Environmental Engineering- II

L-3
Collection and Conveyance of Sewage

Types of collection systems

- Depending upon the type of *waste*, two systems may be employed for its collection, conveyance and disposal :

(a) **Conservancy system**

(b) **Water carriage system.**

CONSERVANCY SYSTEM

- **This is an old system in which various types of wastes, such as night soil, garbage etc. are collected separately in vessels or deposited in pools or pits and then removed periodically at least once in 24 hours.**
- The system is also known as the ***dry system.***

Types of wastes in the conservancy system

- ***1. Night soil -*** Night soils or human excreta in latrines, privies or cesspools etc. is collected separately in pans or pails and carried on heads of sweepers to a central place from where it is transported in bullock carts or motor vans to a place away from the town for its final disposal. Normally, it is buried into ground, in trenches, to give excellent manure in one or two years.

2. Garbage

- Garbage is collected separately, in dust bins and conveyed on hand carts or motor van once or twice is a day.
- It may consist of waste matter of both non-combustible as well as combustible type. The two are therefore sorted out.
- Then it is dumped by suitable method

3. Sullage and storm water

- Sullage and storm water are collected and conveyed separately in closed or open gutters.

Disadvantages of conservancy system

- ***1. Hygiene and sanitary aspect:*** The conservancy system is highly unhygienic and cause insanitary conditions since the excreta starts decomposing within few hours of its production.

2. Transportation aspect:

- Transportation of night soil takes place in open carts through streets and other crowded localities. This is highly undesirable.

3. Labour aspect:

- The working of the system depends entirely on the mercy of labour (sweepers). If they go on strike even for one day for any reason whatsoever, the previes/ lavatories can not be used because of foul smell.
- The whole locality will smell very badly.

4. Building design aspect

- The lavatories or previes are to be located outside the house and slightly away from the main building.
- The compact design is therefore not possible.

5. Conditions of drains

- Insanitation may be there due to carriage of sullage through open drains laid in the streets.

6. Human aspect

- In the present day world, when man has progressed much, it is highly humiliating to ask human beings to transport night soil in pails on their heads.

7. Risk of epidemic

- Due to improper or careless disposal of night soil, there are more chances of. outbreak of epidemic.

8. *Pollution-problems*

- The liquid wastes from lavatories etc., during their washing, may soak in the ground, thus contaminating the soil.
- If the ground water is at a shallow depth, it may also be polluted due to percolation of waste water.

9. Cost consideration

- Though the system is quite cheap in the beginning, its maintenance and establishment costs (i.e. recurring expenditure) are very high

10. Disposal land requirement

- The system requires considerable land for the disposal of sewage.

2. WATER CARRIAGE SYSTEM

- In this system, the collection, conveyance and disposal of various type of wastes are carried out with the help of water.
- Thus, water is used as medium to convey the waste from its point of production to the point of its treatment or final disposal.
- Sufficient quantity of water is required to be mixed with the wastes so that dilution ratio is so great that the mixture may flow just like water.

Advantages of water carriage system

1. Hygienic and sanitary aspect :

The system is very hygienic since the night soil and other waste water is conveyed through closed conduits which are not directly exposed to the atmosphere. There is no bad smell because of continuous flow.

2. Epidemic aspect

- There are no chances of outbreak of epidemic because flies and other insects do not have direct access to the sewage.

3. *Pollution aspect*

- The liquid wastes etc. are directly conveyed through the sewers, and therefore there are no changes of the waste water being soaked in the ground thus contaminating the soil.
- No possibility of groundwater contamination

4. Compactness in design

- Since the latrines are flushed after every use, excreta does not remain and there are no foul smells. The latrines can therefore be attached to the living and bed rooms. This permits a compact design.

5. Labour aspect

- The labour required for the operation and maintenance is extremely small.
- Labour may be required for pumping operations and blockage cleaning

6. *Treatment aspect*

- The system permits the use of modern methods of treatment of the sewerage collected through the sewers. The treated waste water and sewage can be safely disposed off without any risk.

7. Land disposal requirements

- Because of treatment facilities, the land required for the disposal of the treated wastewater is very much smaller than· that required for the conservancy system.

8. Cost consideration

- Though the initial cost of installation of the system are very high, the running costs are very small since manual labour is very much reduced.

Comparison of both the systems

- This has been left to you as a home work

Classification of water carriage system

- The water carriage system can be divided into the following types:

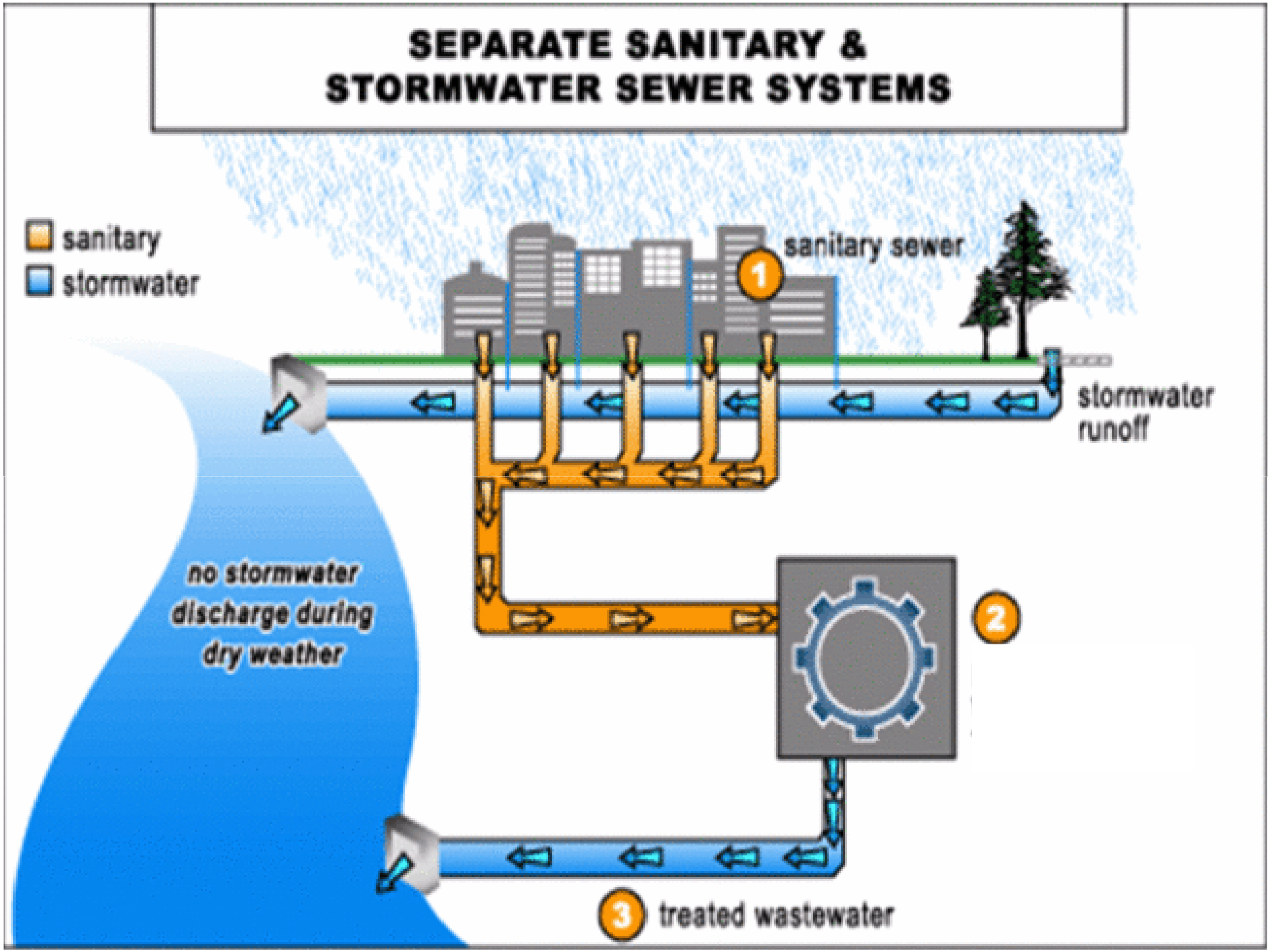
A. **Separate system**
B. **Combined system**
C. **Partially separate system**

A. Separate System

- The separate system provides two separate systems of sewers.
- The one intended for the conveyance of foul sewage only; and
- the other for the rain water, including the surface washing from certain streets, overflow from public baths and foundations etc.

- The sewage from the first system of sewers can be led to the treatment works, while the flow from the second system of sewers can be discharged directly to natural streams etc. without any treatment.


household wastewater
(toilet, sinks, etc.)
catch basin
sewer pipe
storm drain
tunnel


SEPARATE SANITARY &
STORMWATER SEWER SYSTEMS
sanitary
stormwater
sanitary sewer
1
stormwater
runoff
no stormwater
discharge during
dry weather
2
3
treated wastewater

Advantages

1. The cost of installation is low-

The storm water can be disposed off through the open channels along the road sides. Old sewers may also be suitably converted to carry rain water. Thus, the actual sewers carrying foul sewage will be of smaller size.

2. The load on the treatment units will be lowered, since only the foul sewage carried by the separate sewers need be treated.
3. The sewages in the separate system will be of more uniform character, and so will lend itself more easily to putrification.

4. There is no necessity of providing automatic flushing tanks, for use in dry weather, because the flow in a sewer of smaller section is much more efficient.
5. Sewers of smaller section can be easily ventilated than those of larger section.

6. The night flow will be comparatively small this may facilitate operations at the outfall works.
7. Rain water can be discharged into streams or rivers without any treatment.

Disadvantages

1. Since the sewers are of small size, it is difficult to clean
2. They are likely to get chocked.
3. Two sets of sewers may ultimately prove to be costly.
4. There is a likelihood of connections being wrongly made through a confusion of the systems.

5. Storm water sewers or drains comes in use only during the rainy season. During other part of the year, these may serve as dumping place for garbage, and may get chocked.
6. Because of lesser air contact in small size sewers, foul smell may be there due to the sewage gas formed.

B. Combined System

- The combined system provides only one sewer to **carry both the foul sewage as well as the rain water.**
- The sewage and rain water are carried to the sewage treatment plant, before its final disposal.

Advantages

1. The system requires only one set of sewers. Hence **the maintenance costs are reduced.**
2. **The sewers are of larger size, and therefore the chances of their choking are rare**. Also, it is easy to clean them.

3. The **strength of the sewage is reduced** by dilution.
4. There is more air in the larger sewers than in smaller ones of the separate system. Hence the sewer gas that may be formed gets diluted. Thus the chances of foul smell are reduced.

Disadvantages

1. **The cost of construction are very high because of large dimensions** of the sewers to be constructed at sufficient depth to receive the sewage from the basement.
2. Because of large size of sewers, their **handling and transportation is difficult.**
3. Due to the inclusion of the storm water, the **load on the treatment plant increases**.

4. The system is **uneconomical** in the circumstances when **pumping is required for lifting of sewage.**
5. **During heavy rains**, the sewers may overflow, and may thus create **unhygienic conditions** and cause pollution problems.
6. **Storm water is unnecessarily polluted.**

7. **The large sewers get easily silted if not properly designed**. They may become foul in dry weather, when rain water, is not available.
8. Large sewers are more difficult to be ventilated than the smaller ones

C. Partially combined system

- In this system, only one set of underground sewers is laid.
- These sewers admit the foul sewage as well as the early washings by rains. **As soon as the quantity of storm water exceeds a certain limit, the storm water overflows, and is thus collected and conveyed in open drains to the natural streams.**

Advantages

1. **The sewers are of reasonable size.** Their cleaning is therefore not very difficult.
2. It combines the **advantage of both the separate as well as the combined systems**.
3. The storm water permitted in the sewers eliminates its chances of chocking. The sewers are completely cleaned during rainy season.
4. The problem of disposing off storm water from homes is simplified.

Disadvantages

1. During the dry weather, when there is no rain water, the velocity of flow will be low. Thus self cleansing velocity may not be achieved.
2. The storm water increases the load on treatment units.
3. The storm water also increases the cost of pumping.

Factors affecting selection of separate system

1. Financial aspects
2. Flat topography
3. Rainfall pattern
4. Outlet conditions
5. Pumping aspect
6. Subsoil conditions
7. Development pattern

Factors affecting selection of Combined system

1. Space restriction
2. Integrated development
3. Even rainfall pattern
4. *Conversion of existing storm water drains*
5. *Pumping requirements*

Objective Questions

1. Conservancy system is also known as _____.
2. If the rainfall is there for a shorter duration, and does not take place throughout the year, it is more economical to adopt _____.
3. _____is preferred when, space available for laying the sewers is restricted.

Theory Questions

Q1. Differentiate between

i. Conservancy system and Water carriage system
ii. Combined sewer and separate sewers

Q2. Explain factors affecting selection of

i. Combined sewers
ii. Separate sewers

Q3. Write short notes on

i. Conservancy system
ii. Water carriage system
iii. Combined sewer
iv. Separate sewer

Q4. Mention 5 advantages of water carriage system. *(May 2011, 5 marks)*

Q5. Explain the combined system of sewerage. Also mention the factors governing choice of combined system. *(May 2011, 8 marks)*

Q6. Compare conservancy system with water carriage system. *(Nov 2011, May 2010, 8 marks)*

Q7. Describe any two methods of collection of various types of wastes in the conservancy system. *(May 2010, 5 marks)*