Appendix A

Definition of Terms and Descriptions of Wastewater Systems

DEFINITIONS

Activated Sludge: A wastewater treatment process that uses suspended microorganisms to digest the organic contents of wastewater. (see "Suspended Growth Systems' in the Description of Wastewater Systems" section below)

Alternative onsite system: An onsit treatment system other than a conventional septic tank and leach field design. Alternative systems are used to accommodate a variety of site conditions (e.g., high ground water, low-permeability soil) and/or to provide additional treatment. Examples of alternative systems include alternative collection sewers, sand mounds, sand filters, anaerobic filters, disinfection systems, and cluster systems, among others, as described in "Descriptions of Wastewater Systems".

Alternative Sewers: Low-cost wastewater collection systems for small communities and/or areas with difficult topography or high ground water or bedrock. Alternative sewers are smaller in size than conventional sewers and are installed at shallower depth, providing a more cost-effective method of wastewater collection. The three main classes of alternative sewers are pressure sewers, small diameter gravity sewers, and vacuum sewers.

Black Water: Wastewater from the toilet, which contains most of the nitrogen in sewage.

BOD: Biochemical Oxygen Demand (BOD) is the measure of the amount of oxygen required by bacteria for stabilizing material that can be decomposed under aerobic conditions. BOD is a commonly used determinant of the organic strength of a waste.

Centralized System: A collection and treatment system containing collection sewers and a centralized treatment facility. Centralized systems are used to collect and treat large volumes of wastewater. The collection system typically requires large-diameter deep pipes, major excavation, and frequent manhole access. At the treatment facility, the wastewater is treated to standards required for discharge to a surface water body. The large amounts of biosolids (sludge) generated in treatment are treated and either land applied, placed on a surface disposal site, or incinerated.

Class V Well: A shallow waste disposal well, stormwater and agriculture drainage system, or other device, including a large domestic onsite wastewater system, that is used to release fluids above or into underground sources of drinking water. EPA permits these wells to inject wastes provided they meet certain requirements and do not endanger underground sources of drinking water.

Cluster System: A decentralized wastewater collection and treatment system where two or more dwellings, but less than an entire community, is served. The wastewater from several homes often is pretreated onsite by individual septic tanks before being transported through alternative sewers to an off-site nearby treatment unit that is relatively simple to operate and maintain than centralized systems.

Conventional Onsite System: A conventional onsite system includes a septic tank and a leach field.

Decentralized System: An onsite or cluster wastewater system that is used to treat and dispose of relatively small volumes of wastewater, generally from dwellings and businesses that are located relatively close together. Onsite and cluster systems are also commonly used in combination.

Effluent: Partially or fully treated wastewater flowing from a treatment unit or facility.

Eutrophication: A process by which nutrient-rich surface water or ground water contributes to stagnant, oxygen-poor surface-water environments which may be detrimental to aquatic life.

Facultative Pond: A lagoon that is sufficiently deep (i.e., 5 to 6 feet) where organic solids settle to the bottom as sludge and decay anaerobically; a liquid layer forms above the sludge where facultative and aerobic bacteria oxidize the incoming organics and products of anaerobic sludge decomposition.

Fecal Coliform Bacteria: Common, harmless forms of bacteria that are normal constituents of human intestines and found in human waste and in wastewater. Fecal coliform bacteria counts are used as an indicator of presence of pathogenic microbes.

Gray Water: Non-toilet household wastewater (e.g., from sinks, showers, etc.).

Leaching Field: See "Subsurface Soil Absorption Field".

Management of Decentralized Systems: The centralized management and monitoring of onsite or cluster wastewater systems, including, but not limited to, planning, construction, operation, maintenance, and financing programs.

National Pollutant Discharge Elimination System (NPDES): A regulatory system that requires wastewater treatment systems discharging into surface waters to obtain a permit from the EPA which specifies effluent quality.

Nonpoint Source Discharges: Relatively diffuse contamination originating from many small sources whose locations may be poorly defined. Onsite wastewater systems are one type of Nonpoint source discharge.

Onsite System: A natural system or mechanical device used to collect, treat, and discharge or reclaim wastewater from an individual dwelling without the use of community-wide sewers or a centralized treatment facility. A conventional onsite system includes a septic tank and a leach field. Other alternative types of onsite systems include at-grade systems, mound systems, sand filters and small aerobic units. These and other types of onsite systems are described in the "Description of Wastewater Systems" section.

Package Plant: Prefabricated treatment units that can serve apartment buildings, condominiums, office complexes, and up to a few hundred homes. Package plants generally are used as cluster systems, but can also be used in an onsite wastewater treatment train. They are usually of the activated sludge or trickling filter type, and require skilled maintenance programs.

Point Source Discharges: Contamination from discrete locations, such as a centralized wastewater treatment facility or a factory.

Pressure Sewers: An alternative wastewater collection system in which household wastewater is pretreated by a septic tank or grinder and pumped through small plastic sewer pipes buried at shallow depths to either a conventional gravity sewer or a treatment system. Pressure sewers are used in areas with high groundwater or bedrock, low population density, or unfavorable terrain for gravity sewer collection. They require smaller pipes and less excavation than conventional sewers. Two types of pressure sewers include:

Septic Tank Effluent Pump (STEP). A submersible pump located either in a separate chamber within a septic tank or in a pumping chamber outside the tank pumps the settled liquid through the collector main. Because the wastewater is treated in a septic tank, the treatment facility may be smaller and simpler than would otherwise be needed.

Grinder Pump. Household wastes flow by gravity directly into a prefabricated chamber located either in the basement of a house or outside the foundation wall. The chamber contains a pumping unit with grinder blades that shred the solids in the wastewater to a size that can pass through the small-diameter pressure sewers.

Pumping Stations: A pumping facility is used to lift wastewater where topography is too flat or hilly to permit natural gravity flow to treatment facility.

Receiving Water: Streams (i.e., surface water bodies) into which treated wastewater is discharged.

Residuals: The by-products of wastewater treatment processes, including sludge and septage.

Secondary Treatment: Typical effluent quality achieved by a conventional centralized treatment facility, typically defined as 85% reduction of influent BOD and TSS or 30 mg/l or both; which ever is least.

Septage: The solid and semi-solid material resulting from onsite wastewater pretreatment in a septic tank, which must be pumped, hauled, treated, and disposed of properly.

Sludge: The primarily organic solid or semi-solid product of wastewater treatment processes. The term sewage sludge is generally used to describe residuals from centralized wastewater treatment, while the term septage is used to describe the residuals from septic tanks.

Small-Diameter Gravity Sewers: An alternative wastewater collection system consisting of small-diameter collection pipes (e.g., between three and six inches) that transport liquid from a septic tank to a treatment unit, utilizing differences in elevation between upstream connections and the downstream terminus to achieve gravity flow.

Subsurface Soil Absorption Field: A subsurface land area with relatively permeable soil designed to receive pretreated wastewater from a septic tank or intermediate treatment unit (e.g., sand filter). The soil further treats the wastewater by filtration, sorption, and microbiological degradation before the water is discharged to ground water.

Trickling Filter: A fixed-film (see "Fixed Growth Systems" in "Description" section below) biological wastewater treatment process used for aerobic treatment and nitrification.

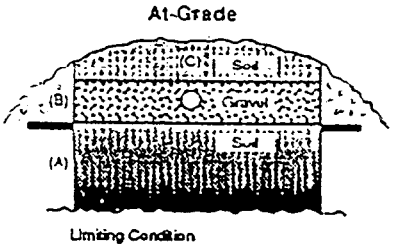
Total Suspended Solids (TSS): A measure of the amount of suspended solids found in wastewater effluent.

Vacuum Sewers: An alternative wastewater collection system that uses vacuum to convey household wastewater from each connection to a vacuum station which includes a collection tank and vaccum pumps. Wastewater is then pumped to a treatment facility or conventional sewer interceptor.

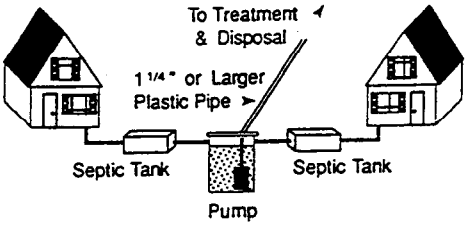
DESCRIPTIONS OF WASTEWATER SYSTEMS

Anaerobic Filters: Anaerobic filters are used as part of a treatment train designed to minimize nitrate concentration in areas where discharge of nitrates to surface water or ground water is a concern. Anaerobic filters convert nitrate (NO_3) to gaseous forms of nitrogen (N_2, N_2O, NO). The key design consideration for anaerobic filters is to ensure that the carbon-to-nitrogen ratio is sufficient for denitrification. Good performance can be obtained by treating septic tank effluent with a nitrifying (usually sand) filter before the anaerobic filter.

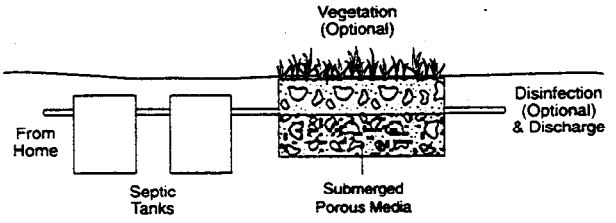
At-Grade Soil Absorption Systems: At-grade soil absorption systems are similar to the subsurface soil absorption systems, but bedding material (usually gravel) is placed at the ground surface rather than below ground and is covered with soil fill material. At-grade systems are used in areas with relatively high ground-water tables or shallow bedrock.



Cluster Systems: Decentralized wastewater collection and treatment systems serving two or more dwellings, but less than an entire community. Sometimes, the wastewater from several homes is pretreated onsite by individual septic tanks before being transported through alternative sewers to an off-site, nearby treatment unit that is relatively small compared to centralized systems.



Constructed Wetlands: Constructed wetlands are engineered systems designed to optimize the physical, chemical, and biological processes of natural wetlands for reducing BOD and TSS concentrations in wastewater. Wastewater from a septic tank flows through a pipe into the wetland, where the wastewater is evenly distributed across the wetland inlet. Sedimentation of solids with the media substrate occurs. Constructed wetlands are reliable for BOD and TSS removal, and may contribute to nutrient removal when used after a nitrifying unit process.



Disinfection Systems: Disinfection refers to the destruction of disease-causing organisms called pathogens (e.g., bacteria, viruses) by the application of chemical or physical agents. Disinfection may be necessary where other types of treatment are inadequate to reduce pathogen levels to the required regulatory standards for surface discharge. The most common types of disinfection for decentralized systems are:

Chlorination Systems. Chlorination occurs by mixing/diffusing liquid or solid chlorine forms with wastewater. Chlorination is considered to be the most practical disinfection method for onsite wastewater treatment because it is reliable, inexpensive, and easy to use; however, dechlorination may be needed to prevent the dispersal of residuals that may be harmful to aquatic life.

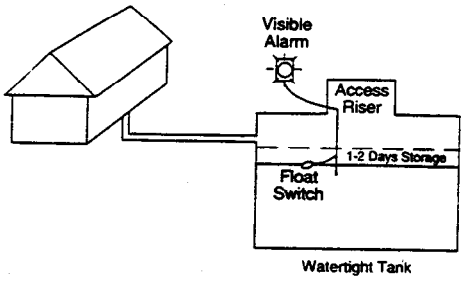
Ultraviolet Disinfection. In an ultraviolet treatment system, high intensity lamps are submerged in wastewater or the lamps surround tubes that carry wastewater. Disinfection occurs when the ultraviolet light damages the genetic material of the bacterial or viral cell walls so that replication can no longer occur. Care must be taken to keep the surface of the lamps clean because surface deposits can shield the bacteria from the radiation, thus reducing the performance of the system. Ultraviolet radiation is a highly effective technique especially attractive in cluster systems where the effluent cannot include any residuals or where there are overriding concerns with safety.

Effluent Distribution Systems: Effluent distribution systems are essential components of subsurface wastewater treatment systems. These systems deliver wastewater to soil infiltrative surfaces either by gravity or by pressure distribution.

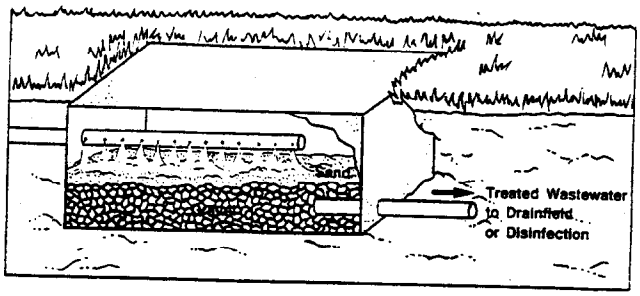
Pressure distribution. Pressure dosing systems distribute water over more infiltrative surface and provide a resting period between doses that increases the life and performance of the leach field. Dosing siphous or pumps provide the pressure; the latter requires additional maintenance demands.

Fixed Growth Systems: In fixed growth systems, aerobic microorganisms attach and grow on an inert media. Wastewater flows across a slime layer created by the attached microorganisms, which extract soluble organic matter from the wastewater as a source of carbon and energy.

Holding Tank: A large storage tank for wastewater or septage. An alarm on the tank signals when the tank is full and the contents need to be pumped and properly disposed.



Intermittent Sand Filters (ISF): An intermittent sand filter consists of sand media with a relatively uniform particle-size distribution above a gravel layer. An ISF reduces BOD and TSS concentrations to 10 mg/L or less. Wastewater passes through the filter and drains from the gravel to the collector. Uniform distribution of influent is very important to filter performance. Influent is dosed to the surface 4 to 24 times per day, with best performance from higher numbers of smaller doeses. The sand filter material may be left exposed or covered with removable covers. A septic tank (or other pretreatment system) is required to remove settleable solids and grease, which can clog the sand. Covers are used in cold climates. If sand filter material is left exposed, it must be checked regularly for litter, vegetation growing on the surface. It may require raking perodically. An uncovered system also is susceptible to potential odor problems. Less frequently, the sand may require removal and replacement of the top layer.



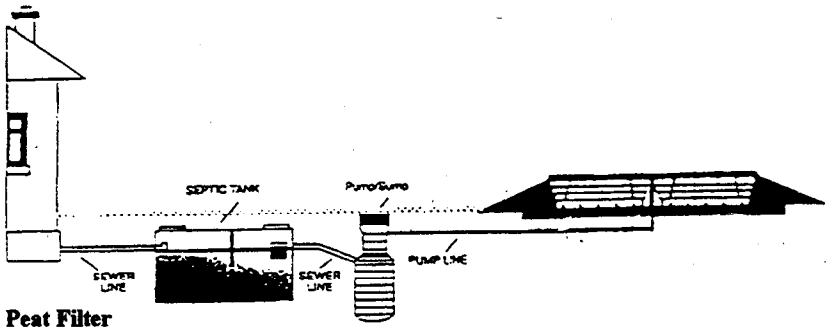
Nitrogen Removal Systems: Several types of treatment processes are capable of removing nitrogen in wastewater. Nitrogen removal systems are used in onsite treatment trains to ensure protection of ground water as well as coastal waters recharged by ground water. Biological nitrogen removal requires aerobic conditions to first nitrify the wastewater, then anaerobic conditions to denitrify nitrate-nitrogen to nitrogen gas. The successful removal of nitrogen from wastewater requires that environments conducive to nitrification and denitrification be induced and positioned properly. Three types of nitrogen removal systems are described below:

Separation of Black Water and Gray Water. Black water (toilet water) can be segregated from other sources of household wastewater (gray water) for separate treatment and disposal. A separate plumbing system within a house is required. Black water, which contains 80% or more of the nitrogen in household wastewater, can be discharged directly to a holding tank; the remaining gray water is discharged to a septic tank/soil absorption system.

Nitrification/Denitrification Trickling Filter Plant. Septic tank effluent is recycled by a pump toa low-loaded, plastic-media trickling filter for aerobic treatment; and nitrification can occur. Filtrate from the trickling filter returns to the lower anaerobic septic tank effluent, providing an environment conducive to biological denitrification.

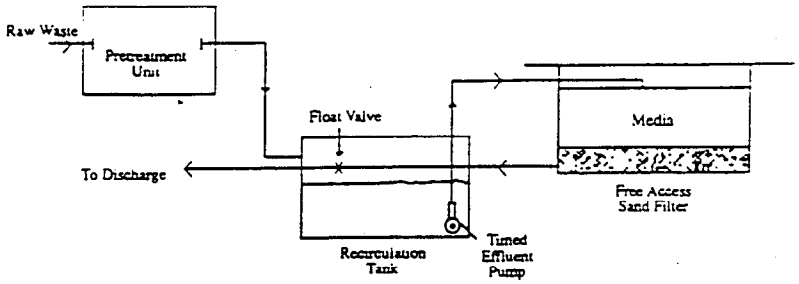
Recirculating Sand Filters. Recirculating sand filters also can provide consistent nitrogen removal (See "Recirculating Sand Filter" below).

Non-Sand Filters: Non-sand filters function similarly to sand filters but use materials other than sand as the filter medium, including natural media such as peat and bottom ash, and synthetic media such as expanded polyurethane foam and honeycombed plastic to reduce levels of TSS, BOD, and fecal coliforms. Most non-sand filter media are packaged in units or placed in enclosures and use pressure dosing to distribute the effluent in the filter.

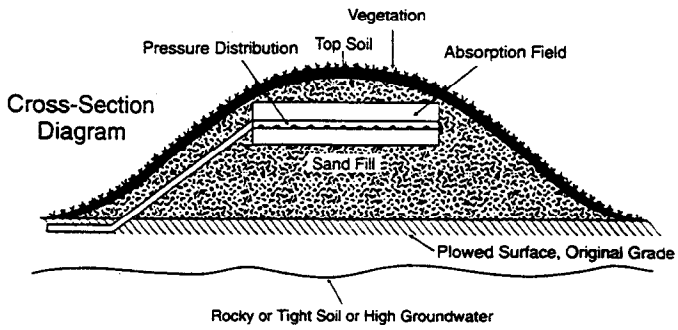


Peat Filter

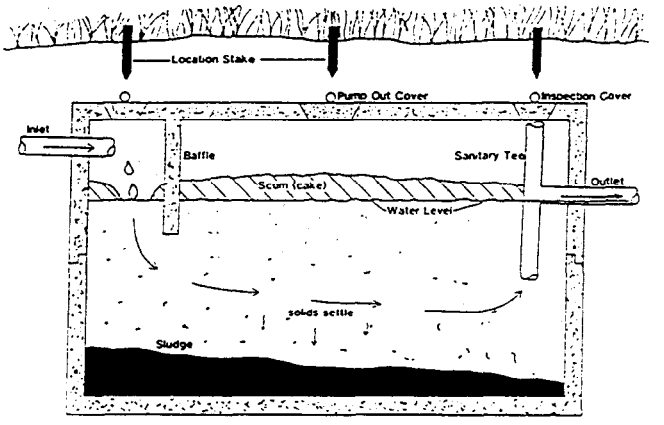
Recirculating Sand Filters (RSF): A recirculating sand filter uses relatively coarse sand or gravel media for filtration of wastewater. The wastewater is dosed from a recirculating tank, which receives septic tank effluent and returned filtrate. A portion of the filtrate is diverted for disposal during each dose. RSFs are suitable in areas too small for conventional soil absorption systems or with shallow depths to groundwater or bedrock. RSFs can be used for reducing TSS, BOD, fecal coliform, and nitrogen. RSFs are reliable, requiring little maintenance in comparison to activated sludge systems.



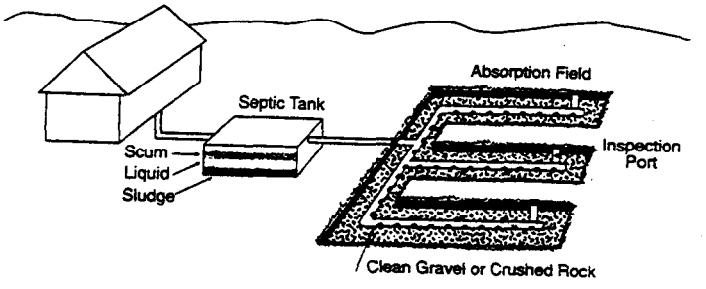
Sand Mounds: Sand mounds are used when soil depth is too shallow for a conventional septic tank and leach field system. The sand mound filters septic tank effluent before it reaches the natural soil. Sand fill is placed above the ground surface, and a pipe distribution system and pressure dosing is used to distribute the effluent. A septic tank or other pretreatment is required to remove settleable solids and grease.



Septic Tank: A buried tank designed and constructed to receive and pretreat wastewater from individual homes by separating settleable and floatable solids from the wsteater. Grease and other light materials, collectively called scum, float to the top. Gases are normally vented through the building's sewer pipe. An outlet blocked off from the scum layer feeds effluent to a subsurface soil absorption area or an intermediate treatment unit.



Subsurface Soil Absorption Systems: A typical soil absorption system consists of perforated piping and gravel in a field or trench, although gravelless systems can also be used. Soil absorption systems are normally placed at relatively shallow depths (e.g., <2 ft). Excellent TSS, BOD, phosphorus, and pathogen removal is provided in the unsaturated soil which surrounds the infiltrative surfaces. If properly sited, designed, constructed, and maintained, subsurface soil absorption systems are very reliable and can be expected to function for many years.



Suspended Growth Systems: Suspended growth treatment systems are variations of the activated sludge process in which microorganisms are suspended in an aerated reactor by mixing. Oxygen is supplied to oxidize organic carbon and, possibly, nitrogen compounds. Effluent is discharged either to surface water or subsurface systems . Suspended growth systems can be engineered as package plants to serve clustered residential housing, commercial establishments, or small communities with relatively small flows.

Trickling Filters: Used to reduce BOD, pathogens, and nitrogen levels, trickling filters are composed of a bed of porous material (rocks, slag, plastic media, or any other medium with a high surface area and high on permeability). Wastewater is first distributed over the surface of the media where it flows downward as a thin film over the media surface for aerobic treatment and is then collected at the bottom through an underdrain system. The effluent is then settled by gravity to remove biological solids prior to being discharged.