Installing an Underground Sprinkler System

Living landscapes need water to survive and flourish. Relying completely on natural rainfall isn't usually the best method of supplying water. Depending on the type of grass and other plantings you have in your landscape, a more constant source of water may be required. Standing with a garden hose for hours is not the answer. A home irrigation system might be what you need. A properly installed and maintained in-ground/underground sprinkler system conserves water by directing it exactly where and when it's needed.

Before You Start Digging

Installing your own home irrigation system can save you money. However, it's not one of the easiest do-it-yourself projects around. Planning and purchasing the correct components are the keys to success. Keep in mind that putting in an irrigation system isn't your typical Saturday morning project. Installing a system usually takes more than one weekend to fit and fine tune.

But don't be discouraged. The great news is that most manufacturers of home irrigation systems have design and planning guides that simplify the job considerably. The available are an excellent resource and service. Pick one up, take it home and follow the instructions. Then decide whether to do it yourself or hire a pro. Maintaining an improperly installed system can be difficult to say the least, so take the time to do it right from the beginning.

Ask yourself: "Do I really need an underground irrigation system?" Some areas do not adapt well to portable hose end sprinklers. Under some conditions, a high arcing spray emitted from a sprinkler may blow away or partially evaporate before it hits the ground. The type of grass in your lawn also determines irrigation needs. Some turfgrass varieties have higher water requirements than others.

Your soil type affects the efficiency of irrigation as well. Sandy soils absorb water more quickly than clay soils. If you supply more water than the soil can absorb, runoff is the result. An irrigation system gives you better control of the moisture content of your soil.

Before installing a permanent irrigation system, you'll need to:

- See if your locality requires a building permit.

- Check for underground utilities before digging. Before you begin any excavation (that means even digging a hole), you've got to call and check for underground utilities. This isn't just a good idea, it's the LAW. The North America One Call Referral Service at **1-888-258-0808** connects you to a national directory of utility companies.

- Research your local municipal watering ordinances.

Because any of the above may become an issue, always check your local building codes before starting an irrigation project.

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In order to purchase the right components, you'll also have to determine your own specific:

- Water pressure in pounds per square inch (psi).
- Water meter size (for a municipal system) or well pump size (for a well).
- Water service line size.
- Water flow rate in gallons per minute (GPM).
- Type of backflow prevention required by local code.

Determining Water Pressure

There are two measurements of water pressure, working (when the water supply is turned on) and static (when the water supply is shut off). You'll need your working water pressure number.

Checking your water pressure requires a pressure gauge. If you can't borrow one from a plumber buddy, you can buy one. The gauge attaches to the outside faucet and provides a pressure reading in pounds per square inch (psi). Make sure all other water faucets (indoors and out) are turned off when you take the reading.

You can also get your water pressure from your local municipality, but it's likely to be an average for the neighborhood, rather than for your home specifically.

Determining Water Meter Size

If you're on a municipal water system, you should find the size imprinted on the meter itself. If you can't locate it, look on your utility bill or call your water provider. Water meters are 5/8", 3/4", or 1".

If your water comes from a source other than a municipal system, such as a well, you'll need the pump size. Look in the owner's manual or if necessary, contact the manufacturer.

Determining Service Line Size

To match the size of irrigation pipe to your existing water service, you'll need to know the size of your incoming supply line. To do so:

1. Get a piece of string.
2. Wrap it once around the water pipe.
3. Measure the length and compare to the chart below.

String Length		2¾"	3¼"	3½"	4"	4¼"	5"
Type of Pipe	Copper	*¾"*		*1"*		*1¼"*	
	Galvanized		*¾"*		*1"*		*1¼"*
	PVC (sch. 40)		*¾"*		*1"*		*1¼"*
Service line size is in Italics							

Determining Flow Rate

This is measured in gallons per minute:

1. Get a container that has a measurable or known capacity.

2. Turn on the water.

3. Record the time it takes to fill to a measurable level.

4. Divide the filled container size (in gallons) by time (in seconds) it takes to fill it.

5. Multiply it by 60 seconds.

6. The number you get is the flow rate in gallons per minute (GPM). (Multiply that number by 60 if you need to determine gallons per hour).

Examples:

• A 3-gallon bucket takes 15 seconds to fill.

3 / 15 = 0.2

0.2 x 60 = 12 GPM or 720 GPH.

• A 4-gallon bucket takes 30 seconds to fill.

4 / 30 = 0.13

0.13 x 60 = 7.8 GPM or 468 GPH.

Determining Backflow Requirements

Refer to local ordinances for backflow prevention requirements.

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Map It

When you've completed all of the preliminary research, it's time to start laying out your system. Most yards have a variety of elements that have to be considered when laying out an irrigation system:

- Shrubs or other foundation plantings
- Flower beds or mulched areas
- Trees
- Sidewalks
- Fences and other man-made features
- Slopes
- Areas of sun and shade

Because of these features, you'll most likely have to create more than one watering zone. The number of zones you need also depends on the GPM your system can supply. A zone is an independently contained set of pipe and sprinkler heads. Zones are determined by the physical attributes of your landscape and the capacity of your water supply. Each zone has its own control valve.

A map is essential when establishing watering zones. Begin by measuring and mapping your property to scale on graph paper. A scale of 1" = 10' is recommended. The map should include the house and all permanent landscape features. Mark on the map where the water meter is located.

Landscape features need to be clearly marked so that the installed system will water only areas with living materials and will provide complete coverage for them. Note prevailing winds if you feel they'll affect coverage. More importantly, mark sloping areas in your lawn. If your yard is sloped, the water pressure changes (lower as the elevation increases, higher as it decreases), affecting the amount of water delivered by the sprinkler.

You'll also need to draw where the manifold will be located. The manifold needs to be located in an inconspicuous spot near the water supply line.

Be prepared to make more than one version of the map if necessary. It's much easier to explore alternatives on paper before you begin digging.

Make sure electric or water utilities are not affected. If in any doubt, check with your local utility companies - they will assist you.

Keep the final zone map for reference. It will come in handy if future maintenance is required.

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Coverage

When installing a sprinkler system, 100 percent coverage is essential to avoid dry spots. In order to achieve this, overlap the spray pattern. “Head to head” coverage refers to the sprinkler head layout that allows spray from each sprinkler head to reach the adjacent head, ensuring overlap.

Each sprinkler head is designed for a specific watering need. Many are adjustable to allow targeted spot-watering without watering inorganic objects such as sidewalks, driveways or the house.

Select sprinkler heads based on the coverage required. The number of zones and the sprinkler head size and style depend on the location of trees, shrubs, lawn and sidewalks. Large areas need one style, corners need another, and areas under shrubs need still another type. Your irrigation planning guide should have a list of sprinkler head types.

Pop-up style lawn sprinkler heads are installed just below ground level. Set pop-up sprinkler heads so that they will not be damaged by mowers or foot traffic when retracted. The best ones are adjustable. Shrub sprinklers are taller for use in flower and shrub beds. When selecting the proper height to install, keep in mind the mature size of the plants.

Remember:

- Pressure loss in the system causes uneven watering. To avoid unnecessary pressure loss, plan the irrigation pipe layout with as few turns as possible.

- Long extensions of pipe also reduce water pressure. It’s better to create another zone than to overextend a single one.

- Mixing head types in one zone decreases efficiency. Always use the same type of head for each zone.

Primary Parts

Done with the planning? Take your water measurements and maps with you when shopping for parts.
You must select your system components to match your water supply and water pressure. A mismatch will either overstress the system or provide insufficient irrigation.

- Valves open and close pipes to allow watering of each zone.

- Head styles vary based on the water requirements of the plantings and your water supply. Sprinkler heads are rated according to the GPM they can supply water at your particular psi.

- Risers connect pipe to sprinkler heads.

- Fittings or couplings, such as tees and elbows, connect and redirect pipe.

- A manual control should be able to maintain several areas with differing needs.

- A backflow preventer is an anti-siphon device that’s required in most areas.

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- Timers allow presetting of the on/off function of the system.
- The valve manifold is the master control of the system.
- Pipe choice depends on the region you live in. You'll use either PVC or polyethylene pipe.

Which Pipe Do I Use?

Polyvinyl chloride (or **PVC**) pipe is the most common irrigation material. The familiar rigid white material is stronger than polyethylene. Connections are made using adhesive.

The alternative material is **polyethylene**. Because it's flexible, it's used in colder climates to adapt to extended freeze cycles. Polyethylene comes in rolls and can be curved around natural and manmade obstacles, requiring fewer fittings than PVC. Connections are made with specially designed clamps.

Both types of pipe are cut with a handsaw or pipe cutter.

A machine called a **pipe puller** is great for installing polyethylene pipe, but requires a little expertise to operate. Unless you want to get some on-the-job training in your front lawn, this machine is perhaps best left to the pros.

Digging

The design is done, the parts are selected and you are ready to dig and install. Lay out the location of the lines with stakes and string. Place a flag or other marker where the sprinkler heads will be located.

The trenches required for the system are relatively shallow - 6-12" deep depending on the freeze cycles and frost severity in your area. The trench must also be deep enough to allow the sprinklers to retract underground to prevent breakage from lawn machines.

Dig the trench by hand or rent a trencher (a real time saver). If you choose to dig by hand, a garden spade with a square edge is the best tool to use. A ditch spade is also pretty handy for working in a narrow space. It's advisable to hand dig in flower or shrub beds to prevent damage to plants.

The trenches must be level. If some heads are lower than others are, gravity will win in the end and reduce efficiency. Dig only as much as you can install in each work session. Save the sod to re-cover the trench.

Assembly

Assembly is a snap once all of the preplanning is complete. Lay out the pieces first. Pre-assemble parts when possible before putting them in the trench. It's best to connect components working out from the manifold.

Connecting PVC Pipe

1. Cut the pipe to length with a hacksaw or pipe cutter. Make your cut straight so the pipe is fully seated in the fitting.

2. Smooth and bevel the edges slightly with a knife or fine file.

3. Insert the pipe into the fitting and adjust to the correct position. Mark the pipe and fitting with a reference line to make it easy to find the position again after you have added the cement.

4. Remove the pipe from the fitting.

5. Clean the surfaces to be mated with a solvent primer.

6. Brush both the outside of the pipe and the inside of the fitting with cement.

7. Push the pipe into the fitting with the marks ¼ turn apart. Twist the pipe to align the marks. This spreads the cement and makes a bead along the edge of the fitting. The bead should extend all the way around the pipe. Work quickly, the adhesive sets in about 30 seconds. If you make a mistake, separate the parts quickly. Once the joint is set, it's stuck for good.

Connecting Polyethylene Pipe

1. Cut the pipe to length with a pipe cutter or hacksaw.

2. Place a clamp on each end.

3. Insert the fitting into the pipe.

4. Tighten the clamps.

Connecting Heads

Systems vary by manufacturer, with the heads usually threading onto the riser. Read and follow your individual model's instructions carefully.

It's very important to flush debris from the line before final connection of sprinkler heads. It's difficult to locate blockages after everything is in place. A final flush also allows you to check for leaks in the pipeline.

Connecting the System to the Service Line

There are two ways to connect your irrigation system to the water supply.

- The valve can be connected (like a garden hose) to an existing outdoor faucet, which is usually located directly outside the house.

- The system can also be directly connected to the service line.

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1. Shut off the water supply.

2. Between the main shut off and the house, cut a one-inch section out of the service line.

3. Add a compression tee fitting and an additional valve to allow the system's water supply to be controlled independently of the house system.

Backflow

Most municipalities require installation of backflow preventers on irrigation systems. Backflow can be caused by:

- Water being siphoned back into the water supply.

- Reverse pressure from the system.

Backflow can allow chemicals from the lawn to enter the water supply and cause serious problems. A backflow prevention mechanism closes the system when not in use. Make sure it's installed properly.

Always read and follow the manufacturer's instructions.

Controls

Each zone will have its own controlling valve (only one valve per zone). For future maintenance and repair, note which valve is for which zone.

The manifold groups the valves in one area and allows all zones to be routed through one control. You will be able to run one zone at a time to maximize water pressure.

The timer controls which zone is being watered. Choose timers based on the number of zones you have. Keep a copy of the timer/zone assignments (much as you would keep a reference of electrical circuits in a breaker box). Timers can be programmed to run for a specified time and shut off automatically. A moisture sensor feature is available to detect water levels and shut on and off when needed - a great way to water when you're away from home.

Sprinkler System Tips

- You probably want 1-2" of water per week, depending on your vegetation. Measure water by placing a cup or other container in each zone. Run the system for a regular cycle and measure the amount of water in the container. This will tell you how long your system needs to run to get the right amount of water.

- At the end of the season in colder regions you may need to blow out residual water from the system before the ground freezes. Compressed air is the normal "tool" used. Find a pro to do this task. Exposed backflow preventers and valves may need to be protected from freezing.

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• Part of your ongoing maintenance program is observation. Don't wait for brown spots to appear to look for a clogged sprinkler head or pipe.

These How-To's are provided as a service. The information intended to simplify the job. Tools, products, materials, techniques, building codes and local regulations change; therefore, we assume no liability for omissions, errors or the outcome of any project. The reader must always exercise reasonable caution, follow applicable codes and regulations, and is urged to consult with a professional if in doubt about any procedures

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