

Preface

This reader is supposed to give an overview on the subject wastewater management and wastewater treatment technologies. To gain an understanding for the relevance and techniques of the subject a lot of emphasis is placed on introducing the relation of wastewater treatment to the IWRM concept. This is followed by a systematic description of wastewater sources and characteristics leading to detailed treatment methods.

In the course “sanitation and wastewater treatment” only certain aspects are going to be discussed into depth, but the reader can be used as reference literature, for a large and detailed range of sanitation topics.

Glossary

Acronyms

"BOD"	Biochemical oxygen demand, typically expressed in mg/L.
"CBOD ₅ "	Carbonaceous biochemical oxygen demand, typically expressed in mg/L.
"COD"	Chemical oxygen demand, typically expressed in mg/L.
"FC"	Fecal coliform, typically expressed in number of colonies/100 ml.
"TN"	Total nitrogen, typically expressed in mg/L.

Definitions

Term	Definition
Additive	Commercial product added to an sewage system intended to affect the performance or aesthetics of an sewage system.
Alkalinity	Refers to the relative amounts of alkaline chemicals in a solution. Sodium, potassium, and calcium are alkaline chemicals and are often combined with carbonates, sulfates, or chlorides. Plants do not tolerate high concentrations of alkaline salts.
Biodegradability	The word biodegradable means that a complex chemical is broken down into simpler components through biological action. Do not be confused by the word biodegradable, which often is used to imply environmentally safe. Harmful chemicals as well as beneficial ones may be biodegradable.
Blackwater	Water that is flushed from toilets and urinals that contains human waste.
Coliform (Bacteria)	A group of bacteria that produce gas and ferment lactose, some of which are found in the intestinal tract of warm-blooded animals. They are indicators of potential ground water and/or surface water contamination with such fecal material.
Design flow	The maximum volume of sewage a residence, structure, or other facility is estimated to generate in a twenty-four-hour period. It incorporates both an operating capacity and a surge capacity for the system during periodic heavy use events. The sizing and design of the sewage system components are based on the design flow.
Development	The creation of a residence, structure, facility, subdivision, site, area, or similar activity resulting in the production of sewage.
Disinfection	The process of destroying pathogenic microorganisms in sewage through the application of ultraviolet light, chlorination, ozonation or others.
Distribution technology	Any arrangement of equipment and/or materials that distributes sewage within a sewage system.
Dosing	The application of wastewater to a treatment or disposal system in discreet amounts over a definite time period, as opposed to an unregulated flow.

Dosing Tank / Chamber	A watertight receptacle containing dosing equipment which collects treated effluent and periodically discharges it into another treatment / dispersal component, depending upon the needs and design of the particular on-site sewage system.
Effective Particle Size (ES)	The diameter (size) of the particle in a granular sample such as sand for which 10 percent of the total grains are smaller and 90 percent larger on a weight basis. Stating it differently, it is the diameter of an opening of an ideal sieve which would retain 90% of a sample, while passing 10% of the sample. (Symbolically ES = D10)
Effluent	Liquid discharged from a septic tank or other sewage system component.
Failure	A condition of an on-site sewage system or component that threatens the public health by inadequately treating sewage or by creating a potential for direct or indirect contact between sewage and the public. Examples of failure include: (a) Sewage on the surface of the ground; (b) Sewage backing up into a structure caused by slow soil absorption of septic tank effluent; (c) Sewage leaking from a sewage tank or collection system; (d) Cesspools or seepage pits where evidence of ground water or surface water quality degradation exists; (e) Inadequately treated effluent contaminating ground water or surface water; or (f) Noncompliance with standards stipulated on the permit.
Fecal coliform	Bacteria common to the digestive systems of warm-blooded animals that are cultured in standard tests. Counts of these organisms are typically used to indicate potential contamination from sewage or to describe a level of needed disinfection. Generally expressed as colonies per 100 ml.
Filter	A device or structure for removing suspended solid or colloidal material from wastewater. Also a sewage treatment component which contains a specified filter media which is used to treat sewage physically, chemically and biologically.
Filtrate	Liquid which has passed through a filter.

Gray water	Sewage from bathtubs, showers, bathroom sinks, washing machines, dishwashers, and kitchen sinks. It includes sewage from any source in a residence or structure that has not come into contact with toilet wastes.
Ground water	Subsurface water occupying the zone of saturated soil, permanently, seasonally, or as the result of the tides. Indications of ground water may include: (a) Water seeping into or standing in an open excavation from the soil surrounding the excavation or monitoring ports. (b) Spots or blotches of different color or shades of color interspersed with a dominant color in soil, caused by reduction and oxidation of iron. These color patterns are redoximorphic features, commonly referred to as mottling. Redoximorphic features often indicate the intermittent presence of ground water and may indicate poor aeration and impeded drainage. Also see "water table."
Holding tank sewage system	An on-site sewage system which incorporates a sewage tank without a discharge outlet, the services of a sewage pumper/hauler, and the off-site treatment and disposal for the sewage generated.
Hydraulic Conductivity	The ability of soil to transmit liquids through pore spaces in a specified direction, e.g., horizontally or vertically.
Hydraulic loading rate	The amount of effluent applied to a given treatment step, in this chapter expressed as m ³ per square meter per day (m ³ /m ² /day).
Industrial wastewater	The water or liquid carried waste from an industrial process. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feedlots, poultry houses, or dairies. The term includes contaminated storm water and leaching from solid waste facilities.
On-site sewage system (OSS)	An integrated system of components, located on or nearby the property it serves, that conveys, stores, treats, and/or provides subsurface soil treatment and dispersal of sewage. It consists of a collection system, a treatment component or treatment sequence, and a soil dispersal component. An on-site sewage system also refers to a holding tank sewage system or other system that does not have a soil dispersal component.

Particle Size	The diameter of a soil or sand particle, usually measured by sedimentation or sieving.
Percolation	The flow or trickling of a liquid downward through a contact or filtering medium. The liquid may or may not fill the pores of the medium.
Phosphate	A plant nutrient often added to soil as a fertilizer. Soils in some areas are low in phosphate and thus, there may be some benefit to plants if phosphate is present in greywater. This should not be relied upon, however, since many forms of phosphate are not readily usable by plants and soils.
Public sewer system	A sewerage system: (a) Owned or operated by a city, town, municipal corporation, county, or other approved ownership consisting of a collection system and necessary trunks, pumping facilities and a of final treatment and disposal; and (b) Approved by or under permit from the department of ecology, the department of health and/or a local health officer.
Raw Wastewater	Wastewater before it receives any treatment.
Residential sewage	Sewage having the constituency and strength typical of wastewater from domestic households.
Sand Filter	A biological and physical wastewater treatment component consisting (generally) of an under drained bed of sand to which pre-treated effluent is periodically applied. Filtrate collected by the under drains is then disposed of by an approved soil absorption system. Pretreatment can be provided by a septic tank or another approved treatment component.
Seepage pit	An excavation more than three feet deep where the sidewall of the excavation is designed to dispose of septic tank effluent. Seepage pits may also be called "dry wells."

Septic tank	A watertight treatment receptacle receiving the discharge of sewage from a building sewer or sewers, designed and constructed to permit separation of settleable and floating solids from the liquid, detention and anaerobic digestion of the organic matter, prior to discharge of the liquid.
Sewage	Any urine, feces, and the water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments or other places.
Sewage quality	Contents in sewage that include: (a) CBOD ₅ , TSS, and O&G; (b) Other parameters that can adversely affect treatment. Examples include pH, temperature, and dissolved oxygen; (c) Other constituents that create concerns due to specific site sensitivity. Examples include fecal coliform and nitrogen.
Sewage tank	A prefabricated or cast-in-place septic tank, pump tank/dosing chamber, holding tank, grease interceptor, recirculating filter tank or any other tanks as they relate to on-site sewage systems including tanks for use with proprietary products.
Sodium	Can act as a plant poison by reducing the plant's ability to take up water from the soil. Too much sodium can destroy the structure of clay soils, making them slick and greasy by removing air spaces and thus preventing good drainage. Once a clay soil is damaged by sodium, it can be very difficult to restore it to a viable condition.
Standard methods	<i>The 20th Edition of Standard Methods for the Examination of Water and Wastewater</i> , prepared and published jointly by the American Public Health Association, the American Water Works Association and the Water Environment Federation.
Surface water	Any body of water, whether fresh or marine, flowing or contained in natural or artificial unlined depressions for significant periods of the year, including natural and artificial lakes, ponds, springs, rivers, streams, swamps, marshes, irrigation canals and tidal waters.
TN-Total Nitrogen	Total nitrogen, typically expressed in mg/L. A measure of the complete nitrogen content in wastewater. The forms of nitrogen of greatest interest are nitrate (NO ₃ ⁻), nitrite (NO ₂ ⁻), ammonia (NH ₃), and organic nitrogen; all these forms of nitrogen, as well as nitrogen gas (N ₂), are biochemically interconvertible and are components of the nitrogen cycle; the total nitrogen content of wastewater can be determined by measuring nitrate, nitrite, ammonia, and Kjeldahl nitrogen.

Total Suspended Solids (TSS)	Suspended solids refer to the dispersed particulate matter in a wastewater sample that may be retained by a filter medium. Suspended solids may include both settleable and unsetttable solids of both inorganic and organic origin. This parameter is widely used to monitor the performance of the various stages of wastewater treatment, often used in conjunction with BOD5 to describe wastewater strength. The test consists of filtering a known volume of sample through a weighed filter membrane that is then dried and re-weighed.
Treatment component	A technology that treats sewage in preparation for further treatment and/or dispersal into the soil environment. Some treatment components, such as mound systems, incorporate a soil dispersal component in lieu of separate treatment and soil dispersal components.
TSS	Total suspended solids, a measure of all suspended solids in a liquid, typically expressed in mg/L.
Wastewater	See "sewage."
Wastewater Treatment Unit	A unit designed, constructed, and installed to stabilize liquid waste by biochemical and physical action.
Water table	The upper surface of the ground water, whether permanent or seasonal. Also see "ground water."
Well	Any excavation that is constructed when the intended use of the well is for the location, diversion, artificial recharge, observation, monitoring, dewatering or withdrawal of ground water for agricultural, municipal, industrial, domestic, or commercial use.