Drip Irrigation in the Arizona Desert

A Design and Installation Guide

What is drip irrigation?

Drip irrigation is designed to deliver the water at a very low rate and at a very low pressure into the soil where the roots are.

Why use drip irrigation?

Drip irrigation has the potential to save water over previously used irrigation techniques. With a proper design and the right components used it is very efficient in how it delivers the water to each individual location. There is less water lost to evaporation because the water is not being sprayed through the air like sprinklers.

In some cases improved plant health has been observed as drip irrigation wets the soil and not the plant itself. This prevents the minerals in the water from building up on the leaves, salt in particular.

When polyethylene tubing is used, the system is easier to install and easier to modify as the landscape water needs change.

There are some things to take into consideration when using drip irrigation. Because it is operating at a low pressure, leaks are not as obvious as sprinkler systems and they must be inspected regularly to locate them. Additionally drip emitters can clog or become what are called “blown” where they are putting out much more water than they should. The polyethylene tubing can also become damaged by digging. PVC pipe is a more robust material and will be more durable but it is more difficult for the average person to make modifications to as the landscape changes such as adding in new emitters. A properly designed, installed, and maintained polyethylene tubing system will last decades.

Drip Irrigation Components

WHAT ARE THE COMPONENTS OF A DRIP IRRIGATION SYSTEM?

Pipe:
Polyethylene tubing and PVC are the two most commonly used types of pipe.

Emitters:
These connect to the tubing and deliver water at a slow, consistent rate, usually 1/2, 1, or 2 gallons per hour.

Micro-tubing:
This tubing delivers water from the emitters to the plants.

Valves:
Manually or automatically operated control valves are used to turn the water on and off. Automatic control valves are wired to a controller.

Pressure regulator:
Most drip systems operate at low pressure, usually less than 20 PSI. Pressure regulators reduce incoming water pressure to the ideal pressure for the drip system.

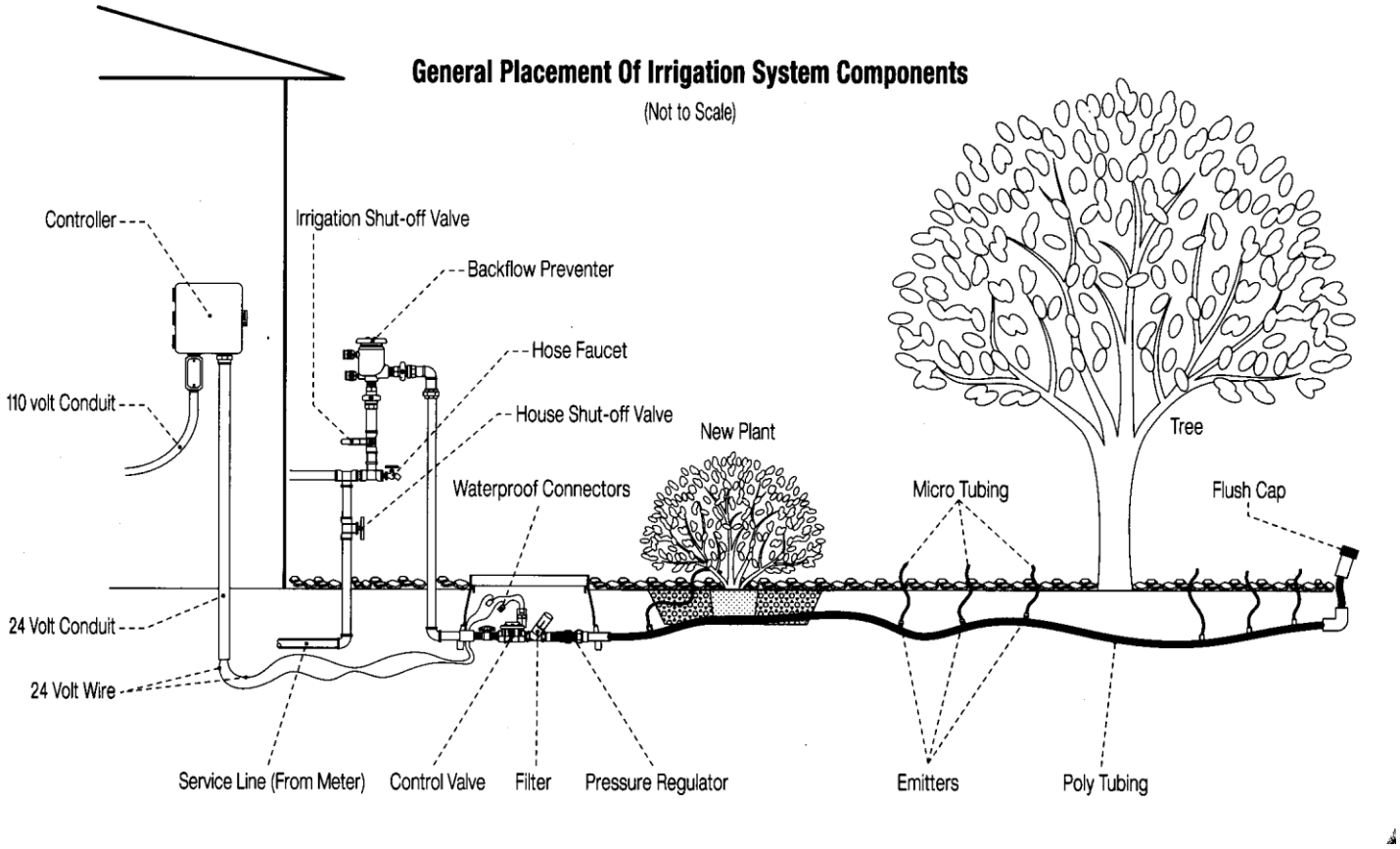
Filter:
All drip systems need some type of filter to keep dirt and debris from clogging the emitters.

Backflow Preventer:
This device prevents the irrigation system water from being siphoned back into your drinking water. All cities have ordinances that require installation of backflow preventers. Contact your city for permit and installation requirements.

Controller/Timer:
Controls the watering cycle by automatically activating the control valves on the days and times you preselect, thereby directing when, how long and how often the system operates.

Flush Valve/Cap:
A flush cap is attached to the end of each irrigation line so that dirt and debris can be flushed out of the irrigation system.

Placement of Irrigation Components



The best place to get the source of the water for the irrigation system is where the water comes into the house from the water meter. Because of the low flow demands of drip irrigation the point of connection can be made at the back hose faucet location as a last resort. This can however cause problems if water is being used inside the house at the same time the drip irrigation is running.

Designing the System

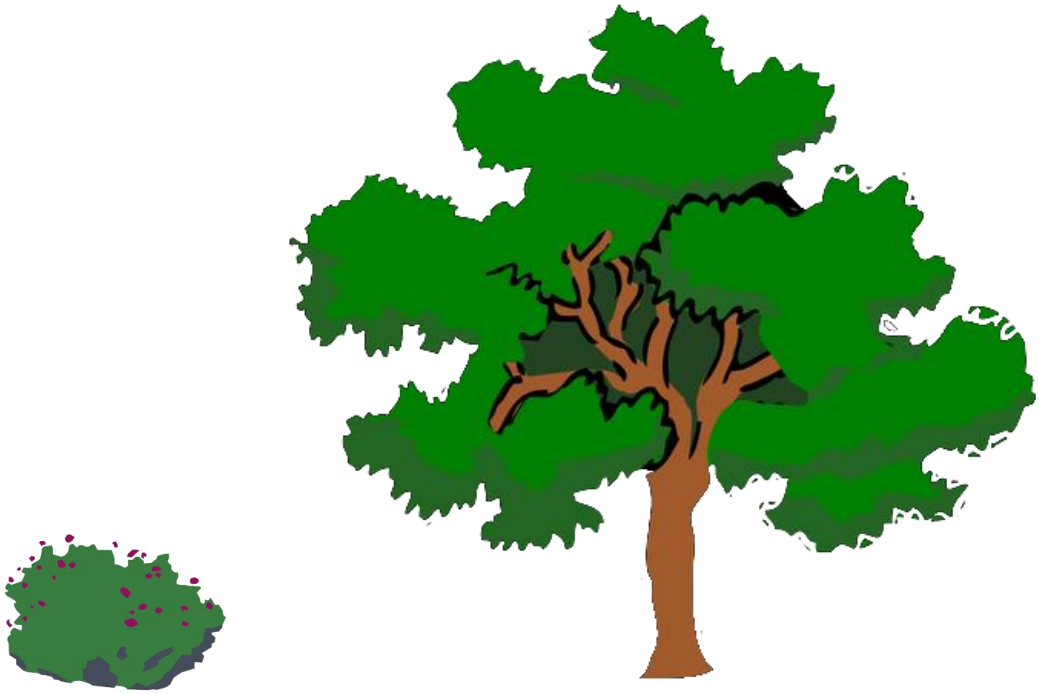
Start by drawing the yard to scale, either on paper or using software on the computer. This can be used to create a shopping list of the materials you need. This will help eliminate, or at least reduce, the number of extra trips to the store to get everything needed. This will also be helpful as an As-Built plan in helping you locate where the piping is later when you need it.

Include driveways, patios, sidewalks, and any other obstacles you will need to get around, under, or through. Draw in where the plants and trees will be to help decide the shortest routing of the tubing.

Zoning

Separate the plant materials into groups with similar watering needs. This is often referred to as hydro-zoning. This will allow you to water the plant groups appropriately and efficiently. The decision to separate different plants will be based on how deep the system needs to water; this is driven by how long the system runs, and how often it needs to water.

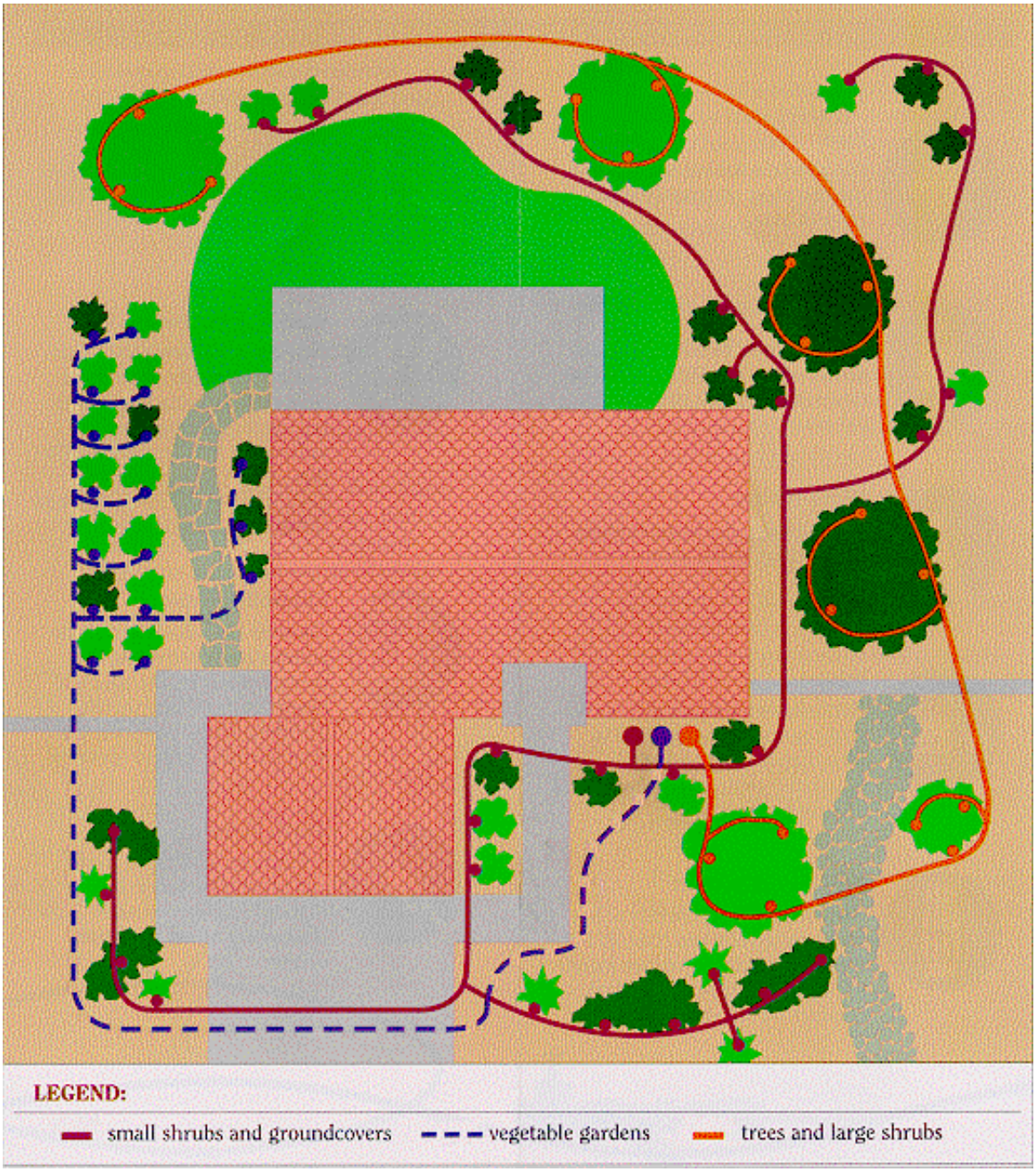
The biggest difference is going to be between shrubs and trees. From planting to maturity, the size of the trees will increase significantly more than the shrubs will.



Trees have a much larger and deeper root system. To deliver the water deeper with a drip system it is run for a longer time. The root zone on trees are larger and deeper, so they can go longer in between watering than the shrubs can. If both of these are on the same zone they cannot be watered effectively.

Flower pots, flower beds, and vegetable gardens have very different watering needs than the shrubs and trees in the yard and need to be separated into their own hydro-zones. They are higher water using plants, the soil structure is very different, and a different type of emission device will have to be used that delivers the water at a much faster rate. These things will affect how long and how often the zone is run.

Zoning Example



In the illustration above there are three separate irrigation valves.
Small shrubs and groundcovers are watered once every 1-2 weeks.
The trees and large shrubs are watered once every 2-4 weeks.
The vegetable garden is watered every 2-3 days or as
needed during the growing season.
The lawn sprinklers would be zoned separately from the drip.
If flower pots were present they would be zoned separately and
may be watered every day in the summertime.

Hydraulics

Irrigation systems are moving water through piping. The movement of the water in the pipe creates a loss in pressure. A good irrigation design will make sure you are not trying to move too much water through the piping and not going too long of a distance so the pressure loss will be at an acceptable amount. This is especially important because the system is working at a lower pressure to begin with.

- Don't exceed 200' of poly tubing per leg of the system
- Don't exceed 200 gallons per hour (GPH) per leg of the system
- Don't exceed 6 feet of ¼" micro tubing after the emitter

These are guidelines and there are instances where the tubing can be run a longer distance. If you need to do this, first consider changing the location of the valves to be in a more central location of the zone or have someone calculate the pressure loss to make sure it will work. Design the system for the amount of emitters that the plants and trees will need at maturity. As they grow, more emitters will be needed to adequately water the larger root zones. The emitters will also need to be moved away from the original location as the plant material grows.

Suggested Quantities of Drip Emitters

TYPE OF PLANT	# OF EMITTERS			EMITTER PLACEMENT
	1 gph	2 gph	4 gph	
VEGETABLE GARDENS	1	1	-	Every 12"-16"
GROUND COVERS	1-2	1	-	In between base of plant & edge of rootball
LOW SHRUBS – 2' TO 3'	1-2	1	-	In between base of plant & edge of rootball
SHRUBS 3' TO 6'	2-3	2	-	1' from plant on each side of trunk
TREES - 6' TO 10'	5-6	3-4	2-3	Equally spaced around the dripline
TREES - 10' TO 20'	-	5-10	4-6	Equally spaced around the dripline
TREES - 20' AND ABOVE	-	11+	7-10+	Equally spaced around the dripline

Selecting the components

99% of the irrigation system will be below ground. Use high quality components that are durable and will reduce the amount of time and effort in replacing them.

- Talk to irrigation supply store professionals
- Talk to landscape professionals
- Talk to nursery professionals
- Research manufacturer specifications
- Consider cost
- Consider warranties

Local Irrigation Supply Stores:
Ewing
Horizon
Site-One
Sprinkler World

Emitter selection

The most important thing in selecting emitters is to make sure they are pressure compensating. The last emitter on the line will always have less pressure than the first one. A pressure compensating emitter will put out the same rated delivery of water within a range of pressures. Conversely, non-pressure compensating emitters will instead deliver more water at the beginning of the line leaving less or no water at the last emitters on the line. This is critical for the efficiency of the system.

Pressure compensating emitter

Non-pressure compensating emitter

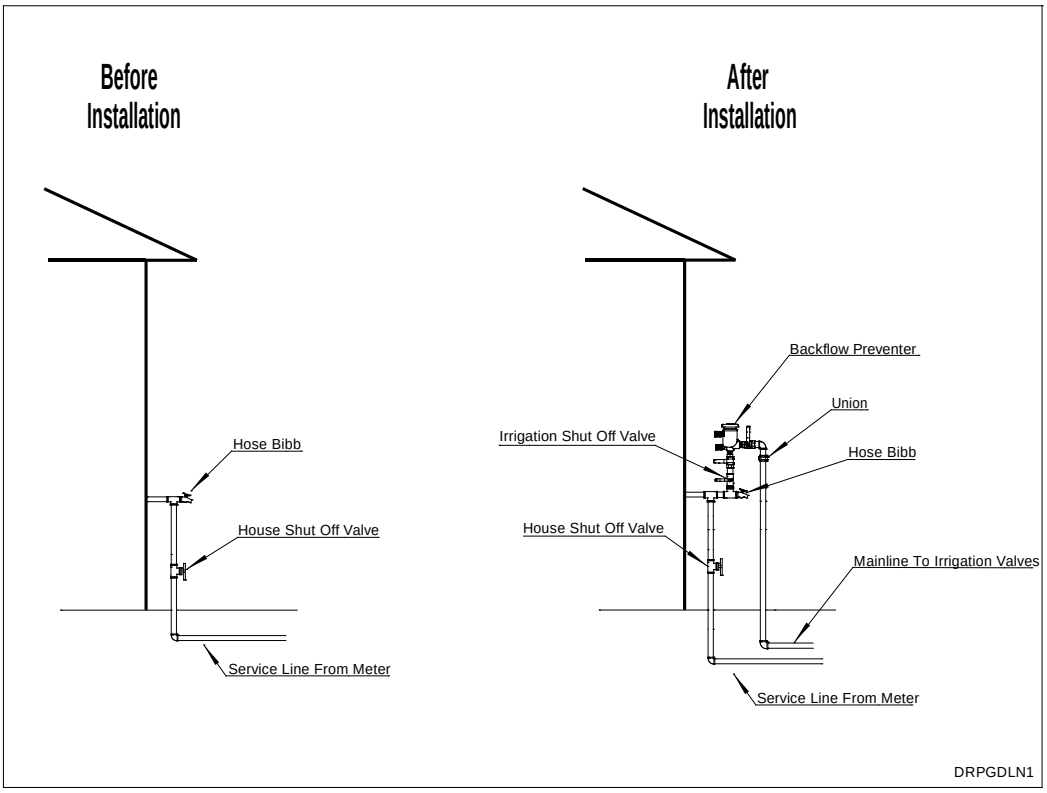
Installation

Call Blue Stake about five days before digging. They can be reached by calling 811. They will mark where the utilities come into your yard. The different utilities will be marked with different paint colors. The will have a brochure that tells you what color is for what utility. Dig carefully in these areas until you are sure that you are safely away from them.

Backflow Prevention

The backflow preventer will keep the irrigation water from coming back into the drinking water after it has entered the irrigation system. The preferred way to do this is with a Pressure Vacuum Breaker (PVB). This will allow you to install the valves in boxes underground.

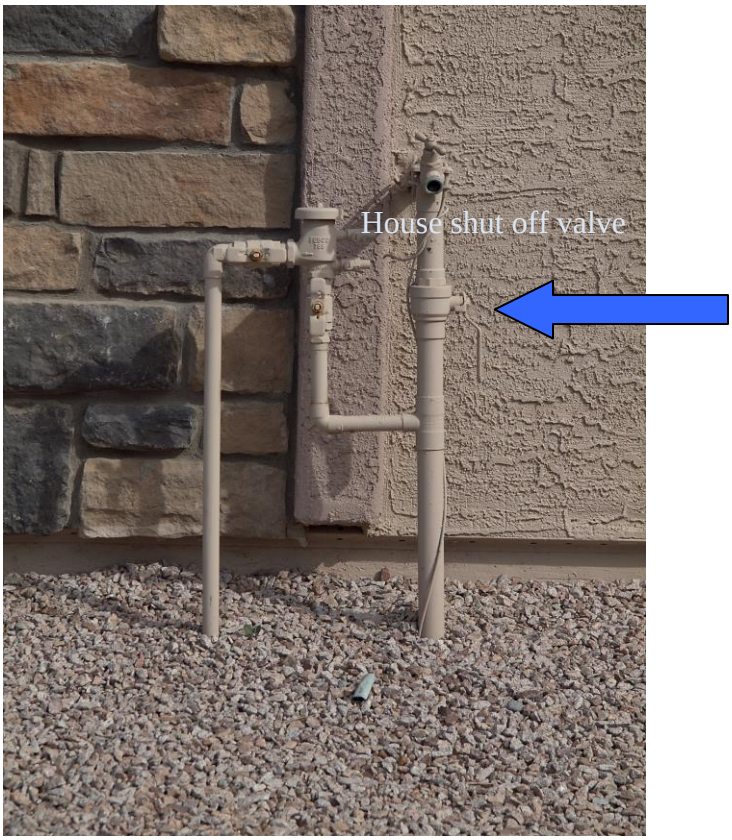
If an irrigation system has never been installed, attaching it to where the hose faucet is located is the easiest way.



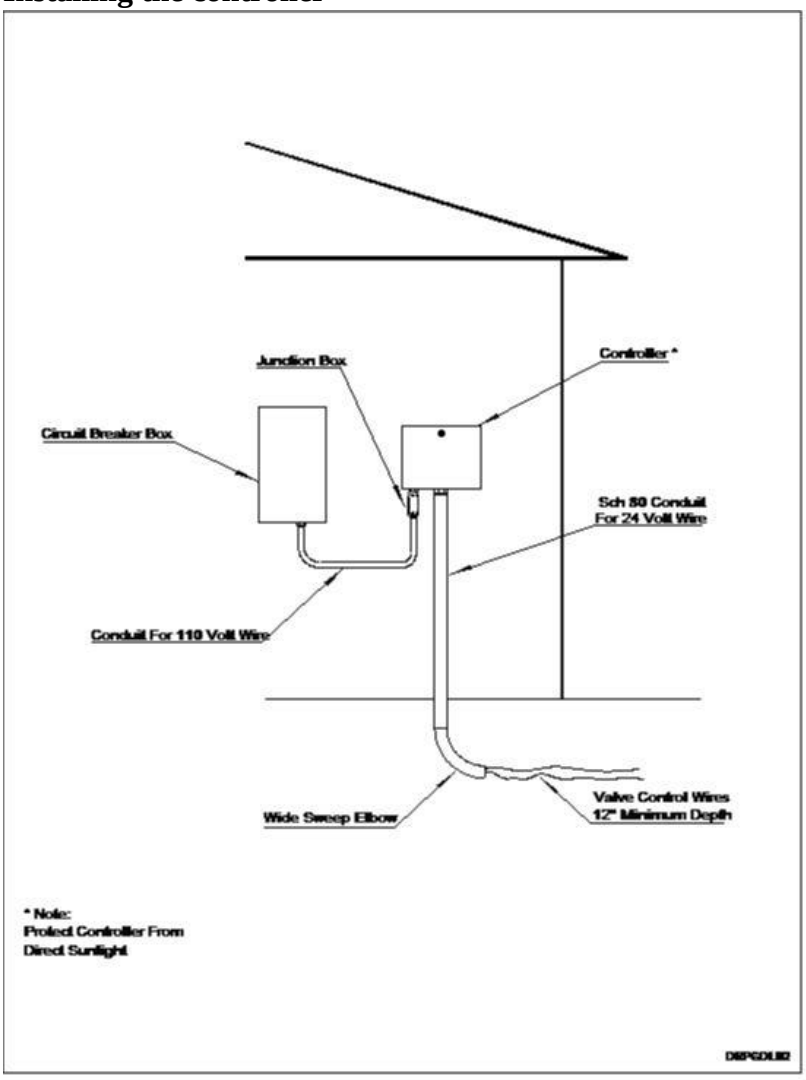
- Must be above ground
- Must be above any downstream piping
- Valves allowed downstream
- Can be tested
- Installed with copper pipe not PVC

If it is possible cutting into the pipe and installing the connection in front of the shut off valve for the house is preferred. This allows the water to be shut off to the inside of the house and still have water available for the irrigation. If the downstream piping is going to be higher than the assembly then a reduced pressure assembly (RPA) needs to be used instead. Once the piping is back below ground it can be transitioned to PVC pipe.

Use schedule 40 PVC for the piping going from the backflow preventer to the valves.



Installing the controller



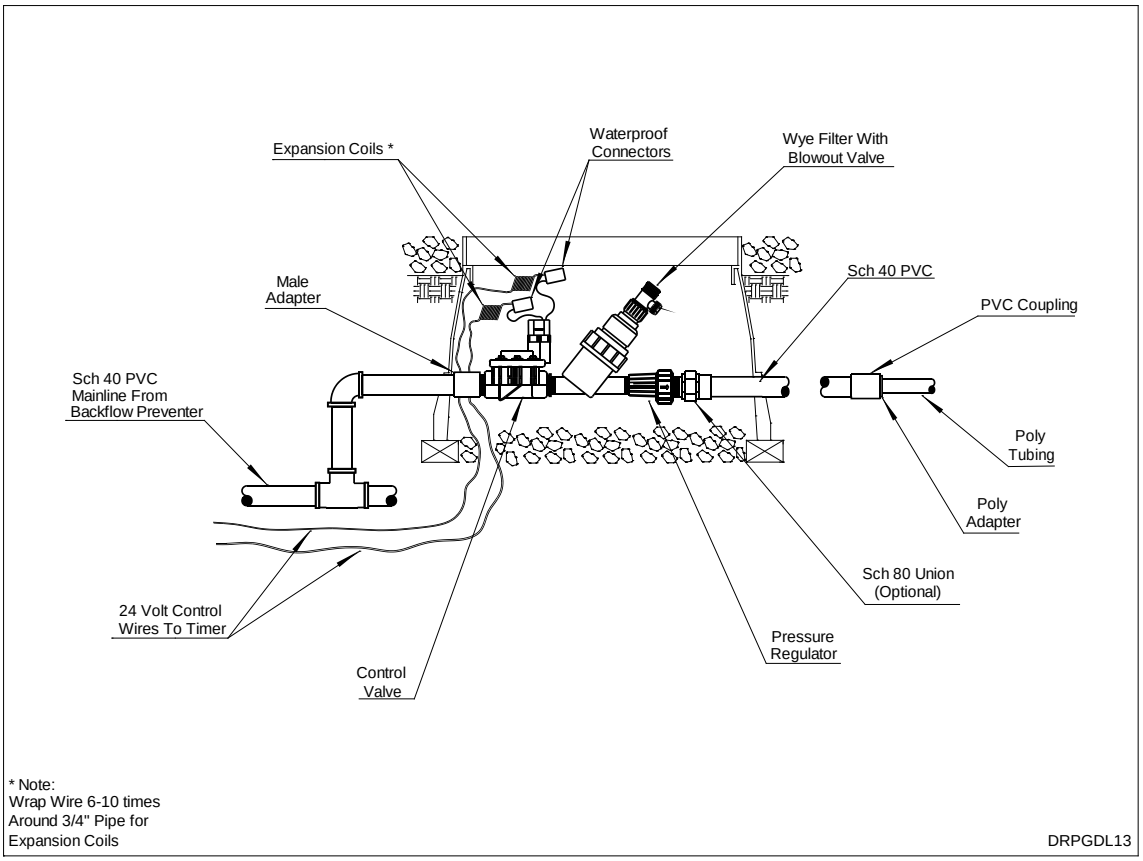
Outdoor mount controllers are in weatherproof cabinets. They are especially preferred if you need someone else to access it. These controllers are designed to be wired into the circuit breaker box of the home. If you are unfamiliar with the wiring in circuit breaker boxes hiring a licensed electrician to do this wiring is highly advised. The power in these boxes can be fatal.

It is recommended that the controller has it's own dedicated circuit breaker. This is a minor increase in cost and allows the controller to be powered off without affecting any appliances such as clocks that would need to be reset if powered off.

The 120V power line needs to be in conduit. The 24V wires going to the valves are in conduit above ground only to keep them protected from the sun and other damage.

Installing the valves

With the preferred backflow prevention the valves can be installed underground in a valve box to keep them protected and less visible.

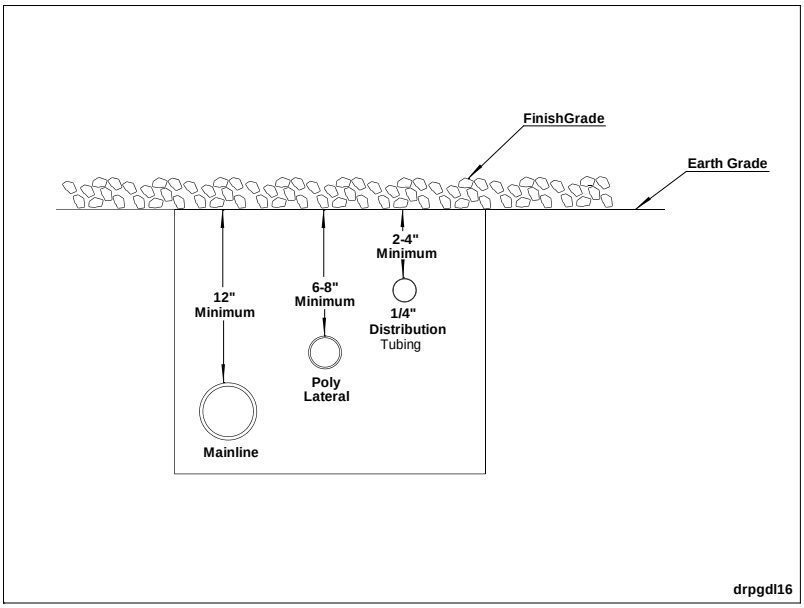


Make sure to use waterproof wire connectors and leave extra wire in the box to allow for future repairs. It is recommended that the wires back to the controller are installed under the mainline piping to keep them protected from any digging.

Many manufacturers are now making combination filter and pressure regulator units and this can help shorten the length of the components in the box.

Installing PVC unions in front of and behind the control assembly will allow the entire assembly to be removed from the valve box without digging it up for future repairs or replacements.

Depth of piping

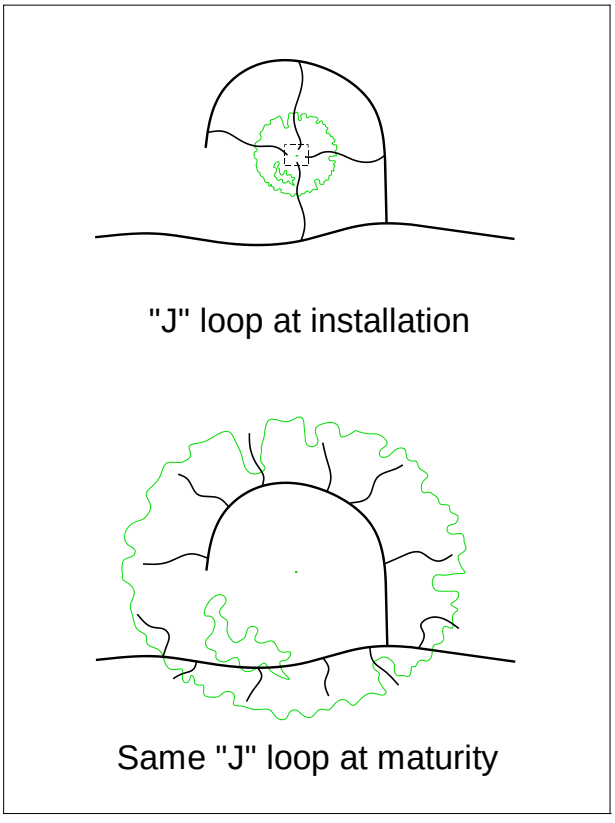


- Mainline piping is between the backflow preventer and the valves
- Lateral piping is after the valves
- ¼" distribution tubing is between the poly lateral and the final emitter placement

Emitter placement

When you run your drip irrigation you are not watering plants. You are watering roots. The initial emitter placement on newly planted shrubs and trees must be on the nursery rootball, that's where the roots are. Moving the emitters out as the plant material grows will encourage a deep wide root zone that will stabilize the plant and help maintain it's health through the hot dry seasons.

Moving and adding emitters as the plants grow is rarely done. To make this easier install piping and the emitter lines where the future dripline of the plant material will be now. This is especially important with trees. They can temporarily be capped off with a goof plug until the roots reach the area.

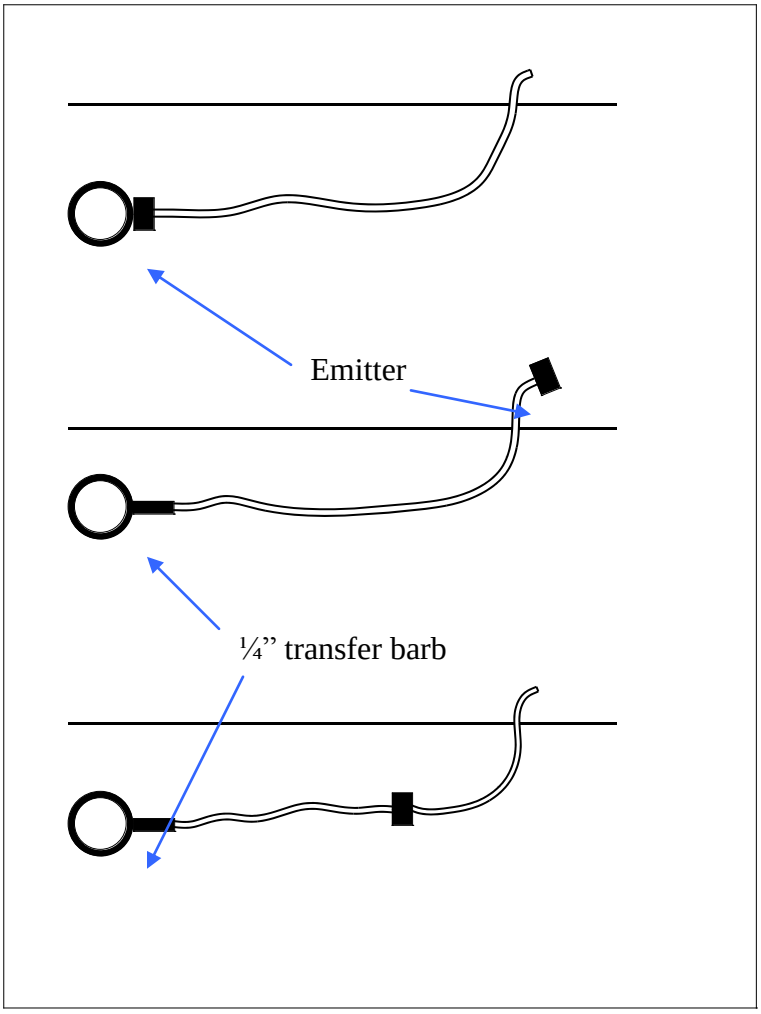


Installing the emitters

Option 1:
The fastest and easiest way is to install The emitter directly into the poly tubing And run the ¼" micro tubing to the final emission point. This requires digging up the emitter when it needs to be placed.

Option 2:
A better way is to use a ¼" transfer barb Inserted into the poly tubing and placing the emitter at the end above ground. This allows the emitter to be more easily replaced. It also allows a longer run of the 1/4" tubing when needed.

Option 3
If rodents or other animals such as rabbits are a problem and the extra reach is needed then placing the emitter just before the final emission point and adding another piece of ¼" tubing to bring the delivery back above ground will maintain the proper water delivery even if it is chewed.



End/flush caps

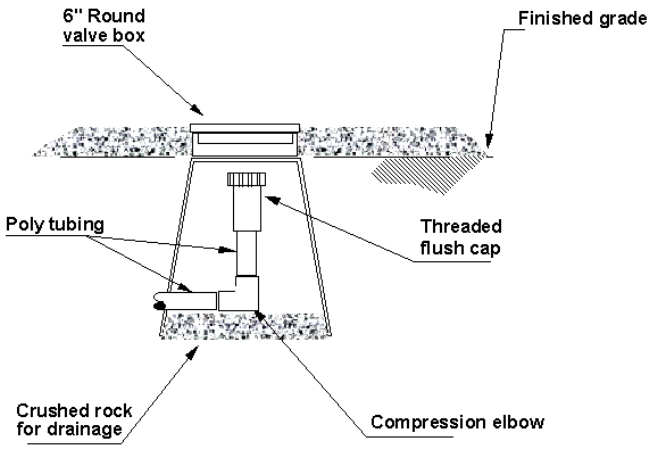
You will need to access the ends of the lines for flushing as part of regular maintenance and if the polyethylene tubing becomes damaged allowing dirt to enter the system. Opening the ends and turning on the system will flush most of the dirt out of the system keeping the emitters from becoming clogged.

The most commonly used way to end the poly tubing lines is to use a figure eight closure fitting. This is simply folding over the line and kinking it off. It is easily accessible but it does have some drawbacks.

It is exposed to the sun and will deteriorate fairly quickly becoming a leak. It is also susceptible to damage from vandalism.

A preferred way to do this is to install a threaded flush cap inside an access box as shown below. This will keep it accessible and also protected from the elements and potential vandalism.

Just make sure the box is not buried too deeply that it gets covered by the decomposed granite.



Final installation

The poly tubing will want to come out of the trenches when you lay it in. Hold it in place with soil every ten feet or so. This will allow you to inspect the system for leaks before the final backfilling. Fill in the trenches with clean soil, any rocks will puncture the tubing over time. Gently tamp the soil down, be careful not to crush the tubing. Then soak the trenches with water, this will bring the soil back to compaction.

Make any adjustments to your drawing to reflect any changes that had to be made from the original design.

You now have an irrigation system that will water your landscape effectively and efficiently.

Resources

The major irrigation manufacturer's websites:

- Rainbird.com
- Hunterindustries.com
- Irritrolsystems.com
- Toro.com

The Irrigation Association:

- Irrigation.org

The Arizona Municipal Water user's Association:

- AMWUA.org

The Arizona Landscape Contractors Association:

- Azcla.com

Water Use it Wisely Watering Guide:

- https://wateruseitwisely.com/100-ways-to-conserve/landscape-watering-guide/

University of Arizona Cooperative Extension Office:

- https://extension.arizona.edu/maricopa