KY•A•Syst
Home and Farmstead
Water Quality Assessment

Assessing and Reducing the Risk of Groundwater Contamination from

HOUSEHOLD WASTEWATER TREATMENT

Why should I be concerned?

Kentucky's groundwater is one of its most vital resources. It supplies drinking water for hundreds of thousands of Kentuckians. Groundwater is the source of water for drinking water wells, springs, and some municipal, or "city," water supplies. All of us do things at our homes every day which can possibly pollute the groundwater. Nobody wants to pollute the groundwater, but if we are not careful and educated about how we manage our day-to-day home or farmstead activities, we can do just that–pollute the groundwater that serves as drinking water for many families. Even if nobody in your community uses groundwater for drinking water, you need to be concerned. This is because groundwater that underlies your home may travel a long way and eventually end up as another family's drinking water.

Almost all rural homes use a septic tank to treat their household wastewater. While these systems generally work pretty well, household wastewater can contain contaminants that degrade water quality for such uses as drinking, stock watering, food preparation, and cleaning.

Potential contaminants in household wastewater include disease-carrying bacteria, infectious viruses, household chemicals, and excess nutrients, such as nitrogen. Viruses can infect the liver, causing hepatitis, or can infect the lining of the intestine, causing vomiting and diarrhea. If coliform organisms (a group of indicator bacteria) are found in your drinking water, they show that the water is potentially dangerous for drinking and food preparation.

Conserving home water use and properly managing your treatment system will help protect the groundwater and extend the life of your system, thereby saving you money.

The goal of KY•A•Syst is to help you protect the groundwater that supplies drinking water for many families.

How will this publication help me protect the groundwater?

Part I of this publication will help you protect the groundwater by asking you questions about your household wastewater treatment system. These questions will help you identify activities or structures on your property which may put groundwater at a high risk of being contaminated. Part II will give suggestions on how to reduce the risk of groundwater contamination by improving your wastewater treatment system.

The KY•A•Syst program is for your benefit only. No information from this publication needs to leave your home. KY•A•Syst does not attempt to offer legal advice or solutions to individual problems but rather to raise general awareness about groundwater protection strategies. Questions about individual problems should be addressed to the appropriate professional.

Part I. *Assessing* the Risk of Groundwater Contamination from Household Wastewater Treatment

Instructions:
Circle the number in front of the appropriate item that ***best*** describes your home. Skip and leave blank any categories that don't apply to your home. For categories separated by "**OR,**" choose only one category.

QUANTITY OF WASTEWATER

Approximately how much water does your household use per day?

4 Conservative water use (less than 20 gallons per person per day). Good maintenance of water-conserving fixtures such as low volume flush toilets. Whole house use is less than design capacity.*

3 Moderate water use (20 to 60 gallons per person per day). No dripping from sinks or toilets. Some water conservation fixtures such as low volume flush toilet used. Water softener recharges twice a week or less. Whole house use is near design capacity.*

2 High water use (60 to 120 gallons per person per day). Some dripping from sinks or toilets. Water softener recharges more than twice a week. Whole house use occasionally exceeds design capacity.*

1 Excessive water use (greater than 120 gallons per person per day). Dripping from sinks or toilets. No water-conserving fixtures such as low volume flush toilet used. Whole house use frequently exceeds design capacity.*

* If design capacity of your treatment system is unknown, estimate at 120 gallons per bedroom per day.

QUALITY OF WASTEWATER

Do you have a garbage disposal, and if so, how often is it used?

4 No use of garbage disposal unit in kitchen sink.

3 Minimal use of garbage disposal unit (1 to 2 times per week).

2 Moderate use of garbage disposal unit (3 to 5 times per week).

1 Daily use of garbage disposal unit.

How much household chemical do you use every week?

4 Minimal use of household chemicals such as everyday kitchen and bath cleansers (cups per week). No disposal of solvents and toxic cleaning agents (drain cleaners, spot removers, or laundry degreasers) down the drain. No disposal of hazardous home maintenance products (paint, paint thinners, pesticides, etc.) down the drain. No water softener or not recharged on site.

3 Careful use of household chemicals such as everyday kitchen and bath cleansers (pints per week). Minimal disposal of solvents and toxic cleaning agents (drain cleaners, spot removers, laundry degreasers) down the drain. No disposal of hazardous home maintenance products (paints, paint thinners, pesticides, etc.) down the drain. Water softener used; recharged on site.

2 Moderate use of household chemicals such as everyday kitchen and bath cleansers (quarts per week). Moderate disposal of solvents and toxic cleaning agents (drain cleaners, spot removers, laundry degreasers) down the drain. No disposal of hazardous home maintenance products (paints, paint thinners, pesticides, etc.) down the drain.

1 Extensive use of household chemicals such as everyday kitchen and bath cleansers (gallons per week). Extensive disposal of solvents and toxic cleaning agents (drain cleaners, spot removers, or laundry degreasers) down the drain. Disposal of hazardous home maintenance products (paint, paint thinners, pesticides, etc.) down the drain.

How much kitchen grease or oil is poured down the drain?

4 No disposal of kitchen grease or oil down the drain.

3 Minimal disposal of kitchen grease or oil down the drain. Oil and grease wiped from cooking utensils before washing.

2 Moderate disposal of kitchen grease or oil down the drain. No attempt to reduce disposal of grease and oil from household, but little generated.

1 Extensive disposal of kitchen grease or oil down the drain.

Is all wastewater collected for treatment? Does any water that does not need treatment (rainwater, water from sump pump) enter the treatment system?

4 All wastewater collected for treatment. No water enters the treatment system that does not need treatment (rainwater, water from sump pump). No ponding of water near septic tank or house sewer (collection system-pipe). House sewer (collection system-pipe) more than 50 feet from well or spring.

3 All wastewater collected for treatment. Some water that does not need treatment (rainwater, water from sump pump) enters the treatment system.

2 Some wastewater is not treated. Some water that does not need treatment (rainwater, sump pump) enters the treatment system.

1 Water that does not need treatment (rainwater, water from sump pump) enters the treatment system. Some wastewater is not treated. House sewer (collection system-pipe) less than 50 feet from well or spring (illegal for new well installation–existing wells must meet separation requirements in effect at time of construction).

PRETREATMENT SYSTEM

Answer *one* of the four questions from the box below:

Is a serial (multiple) or single septic tank used? How often is it pumped? Are there leakage losses from the septic tank?

4 ----------

3 Serial tanks used. No leakage from septic tank. Pumped at least every 3 years and maintained. Baffles checked. Tanks checked; no leakage.

2 Single tank. Pumped at 4 to 6 year intervals.

1 Leakage losses from tank (ponding or surfacing of sewage or water near septic tank). Seldom pumped out (greater than 7-year interval). Less than 50 feet from well, spring, sinkhole, or other water resource (existing well must meet separation requirements in effect at time of construction).

OR

If a holding tank is used, is it pumped enough to prevent overflow? Where is it located in relation to the well?

4 Holding tank capacity more than adequate. More than 50 feet downslope from well, spring, sinkhole, or other water resource. Holding tanks checked; no leakage from holding tanks.

3 Holding tank capacity adequate. More than 50 feet upslope from well, spring, sinkhole, or other water resource. Holding tanks checked; no leakage from holding tank.

2 Occasional overflow or leakage from holding tank.

1 Less than 50 feet from well, spring, sinkhole, or other water resource (existing well must meet separation requirements in effect at time of construction). Leakage losses from holding tank. Upslope from well, spring, sinkhole, or other water resource.

OR

Is a dry well, seepage pit, cesspool, or straight pipe used for wastewater disposal?

4 ----------

3 ----------

2 ----------

1 Any dry well, seepage pit, or cesspool used, or direct discharge (straight pipe) of wastewater (violates Kentucky regulations).

OR

If a packaged aerobic system is used, how frequently does it fail? Is it loaded within its design capacity?

4 Maintenance program followed. Loaded at less than design capacity.*

3 No mechanical failures. Loaded near design capacity.*

2 Occasional failures.

1 Frequent system failure. Load exceeds design capacity.*

* If design capacity of your treatment system is unknown, estimate at 120 gallons per bedroom per day.

Are any additional treatments of septic tank discharge used?

4 Aeration of septic tank discharge, filtration and disinfection of septic tank discharge. Use of constructed wetland.

3 Aeration of septic tank discharge.

2 Filtration and/or disinfection of septic tank discharge.

1 No additional treatment.

TREATMENT AND DISPOSAL OF WASTEWATER

How far from any well, spring, sinkhole, or other water resource is the wastewater disposed of?

4 Household wastewater runs to public sewer.
3 Subsurface disposal more than 70 feet downslope from well, spring, sinkhole, or other water resource. Surface disposal more than 200 feet from well, spring, etc.
2 **Subsurface disposal less than 70 feet downslope from well, spring, etc.** Surface disposal less than 200 feet from well, spring, etc.
1 Upslope and **less than 70 feet** from well, spring, etc.

Answer questions from Box 1 (Subsurface application) OR Box 2 (Surface application)

Box 1 -- Subsurface application

What type of subsurface application of wastewater is used?

4 Household wastewater runs to public sewer.
3 Pressure or gravity-fed distribution to trench or bed system.
2 Seepage pit, dry well, or cesspool (violates Kentucky regulations).
1 Straight pipe (direct discharge of wastes to soil or water) used for wastewater disposal (violates Kentucky regulations).

What is the vertical separation between the septic system lateral field and the restrictive horizon (hardpan, bedrock, water table)?

4 Household wastewater runs to public sewer.
3 More than 18 inches to saturated soil or bedrock.
2 Between 12 and 18 inches to saturated soil or bedrock.
1 Less than 12 inches to saturated soil or bedrock (violates Kentucky regulations).

At what application rate is wastewater disposed of in the lateral field?

4 Household wastewater runs to public sewer.
3 Below design capacity.
2 At design capacity.
1 Above design capacity (ponding or surfacing of sewage–wet spot in the field).

How often is the septic tank pumped?

4 Pumped every 3 years.
3 Pumped more than 5 years ago.
2 Pumped only when system problems are experienced.
1 Never been pumped.

Box 2 - Surface application

What surface application method is used to dispose of wastewater?

4 Household wastewater runs to public sewer.
3 Holding tank with approved disposal plan.
2 Frequent spreading. No incorporation.
1 Straight pipe (direct discharge of wastes to soil or water) used for wastewater disposal (violates Kentucky regulations).

If a holding tank is used, what is done with the holding tank wastes?

4 Household wastewater runs to public sewer.
3 Holding tank has sufficient storage capacity. Pumped by licensed septic tank pumper.
2 Holding tank pumped by non-licensed septic tank pumper. Holding tank wastes disposed of at unapproved disposal site (violates Kentucky regulations).
1 Holding tank not pumped, or outlet pipe or holes in holding tank (violates Kentucky regulations).

SITE EVALUATION

What type of soil is on your property?

4 Fine-textured or "heavy" soils (clays).
3 Medium-textured soils (silt loam).
2 Medium- to coarse-textured soils (loam, sandy loam).
1 Coarse-textured soils (sands).

After a 1-inch rain in April, how long do you (or farmers in your area) have to wait to get into the field?

4 More than four days.
3 Four days.
2 Three days.
1 Zero to two days.

How sensitive is your region of the state to groundwater contamination (see map at end of publication)?

4 Low sensitivity.
3 Moderate sensitivity.
2 High sensitivity.
1 Very high sensitivity.

Does your property lie above or near any active/abandoned underground coal mines?

4 No underground mining is being done below or near your property.
3 Underground mining is currently being done.
2 An underground mine was abandoned underneath or near your property more than ten years ago.
1 An underground mine was abandoned underneath or near your property more than twenty years ago.

If your property does lie above or near any active/abandoned underground coal mines, what type of mine is it, and how deep is the mine? (See Part II for more information.)

4 No underground mining is being done below or near your property.
3 Underground mine is more than 400 feet deep.
2 Underground mine is 200 to 400 feet deep.
1 Underground mine is less than 200 feet deep. Mine is a "longwall" type mine.

What do I do with these rankings?

Take a look at your rankings for the individual questions you answered.

For Questions Where You Received A:	The Risk of Contaminating Groundwater Is:
4	Low
3	Low to Moderate
2	Moderate to High
1	High

Use this table to list any questions from Part I where you received a "1" (high risk activity or structure), or that were identified as being against Kentucky regulations. Next, write down the first step that can be taken to better the situation. Then read Part II of this publication, "Reducing the Risk of Groundwater Contamination by Improving Household Wastewater Treatment." This will help you to improve any problem areas (1's or 2's) which were identified.

Activity or structure identified as high risk ("1")	**What is the first step that can be taken to solve the problem?**
Example: family uses excessive amount of water.	*Cut down on the amount of water used; install water-conserving fixtures.*

Part II. *Reducing* the Risk of Groundwater Contamination by Improving Household Wastewater Treatment

A properly installed and maintained system for treating and disposing of household wastewater is necessary to lessen the risk that household wastewater will contaminate groundwater and surface water. State and local codes specify how wastewater systems must be designed, installed, and maintained. For example, Kentucky regulations (KRS 211.350), administered by the KY Cabinet for Human Resources, set minimum standards for household sewage treatment systems.

At a minimum, follow the codes. But also consider whether the minimum requirements are sufficient for your site.

SEPTIC TANK/LATERAL FIELD (SOIL ABSORPTION SYSTEM)

The most common on-site wastewater treatment is a septic tank/lateral field (soil absorption) system. In this system, wastewater flows from the household sewer into an underground septic tank.

The following processes treat household wastewater in a septic tank and lateral field unit:

Inside the tank:

- Wastewater components are separated–the heavier solids (sludge) settle to the bottom, and the grease and fatty solids (scum) float on top.
- Anaerobic bacteria partially decompose and liquefy the solids.
- Baffles are placed in the tank to provide maximum retention of solids, prevent inlet and outlet plugging, and prevent rapid flow of wastewater through the tank.
- The more liquid portion (effluent) flows through an outlet to the lateral field.

Inside the lateral field (soil absorption field):

- The lateral field usually consists of a series of parallel trenches (fingers), each containing a distribution pipe or tile embedded in drain field gravel or rock.
- The effluent is exposed to oxygen as it trickles out through holes in the pipe or seams between tile sections. It then flows down over the drainfield gravel or rock.
- Aerobic bacteria then utilize the remaining nutrient by forming a bio-mat (slime layer) at the bottom of the lateral field trench.
- The soil filters out the remaining minute solids and pathogens (disease-causing organisms) from the effluent. The remaining water and dissolved substances are either used by plants, or they slowly percolate down to groundwater.

Figure 1 shows a typical household system for wastewater generation, collection, treatment, and disposal. While systems for many homes may be very similar (groundwater supply, septic tank, subsurface treatment, and disposal), note the lists of options below each part of the diagram. You may wish to circle the parts found in your system. The "leakage," "overflow," "infiltration," and "clearwater" components represent possible problems with the system. Unfortunately, these problems are often difficult to recognize. Overflow from systems may be noticed as wet spots, odors, and some changes in vegetation cover. Water entry will be more difficult to detect, involving tracing where floor drains, roof drains, foundation drains, and sumps are directing waters that do not need treatment into the treatment system. Leakage from the collection and treatment system as well as infiltration of water into the system through unsealed joints, access ports, and cracks can be difficult to assess. The flow chart in Figure 1 follows the flow of wastewater and sludge through the treatment system.

QUANTITY OF WASTEWATER

Reducing the volume of wastewater entering the treatment system is important because less flow (volume) means better treatment, longer system life, and less chance of overflow. For holding tanks, less volume reduces costs by reducing the number of times the tank has to be emptied. Homes connected to a public sewer system also benefit by conserving water use. Lower water use means lower water bills and less wastewater that will eventually be released to the environment.

The quantity of water used depends on the number of people using the dwelling, how water is used, and maintenance of the water supply system. Average water use in households is 40 to 50 gallons per person per day. With low-use fixtures and individual awareness and concern, a reduction to fewer than 25 gallons per person per day is possible. However, even conservative use by several people may exceed the capacity of older wastewater treatment systems.

Reducing the volume of water entering the system will improve the treatment by increasing the time the

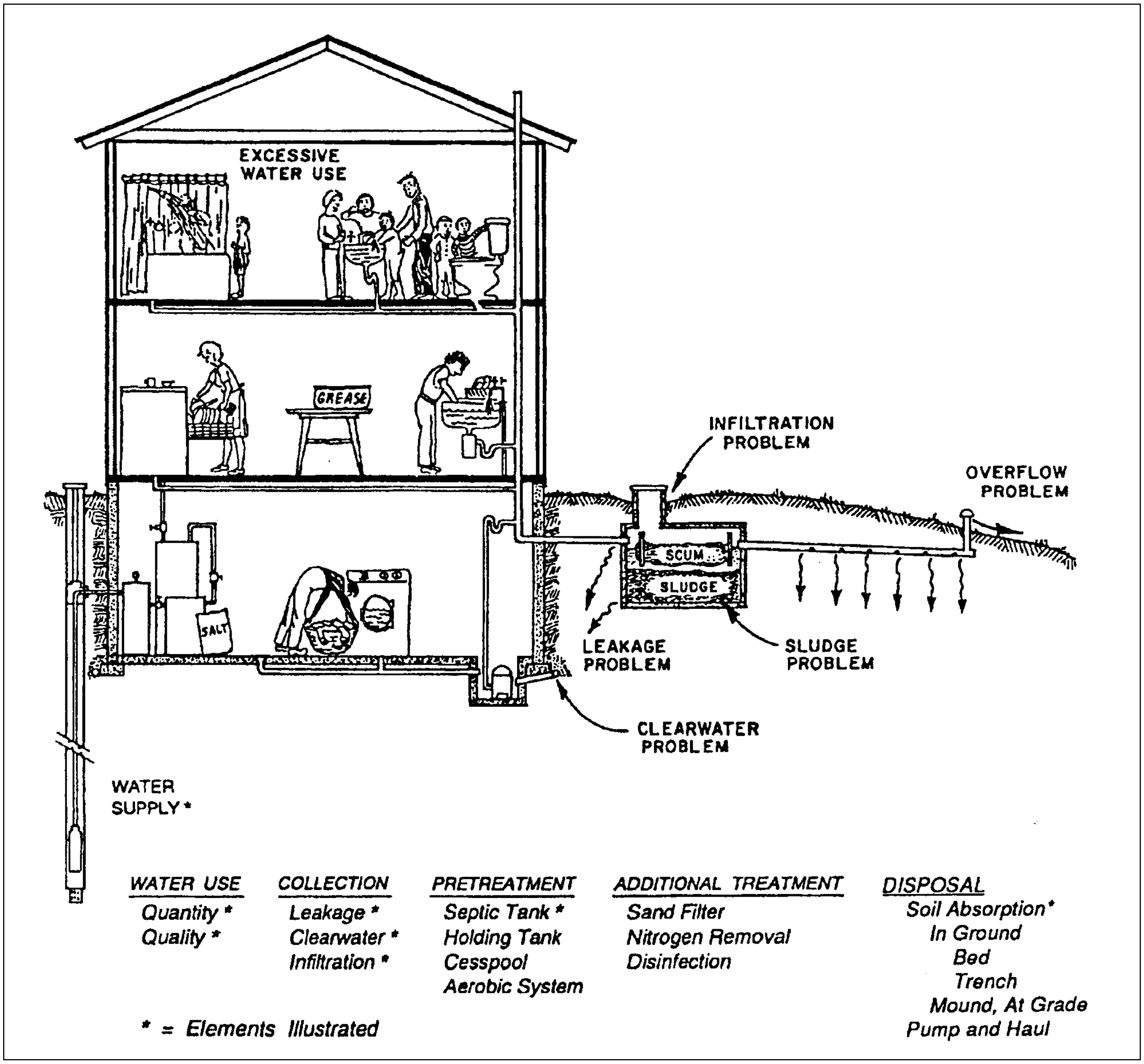

Figure 1. Typical household system for wastewater treatment system with problems. *Source: University of Wisconsin-Madison Ag Eng. Dept.*

waste spends in the system, thus providing more time for settling, aeration, and soil contact.

Methods to minimize water use:

Don't use water when you don't have to. For example, don't flush toilets to dispose of tissues or other wastes that should be thrown in the garbage. Turn off water between uses, fix plumbing fixture leaks, and try to eliminate sources of clear water and infiltration into the system. (For example, divert roof drains away from the lateral field.)

Consider which actions use the most water. Toilet flushing usually uses the most water; bathing and clothes washing are second. Low-flow fixtures and appliances could decrease water use by half. In the United States, 35 to 40 percent of the population has plumbing codes that require 1.5 gallon-or-less toilets on all new construction. Composting toilets allow even greater reductions, but they can present other waste disposal challenges.

- For bathing, consider such reduction options as installing low-flow or controlled-flow showerheads, which give good cleansing with less water; shorter showers; and "wet down - soap up without water - then rinse" showers.
- For clothes washing, use a suds saver and run full loads. Front-loading washers use much less water. When running small loads, be sure to use the reduced water level setting.
- In hard-water areas, the water softener may be a significant user of water. Proper adjustment and timing of the softener's regeneration mechanism can reduce excessive water use.

Keep in mind that your awareness of your family's water use and how each of you can reduce your water use is as important as the use of water conservation devices.

QUALITY OF WASTEWATER

The quality of water refers to what is in the water, not to the water itself. Even wastewater is more than "99.44% pure" water. Wastewater usually contains relatively small amounts of contaminants, but they make a big difference in the usefulness of the water.

Water Use by Fixtures

(conventional and water-saving)

Conventional fixture	gallons used	Water-saving fixture/device*	gallons used
Toilet	4 to 6	air-assisted toilet	0.5
Shower head	4 to 6	low-flow shower head	2.1
Faucets:		faucet-flow-control aerators:	
bathroom	4 to 6	bathroom	0.5
kitchen	4 to 6	kitchen	1.5
Top-loading clothes washer	40 to 55	Front-loading clothes washer	22 to 33

toilets	=gallons per flush
shower heads and faucets	=gallons per minute
clothes washer	=gallons per use

* Installation of all these water-saving devices could reduce water use by about 35 percent.

Figure 2. Water use by fixtures. *Source: Penn State Extension Service.*

Contaminants found in wastewater include:

- Bacteria and viruses, some of which can cause disease in humans. These microorganisms are large enough to be removed by settling or through filtration in beds or soil. Many will die from the adverse conditions or aging in the system.
- Suspended solids, or particles which are more dense (sludge) or less dense (scum) than water. Most can be separated from liquid waste by allowing enough time in a relatively calm tank. Grease and fats are a part of the suspended solids. Filtration beds and lateral field/absorption systems can be clogged by wastewater high in suspended solids.
- Oxygen demand–the microorganisms that decompose organic wastes use oxygen. The amount of oxygen required to "stabilize" wastewater is typically measured as biological and chemical "oxygen demand." Aeration and digestion processes, in the presence of oxygen and organisms, produce stable, low-odor wastewater when given enough time. Wastewater with excess oxygen demand can cause problems for lateral fields, streams, and lakes by reducing levels of oxygen.
- Organic solvents from cleaning agents and fuels may not be degraded or removed through treatment and can pass along with the wastewater back into the water supply.
- Nutrients–primarily nitrogen from human wastes and phosphorus from detergents and other cleaning substances are most notable. Nitrate-nitrogen is a common groundwater contaminant, and phosphorous overfertilizes surface water.

Consider the following ways to improve wastewater quality:

- Minimize use of the garbage disposal. Garbage disposal units contribute a large load of suspended solids and organic matter to wastewater, as well as using additional water.
- Do not put materials down drains that will clog the septic tank (such as fats, grease, coffee grounds, paper towels, sanitary napkins, and disposable diapers).
- Do not put toxic substances in drains that might end up in the groundwater, such as cleaning fluids, oils, paints, disinfectants, or pesticides. (This does not include using bleach to disinfect laundry or to wash clothing worn for pesticide applications.)
- Do not use additives such as yeast, manure, or commercial chemicals to clean or "sweeten" your system. They may interfere with the biological action in the tank, clog the drain field by flushing sludge and scum into the field, or add toxic chemicals to groundwater.

COLLECTION OF WASTEWATER

Collect all wastes that need treatment. Exclude from the treatment system water that doesn't need treatment or disposal. Leaky piping or treatment tanks ("leakage losses") can allow wastewater to return to the local water supply without adequate treatment. Infiltration of "clearwater" overloads the system and dilutes the wastes. Do not allow water that does not need treatment to add to your wastewater volume such as basement floor drain sumps, foundation drains, infiltration of rainwater, or roof drainage. Divert surface runoff away from any well, spring, and the wastewater system.

PRETREATMENT OF WASTEWATER (septic tank or other)

Septic tanks retain most of the suspended solids (sludge and scum) from wastewater. In the tank, bacteria digest and compact the sludge. The partially treated water moves on to additional treatment or disposal (for example, in a lateral field). Design and construction of septic tanks influence their water tightness and effectiveness at retaining solids and scum. Multiple tanks or chambers in series can improve solids and scum removal. Gas deflectors and filter screens or inclined plate settling units help to minimize solids carryover. Tanks should be sized to accommodate at least 24 hours of wastewater flow, while still allowing for sludge and scum retention. Pumping the tank before it is more than a third filled with scum and sludge improves functioning of the system.

Aerobic (oxygen-using) biological systems (packed systems) provide more extensive treatment of wastewater than the typical anaerobic (no oxygen) units, improving solids separation, releasing volatile chemicals, and reducing sludge volume. These systems are, however, more expensive to operate and maintain.

Holding tanks collect and hold the entire wastewater flow. Disposal is generally done by a commercial hauler who spreads the waste on the land at an appropriate site or hauls it to a municipal waste treatment facility. Tank size should allow for ample capacity to accommodate pumpage and disposal at convenient and appropriate times, especially for land spreading. When a tank is pumped, it should also be checked for leaks. (Holding tanks may not be allowed for new construction; check local codes.)

ADDITIONAL TREATMENT OF WASTEWATER

Reduce wastewater concentration and the amount of contaminants in the wastewater to expand options for appropriate disposal.

Aerobic systems, described in the previous section, may be used for additional treatment of septic tank effluent, yielding a better quality effluent suitable for more disposal options.

Sand filters improve the quality of wastewater after septic tank pretreatment. Effective treatment involves aerobic biochemical activity as well as physical filtration. Filters consist of 2 to 5 feet of sand (or other media) in a bed equipped with a distribution and collection system. Wastewater is applied by pressure dosing, and it may be recirculated to improve treatment.

Wastewater treated in such systems is generally lower in bacteria, nitrogen, phosphorus, oxygen demand, suspended solids, and organic matter. The amount of reduction depends on design of the system.

Pretreatment and quality of wastewater, hydraulic loading rate, depth and type of filter media, pressure dosing frequency, temperature and distribution, and collection systems are all important considerations in designing filters. Maintenance includes filter "resting," occasional raking, removal of clogged and crusted surface media, filter media replacement, and attention to dosing equipment.

Constructed wetlands are new "technology" being tried out in Kentucky as an additional treatment of septic tank effluent. Constructed wetlands are still being investigated in regard to their effectiveness, but initial research shows they may be effective at treating various wastewater constituents. A constructed wetland is an artificially constructed "marsh" that makes use of soil, various plants such as cattails and reeds, and the wet condition of a wetland to remove contaminants from wastewater. Approval for the use of a constructed wetland as a supplement to a septic system must be given by your local Health Department. Contact your local Health Department for more information.

Disinfection systems kill disease-causing microorganisms in wastewater and are used where discharge to surface water is permitted. Chlorine, iodine, ozone, and ultraviolet light systems are available for treatment of good-quality effluents, such as those from properly functioning aerobic units and sand filters. Disinfection of holding tank waste prior to land spreading has been studied, but it is not in common use. Disinfection with lime is feasible.

DISPOSAL OF WASTEWATER (after pretreatment in septic tank or other system)

Subsurface treatment and disposal using lateral fields (trenches, beds, mounds, at-grade, and gravel-less) is the common practice for household wastewater after pretreatment in a septic tank or aerobic system. There are, however, sites where lateral fields are not acceptable because of soil permeability, depth to bedrock, or the saturated zone, or other factors. Deep, well-drained, medium-textured soils (such as silt loams) are desirable lateral field sites. Unsaturated soils allow movement of air, which helps keep the wastewater aerobic. Finer-grained soils retain water better, which allows plant roots to take up wastewater and nutrients and increases die-off times for microorganisms. A minimum of 12 to 18 inches of unsaturated soils is required for removal of bacteria.

Off-site disposal of wastewater, by connection to a public sewage system or hauling to a municipal treatment facility, is another acceptable way to dispose of wastewater and can help protect the local water supply.

The direct discharge of wastewater (straight-pipe) to the surface or water is illegal and will contaminate the groundwater or surface water that many families use as their drinking water. This can endanger the health of your family as well as others in your community. Contact your local Health Department if you need help in designing a system for treating your wastewater.

ASSISTANCE WITH FAILING SYSTEMS OR NEW DESIGNS

If you suspect your household wastewater treatment system is backing up or your distribution system is clogged, first contact your tank pumper or a licensed treatment system installer. They may have suggestions for extending the life of your system. Contact your local Health Department if you need a permit to repair or replace your wastewater treatment system.

- Do not use septic tank cleaners that contain degreasing solvents like TCE (Tetrachloroethylene). They can contaminate groundwater.
- Do not place more soil over a soggy section of the surfacing lateral field; this does not fix the system, as water will soon surface again.
- Do not pipe the sewage to the road ditch, storm sewer, stream, or farm drain tile; this can pollute both surface and groundwater and creates a health hazard.
- Do not run the sewage into a sinkhole or dry well; this pollutes the groundwater.
- Do not wait for the system to fail before pumping the septic tank. Once a system fails, it is too late to pump the tank.

A properly designed, constructed, and maintained septic system can effectively treat wastewater for many years. For more information on septic systems, contact your local Health Department.

If you need advice on alternative wastewater systems, such as mounds, at-grades, gravel-less systems, sand filters, aerobic units, and constructed wetlands, or if would like to explore experimental systems, contact your local Health Department.

A FEW WORDS ABOUT YOUR SITE

The way home or farmstead practices such as home wastewater treatment affect the groundwater depends in part on the type of soil and bedrock that is on your property.

How do soils affect the potential for groundwater contamination?

Soil characteristics are important in determining whether a contaminant breaks down to harmless compounds or leaches into groundwater. In general, the soil on your property may act as a filter that prevents contaminants from reaching the groundwater. Different soils have different abilities to "filter" contaminants. Areas with soils that let water flow through them quickly have a greater risk of groundwater contamination. This is because the soil doesn't get a long enough chance to absorb or "grip" the contaminant, and it may flow to the groundwater with leaching rainwater. On the other hand, soils that allow water to flow through slowly will do a better job of protecting the groundwater, but pose a higher risk of contaminating streams because the water will run off and may carry pollutants with it.

Sandy soils have large spaces between individual particles and therefore let water pass through quickly. Contaminants from your property can flow with this water. Because of this, sandy soils have a greater potential to pollute groundwater than clays.

Clay soils, on the other hand, have smaller spaces between individual particles, and therefore water passes through slowly. Slower-moving water allows contaminants a greater chance to be absorbed by or "grip" onto the soil. Because of this, clays do a better job of protecting the groundwater. Since water moves through a clay soil slowly, there is a higher chance of runoff. This can result in surface water (stream) contamination. In other words, there is a tradeoff between groundwater and surface water protection. If your site has a clay soil, it will do a better job of protecting the groundwater, but you must also look out for surface water contamination.

In Kentucky, the type of bedrock on your property is more important than the type of soil in determining your site's ability to protect the groundwater.

How does the bedrock on your site affect the potential for groundwater contamination?

Bedrock is the rock that lies underneath the soil on your property. Like the soil, different types of bedrock have different abilities to protect (or not protect) the groundwater from pollution. Knowing the bedrock that underlies your property is therefore important because it can tell you if you live in an area that is sensitive to groundwater contamination. Many areas of Kentucky have large springs, sinkholes, caves, and "disappearing" or "losing" streams. These areas are called karst and are especially sensitive to groundwater contamination. This is because the bedrock is dissolved by water, and large conduits and caves are formed underground. These conduits and caves allow pollution to flow very quickly from the surface to the groundwater. Basically, karst areas may act like a sewer system that connects your home or farmstead to the groundwater. Look at the map at the end of this publication to see if you live in a region of the state which has a low, medium, high, or very high sensitivity of groundwater contamination. If you live in an area which has a high or very high sensitivity (karst areas), you need to be especially careful with how you manage your home or farmstead pollution sources. This means being very careful around sinkholes and water resources (wells, springs, streams, etc.). **Do not dump garbage into sinkholes, or you will contaminate the groundwater that serves as drinking water for many families.**

Potential effects of underground mining

Underground coal mining done underneath or near your property may result in the subsidence, or settling, of your property. This settling may cause damage to structures as well as put groundwater at risk of being contaminated. The settling causes cracks in the land that can then allow pollution from the soil surface to enter the groundwater. The chance of subsidence occurring on your property depends on when the underground mining occurred, the depth of the mine, and what type of mining was done.

Depending on the type of underground mining done, different precautions are taken by mining companies to prevent subsidence. "Room and pillar" mining leaves pillars in the mines that support the land above when the mine is abandoned. As time passes, there is a greater risk that these pillars can degrade and result in the subsidence, or settling, of the land above. Certain types of "longwall" mines do not provide pillars. Therefore, these mines have a greater chance of resulting in subsidence. The depth of the mining also affects the chance that subsidence will occur. Deeper mines (greater than 400 feet) are less likely to cause subsidence than shallow mines (less than 200 feet). Information regarding the type and depth of underground coal mines may be obtained from the Department of Mines and Minerals at 606-254-0367 (ask for the Map Room). Be prepared to describe the location of your property in as much detail as possible (use a topographical map if possible).

GLOSSARY

Household wastewater treatment

These terms may help you make more accurate assessments when completing Part I of this publication. They may also clarify some of the terms used in Part II.

Cesspool: An underground pit into which raw household sewage or other untreated liquid waste is discharged. The liquid from a cesspool seeps into the surrounding soil. Cesspools are prohibited in Kentucky.

Clear water infiltration: Entry of water into a septic system that does not need treatment, such as through unsealed joints, access ports, and cracks.

Design capacity: Maximum volume of liquid that can be treated in a particular wastewater treatment system. For systems that include subsurface wastewater disposal and distribution, capacity is based on the soil's ability to treat sewage effluent. In filling out Part I, if you don't know the design capacity of your system, use 120 gallons per bedroom per day as an estimate.

Effluent: Liquid discharged from a septic tank or other treatment tank.

Holding tank: An approved, watertight receptacle for the collection and holding of sewage.

Hydraulic loading rate: The volume of waste discharge per unit area per unit time (gallons/day or gallons/hr).

Scum: Floatable solids, such as grease and fats.

Seepage pit (dry well): An underground pit into which a sewage tank discharges effluent or other liquid waste. The liquid then seeps into the surrounding soil through the bottom and through openings in the sides of the pit.

Sludge: Settleable, partially decomposed solids resulting from biological, chemical, or physical waste treatment.

CONTACTS AND REFERENCES

Who to call about...

Constructed wetlands

Technical advice

Univ. of Ky., Dept. of Agronomy . . . . (606) 257-4633
(Dr. Bill Thom)

Technical advice, installation regulations, permit

Local Health Department . . . . check local listing

Home water conservation

Univ. of Ky., Home Economics Extension . . . . (606) 257-7775
(Linda Heaton)
County Extension agent . . . . check local listing

Septic Systems

Ky. Division of Environmental Health and Community Safety
(Environmental Sanitation Branch) . . . . (502) 564-4856
(Wes Combs)
Local Health Department . . . . check local listing
Licensed system installer . . . . check local listing

What is KY•A•Syst?
KY•A•Syst is a series of publications which will help you assess *and improve* how effectively your home or farmstead practices protect the groundwater. The publications ask you about your home or farmstead structures and activities. Your answers will help you see how your practices might be affecting the groundwater. Each publication then gives suggestions about things you can do to improve your home or farmstead practices to better protect the groundwater.

The topics of the program include:
- Drinking Water Well Condition
- Agricultural Chemical Storage and Handling
- Petroleum Product Storage
- Household Waste Management
- Household Wastewater Treatment
- Livestock Waste Storage
- Livestock Yards Management
- Silage Storage
- Milking Center Wastewater Treatment

Some of these topics apply only to people who have farms, and others apply to both farm owners and non-farm owners. ***This program is a completely voluntary program: it is an assessment you can perform in the privacy of your own home. No information from the publications needs to leave your home. The goal of KY•A•Syst is to help you protect the groundwater that supplies drinking water for many families.***

Edited and compiled by Mark Dravillas, former Extension Associate for Water Quality, and Tom Ilvento, former Associate Extension Professor in Sociology, University of Kentucky Cooperative Extension Service. Based on materials from the National Farm•A•Syst Program, University of Wisconsin (authors: Jim O. Peterson, James C. Converse, and E. Jerry Taylor, University of Wisconsin). Special thanks to Wes Combs, Kentucky Cabinet for Human Resources, Division of Environmental Health and Community Safety, Department for Health Services, Environmental Sanitation Branch; and Department of Agronomy, University of Kentucky, for technical review and comments.

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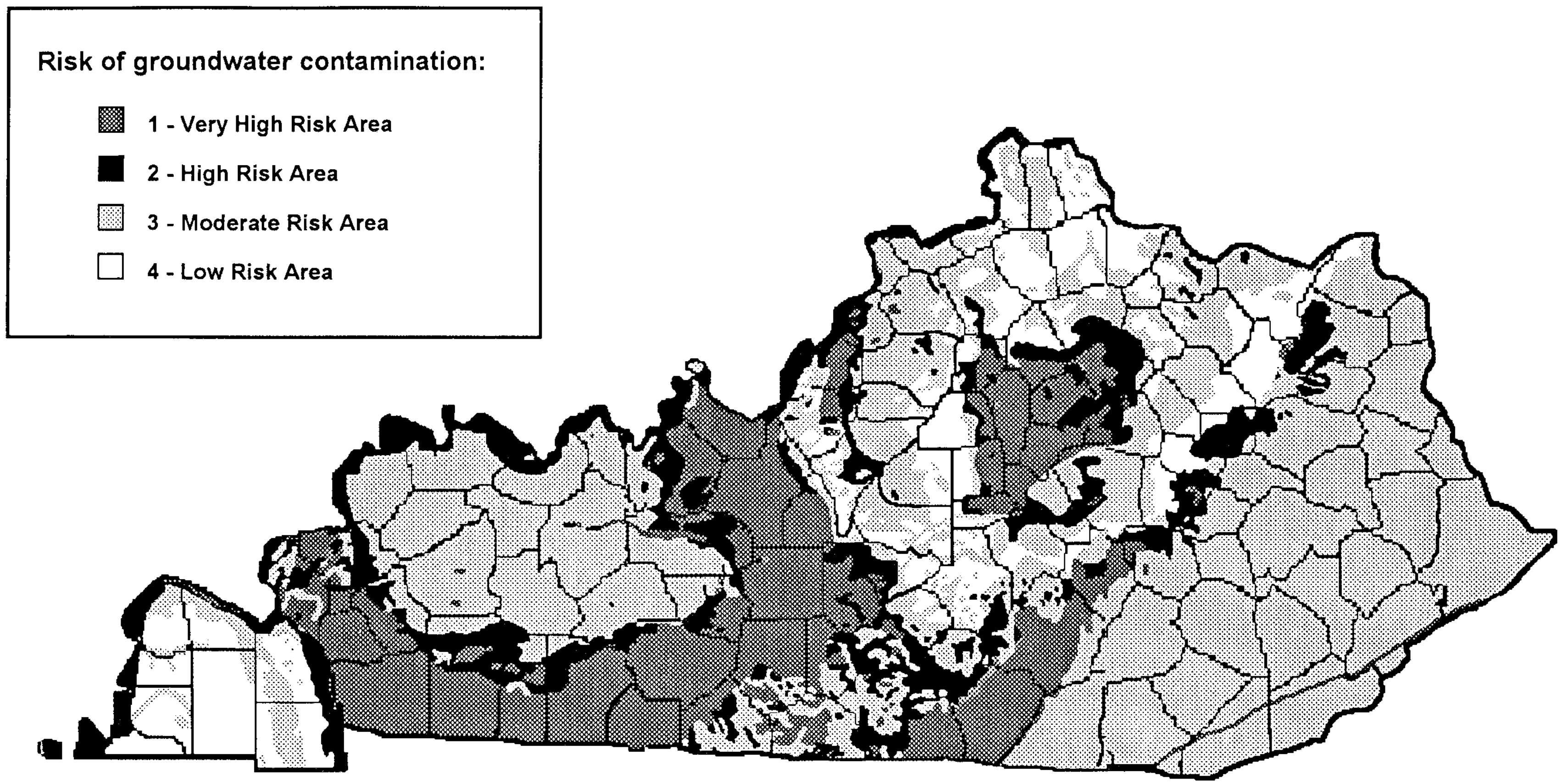
The KY•A•Syst project is coordinated by the Kentucky Cooperative Extension Service in collaboration with various Kentucky state and federal organizations and agricultural commodity and environmental groups.

KY•A•Syst publications can be obtained at your county Cooperative Extension Service office. For additional information on the KY•A•Syst program, contact Marla Barnett at (606) 257-2735 or Dr. Curtis W. Absher at (606) 257-1846.

Groundwater Sensitivity Map



Reproduced from a map created by Division of Water - Groundwater Branch : Frankfort, Ky.

This map shows the potential for groundwater contamination in the different areas of Kentucky. Find the county you live in to determine how sensitive your region is to groundwater contamination.