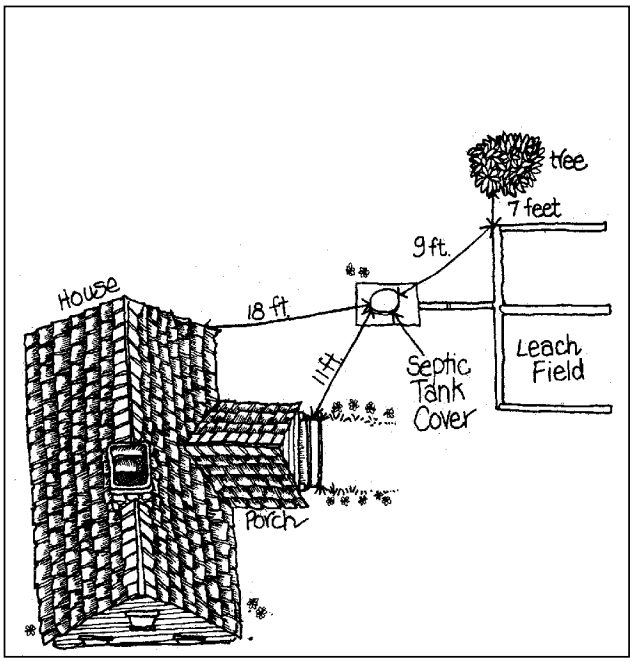
What Remodelers Should Know About

SEPTIC SYSTEMS

by Russ Lanoie

How to avoid "pitfalls" and other unpleasant and costly encounters with on-site sewage systems



Vt. On-Site Sewage Program

allowed by code in your area.

So you've landed your first big remodeling job and everything is off to a great start until the excavator that's digging for a new frost wall suddenly disappears into the ground and a strong smell comes back out. Why didn't somebody tell you that the septic tank was out here? Who's going to pay to get it fixed? Is all the profit from this job going to go into that smelly hole rather than into your pocket?

I became involved in a situation just like this last spring, after the damage was done. Upon exploring the situation I found that not only did the builder forget to ask the whereabouts of the septic tanks, but also that none of the dozen or more owners of the building had ever thought to do any maintenance (pump the tanks) for the fifteen years or more that the building had been in use. I'll skip (but not forget) the messy details...

The point is that many suburban or rural remodeling or add-on projects can involve a confrontation with a septic system for any one of a number of reasons:

- increasing the amount of sewage generated by changing the use of the building or adding facilities;
- changing the footprint of the building, interfering with the location of septic tanks, pipes, and absorption wells or fields;
- providing for delivery of materials or the passage of heavy construction equipment over a portion of a septic system.

In order to avoid problems, either with code violations or with septic system operation, it's wise to have a basic understanding of septic system fundamentals. I'd recommend reading "On-Site Sewage Systems," by Henri De Marne in the July 1986 issue of *New England Builder*. For those who do not have that issue handy, I'll provide a quick review.

Sewerage systems were originally just holes in the ground that were blocked up with stones, bricks, blocks, wood, or any other available material to provide a cavity for all household waste to enter and be absorbed into the ground. When one of these cesspools failed, another one was usually added after it, and then another and so on. Then came the modem septic system, which generally consists of two basic components to handle household waste, a septic tank which acts as a settling and digestion chamber and a *leaching system* (dry well, leach bed, or leach field) which returns the *clarified effluent* to the ground.

In many states, the bottom of the leaching system must be located a minimum of 4 feet above the seasonal high groundwater level in an attempt to provide proper treatment of effluent before it reaches the water table. This requirement has resulted in the "elephant mounds" (raised leach beds) so common now on poor soils. It also often requires a *pumping station* to get the effluent up to the field. (Refer to the glossary for a fuller explanation of septic system terminology.)

Let's look at some situations where septic systems should concern a remodeling contractor and what he should do to save himself expense and aggravation.

Increasing Load

It is often necessary to demonstrate to code-enforcement people that an existing system is adequate to handle increased loads. In New Hampshire, as in many other states, this is required whenever the number of bedrooms (not bathrooms) in a dwelling is increased. Bedrooms rather than fixtures determine occupancy. Verification is also required when the use of a dwelling changes, such as from seasonal to year-round use. If a system is shown to be inadequate for the increased flow (which is often the case), a new one will have to be designed, approved, and installed.

Adding a hot tub, a dish or clothes washer, or a garbage disposal onto an older system may not require a septic system upgrade. Whether an upgrade is required by code or not, however, increased usage of a system built to handle the water consumption of thirty years ago will probably create a problem.

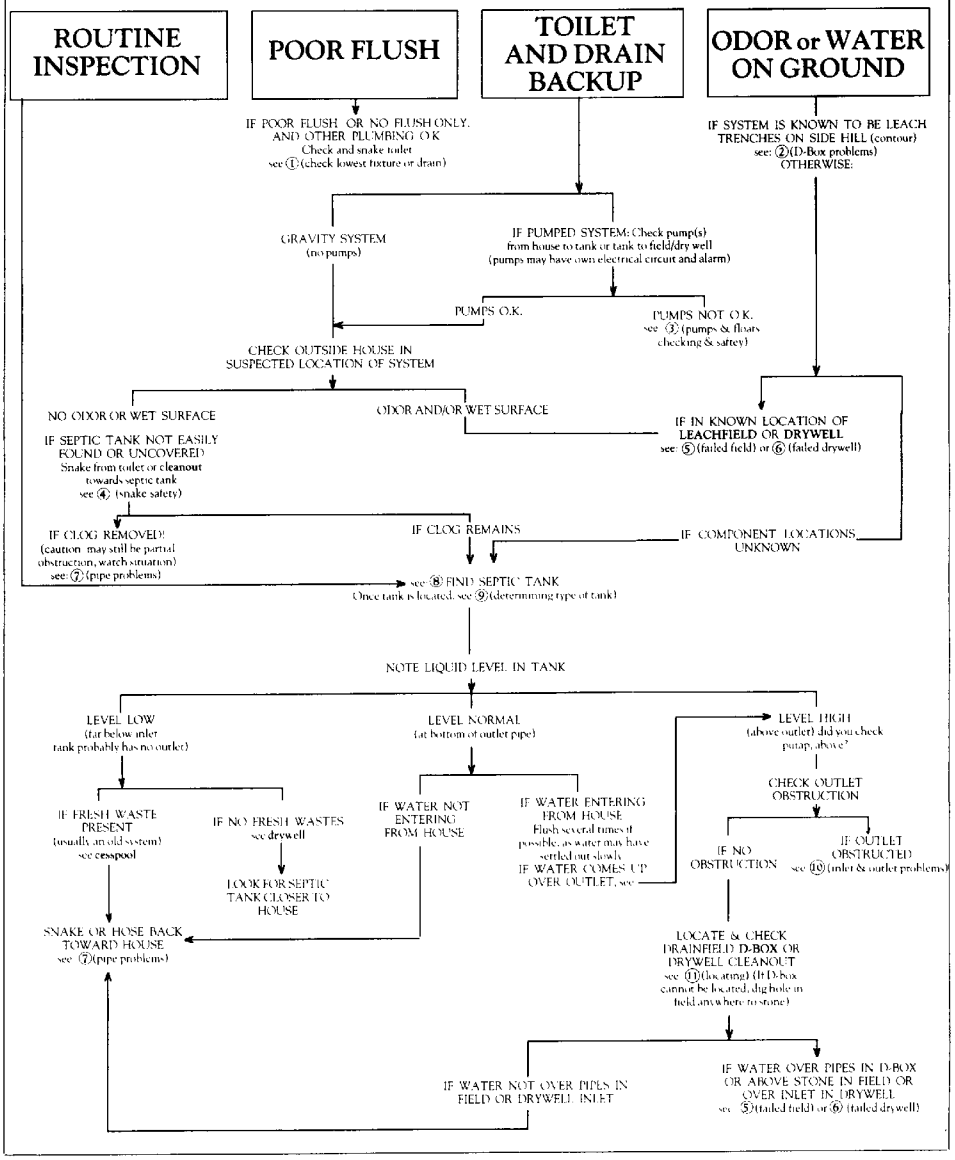
Solutions. Where it's permissible, I'd add a separate dry well or a leaching line for a washing machine or hot-tub drain to avoid introducing excessive soaps and bacteria-killing chemicals into an existing system. The grey water from these two fixtures is likely to cause more upset to a functioning system than any other wastewater we could add.

Dishwashers and garbage disposals, however, should be discharged into septic tanks in order to separate and trap solids and greases, separating them from the wastewater. This protects the absorption surfaces of leachfields or dry wells.

Although septic systems designed within the last ten years in New Hampshire are supposed to he able to handle all of these appliances, many systems have proven marginal. Consequently, New Hampshire is starting to

Septic System Troubleshooting Guide

Items in bold are explained in glossary (page 35)
Items numbered are explained in accompanying notes



Troubleshooting Notes

① ***Check lowest fixture or drain.*** If problem is septic blockage, water should back up through any drain which is below level of toilet when flushed. Check washing maching outlet, floor drain, bathtub, downstairs apartment, or remove cleanout plug carefully (to avoid a flood). If not backup, problem is probably with toilet or other household plumbing *only.*

② ***D-Box problems.*** If distribution box for side-hill trench system is out of level, one trench may be taking all water and "failing." Re-level pipes and block outlet to overload trench for several months. Roots may also be blocking one or more pipes. Remove roots and seal joints where roots enter if possible. (Unlevel D-Box will not affect leach bed as severely, because water will find its own level throughout stone.)

③ ***Pumps and floats.*** Exercise care handling pumps as they have a 110- or 220-volt line supplying them, which may not have a ground-fault interruptor. Some float systems (which turn pump and alarm on and off) may also contain full line voltage. Use insulating rubber gloves and follow procedures with a disinfecting hand wash for sanitation. Or call licensed plumber, if required by code.

④ ***Snake safety.*** Exercise care using snake in cleanouts or drains as some waterborne diseases can be transferred through contact. Use rubber gloves and surgical mask and follow with disinfecting wash. Note that stiff garden hose can sometimes be used in place of snake. Also disinfect after use.

⑤ ***Failed field.*** Usually means soil plugged due to age, overuse, underdesign, lack of maintenance, or a combination of these. Requires field replacement or rest. (See **alternating fields** in glossary.)

⑥ ***Failed drywell:*** Same reasons as (5) above. However, drywells can sometimes be excavated around and repacked with crushed stone to create a new soil surface for absorption. Check codes.

⑦ ***Pipe problems:*** Settling, breaking, crushing, pulling apart, and back-sloping are installation related. Freezing, plugging at joints, and root plugging (though also caused by poor installation) can occur later. Insulating, replacing, releveling, sealing joints, and properly backfilling will resolve most problems.

⑧ ***Find septic tank:*** If homeowner does not know exact location of septic system or have accurate plan to follow, start looking for septic tank outside of house where waste pipe exits basement wall. (Note pipe direction through wail.) If plumbing exits below slab, check side of house with roof vent, especially if most of plumbing is on that side of house. Look for spot on the ground where snow melts first, grass turns brown, or there is a slight depression or mount. Steel tanks will sometimes bounce slightly when jumped on, but be careful, steel lids rust out!

A thin steel rod with a tee handle makes a handy probe. Drive probe until achieving several "hits" at the same depth to indicate tank top. A metal detector can help. Even concrete tanks and cesspool covers generally have steel reinforcing within. Another trick is to insert a snake in house cleanout and push it until it stops. Gently sliding snake against inlet baffle can often send a shock that can be heard and/or felt at ground surface by second person. (Note that sometimes a snake can curl up within a septic tank or, particularly, in a cesspool, sometimes making technique useless.)

If snake hit obstruction but cannot be felt at surface, remove it from cleanout and measure its penetration. Draw an ark the distrance of snake penetration from the house and try again with the probe. Remember that the pipe from the house may not be heading straight towards the tank.

If all else fails, locate and uncover the waste pipe where it leaves the house and again every few feet until the tank is located. Or ask previous owner, neighbor or septic pumper who may have serviced the system in the past.

Note: New devices are available that transmit a radio signal along a snake or from a tiny "mole." Signal is traced by a receiver wand as snake is pushed through waste pipe. (I use model MAC-51B, made by Schonstedt Instrument Co. , 1775 Wiehle Ave., Reston, VA 22090.)

⑨ ***Determining the type of tank found:***

• *Primary/secondary septic tank.* Two or more tanks are used in some installations for better settling and detention of solids. First tank should have fresh waste entering directly from house. (Flush colored paper towel down toilet and watch it enter at inlet manhole.) Second tank should have a little floating grease and scum, with some settled sludge at bottom. Note that septic tank always has an outlet unless it is being used as a holding tank.

• *Cesspool or drywell.* Would likely have no outlet and would seldom have an inlet baffle. Liquid level could be low in a septic tank if tank is rusted out (steel tank) or if center seam leaks (concrete tank). If fresh waste is present, see **cesspool.** If no fresh waste present, see **drywell.**

• One of a series of cesspools (explained in glossary).

• A greasetrap. Found in restaurants, inns, markets, etc. (see glossary).

• A pump tank (see glossary).

Note that if water runs back into the septic tank from the outlet pipe when the tank is pumped out, system is probably failed. See (5) or (6) above.

⑩ ***Inlet/Outlet problems:*** plugging often occurs from scum buildup within baffles, roots entering through poorly sealed joints, tanks installed out of level or backwards, or pipes sticking into the tank too far and nearly hitting baffles, blocking waste passage. Correct as needed.

⑪ ***Locating field or drywell:*** Is identical to (8) except start at septic tank outlet rather than house. Snake will not hit a baffle within drywell as there is none. It may or may not hit side of D-Box but could pass through into one of outlet pipes. Smaller concrete or plastic D-Boxes have no metal to be found when using detector.

High-tech comes to the rescue. The hand-held wand can locate a small transmitting "mole" attached to the end of a snake. Here the snake is inserted through the tank outlet to locate the leach field or drywell.

require a 50 percent increase in the size of septic tanks, or some means of reducing or separating kitchen-wastes input, whenever a garbage disposal is installed.

Low-volume appliances. Water conservation, where permitted, is a realistic option for offsetting increased demands on a septic system. Reducing the volume of water a flush toilet uses from over five gallons to less than one-and-a-half could make it possible to install other water-consuming fixtures or provide relief for a marginal system. Low-volume sink and shower aerators are also available. (Unfortunately, New Hampshire grants little credit for new water-conserving equipment in private homes as yet. Maine, on the other hand, permits a considerable reduction in leach-field size for such systems.)

In short, it's best to check with the appropriate state agency, the local building inspector, or a septic designer familiar with local codes to be sure that you are covering yourself for any of these upgrades. When working in an unfamiliar town, keep in mind that local codes can be more strict than state codes.

Changing Footprints

Many building codes ignore the existing septic system for any project that does not change use or flow as discussed above, even when plans involve adding onto the building. In these cases, it's completely up to a builder to locate and identify septic system components at the planning stage to avoid later conflict, either with the system or the owner.

No one wants to have the top of their septic tank become the thermal mass of their new sunspace. Septic tanks generate offensive and expolsive gasses during normal operation and can, in some cases, leak their contents into the surrounding ground. For safety reasons, in New Hampshire a septic tank is supposed to be at least 25 feet from a basement with perimeter drains, 10 feet from a basement without drains, and 5 feet from a slab structure. A leach field is supposed to be 35 feet from a drained basement, 10 feet from an undrained basement, and 5 feet from a slab.

There are many other distance requirements, which can be supplied by your designer or inspector. New Hampshire may grant waivers in certain cases where it is impossible to meet requirements and the solution is deemed appropriate.

Let's consider what we might do when it becomes impossible to construct an addition without interfering with some part of a septic system.

Moving or replacing a system. Surprisingly, it's not really difficult to move a concrete septic tank. Most septic tank companies should be willing to lift and reset a tank for fifty to a hundred bucks given reasonable access to the site and a tank that has been almost completely emptied and unearthed all the way to the bottom. Tanks over 1,000-gallon capacity may be a different story, as they are generally delivered in two halves (most septic truck hoists cannot lift an assembled 1,500 gallon tank), and once they are in place for some time they are hard to get apart. Fortunately, they are uncommon for most homes.

Moving a steel septic tank would be an unlikely consideration, as most steel tanks last 30 years at best, and should be replaced by concrete tanks when relocated. Don't plan to replace a 500-gallon steel tank with a 500-gallon concrete tank, however, even if code permits (which is unlikely), and the smaller tank is available. the cost difference between even a 750-gallon and a 1,000-gallon tank is only about $50. The larger tank is a better value because it does a better job.

Plastic tanks (a more recent innovation) would be well worth moving, especially because of their high cost (around twice that of concrete). Because of their ease of handling, they may provide a good replacement alternative for hard-to-reach sites. As for reusing fiberglass tanks, I've heard stories about them deteriorating, so I would assess the tank's condition before moving. In all cases, call a pumper to have the tank cleaned out beforehand, both for ease of handling and for inspection of the tank and its baffles.

Moving a leach field is quite a different story. There is no practical way to reuse much of anything in a new leach field, except perhaps the distribution box (and I'm not sure that there are many folks who would want to handle a used "D-box"). Because of the life expectancy of an average leach field, it would probably be best to rebuild the field in a different location if it is over ten years old anyway, especially if the system has been poorly maintained.

I suspect that most states will require a new system approval if the leach field is being moved more than just a few feet or if it is within 75 feet of surface water or wells. If possible, eliminating a portion of the existing leach field to meet distance requirements and adding a second alternating leach field to fulfill size requirements would be best.

If a leach field or dry well must be replaced, the materials excavated from the old field or well will be quite offensive at first and should be handled with caution, but a few hours of good sunny weather will dispel the odors amazingly well, and the resulting material spread out below a few inches of clean topsoil will provide a good base for a lawn. Keep this material at least 75 feet from water supplies, and the customer's and neighbor's wells. (Check your local codes, please!) If the old field or dry well has begun to fail, that is, waste water is standing in the system, it is best to have it pumped out first. Try to find a patient and understanding licensed septic hauler to help you out.

Avoiding Vehicle Damage

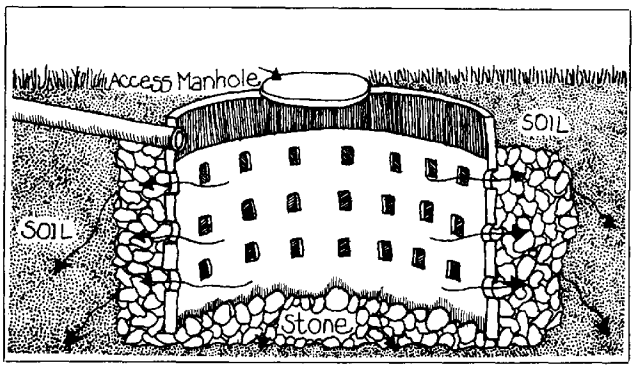
I asked the manager of a local rental company recently if his company (part of a large construction firm) had a device with which septic tanks could be located. He replied yes, several, but it usually took another one of equal or larger size and a big chain to pull it out after it had gone through the lid.

Once again it is prudent to know the exact location of a septic tank and other components if you are expecting the delivery of heavy materials or will be operating heavy equipment on site, even if only on the driveway. (I've seen more than one drywell or old steel septic tank under the middle of a driveway.) Because some tanks may weaken with age and modern trucks and equipment are often much heavier than older models, it would be well to know what you are dealing with to avoid costly "pitfalls."

It may be possible to brace the lid of a tank that must be driven over with thick steel plates, railroad ties, or other materials once you know its location. A leach field should never be driven over and would be considerably more difficult to protect because of the greater area involved. Use good judgment, discuss liability with the owner, and perhaps seek the assistance of a local installer or pumper willing to help you assess the situation.

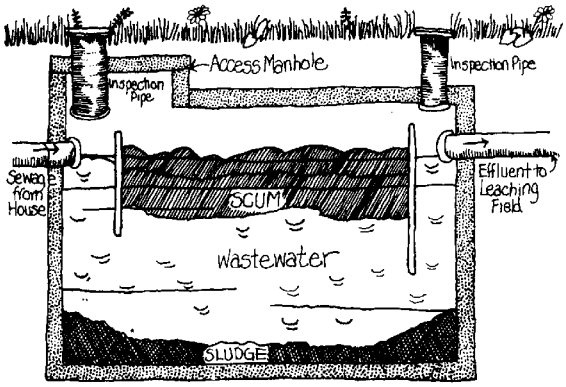
Special Situations

Setting a Sonotube on top of a con-



Cesspools and drywells are identical in construction The only way to tell the difference is by what's going into it: fresh sewage (cesspool), or clarified effluent (drywell).

The Septic Tank



Untreated household sewage will quickly clog all but the most porous gravel if applied directly to the soil. The function of the septic tank is to condition the sewage so that it can percolate into the ground without clogging the soil. Within the tank, three important processes take place:

1. The heavier, solid particles in the sewage settle to the bottom of the tank forming a layer of sludge. Lighter materials, including fat and grease, float to the surface forming a scum layer.

2. Bacteria living in the septic tank break down some of the organic solids into liquid components, helping to reduce the buildup of sludge in the tank.

3. Sludge and scum are scored within the septic tank rather than being allowed to flow out into the leaching system where they would quickly clog the soil.

SEPTIC SYSTEM GLOSSARY

Alarm: An electromechanical device that provides audible and visual indication that the water level in a pump or holding tank is above what it is supposed to be.

Alternating leach field: One of two or more leach fields designed to be used while the other(s) rest. They are generally fed via a manually operated diverter valve located in the line from the septic tank.

Baffles: Pipe tees or partitions within a septic tank, which reduce turbulence at the inlet and prevent floating greases and scum from escaping into the leaching system at the outlet. (They are usually the first part of a steel tank to rust away, leaving the leach field or dry well unprotected from excessive solids overloading.)

Cesspool: The original type of sewerage system, often still in use in older homes. They were simply a single hole in the ground loosely blocked up with locally available materials-stone, brick, block or railroad ties-and capped either with ties covered with a layer of old steel roofing or a cast-in-place concrete lid with a cleanout hole near the center. All household wastewater entered and the liquid portion was absorbed into the ground. When the soil plugged, a new cesspool was added. Wiser installers placed an elbow, or, better still, a tee in the outlet pipe from the first cesspool, creating a baffle to hold back the floating greases and scums (see **Baffles**).

In a sense, this created the first type of septic system, because the first cesspool in the line, sealed by its own demise, served as a septic tank and the subsequent pits served as dry wells. Each subsequent tank provided a greater degree of settling and separation of soil plugging solids and some absorption. (Owners often have the first tank pumped out to maintain system operation.)

Chambers or ameration chambers: Open bottomed precast concrete or plastic structures, which are placed next to each other in an excavation to take the place of crushed stone in a leach field. Unlike leach fields, heavy-duty chambers can be driven over.

Cleanout: A removable plug in a "wye," or a "tee" in a sewer line, where a snake can be inserted to clear a blockage.

Distribution box or D-Box: Usually a small square concrete box within a leach field from which all pipes lead to disperse effluent within the field. Newer boxes may be plastic. Distribution boxes should be marked at the surface to protect from vehicle traffic.

Drywell: Constructed identically to a cesspool and differs only in that the clarified effluent from a septic tank or the wastewater from a washing machine or other grey water may enter. Modem drywells are often precast perforated rings surrounded by crushed stone to increase the absorption area.

Drywells are not commonly installed today because of the laws requiring the bottom of a leaching system to be 4 feet above the seasonal high-water table.

Effluent: The liquid that flows out of the septic tank after the tank has "taken out the big pieces."

Grease Trap: An in-ground chamber similar to a septic tank, usually used at restaurants, markets, and inns to trap grease from the kitchen wastewater before it reaches the septic tank. Unusual to find in private homes.

Grey Water: All liquid waste water except for the toilet wastes (sink, shower, washer, etc.).

Leaching System: The part of a septic system that returns water to the ground for reabsorption. Could be a drywell, leach field, trenches, chambers, etc.

Leach Bed: A leaching system which consists of a continuous layer of crushed stone about a foot deep, usually in a rectangular layout, with perforated pipes laid level throughout to disperse effluent as evenly as possible over the entire bed,

Leach Field: Term often used to describe either a leach bed or leach trenches,

Leach Trenches: Built essentially like beds, except that each pipe is in its own stone-filled level trench, usually 3 feet wide. Each trench can be at a different level than the other trenches. Well suited to sloping ground.

Mound (or raised) system: A leach bed built on a mound of fine to medium-grained sand to elevate it above the seasonal high water table and/or to accommodate a system on a hillside.

Percolation test: A shallow, hand-dug hole saturated with water, performed as a part of a septic design to determine the permeability- the rate at which water is absorbed by the soil - which dictates system size.

Pump station, pump tank: A watertight container, usually (but not always) separate from the septic tank, into which effluent flows by gravity and is then ejected by a submersible electric pump through a pressure line to the leaching system. Pump tanks often are hooked to an alarm to warn of pump failure.

Seasonal high water table: The highest elevation that groundwater reaches within the year (usually in the spring). Many states require the bottom of a leaching system to he at least 4 feet above this point.

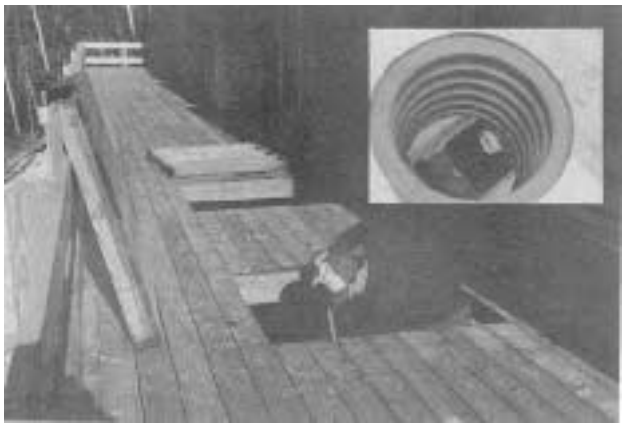
Septic tank: A watertight chamber, which all household wastewater enters for settling and anaerobic digestion of greases and solids. Original tanks were made of asphalt-coated steel. Modern tanks are made of concrete, fiberglass, or plastic. All tanks should have a set of baffles, which are critical to their operation.

Most tanks have an inspection hatch at both the inlet and the outlet and some have a third hatch in between for pumping access. Locations of each of these should be recorded and/or marked. Steel tanks often have one round lid that covers the entire tank.

Septic tanks should be pumped every three years or so in normal operation. They should not be treated with any additives and should be protected from receiving any of the harmful chemicals used in many homes and commercial workshops. This includes disinfectants or bleaches, which can kill bacteria in the tank, and solvents, darkroom chemicals, or other materials that could pollute the water supply.

Septic design: (In New Hampshire) consists of a topographic survey, test pit, and perc test plus information about the water supply and subdivision and a filing fee to the state prepared by either a licensed designer or the owner.

Test pit: A hole dug to determine soil. type, seasonal high water table and depth to ledge. New Hampshire requires a 10-foot-deep test pit (to determine that ledge is a minimum of 8 feet below bed bottom) while Maine requires only a shallow pit to determine depth to hardpan soils.



Ideally, septic tanks will have inspection hatches at both the inlet and outlet. Here, hatches in the deck allow access to the lids. And plastic culvert pipes (inset) form lid extensions from the ground surface to the tank.

crete septic tank to support a deck would probably cause little harm as long as the inlet, cleanout, and outlet openings on top of the tank were not obstructed by either the tube or the deck. (Indeed, this footing would probably be the most substantial of the whole job.) Supporting a heavier load might warrant keeping a tube close to the edge of a tank unless it were a heavy-duty variety. The same principles would apply to drywells. (In all cases, check code,.)

Avoid setting anything on steel tanks because they cannot support much weight. If a steel tank is that close to an addition, it should he replaced while work is being done anyway because of its limited life expectancy and the possibility of reduced access to replace or maintain it in the future.

As for setting a Sonotube in the middle of a leach field, I doubt there would be much of an effect on the operation of the field. The problem would arise in digging for the tube footing, which should be on firm ground well enough below the layer of crushed stone to be unaffected by the instability of constantly wet soil. Because of the potential problems involved, New Hampshire does not permit anything to be built over the field except lawns and gardens (no trees or shrubs).

Note that decks installed over shallow septic tanks or pipes can create freezing problems by keeping the insulating layer of snow from reaching the ground. A couple of inches of extruded polystyrene over tanks and pipes can help prevent problems.

Documentation

Perhaps the easiest part of this whole task, yet the part that is most often overlooked, is making a record of the work for future reference. A customer should minimally he provided with accurate measurements of all known parts of his system for maintenance needs and the dates at which work was done. A simple plot plan hung on the cellar wall next to the plumbing can provide great assistance to a homeowner in a future emergency.

In Conclusion

Forewarned is forearmed, as the saying goes. Anticipate that there may be conflicts with a septic system on an upcoming project and discuss concerns and options with the customer before work starts. That way, neither of you will become the victim of oversight. Be aware of all rules that pertain to modifying septic systems, as the rules are continually being tightened. Exercise caution when working in an unfamiliar town.

If necessary, seek the help of a reputable local septic designer or installer, or an engineer to help you determine just what you need to do to steer clear of problems and comply with code. ■

Russ Lanoie is a New Hampshire licensed septic system designer and installer; specializing in troubleshooting and repairs. He serves as education chairman for the Granite State Designers and Installers.