

## Reed Bed System

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A reed bed system is a natural wastewater treatment method that uses reeds (typically *Phragmites australis*) planted in a constructed bed to filter and treat sewage, greywater or industrial effluent. It mimics the natural process of wetland filtration by relying on the roots of the reeds and soil or gravel substrate to break down pollutants and remove contaminants.



### Key Components

**Reeds:** The plants provide a habitat for beneficial microorganisms that break down organic matter and pollutants.

**Substrate:** Usually made up of gravel, sand or soil that act as a substrate helps filter out solids and offers a surface for microbial growth.

**Water Flow:** Wastewater is either passed through the reed bed horizontally or vertically, allowing for the removal of contaminants.

### Types of Reed Beds

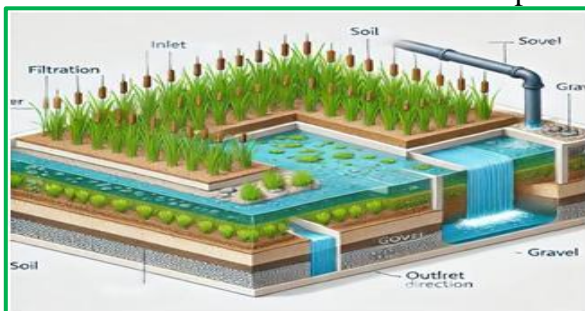
- **Horizontal Flow :** Water flows horizontally through the root zone.
- **Vertical Flow :** Water is applied to the surface and flows vertically through the bed.

### Layering in Reed Beds

- **Bottom Layer:** Coarse gravel (10-20mm) is used to promote drainage
- **Middle Layer:** Medium gravel (5-10mm) supports root growth and provides a habitat for microorganisms.
- **Top Layer:** Fine gravel (2-5mm) or sand allows for effective filtration, microbes used to colonization and acts as a root bed for the reeds.

### *Phragmites australis*

It is commonly called as common reed plays a central role in filtering wastewater through using its dense root hairs spreading horizontal due to this traps the solid material and sediments from the wastewater becomes pure water without any heavy metal trace.



It has unique ability to transfer oxygen from its shoots to its roots, creating aerobic conditions around the root zone (rhizosphere). This oxygenation supports the growth of aerobic bacteria, which are crucial for breaking down organic pollutants. The reeds absorb nutrients, such as nitrogen and phosphorus from the wastewater. These nutrients, often leads to eutrophication. The plants also absorb the heavy metals like (lead, zinc, cadmium), these are reduced their concentrations before the water is discharge. The plant contributes to evapotranspiration, a process where water is absorbed by the roots and then released into the atmosphere through the leaves. Due to its robust root structure it prevents soil erosion in wetland ecosystem.

**Water Hyacinth:** *Eichornia crassipes* it effectively absorbs nitrate and phosphates besides heavy metals.

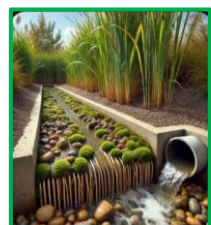
**Typha:** *Typha latifolia* it is effectively remove heavy metals and salts by immobilization through roots. It is a Perennial herbaceous plants.



**Vermiculite:** A hydrous, silicate mineral with high cation exchange, high water holding capacity so it absorbs large amount of heavy metals and also maintain moisture capacity due to its porosity structure.

### Research History

The Max Planck Institute for Limnology in Plon, Germany. In 1950 Dr. Kathe Seidel, a researcher used to the common reed weeds for reed bed system. Limnology is a scientific study of inland waters like lakes, rivers, ponds, reservoirs, wetland and streams. It is a branch of environmental science.



### Advantages

Removes heavy metals 90% - 100% from industrial wastewater. Reduces BOD and COD 70% - 90%. Reduces TDS >90% and removes nitrate and phosphates 80% - 98%

### Conclusion

Reed bed systems offer a sustainable, efficient and cost effective solution for wastewater treatment by mimicking natural wetland process and also enhance the biodiversity, ecosystem in environment. As the global demands for pure water for all the living beings, so it is an alternative way to overcome water pollutants in water ecosystem.