PURDUE UNIVERSITY

PURDUE EXTENSION

HENV-9-W

Home & Environment

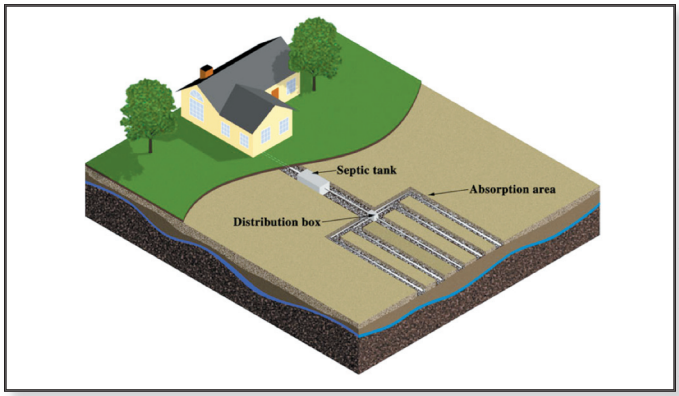
Water Use and Septic System Performance

Brad Lee and Don Jones

Department of Agronomy and Department of Agricultural and Biological Engineering, Purdue University

All Indiana residential households not connected to a central sewage system require septic systems. As described in Indiana State Rule 410 IAC 6-8.1, "Residential Sewage Disposal Systems," all wastewater effluent leaving a household must go to a septic system. The most common type of septic system used in the state is the conventional trench system (see Figure 1).

All septic systems permitted in Indiana (whether conventional or not) rely on the soil to treat and disperse wastewater (for more about soil's role in septic systems, see HENV-7-W, *Indiana Soils and Septic Systems*, http://www.ces.purdue.edu/extmedia/HENV/HENV-7-W.pdf). Soils can adequately treat wastewater as long as the amount of wastewater leaving the home does not exceed the soil's ability to absorb and treat it. However, when the volume of wastewater entering the soil absorption field exceeds the soil's ability to disperse it, the system will hydraulically overload.



Sharon Katz, Purdue Agricultural Communication

Figure 1. *In a conventional trench septic system, wastewater flows from the house into the septic tank. In the tank, solids settle out and liquid waste flows into a distribution box, then through a network of perforated pipes placed in gravel filled trenches that are covered with soil. Collectively, this network of pipes is called the soil absorption field.*

Hydraulic overload results in wastewater backing up into bathtubs and other plumbing drains, or ponding of effluent on the ground surface (see Figure 2 — for more about hydraulic overload and other types of failure, see HENV-1-W, *Septic System Failure*, http://www.ces.purdue.edu/extmedia/HENV/HENV-1-W.pdf).

The purpose of this publication is to discuss home water use patterns and suggest water conservation measures that could improve septic system performance and reduce the risks of hydraulic overload or other kinds of system failure.

Hydraulic overload failure resulting in discharge of wastewater on the soil surface.

Figure 2. *This photo shows an example of a septic system failing due to hydraulic overload. The soil absorption field could not accept the volume of water discharged from the home, resulting in septic tank effluent coming up to the ground surface.*

Household Water Use

The average person uses about 69 gallons of water per day, according to the U.S. Environmental Protection Agency (2002). This includes typical activities such as flushing toilets, showering and bathing, washing clothes and dishes, using faucets, and other uses (see Figure 3).

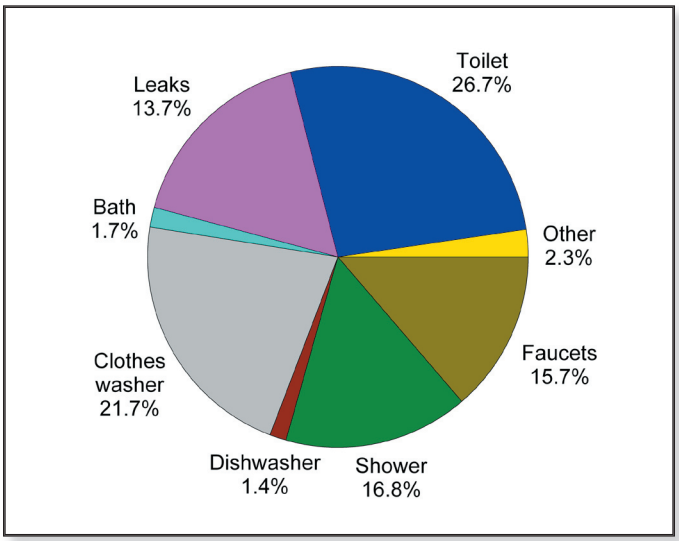


Figure 3. *Typical residential water use by fixture or appliance (Mayer et al., 2000).*

A home's water use varies widely during a typical day. There are minimum and maximum flows of wastewater each day and each hour, as well as instantaneous peak flows. Depending on individual habits, the amount of wastewater leaving a home at any given time can vary widely. Hourly fluctuations in wastewater flow (see Figure 4) can adversely affect septic system performance and result in hydraulic overload during peak flow conditions.

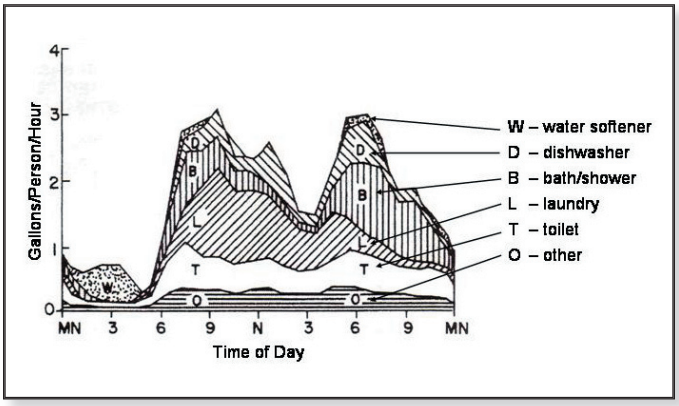


Figure 4. *Gallons of residential water use per person over a 24-hour period by fixture or appliance (University of Wisconsin-Madison, 1978).*

Because water use is not uniform throughout the day, Indiana (and most other states') rules require septic systems to be somewhat oversized to accommodate for these fluctuations. For example, in Indiana systems must be designed to handle 150 gallons of wastewater per bedroom per day. So, for a three-bedroom home, a septic system must be designed to handle 450 gallons of wastewater per day. If that same home has only four occupants, the average daily flow would be 276 gallons (based on the EPA average of 69 gallons per person), well under the designed 450 gallons per day. Because of this rule, the designed septic systems can accommodate wastewater fluctuations as well as brief periods of high water use — such as when several relatives visit over a holiday.

Although oversizing the soil absorption field can account for most peak loading, there may still be situations when septic systems cannot keep up with wastewater loads. For example, in spring, soils can become saturated during periods of snowmelt or high rainfall. Under these conditions, household plumbing may drain slower than usual. In another example, excessive peak wastewater flows can occur after the arrival of an infant, or during extended holiday visits from relatives or friends. When experiencing any of these conditions, it is a good practice to reduce wastewater load on the septic system.

Methods to Reduce Wastewater Load

There are several modifications to plumbing and behavior that can reduce the amount of wastewater generated in the home. A number of these modifications are listed below (as adapted from U.S. Environmental Protection Agency, 1995).

Plumbing Modifications

Replacing older indoor plumbing fixtures with new water-saving fixtures can usually reduce water use. Low-flow plumbing fixtures and retrofit programs are permanent, one-time conservation measures that can be implemented with little cost. In addition to reducing septic system loads, these modifications usually can save homeowners money over the long term by reducing water use. Those who own homes built after January 1994, probably have many of these water-saving fixtures already installed, due to the U.S. Energy Policy Act. The act required national standards governing the flow capacity of showerheads, faucets, urinals, and toilets. Below are some examples of plumbing modifications homeowners can make to reduce wastewater flow.

Low-flow toilets: More than 4.8 billion gallons of water are flushed down toilets each day in the United States. Prior to 1994, the average American used about 9,000 gallons of water per year to flush 230 gallons of waste (Jensen, 1991). During remodeling projects, there is great potential to reduce water consumption by installing low-flow toilets. Conventional toilets use 3.5 to 5 gallons (or more) of water per flush. Low-flow toilets use 1.6 gallons of water or less, substantially reducing the volume of wastewater produced. If all high-flow toilets in a home are replaced with low-flow units, wastewater load could be reduced by 10-15 percent. While early low-flow toilet models generated a number

of complaints about their effectiveness and noise, newer models work much better.

Toilet displacement devices: An inexpensive alternative to replacing old, high-flush toilets is to place plastic containers (such as plastic milk jugs) filled with water or pebbles into the flush tank of older units, reducing the amount of water used per flush. When installing such devices, make sure containers do not interfere with flushing mechanisms or water flow. Displacement devices can reduce the water volume from older toilets by a gallon or more per flush. Similarly, a toilet dam, which holds back a reservoir of water when the toilet is flushed, can also be used in a high volume toilet flush tank to save water. If toilet dams are installed in all high-flush toilets in a home, wastewater load could be reduced 3-5 percent.

Low-flow showerheads: Showers account for about 20 percent of total indoor water use. By replacing older 4.5-gallon-per-minute showerheads with 2.5-gallon-per-minute heads (which cost less than $5 each) a family of four could save approximately 20,000 gallons of water per year (Jensen, 1991). This can reduce the loading on septic systems by about 10 percent.

Faucet aerators: Faucet aerators break flowing water into fine droplets and trap air bubbles in the flow while maintaining wetting effectiveness. Aerators are inexpensive and homeowners can easily install them to reduce each faucet's water use by as much as 60 percent while still maintaining a strong flow. If all a home's faucets are retrofitted, wastewater load can be reduced 8-9 percent.

Pressure reduction: Because water flow rate is related to pressure, the maximum water flow from fixtures operating on fixed settings can be reduced if water pressure is reduced. Homeowners can reduce a home's water pressure by installing pressure-reducing valves or by modifying the pressure on-off settings that control the well pump. Many home water fixtures, however, such as washing machines and toilets, operate on a fixed amount of water, so reducing water pressure would have little effect on water use at those locations.

Behavioral Modifications

Changing personal habits to use water more efficiently can also reduce water consumption and reduce the chances of septic system failure. Because they do not require money, modifying water use habits are the most cost effective changes available to homeowners. Following any one of these practices may not dramatically reduce water use. But taken together, these practices can make a significant difference in water use and wastewater generated when the entire family adopts a number of them.

Dishwashing: Typically, 10-20 gallons of water can be saved each day by running the dishwasher only when it is full, rather than after each meal. If dishes are washed by hand, filling the sink or a dishpan with water, rather than running the faucet continuously, will reduce wastewater load.

Brushing teeth and shaving: Water can be saved in the bathroom by turning off the faucet while brushing teeth or shaving.

Showers: Water can be saved by taking shorter showers and by turning the water off while soaping.

Toilets: Toilets should be used only for sanitary waste (not ash tray contents, cat litter, facial tissues, or diapers).

Laundry: Water can be saved in the laundry room by adjusting the washing machine's water level to match the size of the load. If the washing machine does not have a variable load control, run the machine only when it is full. If washing is done by hand, water should not be left running. A laundry tub should be filled with water, and the wash and rinse water should be reused as much as possible. Also, spreading laundry throughout the week (rather than running the machine several times in one day) will reduce peaks in water use that could overload septic systems.

References

Indiana State Department of Health. 1990. Rule 410 IAC 6-8.1. Residential Sewage Disposal Systems. Indiana State Department of Health, Sanitary Engineering, Indianapolis, IN.

Jensen, R. 1991. Indoor Water Conservation. Texas Water Resources 17(4).

Mayer, P.W., W.B. DeOreo, and D.M. Lewis. 2000. Seattle Home Water Conservation Study: The Impacts of High Efficiency Plumbing Fixture Retrofits in Single-Family Homes. Submitted to Seattle Public Utilities and US Environmental Protection Agency by Aquacraft, Inc. Water Engineering and Management, Boulder, CO.

University of Wisconsin-Madison. 1978. Management of Small Wastewater Flows. EPA- 600/7-78-173. U.S. Environmental Protection Agency, Office of Research and Development, Municipal Environmental Research Laboratory (MERL) Cincinnati, OH.

U.S. Environmental Protection Agency. 1995. Cleaner Water Through Conservation. EPA 841-B-95-002.

U.S. Environmental Protection Agency. 2002. Onsite Wastewater Treatment Systems Manual.

Other Purdue Extension bulletins in this series:

HENV–1–W, *Septic System Failure*, http://www.ces.purdue.edu/extmedia/HENV/HENV-1-W.pdf.

HENV–2–W, *Increasing the Longevity of Your Septic System*, http://www.ces.purdue.edu/extmedia/HENV/HENV-2-W.pdf.

HENV–3–W, *Turfgrass Color: Indicator of Septic System Performance*, http://www.ces.purdue.edu/extmedia/HENV/HENV-3-W.pdf.

HENV–4–W, *Septic System Distribution Boxes: Importance of Equal Distribution in Trenches*, http://www.ces.purdue.edu/extmedia/HENV/HENV-4-W.pdf.

HENV–5–W, *Septic Tanks: The Primary Treatment Device of Your Septic System*, http://www.ces.purdue.edu/extmedia/HENV/HENV-5-W.pdf.

HENV–6–W, *Grandfathered Septic Systems: Location and Replacement/Repair*, http://www.ces.purdue.edu/extmedia/HENV/HENV-6-W.pdf.

HENV–7–W, *Indiana Soils and Septic Systems*, http://www.ces.purdue.edu/extmedia/HENV/HENV-7-W.pdf.

HENV–8–W, *Gravel and Gravelless Trench Soil Absorption Fields*, http://www.ces.purdue.edu/extmedia/HENV/HENV-8-W.pdf.

HENV–10–W, *Septic Systems in Flooded and Wet Soil Conditions*, http://www.ces.purdue.edu/extmedia/HENV/HENV-10-W.pdf.

Visit the Home & Environment Web site for science-based information about homes and the home environment: http://www.ces.purdue.edu/HENV/index.htm.

Authors:

Brad Lee, Assistant Professor and Soil and Land Use Extension Specialist, Department of Agronomy, Purdue University

Don Jones, Professor and Agricultural Engineering Extension Specialist, Department of Agricultural and Biological Engineering, Purdue University

Purdue Extension
Knowledge to Go
1-888-EXT-INFO

EXPERT REVIEWED

2/04