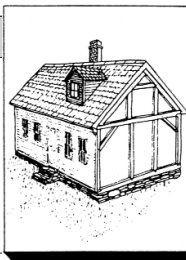


How to Fix (or Fill) In-Ground Cisterns

by James M. Smith



In-ground cisterns still are used in some rural areas to supply water for washing and other household needs. In my years of running a building-supply center in one of these areas, I've picked up quite a few tips on cistern repair, which I'll summarize here.

First, some important safety tips. Don't go down into an old cistern for a day or so after pumping it out. Due to the decreased pressure on the side walls, cisterns have been known to cave in soon after being emptied. And when you do go down inside, *always* have someone on top who can go for help in case of trouble.

There also is a remote possibility that noxious gases could have built up at the bottom of the cistern. As the bottom sludge (sometimes up to four feet of it) decomposes, it can give off carbon dioxide and other gases that can suffocate a person. The helper on top should keep up a steady conversation with the person in the hole. If there's any sign of slurred speech or disorientation, get out fast. If you should be overcome by the gases, the helper should summon help immediately from an ambulance or fire department with breathing apparatus. He or she should *not* go down into the hole to offer help.

Getting Started

To start, remove the cover from the manhole and pump out as much water and sludge as your pump will handle. Any sludge that you can't pump will have to be hauled out in buckets. Hose down the sides of the cistern with a stream of high-pressure water to knock off any debris and loose plaster, then pump out the wash water.

With hammer in hand, tap for hollow spots that signal loose plaster, and pull away all loose material. Inspect the crown for spalling and weakness. (The crown often is damaged by overfilling, which holds water against it.) If the crown is in bad shape, exit promptly—and start to disassemble the crown for rebuilding.

As you are tearing it apart, observe how the old crown was built. Build formwork inside the cistern to hold materials in place as the new crown is being laid up.

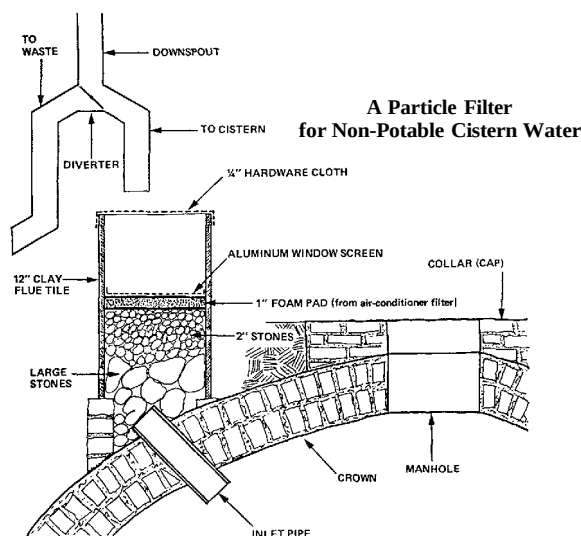
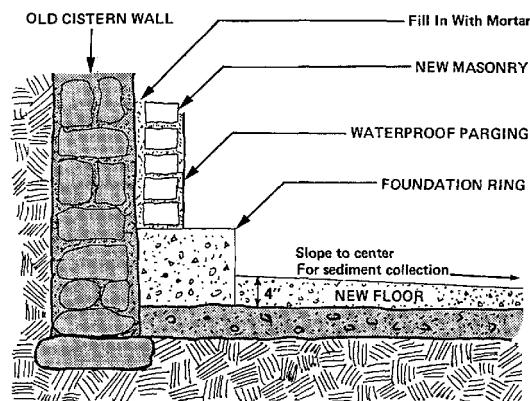
If the crown is stable, continue your cleanup by scrubbing the walls with a stiff brush. Then you're ready to start patching. If the floor needs patching, fill small holes with a two-to-one mixture of sand and portland cement. If much of the floor is bad, you're better off pouring a new four-inch concrete floor (more than four inches will be needed if you're also laying up new walls).

Small patches in the walls also can be made with the mixture. Larger holes should be filled with bricks or stones and held with the same mortar. Cracks should be chiseled out to a depth of three-quarters of an inch before patching.

If a final waterproof coating is deemed necessary, you can use a commercial sealer such as Dryloc or Thoroseal. A cheaper alternative is two thin coats of a thick slurry of two parts each of portland cement and lime to one part sand.

If the cistern walls are crumbling and won't hold a patch, construct a new

Relining Deteriorating Cistern Walls with Masonry



The rainwater diverter (also called a "cutoff" shown in the diagram above is a hard-to-find specialty item. It's still made by a few sheet-metal manufacturers that fabricate gutters and other rainwater products. Two producers are the Galvan Manufacturing Co. of New Albany, Ind., and The Billy Penn Corp. of Philadelphia, Pa. These companies sell directly to builders.

masonry liner inside the old walls. The new wall can be made of stone, brick, concrete block or other masonry material. Plaster the inside of the new wall with two coats of the slurry. Continue the new wall up to the height of the crown, and stop there if the crown is in good shape. (If it's not, you'll have to rebuild the crown as described earlier.)

Proper Piping

The inlet pipe for the cistern pump should be at least two feet above the cistern floor. This allows room for a sedimentation basin, which is very important for water collected from a roof. Ideally, the inlet, outlet, and overflow pipes should pierce the cistern at the junction of the crown and wall or through the crown.

The overflow pipe prevents water from reaching the crown and causing masonry deterioration. The overflow should be connected to a dry well. Water-inlet filters can be easily constructed to help keep gutter trash out of the cistern (see diagram).

It's a good idea to install a diverter to direct rainwater from the gutters into, or away from, the cistern at will. This device allows you to divert the first 10 to 15 minutes of a good rain—as the rainwater sweeps the gutters clean—away from the cistern.

Fill 'er Up

For old cisterns that are unwanted or causing problems, there is only one solution: fill them in (after pumping them

out, of course). If trouble was caused by water collecting in the cistern, fill it with subsoil with a high clay content. Don't use aggregate; water will fill in between the spaces.

The fill will settle for three to four years, so you should have more fill on hand. You can reduce slump by vigorous tamping as each six feet of fill is added. Don't fill the cistern with trash containing organic material; as the organics decompose, the fill will slump for many years.

If the cistern stands by itself, the crown may be broken into pieces and used for fill. The remaining void can be filled with clay-rich subsoil in the manner described above. When settlement has ceased, add topsoil to finish off the yard.

If the cistern walls form part of the foundation for a porch or other structure, the crown should remain intact. Fill it with soil, and keep checking and adding fill as required. When the fill has stabilized, cast a permanent concrete plug for the manhole. ■

SEE ALSO CISTERNs, YESTERDAY AND TODAY, NEXT PAGE

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Cisterns, Yesterday and Today

A cistern is a tank for storing rainwater for household use. The rainwater collected in the roof gutters is led to the cistern through connections to the downspouts. There were three basic types of cisterns: wooden or metal tanks located in the house or outside; masonry containment vessels in the basement built into the foundation wall; and masonry-lined pits located a few feet away from the house.

In-ground cisterns provided the best protection against freezing, kept water at a constant cool temperature, and minimized damage from leaks. However, the in-ground cisterns also were the most expensive to build.

Cisterns were made from many different materials: bricks, stones, or other masonry units laid in mortar and plastered on the inside with a waterproof stucco. For in-ground cisterns, a manhole served as a port for routine maintenance and for getting water out by bucket. (Holes in

the manhole should be provided for ventilation, but they should be small "so as not to admit toads," advises one handbook issued when cisterns were common.) Basement cisterns usually had a wooden cover with a trapdoor for access.

There's something about a cistern that fascinates. Perhaps that mysterious hole in the ground conjures up fantasies of buried treasure or activates some dormant archaeological instinct. Or maybe it's a fascina-

tion with a household technology that everyone once knew but has long since forgotten.

Cisterns haven't been gone from the American scene for all that long, however. As recently as the turn of the century, cisterns were featured in most homes, even though municipal water had arrived in most towns by then. But people continued to believe that no well-run household could exist without good, soft rainwater.

True, not many people use cisterns

today. But a few households have never stopped using them. And some old-house owners have begun to reactivate old cisterns—especially to eliminate washing problems caused by a mineral-laden water supply.

Other cistern owners find rainwater preferable for gardening. It's cheap—and isn't spiked with chemicals. And if home owners live far from hydrants, a full cistern can add fire-fighting capacity.

A cistern even could be used as the heat sink in a closed-loop, water-to-air heat-pump system. This depends on the size of the cistern and the heat-pump system; an engineer would have to evaluate each case.

But it is not safe to use a cistern for drinking water.

Regardless of how it is to be used, however, before reactivating a cistern for a client, you'd better find out which bureaucrat is in charge of stopping you. You'll find cistern regulations under one or more of these areas: building codes, water ordinances, health regulations, public-works regulations, wells, diffused water, or cisterns. Because cisterns are unusual today, don't expect any official to encourage you. ■

Sectional View of a Jug-Shaped Cistern

A plan for a typical in-ground cistern as it appeared in the December 1894 issue of *Carpentry and Building* magazine. The details: A, rainwater inlet; B, overflow pipe; C, trap; D, sediment basin; E, pump intake pipe; F, brick wall (unparged) to serve as filter; G, manhole; H, flagstone cap. It's preferable to have pump intake pipe come through crown of cistern to minimize possibility of leaks.

