

1. What are Natural Treatment Technologies?

The term “Natural Technology” refers to a technology designed to employ ecological processes found in natural ecosystems. These techniques harness plants, soils, and associated microorganisms to remove contaminants from wastewater. They are generally reliable systems with no anthropogenic energy sources or chemical requirements and a minimum of operational requirements.

The treatment of wastewater using natural treatment technologies also provides a scope to create or restore ecosystems for environmental enhancement, such as greenbelts, passive recreation associated with ponds, wildlife habitat, and other environmental amenities.

2. What are Green Lake systems?

These are wetland treatment systems where a combination of emergent aquatic plants (like cattail, bulrush, reeds etc.), floating plants (like duckweed, water hyacinth, and others), and submergent aquatic plants are used for the treatment of water pollution.

These systems have open water areas dominated by floating and submergent plants. The boundary may be lined or unlined, depending on regulatory and / or performance requirements. These systems exhibit complex aquatic ecology, including habitats for aquatic and wetland birds.

3. What is Green Bridge Technology?

It is a horizontal filtration unit placed in the continuously flowing channel. It is made up of gravel, sand and natural fibres to retain suspended solids. Biodegradation and biosorption is facilitated by microbial film and green plants.

4. Who has developed it?

Sandeep Joshi of Shrishti Eco-Research Institute has developed these simple natural technologies through his research on rivers in urban areas from last 27 years. These technologies have been already implemented successfully on polluted streams in Pune from 2003.

Sandeep Joshi's other natural treatment systems – Soil Scape Filter and Hydrasch Succession Pond – have been in use for industrial wastewater treatment since the last 15 years.

5. Are Natural Technologies reliable? How do they treat pollution?

Natural technologies are effective and reliable water reclamation systems provided they are properly designed, constructed, and maintained. It is experienced from a decade long running systems, that they are able to remove most pollutants associated with municipal and industrial wastewater such as COD, BOD, metals including cadmium, chromium, iron, lead, manganese, selenium, zinc, and toxic organics etc.

6. What are the mechanisms of natural treatment of wastewater?

A natural system acts as a watershed filter, a sink for sediments and precipitates, and a biogeochemical engine that recycles and transforms some of the nutrients. A natural treatment technique utilizes the same processes such as physical separation of solids by sedimentation, filtration, bio-digestion, bio-oxidation, bio-reduction, bio-sorption etc. These processes occur

sequentially or simultaneously as wastewater moves through the system.

7. What are other benefits of Natural Treatment systems?

Other benefits are water reclamation, water storage, recharging of surface water body and groundwater, carbon sequestration, wildlife habitat, passive recreation and environmental education. These are numerous benefits including energy savings, which cannot be given by conventional mechanistic treatment systems.

8. Can a natural treatment system give treated water complying with secondary effluent standard?

Natural treatment systems can be used to meet a 30 mg/L BOD and TSS discharge standard. The material inputs, land requirement and labour are dependent on the quality of treated water to be achieved.

9. How much area is required for natural treatment systems?

There is no standard reply to this question primarily because it depends on the effluent criteria to be met and buffer areas required. It is noted that designers have employed from <0.2 to over 20 hectares/MLD (i. e. 2 - 200 sq. m / m³ - day). For pond and lake systems the area requirement is 0.5 - 2 sq. m / m³ - day. The Green Bridge is a novel technology, which can filter enormous quantities of water in a day.

10. Do these systems have to be lined to avoid soil and groundwater contamination?

The requirement for liners in natural treatment systems depends on regulatory requirements, the characteristics of surface and subsurface soils, and concentration of key pollution parameters. If soils are porous (e.g. sandy soils) well drained, then lining will be essential while in the case of poorly drained soils composed mostly of clays, lining might not be required. These systems would tend to produce a layer of partially degraded sediments on the bottom that would reduce infiltration with time but improve the recharging of groundwater by sorbing the pollutants.

11. Explain the role of the plants in Natural Treatment Systems.

In Natural treatment systems, plants play several essential roles.

- to provide a canopy over the water column
- phyto-engineered production of phytoplankton
- increase the potential of re-aeration, translocation of oxygen for the microbial systems
- enhance reduction of suspended solids and to some extent dissolved solids
- A role in taking up nitrogen and phosphorus. The effects of litter fall from previous growing seasons as it moves through the water column and eventually decompose into particles, gives good biofertilizer.
- Increase aesthetic look
- Contributes to carbon sequestration by absorbing atmospheric carbon dioxide. Reduction in Green House gases.

12. When does a natural treatment system become fully operational and meet discharge norms?

Pond and Lake Eco-systems may take time to obtain the optimum vegetative density necessary

for treatment processes. The duration is dependent on the original planting density, and adaptation of saplings to new environment. It has been experienced that water quality improves with time implying that vegetation density and accumulated plant litter have a major role in the efficiency of the treatment.

13. Are these systems durable and perform as per the expectations for longer period?

These systems have been employed for treating industrial and domestic wastewaters for the last 10 years. They require minimum maintenance. Treatment capacities of these systems have not shown a decrease in treatment effectiveness with time.

These systems are very affordable as far as electricity consumption is concerned as the requirement is zero. These systems run on solar energy.

14. What are the problems associated with natural treatment systems?

- Odours are associated with all types of the wastewater treatment systems. In STPs, it is more pronounced. But in the natural treatment systems, it gets diluted because of decomposition over a relatively large area, in association with the natural decomposition of plant material, algae, and other biological solids.

- Normally mosquitoes are not a problem in properly designed and operated natural treatment systems. It is experienced that if a mixed effluent from industrial and domestic areas is provided with water hyacinth system, there is no nuisance of mosquitoes even though they are growing in that habitat. But, the plants are selected in such a way that they would not encourage the growth of nuisance insects. Even fish can be introduced to control mosquito breeding ecologically.

15. Do these technologies have approval from pollution regulating authorities?

Being a pioneer of ecotechnological systems in India, SERI has been invited by the Planning Commission – Government of India, Ministry of Environment and Forests – Delhi and the Central Pollution Control Board to work on polluted streams in various geographical conditions in the country. The Planning Commission's Member for Environment and Forests – Dr. K. Kasturirangan appreciated the efforts after visiting Udaipur's Ahar River Restoration site in May 2010.

16. What happens when water level rises by 2 m or more above the Green Bridge system?

Water overflows over our system without any damage to it as this phenomenon / feature has already been taken into account in the design of the Green Bridges.

18. Do the systems clog because of silt or any other material?

No – the silt, along with the biodegradable & non-biodegradable wastes get trapped in the bio mats provided. They have to be removed after the level goes down & replaced with fresh ones. The removed ones have to be kept for drying and thereafter reused.

In case of the Soil Scape Filter, the biomass which may be generated in the process of vertical filtration gets consumed and utilized completely by the bacteria and plants in the system.

19. How many times can the bio mats be reused?

If no physical damage is caused to them, then they should last for 10 years.

20. How many times in a year are the Bio mats in the Green Bridge system to be replaced?

Only if and when they get clogged, this can be gauged by observing the level of water on the incoming side and that on the outlet side of every Green Bridge. This will be demonstrated during the O & M procedure.

21. How often do the ecofert and /or the bio-pellets need to be replenished?

For domestic flows, there is no requirement of replenishment for about 10 years. For industrial wastewaters, 20% replenishment may be required after every 2- 3 years, depending on concentration of mineral acidity.

22. How many people will be required to maintain the system, and what skill should they have?

In general, 2 to 3 people every day should suffice. In case of the Green Bridge system, it all depends upon the quantum of debris which gets caught in the metal screen every day. No special skill is needed as such, the person working should be able to tend to the plants on the banks, should know to multiply them and be able to remove debris which are trapped on the metal screen and dispose them of at a requisite place.

23. Is there any special equipment that has to be provided to the persons working there?

Basic consumables like gloves, gumboots, helmet, life jackets, rakes, garden implements & accessories. On-site requirements vary from place to place and have to be fulfilled.

24. What type of Plants & Shrubs need to be planted and where?

Only Locally available species shall be selected during the course of installation and shall be planted in the presence of our personnel.

25. How can Trouble-shooting be resorted to if your personnel cannot be here 24 x 7?

On receipt of Test Reports by email we will give necessary instructions which can be easily followed and executed by you. This is an ecotechnological solution and Patience is the watchword. Nature takes its own course and after all it is not Rocket Science, so there is no need for worry. In a worst-case scenario, our personnel will definitely be there to sort out the issue.

26. Are there any hidden costs?

This is an Ecotechnological solution requiring only natural material for purification of polluted waters, unlike that of conventional systems where tons & tons of cement, steel & other expensive machines, material and manpower are needed and where there is a possibility of hidden costs.

27. Do we need to add any kind of chemicals to the water?

No, as pointed out earlier this is a totally natural system. We do not use any kind of chemicals.

28. What is the Life of this system? After how many years does the whole system need to be revamped?

A system which is more than 5 years old may need revamping only if & when there is sustained substantial change (more than twice) in hydraulic and pollution parameters.

29. Will the ailing water-body regain its pristine state of bygone years once again by the use of Green Bridge Technology for purifying its waters & removal of Stench?

- A DEFINITE YES

30. Do you suggest anything else that does not form part of your treatment process?

Yes, just installing the system will not serve the purpose. People living along the bank of the river have to be made a part of the purification process and good hygienic habits inculcated in them. To do this they have to be involved at every stage of the installation process so that a feeling of belonging gets embedded in their mind and heart. This will help in interaction between residents & lead to a healthier & Cohesive Society.