# Plumbing a Basement

## Cutting through the slab is grunt work of the highest order, but a relatively easy way to get an extra bath

BY MIKE GUERTIN

Adding a bathroom in a basement might sound like a complicated project, but the plumbing part of the job isn't much different than any above-grade bath. It's simple and straightforward to bring in the small-diameter supply lines for hot and cold water. Cutting the slab and digging the trench for the waste lines are the tasks that set this project apart. I work with my plumber, Paul Murray, to map out the best fixture layout, and we then divide the tasks required to complete the project. I tackle the slab work, and he lays the drain and supply piping. Of course, the sewer-outlet pipe on most of my projects is above the basement-floor elevation, so we have to install a tank to collect the sewage and a pump to send it up to the level of the sewer outlet. The rough-in process takes several days for us to complete; then we can schedule the inspections.

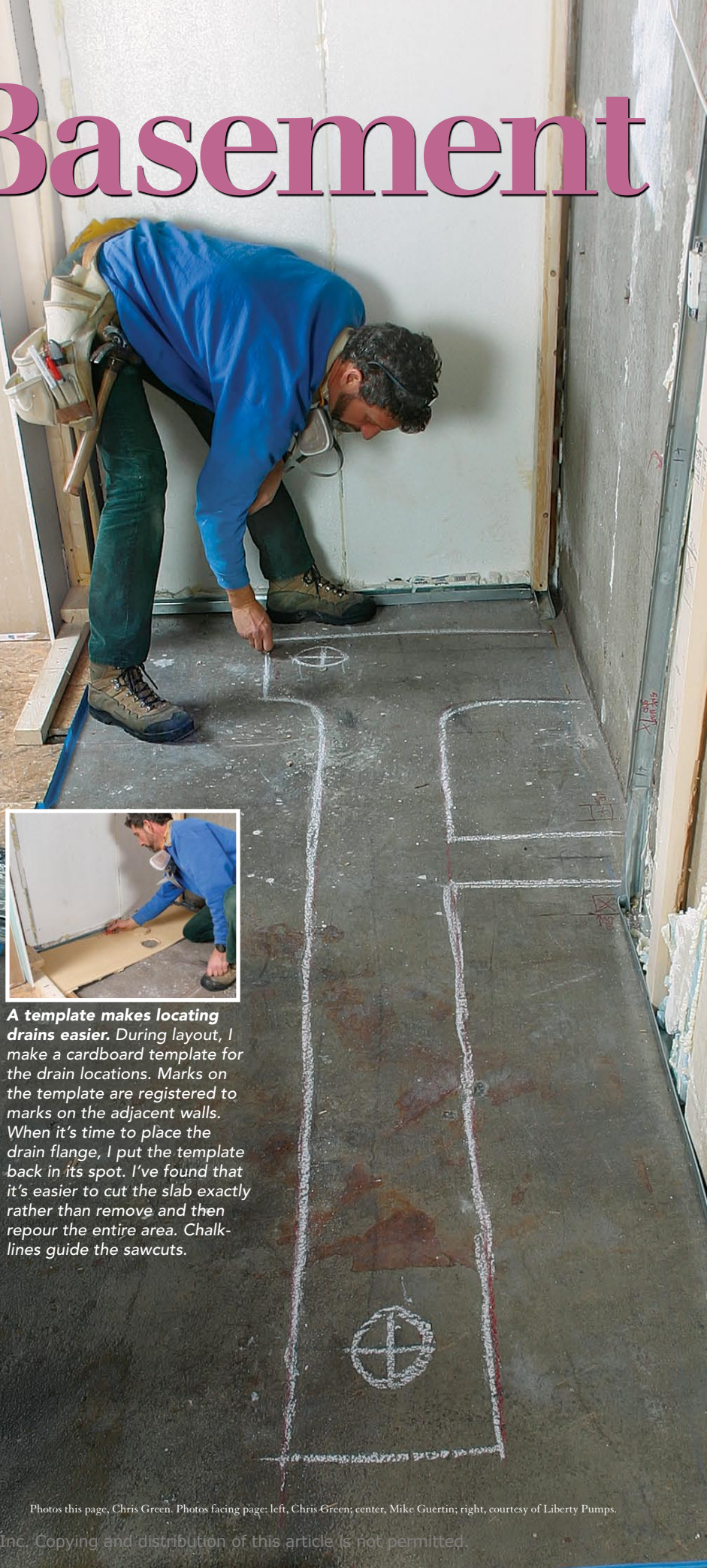
### Plan the drain layout first

Rather than completely breaking out the concrete slab in the prospective bathroom, I cut trenches where the drains will run. This saves me from having to move lots of broken concrete and then repour the slab. I chalk a proposed fixture layout on the concrete slab, then meet with Paul. We review options, and he recommends layout changes that minimize my work and simplify his drain- and vent-pipe arrangement. He also identifies suitable locations for the sewage-ejector tank and draws the final trench layout.

The bathroom in this project is typical and includes a toilet, a pedestal sink, and a one-piece shower stall. Other plumbed fixtures, such as a washing machine, a utility sink, a kitchen sink, and a dishwasher, can be tied in to the same drain system.

### A saw and a sledgehammer open the floor

Before I start breaking up the concrete slab, I make cardboard templates of the drain-riser positions for the shower and the toilet. The templates register to the adjacent wall plates or wall layout lines, so after the slab





***A template makes locating drains easier.*** *During layout, I make a cardboard template for the drain locations. Marks on the template are registered to marks on the adjacent walls. When it's time to place the drain flange, I put the template back in its spot. I've found that it's easier to cut the slab exactly rather than remove and then repour the entire area. Chalklines guide the sawcuts.*

Photos this page, Chris Green. Photos facing page: left, Chris Green; center, Mike Guertin; right, courtesy of Liberty Pumps.



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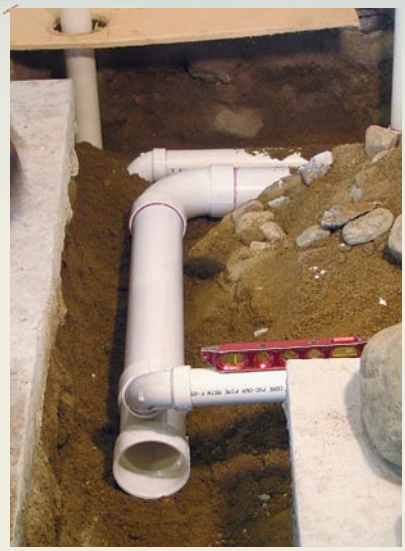
# Bathroom

## EVERYTHING FLOWS DOWNHILL TO A TANK

The key to a basement plumbing system is a tank with a pump that raises gray water and sewage to the main waste line, where gravity can take over. To keep everything flowing properly to the sewage tank, the drain lines from the fixtures should be pitched ¼ in. over a 12-in. run. Here, the fixture farthest from the tank, the toilet, determines the tank's vertical position.

***An economical (and friendlier) way to cut concrete.*** *I outfit an old worm-drive saw with a dry-cut diamond blade. To cool the blade and to reduce dust, I puddle a little water near the line and sweep it behind the blade as it cuts. The saw must always be plugged into a GFCI-protected outlet.*

***Take out only as much as you need.*** *Scored by the sawcuts, the slab is easily broken out with a sledgehammer, then carted away in chunks.*



***Keeping in pitch.*** *As the plumber lays out the drains, he continually checks his work with a torpedo level equipped with a pitch vial.*




## SEWAGE EJECTOR: THE GUTS OF THE SYSTEM

The sewage-ejector pump sits inside a plastic tank. It has a float-controlled switch that activates the pump when the sewage level reaches the discharge height. The sewage is pumped up and out through a 2-in.-dia. pipe to the main waste line, where the sewage flows naturally (due to gravity) rather than under pressure. A check valve mounted on the discharge pipe prevents the sewage in the discharge pipe from flowing back into the tank. In the event of a pump failure or a maintenance check, the pipe can be disconnected beneath the check valve, and the sewage inside the pipe above the valve will not leak out.

Many pumps, including the one I installed, can be serviced only by removing the tank cover and disconnecting the drain. My plumber recommends a pump by Liberty (www.libertypumps.com) with a cover-mounted panel (photo right) that allows easier access to the switch. All ejector pumps are powered by regular household current; the power cord plugs into any nearby GFCI-protected outlet. The cost for a tank and pump can run from $300 to $900.



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is removed and the trench is dug, Paul has a guide for installing the drains.

The largest drainpipe will be 3 in. dia., but the trenches need to be wide enough to be shoveled out. I usually make them 10 in. to 12 in. wide to leave extra working room for fittings. To cut the slab, I use an old worm-drive saw fitted with a $40 dry-cut diamond blade; it must be plugged into a GFCI-protected outlet. The blade cuts only 2½ in. into the slab, which typically is 3 in. to 5 in. thick, but that's deep enough to give me a good, clean fracture line. A gas-powered concrete saw would cut all the way through the slab, but the exhaust inside a poorly ventilated basement would be overwhelming and would migrate into the living space above.

As the saw cuts, I flood the blade with water to cool it, as well as to speed the cut and to minimize dust. I pour a puddle of water on the floor and use a brush to sweep it to the rear of the blade. The blade draws the water forward into the cutting action. The water can be pushed back into the blade until it becomes thick slurry. After every few feet of cutting, I collect the slurry in a bucket or a shop vacuum and start a fresh puddle.

A few whacks with a 10-lb. sledgehammer crack the concrete between the sawcuts; I use a pry bar to pop out pieces of the slab. Once a hole is started, the pieces come out easily. A word of caution: Some slabs are placed over plastic vapor retarders. When I encounter them, I try to be careful not to damage the plastic. I slice it down the middle of the trench and fold back the sides so that I can reuse it when backfilling.

### Everything flows downhill, so pitch the trench accordingly

I use a 3x3 (3-in.-dia. by 3-in.-dia.) elbow fitting to establish the starting depth at the farthest point in the drain run from the ejector tank—in this case, the toilet (drawing p. 71). To accommodate the 3-in.-dia. elbow, I start the bottom of the trench about 4 in. below the bottom of the slab. This leaves enough space above the drainpipe for the slab to be repoured to its full thickness. The trench needs to be pitched at ¼ in. per ft. I use a 6-ft. level with a pitch vial to gauge the slope as I'm digging. Any tangent trenches from incoming fixture drains need to be sloped at the same pitch, starting where they meet the main trench level. The area directly beneath the shower drain needs to be dug several inches deeper than the trench level to accommodate the trap.

The drain line terminates at the sewage-collection tank. These tanks are usually made of thick plastic and have an inlet hole drilled in the side. The pit for the tank needs to be

## PATCHING THE SLAB IS

Once the drains are in place and I've backfilled, (1) I like to compact the fill with water; any resulting low spots are filled and compacted again. Before I pour concrete (2), I isolate the drain risers with a wrap of cardboard, which gives me room to adjust the drain after the concrete is set. After mixing a small, stiff batch of concrete and packing it into the trench with a wooden float (3), I finish by running a vibrator (an Arkie Wall Banger) on a nylon cutting board (4) and, finally, by using a magnesium float and a steel trowel.


## Basement bath without cutting the floor

**Saniflo bathroom systems (www.saniflo.com) eliminate the need to break up the basement slab. Rather than running beneath the floor, 2-in.-dia. drainpipes connect the sink, shower, or toilet to a floor-mounted tank with an ejector pump (photo right); the pipes can run above floor level, either behind the finished walls or on the surface. The drawbacks to the system are that the pump is visible, the shower pan is raised 6 in. to 7 in. off the finished floor, and the price is a bit steep (a toilet and pump combo alone costs about $800). With headroom at a premium in the bathroom, I could afford to lose only 2 in. of a typical shower-stall floor.**

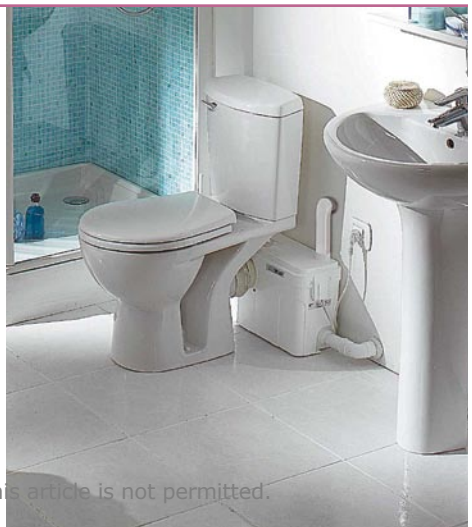

Photo: Courtesy of Saniflo Inc.



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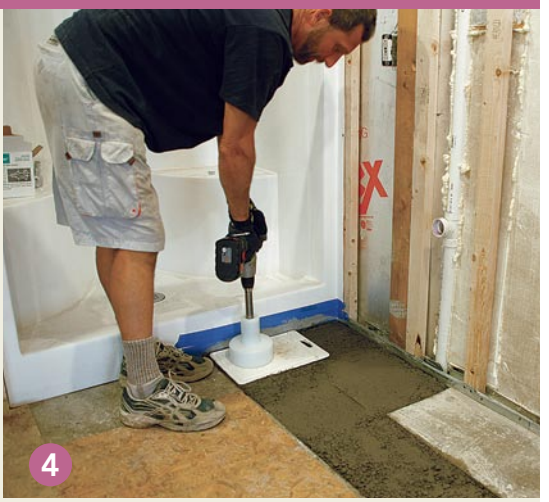



excavated deep enough so that the bottom of the inlet hole matches the bottom of the trench. This level might cause the top of the tank to be beneath the slab level if the drain runs are long. It's important to let the trench level establish the level of the tank and not just position the tank flush with the top of the slab, or there might not be enough pitch in the drainpipes for the sewage to flow properly. On this project, the tank top needed to be 2½ in. below slab level.

### Don't forget the vent lines

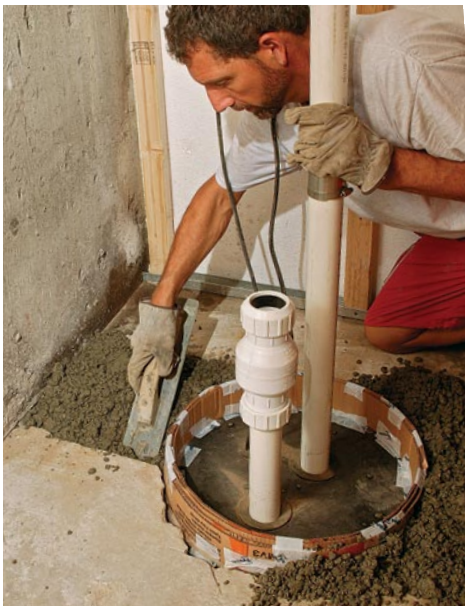
It takes me half a day to break out the slab and to dig the trenches. Then Paul returns to install the drains. Using the cardboard templates, he dry-fits, then glues together the pipes and fittings, running them into the sewage tank. A rubber bushing seals the pipe to the tank.

Once all the pipes have been laid, we backfill about three-quarters of the way around them to keep the pipes from shifting. The top of the trench is left exposed for the rough-plumbing inspection. If I'm working in an area that has a high water table, I fill the tank to the inlet, or I weight it with rocks to prevent it from floating if the groundwater level rises.

While the drain lines are exposed, Paul installs the plumbing vents. Proper venting is required by code and is necessary for the drains to work. The vents equalize air pressure inside drains and prevent traps from being sucked dry. Ideally, we run a vent pipe to the exterior of the building or tap into an existing vent pipe in the floor above. A vent pipe can be run through a wall above, can be concealed in a closet, or can be run on an exterior wall. On this project, we tapped in to a vent pipe on the first floor as part of a more-extensive remodeling project. Although air-admittance valves (see *FHB* #174) are an alternative for venting difficult locations and can be used to vent fixtures in a basement bathroom, don't use them to vent the sewage tank itself. We have run into problems with both odors and poor pump flow when we've used air valves in the past. Pumps perform much better when they are vented atmospherically.

### Leave yourself options after patching the slab

After the inspector's approval, I backfill around the pipes. The cardboard templates are used to position the shower, sink, and toilet risers precisely. While the backfill is still loose, the pipes are easy to shift a little to match the templates.



***Isolate the tank lid, but not the tank.*** *I use a ring of cardboard as a form around the sewage tank's lid so that the repoured patch sits on top of the tank rim but doesn't interfere with the removal of the lid. In some regions, seasonally high water tables can lift the tank right out of its hole if it's not secured.*

I then wrap the risers with strips of corrugated cardboard or surround them with a piece of larger-diameter pipe. The toilet stub, for instance, is left unglued to the fitting below so that it can be trimmed later to match the finished-flooring level when the toilet flange is mounted. The spacer keeps the concrete away from the pipe so that the stub later can be cut to length and glued. The spacers also leave a little wiggle room for fine-tuning the drain risers to match the fixture outlets. This is especially important when you're installing a one-piece shower.

Once the pipes are positioned, I flood the area several times with water to ensure that the backfill is packed tightly around them. The water helps to consolidate the soil and to fill in any gaps. The soil often settles when it's flooded, so I add more dirt flush with the bottom of the old slab and then flood the area again. Finally, I cover the trench with 6-mil plastic as a vapor retarder and tape it to the existing plastic vapor retarder when it is present.

The slab patch usually doesn't require enough concrete to warrant bringing in a ready-mix truck, so I either mix concrete in a wheelbarrow by hand or in a portable mixer. I mix the concrete stiff and then pack it into the trench. I run an Arkie Wall Banger (www.loyola.com/icf) or a concrete vibrator over a plastic cutting board and finish off the surface with a magnesium float and a steel trowel.

After the concrete cures for a couple of days, Paul returns for a few hours to install the supply tubing and to mount the shower mixing valve. I install the subfloor panels, the drywall, and the finished flooring before Paul's final visit to set the toilet and install the sink. □

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Contributing editor Mike Guertin (www.mikeguertin.com) is a builder and remodeling contractor from East Greenwich, R.I. Paul Murray, a second-generation master plumber and mechanical contractor in Johnston, R.I., contributed to this article.
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