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NATIONAL SMALL FLOWS CLEARINGHOUSE

Pipeline

Small Community Wastewater Issues Explained to the Public

BASIC WASTEWATER CHARACTERISTICS

Do you know what happens to your wastewater after you take a shower, wash dishes, or flush the toilet? Where exactly does it go? What is in it? How does it affect the environment? And why should you care?

If you are like most people, you never give much thought to what happens to the wastewater from your home and community. But whether you think about it much or not, wastewater continues to affect your life even after it disappears down the drain.

How Wastewater Affects You

The water we use never really goes away. In fact, there never will be any more or any less water on Earth than there is right now, which means that all of the wastewater generated by our communities each day from homes, farms, businesses, and factories eventually returns to the environment to be used again. So, when wastewater receives inadequate treatment, the overall quality of the world's water supply suffers.

Locally, the amount of wastewater homes and communities produce, its characteristics, and how it is handled can greatly impact residents' quality of life. Wastewater has the potential to affect public health, the local economy, recreation, residential and business development, utility bills, taxes, and other aspects of everyday life.

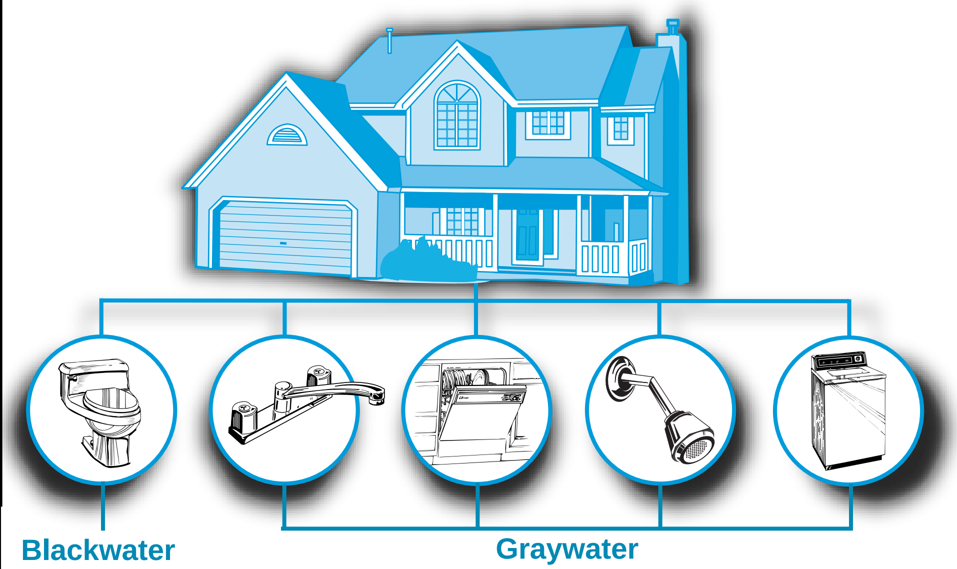
Because small community residents, in particular, are more likely to be directly responsible for making decisions about their wastewater, it is important that they know something about its characteristics (that is, its components, strength, volume, and flow) and how certain characteristics can affect their lives.

This issue of *Pipeline* answers some basic questions about wastewater characteristics and their potential impact on public health and the environment. Some methods for testing and treating wastewater also are discussed. The information can be used as an introduction to wastewater for new community officials and staff or as a tool to educate homeowners and the general public.

Readers are encouraged to reprint *Pipeline* articles in local newspapers or include them in flyers or educational presentations. Please include the name and phone number of the National Small Flows Clearinghouse (NSFC) on the reprinted information and send us a copy for our files.

If you have any questions about reprinting articles or about any of the information in this newsletter, please contact the NSFC at (800) 624-8301 or (304) 293-4191.

Household Wastewater



Adapted from: Siegrist, R. L. l977. "Waste Segregation to Facilitate Onsite Wastewater Disposal Alternatives." ASAE publication 5-77.

Wastewater characteristics are important for:

community officials

- Certain wastewater components can degrade water quality and endanger public health *(see page 3)*.
- Treatment plant workers can be harmed by hazardous substances in wastewater *(see page 4)*.
- Reducing community wastewater flows can save money *(see page 5)*.
- System operators and others can be held liable for pollution from untreated wastewater *(see page 2)*.

homeowners

- Certain hazardous household substances may pollute local wells and drinking water sources *(see page 4)*.
- Reducing household wastewater saves money *(see page 5)*.
- Pollution from malfunctioning onsite systems can harm family, friends, and neighbors *(see page 2)*.

Did You Know . . .

that wastewater treatment is a relatively recent practice? Prior to the mid 1800s, human and other wastes usually were just dumped or conveyed to the nearest body of water without treatment.

As a result, groundwater and other sources for drinking and bathing were regularly contaminated with sewage. Epidemics of cholera, typhoid, dysentery, and other waterborne diseases killed thousands, and outbreaks were especially devastating in densely populated areas.

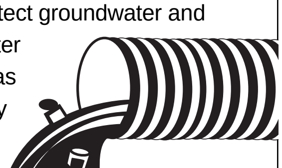
After 1854, when the connection between a cholera outbreak and sewage-contaminated water was first discovered, better attempts were made to treat and dispose of sewage separately from drinking water.

However, until the latter part of this century, many U.S. communities still allowed discharges of untreated or inadequately treated wastewater from homes, industries, and combined storm and sanitary sewers. Treatment standards often varied from town to town, and as population grew, damage to the environment and risks to public health were reaching dangerous levels nationally.

Then in the 1970s, Congress passed legislation that led to the establishment of national water quality standards and limits for the discharge of pollutants. Recent amendments to the Clean Water Act have transferred implementation of pollution control to individual state governments.

Today, community leaders are responsible for ensuring that state standards for wastewater treatment and water quality are met consistently—not only at inspection time, but always to protect public health and the environment. In some cases, treatment plant operators and community leaders may be held personally liable for noncompliance.

Homeowners also are personally liable for malfunctioning onsite systems. Onsite systems must be properly operated and maintained to protect groundwater and other drinking water sources, as well as the health of family and neighbors.



What is wastewater?

Wastewater is sewage, stormwater, and water that has been used for various purposes around the community. Unless properly treated, wastewater can harm public health and the environment.

Most communities generate wastewater from both residential and nonresidential sources.

Residential Wastewater

Although the word *sewage* usually brings toilets to mind, it actually is used to describe all types of wastewater generated from every room in a house.

In the U.S., sewage varies regionally and from home to home based on such factors as the number and type of water-using fixtures and appliances, the number of occupants, their ages, and even their habits, such as the types of foods they eat. However, when compared to the variety of wastewater flows generated by different nonresidential sources, household wastewater shares many similar characteristics overall.

There are two types of domestic sewage:

- blackwater—wastewater from toilets, and
- graywater—wastewater from all sources except toilets.

Sources of blackwater and graywater are illustrated on page 1.

Blackwater and graywater have different characteristics, but both contain pollutants and disease-causing agents that require treatment.

However, some areas in the U.S. permit the use of innovative systems that safely recycle household graywater for reuse in toilets or for irrigation to conserve water and reduce the flow to treatment systems.

See the article on page 6 and the list of resources on page 8 for more about water conservation methods and graywater reuse.

Nonresidential Wastewater

Nonresidential wastewater in small communities is generated by such diverse sources as offices, businesses, department stores, restaurants, schools, hospitals, farms, manufacturers, and other commercial, industrial, and institutional entities.

Stormwater is a nonresidential source and carries trash and other pollutants from streets, as well as pesticides and fertilizers from yards and fields.

Because of the variety of nonresidential wastewater characteristics, communities need to assess each source individually or compare similar types of nonresidential sources to ensure that adequate treatment is provided.

For example, public restrooms may generate wastewater with some characteristics similar to sewage, but usually at higher volumes and at different peak hours. The volume and pattern of wastewater flows from rental properties, hotels, and recreation areas often vary seasonally as well.

Laundries differ from many other nonresidential sources because they produce high volumes of wastewater containing lint fibers. Restaurants typically generate a lot of oil and grease. It may be necessary to provide pretreatment of oil and grease from restaurants or to collect it prior to treatment, for example, by adding grease traps to septic tanks.

Wastewater from some nonresidential sources also may require additional treatment steps. For example, stormwater should be collected separately to prevent the flooding of treatment plants during wet weather. Trash and other large solids from storm sewers often are removed by screens.

In addition, many industries produce wastewater high in chemical and biological pollutants that can overburden onsite and community systems. Dairy farms and breweries are good examples—communities may require these types of nonresidential sources to provide their own treatment or preliminary treatment to protect community systems and public health.

Information about nonresidential wastewater is available through National Small Flows Clearinghouse (NSFC) resources, some of which are listed on page 8. Contact the NSFC for more details.

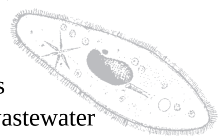
What is in wastewater?

Wastewater is mostly water by weight. Other materials make up only a small portion of wastewater, but can be present in large enough quantities to endanger public health and the environment.

Because practically anything that can be flushed down a toilet, drain, or sewer can be found in wastewater, even household sewage contains many potential pollutants.

The wastewater components that should be of most concern to homeowners and communities are those that have the potential to cause disease or detrimental environmental effects.

Organisms



Many different types of organisms live in wastewater and some are essential contributors to treatment. A variety of bacteria, protozoa, and worms work to break down certain carbon-based (organic) pollutants in wastewater by consuming them. Through this process, organisms turn wastes into carbon dioxide, water, or new cell growth.

Bacteria and other microorganisms are particularly plentiful in wastewater and accomplish most of the treatment. Most wastewater treatment systems are designed to rely in large part on biological processes.

Pathogens

Many disease-causing viruses, parasites, and bacteria also are present in wastewater and enter from almost anywhere in the community. These pathogens often originate from people and animals who are infected with or are carriers of a disease.

For example, graywater and blackwater from typical homes contain enough pathogens to pose a risk to public health. Other likely sources in communities include hospitals, schools, farms, and food processing plants.

Some illnesses from wastewater-related sources are relatively common. Gastroenteritis can result from a variety of pathogens in wastewater, and cases of illnesses caused by the parasitic protozoa *Giardia lambia* and *Cryptosporidium* are not unusual in the U.S. Other important wastewater-related diseases include hepatitis A, typhoid, polio, cholera, and dysentery. Outbreaks of these diseases can occur as a result of drinking water from wells polluted by wastewater, eating contaminated fish, or recreational activities in polluted waters. Some illnesses can be spread by animals and insects that come in contact with wastewater.

Even municipal drinking water sources are not completely immune to health risks from wastewater pathogens. Drinking water treatment efforts can become overwhelmed when water resources are heavily polluted by wastewater. For this reason, wastewater treatment is as important to public health as drinking water treatment.

For a detailed discussion of the health risks associated with wastewater, refer to the Summer 1996 (vol. 7, no. 3) Pipeline, *Item #SFPLNL06.*

Organic Matter

Organic materials are found everywhere in the environment. They are composed of the carbon-based chemicals that are the building blocks of most living things. Organic materials in wastewater originate from plants, animals, or synthetic organic compounds, and enter wastewater in human wastes, paper products, detergents, cosmetics, foods, and from agricultural, commercial, and industrial sources.

Organic compounds normally are some combination of carbon, hydrogen, oxygen, nitrogen, and other elements. Many organics are proteins, carbohydrates, or fats and are biodegradable, which means they can be consumed and broken down by organisms. However, even biodegradable materials can cause pollution. In fact, too much organic matter in wastewater can be devastating to receiving waters.

Large amounts of biodegradable materials are dangerous to lakes, streams, and oceans, because organisms use dissolved oxygen in the water to break down the wastes. This can reduce or deplete the supply of oxygen in the water needed by aquatic life, resulting in fish kills, odors, and overall degradation of water quality. The amount of oxygen organisms need to break down wastes in wastewater is referred to as the biochemical oxygen demand (BOD) and is one of the measurements used to assess overall wastewater strength.

For an explanation of BOD and testing wastewater, refer to the article on page 6.

Some organic compounds are more stable than others and cannot be quickly broken down by organisms, posing an additional challenge for treatment. This is true of many synthetic organic compounds developed for agriculture and industry.

In addition, certain synthetic organics are highly toxic. Pesticides and herbicides are toxic to humans, fish, and aquatic plants and often are disposed of improperly in drains or carried in stormwater. In receiving waters, they kill or contaminate fish, making them unfit to eat. They also can damage processes in treatment plants. Benzene and toluene are two toxic organic compounds found in some solvents, pesticides, and other products.

New synthetic organic compounds are being developed all the time, which can complicate treatment efforts.

Oil and Grease

Fatty organic materials from animals, vegetables, and petroleum also are not quickly broken down by bacteria and can cause pollution in receiving environments.

When large amounts of oils and greases are discharged to receiving waters from community systems, they increase BOD and they may float to the surface and harden, causing aesthetically unpleasing conditions. They also can trap trash, plants, and other materials, causing foul odors, attracting flies and mosquitoes and other disease vectors. In some cases, too much oil and grease causes septic conditions in ponds and lakes by preventing oxygen from the atmosphere from reaching the water.

Onsite systems also can be harmed by too much oil and grease, which can clog onsite system drainfield pipes and soils, adding to the risk of system failure. Excessive grease also adds to the septic tank scum layer, causing more frequent tank pumping to be required. Both possibilities can result in significant costs to homeowners.

Petroleum-based waste oils used for motors and industry are considered hazardous waste and should be collected and disposed of separately from wastewater.

See the article on page 4 for information about safely disposing of hazardous wastes.

Continued on page 4

What is in wastewater?

Continued from page 3

Inorganics

Inorganic minerals, metals, and compounds, such as sodium, potassium, calcium, magnesium, cadmium, copper, lead, nickel, and zinc are common in wastewater from both residential and nonresidential sources. They can originate from a variety of sources in the community including industrial and commercial sources, stormwater, and inflow and infiltration from cracked pipes and leaky manhole covers. Most inorganic substances are relatively stable, and cannot be broken down easily by organisms in wastewater.

Large amounts of many inorganic substances can contaminate soil and water. Some are toxic to animals and humans and may accumulate in the environment. For this reason, extra treatment steps are often required to remove inorganic materials from industrial wastewater sources.

Heavy metals, for example, which are discharged with many types of industrial wastewaters, are difficult to remove by conventional treatment methods. Although acute poisonings from heavy metals in drinking water are rare in the U.S., potential long-term health effects of ingesting small amounts of some inorganic substances over an extended period of time are possible.

Nutrients

Wastewater often contains large amounts of the nutrients nitrogen and phosphorus in the form of nitrate and phosphate, which promote plant growth. Organisms only require small amounts of nutrients in biological treatment, so there normally is an excess available in treated wastewater.

In severe cases, excessive nutrients in receiving waters cause algae and other plants to grow quickly depleting oxygen in the water. Deprived of oxygen, fish and other aquatic life die, emitting foul odors.

Nutrients from wastewater have also been linked to ocean “red tides” that poison fish and cause illness in humans. Nitrogen in drinking water may contribute to miscarriages and is the cause of a serious illness in infants called methemoglobinemia or “blue baby syndrome.”

Solids

Solid materials in wastewater can consist of organic and/or inorganic materials and organisms. The solids must be significantly reduced by treatment or they can increase BOD when discharged to receiving waters and provide places for microorganisms to escape disinfection. They also can clog soil absorption fields in onsite systems.

• *settleable solids*—Certain substances, such as sand, grit, and heavier organic and inorganic materials settle out from the rest of the wastewater stream during the preliminary stages of treatment. On the bottom of settling tanks and ponds, organic material makes up a biologically active layer of sludge that aids in treatment.

• *suspended solids*—Materials that resist settling may remain suspended in wastewater. Suspended solids in wastewater must be treated, or they will clog soil absorption systems or reduce the effectiveness of disinfection systems.

• *dissolved solids*—Small particles of certain wastewater materials can dissolve like salt in water. Some dissolved materials are consumed by microorganisms in wastewater, but others, such as heavy metals, are difficult to remove by conventional treatment. Excessive amounts of dissolved solids in wastewater can have adverse effects on the environment.

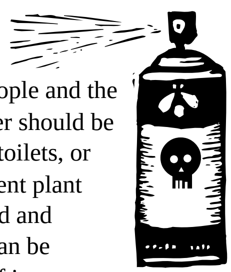
Gases

Certain gases in wastewater can cause odors, affect treatment, or are potentially dangerous.

Methane gas, for example, is a byproduct of anaerobic biological treatment and is highly combustible. Special precautions need to be taken near septic tanks, manholes, treatment plants, and other areas where wastewater gases can collect.

The gases hydrogen sulfide and ammonia can be toxic and pose asphyxiation hazards. Ammonia as a dissolved gas in wastewater also is dangerous to fish. Both gases emit odors, which can be a serious nuisance. Unless effectively contained or minimized by design and location, wastewater odors can affect the mental well-being and quality of life of residents. In some cases, odors can even lower property values and affect the local economy.

Dispose of Household Hazardous Wastes Safely



Many household products are potentially hazardous to people and the environment and never should be flushed down drains, toilets, or storm sewers. Treatment plant workers can be injured and wastewater systems can be damaged as a result of improper disposal of hazardous materials.

Other hazardous chemicals cannot be treated effectively by municipal wastewater systems and may reach local drinking water sources. When flushed into septic systems and other onsite systems, they can temporarily disrupt the biological processes in the tank and soil absorption field, allowing hazardous chemicals and untreated wastewater to reach groundwater.

Some examples of hazardous household materials include motor oil, transmission fluid, antifreeze, paint, paint thinner, varnish, polish, wax, solvents, pesticides, rat poison, oven cleaner, and battery fluid.

Many of these materials can be recycled or safely disposed of at community recycling centers.

For information about hazardous waste disposal and recycling in your area, call the NSFC or the U.S. Department of Agriculture for the number of your local Extension Service office. Contact information is listed on page 7.

Thank You For Your Input!

The many wonderful comments and suggestions we received in response to the *Pipeline* readership survey have been encouraging. So far, we have heard from well over 1,000 readers, and more responses trickle in every day.

Currently, we are in the process of tallying all the information, so we can begin to implement some of the article ideas in upcoming issues. The results will be reported in the next issue of *Pipeline*.

In the meantime, it’s still not too late to respond. If you have any questions about the survey, please contact the National Small Flows Clearinghouse.

Other Important Wastewater Characteristics

In addition to the many substances found in wastewater, there are other characteristics system designers and operators use to evaluate wastewater. For example, the color, odor, and turbidity of wastewater give clues about the amount and type of pollutants present and treatment necessary.

The following are some other important wastewater characteristics that can affect public health and the environment, as well as the design, cost, and effectiveness of treatment.

Temperature

The best temperatures for wastewater treatment probably range from 77 to 95 degrees Fahrenheit. In general, biological treatment activity accelerates in warm temperatures and slows in cool temperatures, but extreme hot or cold can stop treatment processes altogether. Therefore, some systems are less effective during cold weather and some may not be appropriate for very cold climates.

Wastewater temperature also affects receiving waters. Hot water, for example, which is a byproduct of many manufacturing processes, can be a pollutant. When discharged in large quantities, it can raise the temperature of receiving streams locally and disrupt the natural balance of aquatic life.

pH

The acidity or alkalinity of wastewater affects both treatment and the environment. Low pH indicates increasing acidity, while a high pH indicates increasing alkalinity (a pH of 7 is neutral). The pH of wastewater needs to remain between 6 and 9 to protect organisms. Acids and other substances that alter pH can inactivate treatment processes when they enter wastewater from industrial or commercial sources.

Flow

Whether a system serves a single home or an entire community, it must be able to handle fluctuations in the quantity and quality of wastewater it receives to ensure proper treatment is provided at all times. Systems that are inadequately designed or hydraulically overloaded may fail to provide treatment and allow the release of pollutants to the environment.

To design systems that are both as safe and as cost-effective as possible, engineers must estimate the average and maximum (peak) amount of flows generated by various sources.

Because extreme fluctuations in flow can occur during different times of the day and on different days of the week, estimates are based on observations of the minimum and maximum amounts of water used on an hourly, daily, weekly, and seasonal basis. The possibility of instantaneous peak flow events that result from several or all water-using appliances or fixtures being used at once also is taken into account.

The number, type, and efficiency of all water-using fixtures and appliances at the source is factored into the estimate (for example, the number and amount of water normally used by faucets, toilets, and washing machines), as is the number of possible users or units that can affect the amount of water used (for example, the number of residents, bedrooms, customers, students, patients, seats, or meals served).

According to studies, water use in many homes is lowest from about midnight to 5 a.m., averaging less than one gallon per person per hour, but then rises sharply in the morning around 6 a.m. to a little over 3 gallons per person per hour. During the day, water use drops off moderately and rises again in the early evening hours.

Weekly peak flows may occur in some homes on weekends, especially when all adults work during the week. In U.S. homes, average water use is approximately 45 gallons per person per day, but may range from 35 to 60 gallons or more.

Peak flows at stores and other businesses typically occur during business hours and during meal times at restaurants. Rental properties, resorts, and commercial establishments in tourist areas may have extreme flow variations seasonally.

Estimating flow volumes for centralized treatment systems is a complicated task, especially when designing a new treatment plant in a community where one has never existed previously. Engineers must allow for additional flows during wet weather due to inflow and infiltration of extra water into sewers. Excess water can enter sewers through leaky manhole covers and cracked pipes and pipe joints, diluting wastewater, which affects its overall characteristics, and increasing flows to treatment plants sometimes by as much as three or four times the original design load.

See the articles and table on page 6 for information about wastewater quality and measurements.

Reducing Wastewater Saves Money

Reducing wastewater by conserving water is a good idea for a number of reasons. Not only does it lower monthly water bills, but it also can reduce the money that homeowners and communities spend for wastewater treatment.

Community-wide water conservation programs can result in increased wastewater treatment plant efficiency and savings on energy costs. Significant reduction in wastewater flows also can save on personnel costs, such as overtime, and can eliminate or postpone the need to upgrade or expand facilities.

For homeowners, community savings can translate into lower sewer charges, lower taxes, and more community dollars available for schools, roads, and other community projects.

Water conservation also directly benefits homeowners with onsite systems. Simply by reducing water use, homeowners can extend the life of their systems for many years, prevent system failures, and minimize maintenance costs, potentially saving hundreds of dollars.

However, the most important reason to reduce water use is to protect water quality. Many pollutants in wastewater are not removed by treatment or by the natural cleansing abilities of the environment. The best way to ensure that enough clean water will be available in the future is to pollute as little as possible in the first place.

Most water use can be reduced simply and inexpensively. For example, in homes, toilets, showers, and faucets together account for about two-thirds of total water use. In some cases, fixing leaks, installing low-flow fixtures and appliances, and using

Continued on page 7

Q&A

How is treatment achieved?

The goal of wastewater treatment is to remove as much of the floating and biodegradable pollutants and disease-causing agents in wastewater as possible to minimize the risks to public health and impact on the environment.

In many small communities, wastewater treatment often takes place in onsite systems, such as septic systems. It also may be collected and transported through a network of sewers to small decentralized treatment systems or to a central community treatment plant. Some communities use a combination of options.

Most systems achieve treatment through a series of stages. The primary stage often includes separating trash and large solid materials from the rest of the wastewater by screens and/or mechanically grinding them into finer materials. The remaining solids, oils, and greases are allowed to settle or separate from the rest of the stream in a septic tank, clarifier tank, or pond.

The settled materials form a biologically active bottom layer of sludge. In all systems, the sludge accumulates and eventually needs to be removed, treated, and disposed of as well.

The secondary stage of treatment uses a combination of biological and physical processes to reduce the amount of organic wastes. This can be achieved by filtering the wastewater through biologically active media, such as trickling filters, sand filters, other specially designed filters, or soil (the most common method used with septic systems). Or, community systems commonly use an activated sludge process, in which wastewater is exposed to both oxygen and the biologically active sludge, either through wind action or mechanical means, such as mixing and aeration.

Disinfection is often the final step after secondary or tertiary treatment and helps to kill most remaining viruses and bacteria.

A variety of advanced (or tertiary) treatment methods are sometimes required to reduce nutrients, toxic substances, or excessive amounts of dissolved materials in wastewater.

Testing and Measuring Wastewater

System operators, designers, and regulatory agencies use tests to evaluate the strength of wastewater and the amount of treatment required, the quality of effluent at different stages of treatment, and the quality of receiving waters at the point of discharge. Tests also determine whether treatment is in compliance with state, local, and federal regulations.

In small communities, operators and health officials often are trained to collect samples and perform some or all wastewater tests themselves. An option that sometimes is more economical for small systems is to send samples away to a lab for testing.

The following are a few important tests:

BOD—biochemical oxygen demand

The BOD test measures the amount of dissolved oxygen organisms are likely to need to degrade wastes in wastewater. This test is important for evaluating both how much treatment wastewater is likely to require and the potential impact that it can have on receiving waters.

To perform the test, wastewater samples are placed in BOD bottles and are diluted with specially prepared water containing dissolved oxygen. The dilution water is also "seeded" with bacteria when treated wastewater is being tested.

The amount of dissolved oxygen in the diluted sample is measured, and the samples are then stored at a constant temperature of 20 degrees Celsius (68 degrees Fahrenheit). Common incubation periods are five, seven, or twenty days—five days (or BOD_5) is the most common. At the end of the incubation period, the dissolved oxygen is measured again. The amount that was used (expressed in milligrams per liter) is an indication of wastewater strength.

Refer to the table below for some typical BOD amounts in municipal wastewater.

TSS–total suspended solids

In addition to BOD, estimating the amount of suspended solids in wastewater helps to complete an overall picture of how much secondary treatment is likely to be required. It also indicates wastewater clarity and is important for assessing the potential impact of wastewater on the environment.

After larger solids are removed in primary treatment, TSS is measured as the portion of solids retained by a 2.0-micron filter.

Refer to the table below for some typical TSS amounts in municipal wastewater.

Total Coliforms and Fecal Coliforms

Coliform tests are useful for determining whether wastewater has been adequately treated and whether water quality is suitable for drinking and recreation.

Because they are very abundant in human wastes, coliform bacteria are much easier to locate and identify in wastewater than viruses and other pathogens that cause severe diseases. For this reason, coliform bacteria are used as indicator organisms for the presence of other, more serious pathogens. Some coliforms are found in soil, so tests for fecal coliforms are considered to be the most reliable. However, tests for both total coliforms and fecal coliforms are commonly used.

There are two methods for determining the presence and density of coliform bacteria. The membrane filter (MF) technique provides a direct count of colonies trapped and then cultured. The multiple tube fermentation method provides an estimate of the most probable number (MPN) per 100 milliliters from the number of test tubes in which gas bubbles form after incubation.

Typical Municipal Wastewater Characteristics (in milligrams per liter)

	weak	medium	strong	minimum treatment requirements
BOD_5	110	220	400	30
TSS	100	220	350	30
Nitrogen (N)	20	40	85	variable
Phosphorus (P)	4	8	15	variable

**Minimum national pollution discharge and elimination system (NPDES) standards. State and local requirements vary and often are more stringent. For information about local NPDES requirements, contact your regional EPA permit office or the National Small Flows Clearinghouse.*
Source: Metcalf and Eddy, Inc. 1991. *Wastewater Engineering Treatment, Disposal, and Reuse.* 3rd ed. McGraw-Hill, Inc.

Reducing Wastewater Helps CA Resort

Situated approximately halfway between San Francisco and Los Angeles near the coastal town of Paso Robles, California, the Nacimiento Resort has no problem attracting visitors.

On a busy summer weekend, as many as 3,000 people can be found boating, fishing, or swimming at the lake or eating at the resort restaurant. Summer occupancy of campgrounds and rental units averages around 1,200.

Because of its increasing popularity, the resort wanted to expand its facilities by adding 40 new condominiums. But to obtain a permit from the regional water quality authority, it first needed to find a way to accommodate the additional wastewater flows anticipated from the new units.

Nacimiento was already close to reaching its maximum amount of permitted flows of 36,000 gallons per day. During the busiest summer months, public restrooms, showers, and other facilities at the resort are in constant use.

The resort either had to find a way to decrease the amount of wastewater it generated or expand its current wastewater system. A consulting firm was retained to evaluate the situation and offer cost-effective options. Simple water conservation, it turned out, was the most economical solution to the problem.

"Wastewater system capacity is often a limiting factor for projects in our area," says Rob Miller, P.E., an engineer with John L. Wallace and Associates, the firm hired by the resort. "Because of limited water resources, most local communities and developments already employ low-flow fixtures. Nacimiento was unique because they had a relatively small number of older fixtures that were heavily used, which is an ideal opportunity for retrofitting."

The results were dramatic. Old high-flow toilets were replaced by ultra low-flush models using 1.6 gallons of water per flush. Showers that used 5 gallons per minute received new showerheads that use 2 gallons per minute. Each new fixture saved hundreds of gallons of water per day, reducing peak wastewater flows 10,000 gallons per day.

"It was an immediate success, with measurable results on the first busy weekend after the fixtures were replaced," says Miller. "It also lowered costs for water pumping and treatment and deferred costs for capital improvement."

The total reduction of peak wastewater flows was 10,000 gallons per day, which is enough to accommodate the additional flows from the expansion anticipated by the regional water quality board.

Reducing Wastewater Saves Money

Continued from page 5

simple common sense can conserve household water use by as much as 50 percent.

The following are some ways to reduce water use around the home:

- Reduce water pressure.
- Limit shower time.
- Install low-flow showerheads or shower flow control devices.
- Turn off faucets while shaving and brushing teeth.
- Install reduced-flow faucets or water-saving faucet inserts or aerators.
- Run washing machines and dishwashers only when full, or adjust cycle settings to match loads.
- Use front-loading washing machines.
- Fix leaking or dripping faucets and running toilets.
- Replace old high-flow toilets (4 to 7 gallons per flush) with water-saving (3.5 gallons) or ultra low-flush toilets (1 to 2 gallons).*
- Install dams in toilet tanks, or fill a milk jug or plastic container with rocks and place it in the toilet tank.
- Use graywater recycling/reuse systems for toilet flushing, irrigation, and other uses where permitted and appropriate.

**Plumbing in some buildings may not be adequately designed to accommodate certain low-flush toilets.*

CONTACTS

National Small Flows Clearinghouse (NSFC)

The NSFC offers a variety of technical assistance and free and low-cost information and materials about wastewater technologies for small communities. Just a few of the NSFC's many resources and services are mentioned in this newsletter. Call the NSFC at (800) 624-8301 or (304) 293-4191 for more information.

Local Health Departments

Small communities and homeowners interested in wastewater treatment options should contact their local health departments for more information about local regulations and requirements. Health departments usually are listed in the government section or blue pages of local phone directories.

Extension Service Offices

Many universities have U.S. Department of Agriculture Extension Service offices on campus and in other locations that provide a variety of services and assistance to small communities. Contact the NSFC for the number of the office in your area, or call the U.S. Department of Agriculture at (202) 720-3377.

Rural Community Assistance Program (RCAP)

RCAP is a network of nonprofit organizations that provide assistance to rural and low-income communities concerning almost every aspect of planning wastewater projects. Call RCAP's national office at (703) 771-8636 or the NSFC for the number of your regional RCAP office.

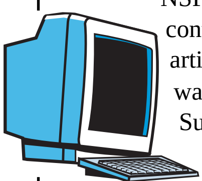
National Rural Water Association (NRWA)

NRWA is a nonprofit association organized to represent small water and wastewater utilities in each state and to meet their needs with operation, maintenance, management, funding, and political concerns. It offers a variety of assistance and services. Contact the NSFC for the number of your state RWA office.

RESOURCES AVAILABLE FROM NSFC

To order products listed as available from the National Small Flows Clearinghouse (NSFC), call (800) 624-8301 or (304) 293-4191, fax (304) 293-3161, e-mail nsfc_orders@estd.wvu.edu, or write NSFC, West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064. Please request each item by number and title. A shipping and handling charge will apply.

Computer Search on Wastewater Characteristics



NSFC's Bibliographic Database contains abstracts of nearly 100 articles with information about wastewater characteristics. Subjects include residential and community wastewater, flow reduction, effectiveness of various treatment methods, and graywater recycling. Many of these articles are available through the NSFC. The price is $10.65. Item #WWBLCM10.

Graywater Information Package

Articles from various sources on the use of household graywater are compiled in this information package from NSFC. The package is updated annually and includes design, performance, and public health information and case studies. The package also includes computer searches of articles and graywater system manufacturers from NSFC's databases. The price is $21.00. Item #WWPCGN82.

Wastewater Treatment/Disposal for Small Communities

Published by the U.S. Environmental Protection Agency (EPA), this 118-page manual includes a chapter on wastewater characteristics and related information. Both residential and nonresidential wastewater are discussed. The price is $16.50. Item #WWBKDM70.

Conservation Effects on Onsite Systems

Water Conservation Effects on Onsite Wastewater Treatment Technology Package includes articles from NSFC's newsletters and Bibliographic Database that are of interest to officials, wastewater professionals, and the general public. The price is $10.80. Item #WWBKGN68.

Regulations for Wastewater Flow Rates

Wastewater Flow Rates from the State Regulations is a compilation of regulations for establishing wastewater flow rates used to determine onsite system size. The package is updated annually and a list of contacts is included. Call NSFC for price information. Item #WWBKRG21.

Graywater Systems Regulations

Graywater Systems from the State Regulations presents sections of state onsite regulations concerning the design and construction of graywater systems. Updated annually. Call NSFC for price information. Item #WWBKRG24.

Video: The Alternative Is Conservation

Water conservation is presented in this 20-minute videotape as a method for lowering overall wastewater volume and demands on water supplies. Low-flow devices also are discussed. The price is $10.00. Item #WWVTGN13.

PIPELINE

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