (green sand)**

Based on the rate of filtration filters can be classified into:

- a Slow sand filter : 100 to 200 litres/ hour/ sq metre**
- b Rapid sand filter : 3000 to 6000 litres/ hour/ sq metre**
- c. Pressure sand filter : 6000 to 15000 litres/ hour/ sq metre**

COMPONENTS OF WATER TREATMENT PLANT

Filtration

Slow sand filter

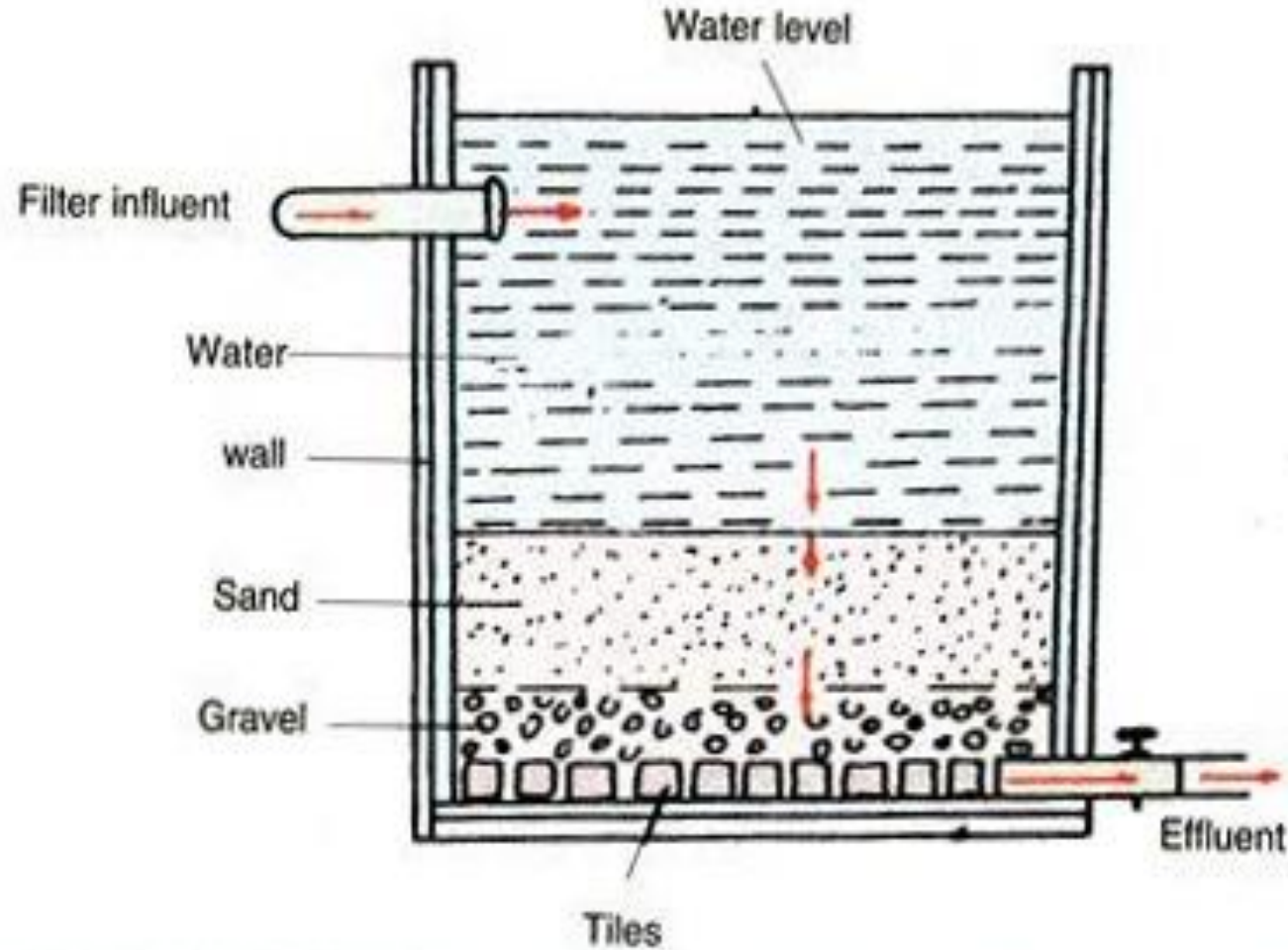


Fig. 31.6 : Diagram of the slow sand filter.

COMPONENTS OF WATER TREATMENT PLANT

Filtration

Slow sand filter

1. Slow sand filter (SSF)

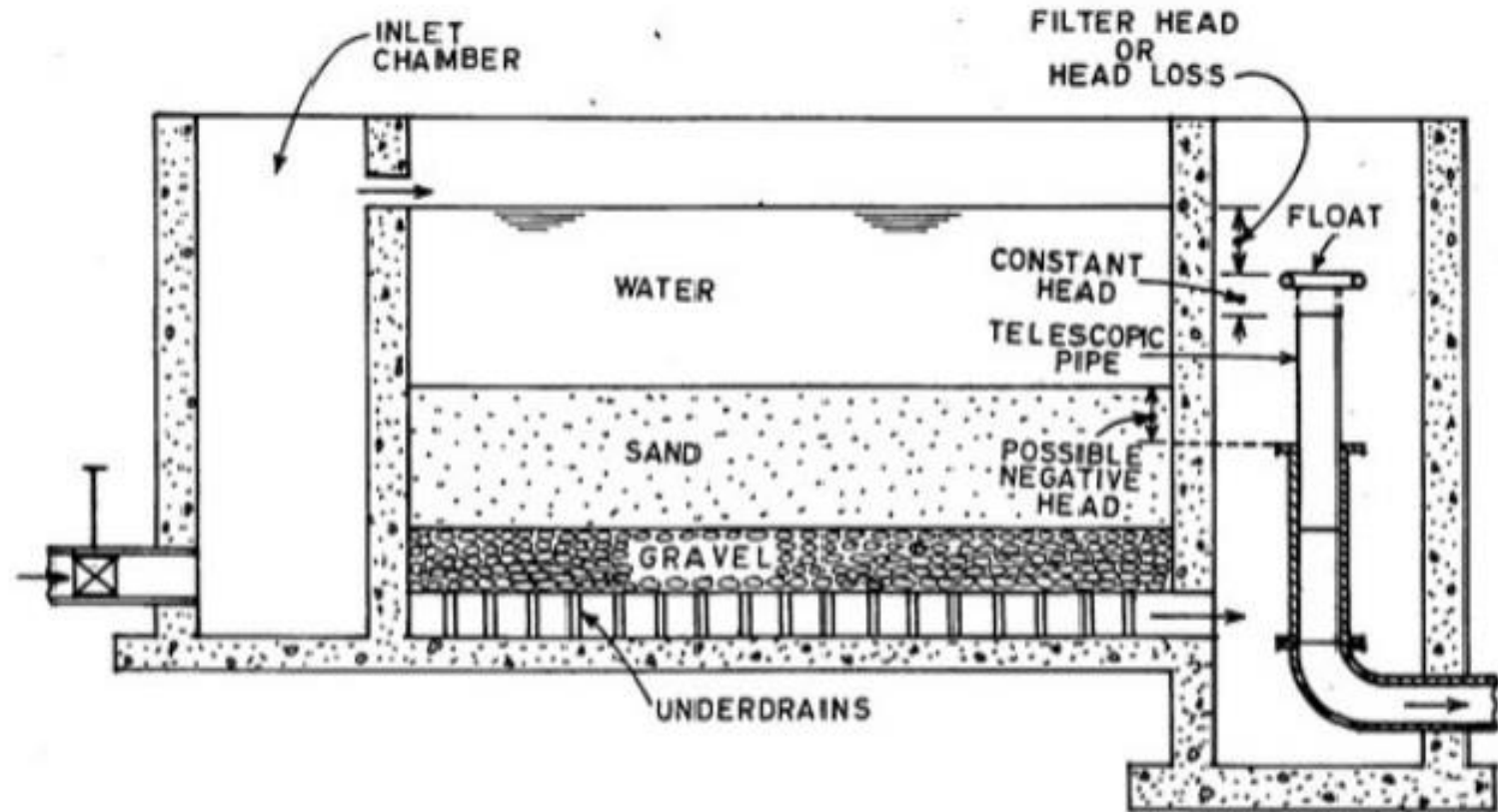


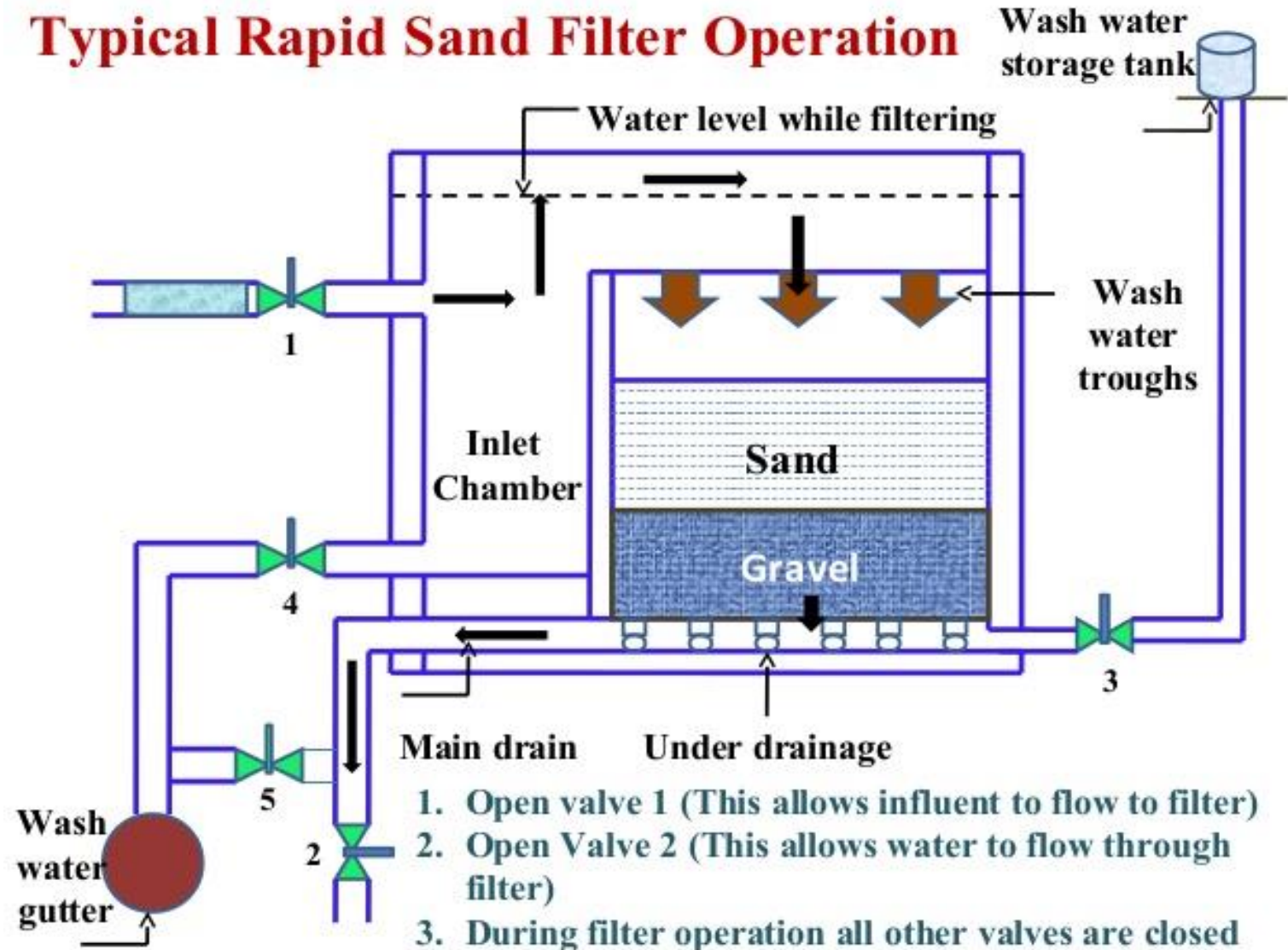
Fig 6.19 Section of slow sand filter (Source: Modi, 1998)

COMPONENTS OF WATER TREATMENT PLANT

Filtration

Rapid sand filter

Typical Rapid Sand Filter Operation



COMPONENTS OF WATER TREATMENT PLANT

DISINFECTION UNIT

Disinfection

- Disinfection is a method of destroying the disease causing bacteria called pathogens from water.
- It destroys existing germs in water and also protect the water from future contamination.
- The substances used to carry out the disinfection is known as disinfectants.
 - > Physical methods for disinfection
 - a. Boiling method
 - b. UV light treatment

COMPONENTS OF WATER TREATMENT PLANT

DISINFECTION UNIT

Disinfection

> Chemical methods for disinfection

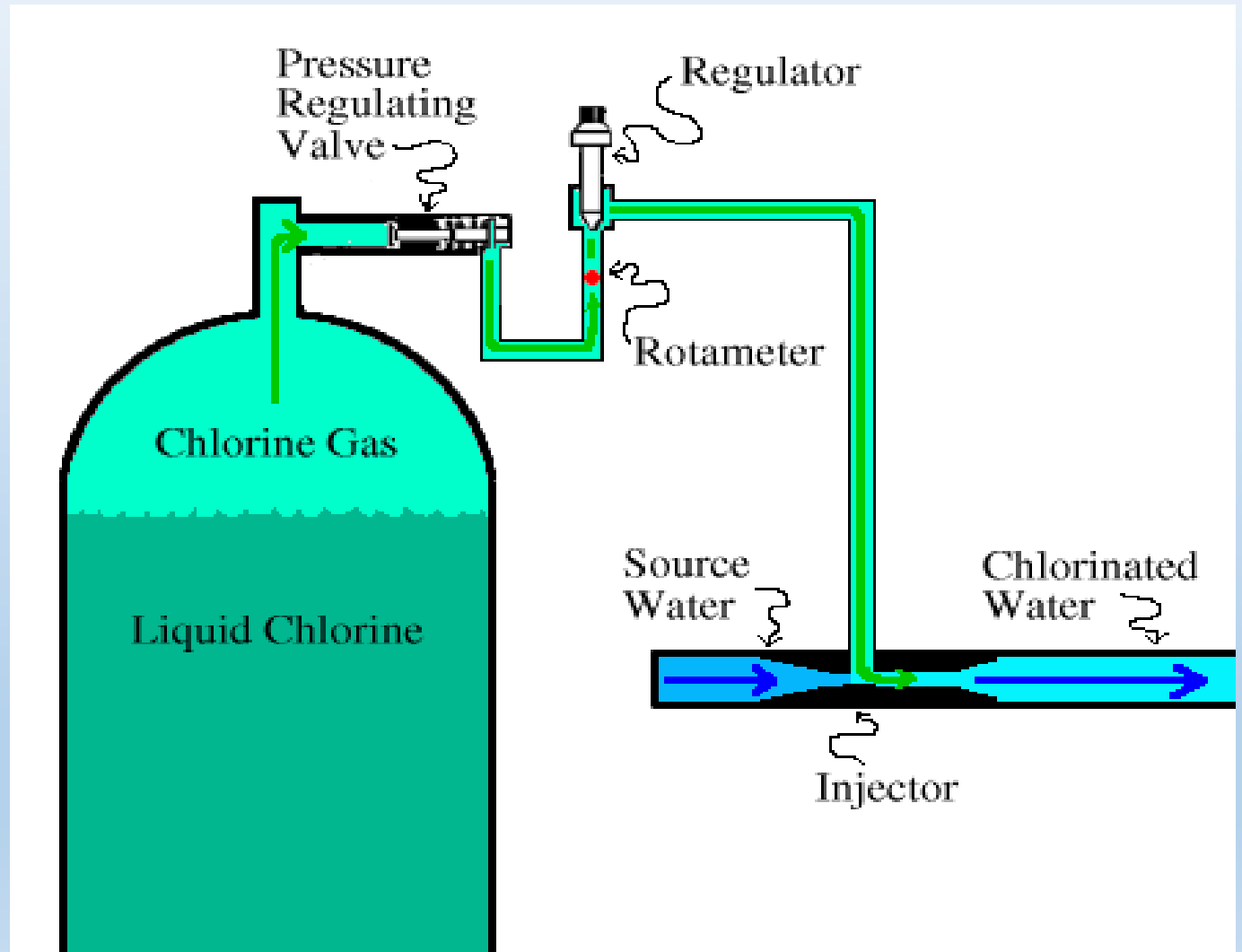
- a. Treatment with excess lime.**
- b. Treatment with metal ions(Silver And Copper).**
- c. Treatment with Potassium permanganate**
- d. Treatment with Ozone.**
- e. Treatment with chlorine**

COMPONENTS OF WATER TREATMENT PLANT

DISINFECTION UNIT

Disinfection

Treatment with chlorine



COMPONENTS OF WATER TREATMENT PLANT

DISTRIBUTION SYSTEM

- **Distribution of treated water is done pipe water distribution system.**
- **Objective of distribution system – to supply water with samee degree ofpurity with minimum residual pressure.**
- **It consists of :**
 - 1.Network of pipes**
 - 2.Pumps**
 - 3.Distribution reservoirs**
 - 4.Valves**
 - 5. Water metres**

CASE STUDY OF WATER TREATMENT PLANT

POINTS HAS TO NOTED FOR PREPARING CASE STUDY

- **LOCATION** of water treatment plant.
- **LAYOUT** of water treatment plant.
- **CAPACITY** of water treatment plant.
- **SOURCE** from which water is collected (River , Lake etc.) and its location details.
- **COMPONENTS** of water treatment plant.
- **LOCALITY** in which water is supplied.

APPENDIX

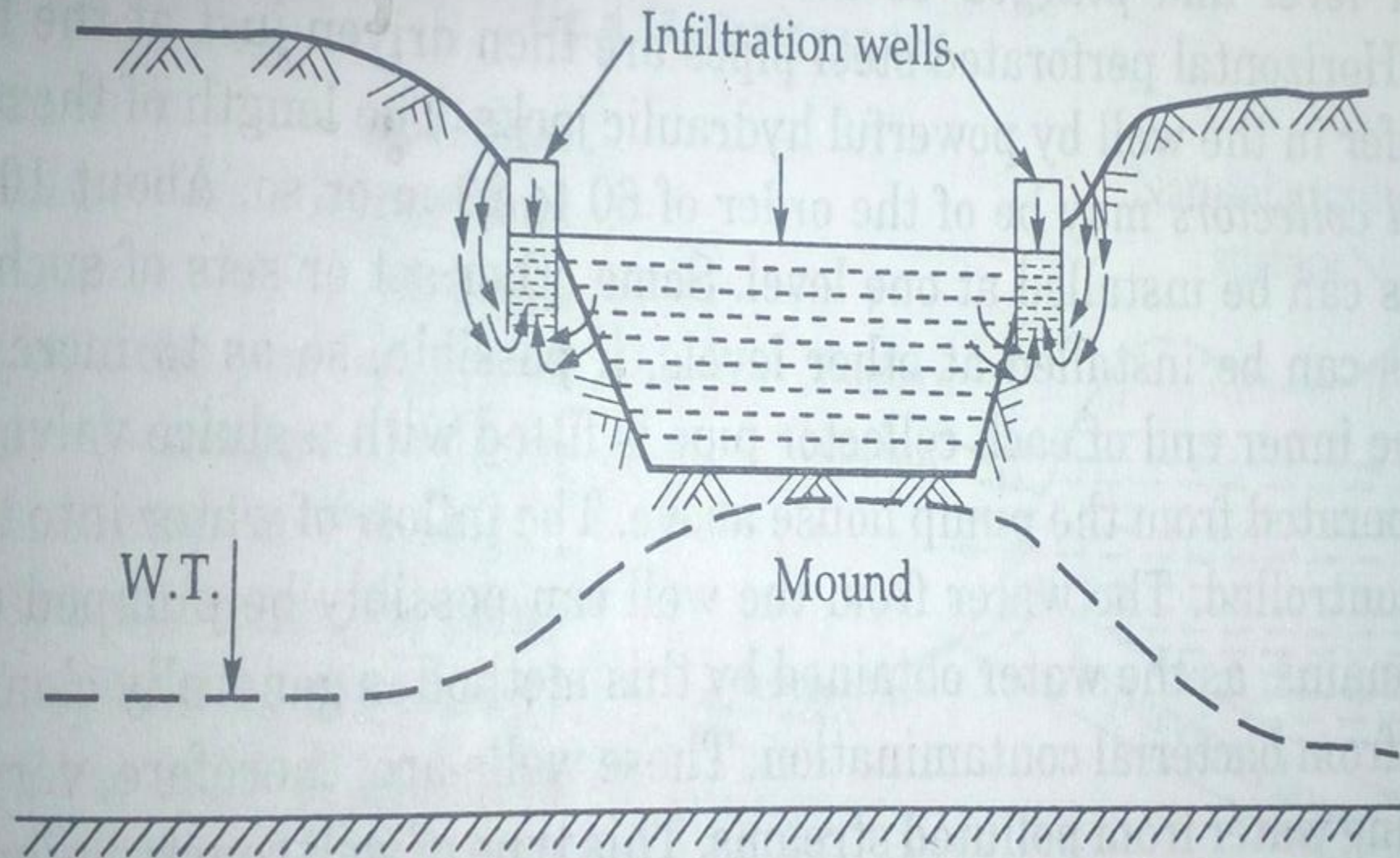


Fig. 4.10. Locations of Infiltration wells.

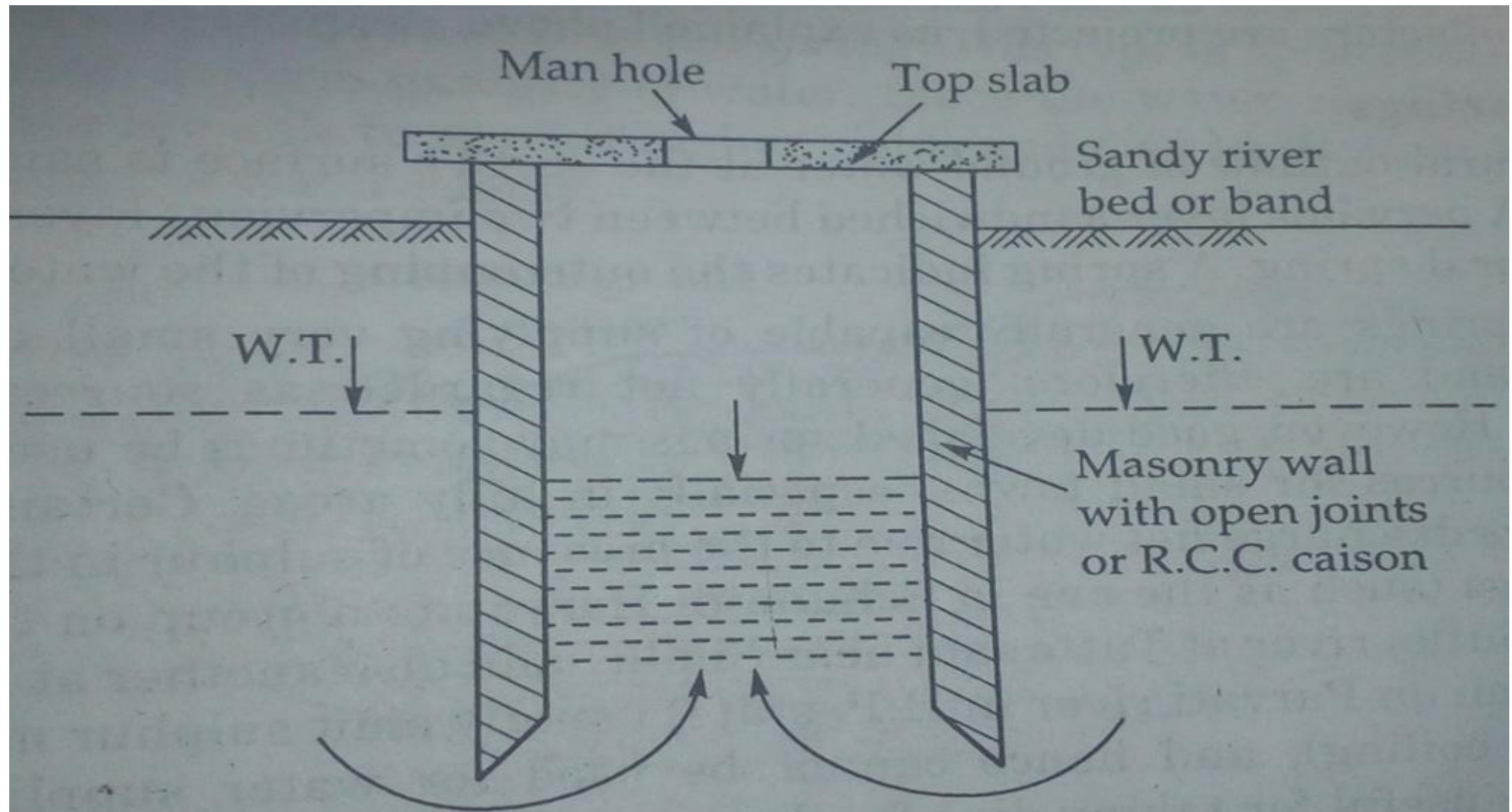


Fig. 4.11. Section of an Infiltration well.

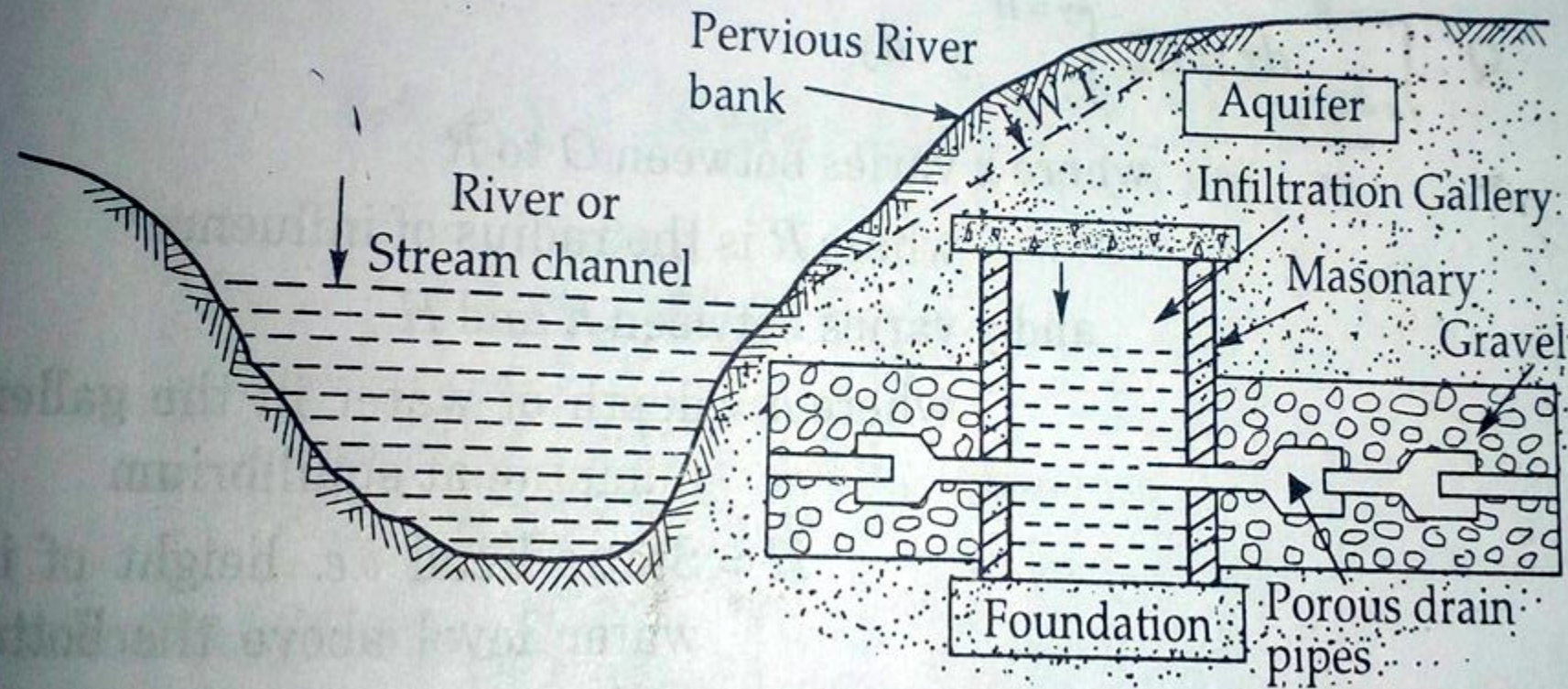


Fig. 4.8. Section of an Infiltration gallery.