Drip Irrigation –
Design, Installation and Maintenance

2019 Whidbey Gardening Workshop

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Benefits of Drip Irrigation

- Places a precise amount of water where you need it
- Prevents overwatering
- Results in less weeding
- Conserves water
- Saves money
- Keeps water off of foliage (less disease)

Drip Irrigation Saves Time

- Eliminates hours of hand watering
- Can be fully automated with a timer
- Reduces weeding time

Drip Irrigation Is Versatile

- Gardens, vineyards, greenhouses, row crops
- Window planters
- Deck and patio pots
- Existing landscapes
- Hillsides or flat terrain
- Long lasting and adaptable

Ancient Drip Irrigation

- Egyptians in 6th millennium BCE created a network of canals to channel water from the Nile to their gardens.
- Irrigation systems arose in China during the same period.
- Andes of Peru during the 4th millennium BCE
- India during the 3rd millennium BCE
- In Egypt and China the use of buried porous clay pots that wept water into the soil is considered the first form of drip or trickle irrigation (aka micro-irrigation).

Modern Drip Irrigation

- In Germany in 1860 systems of clay pipes were developed for combination drainage/irrigation.
- These systems were soon followed in Afghanistan in 1866.
- In the 1920s this idea was expanded in Germany utilizing a system of perforated clay pipes.
- Plastic pipes were introduced by Austrian Hannis Thill after WWII.
- A decade later plastic emitters were introduced in Israel by Simcha Blass.

Present Day Drip Irrigation

- There is a huge variety of drip irrigation methods from which to choose: individual emitters and drip-pers, misters, micro-sprayers, mini-sprinklers, emitter tubings, and drip tapes.
- In addition, there is an entire realm of filters, pressure regulators, water timers, fertilizer injectors, tools, and accessories available.
- With a warming climate and widespread drought, drip irrigation has become even more relevant.

Source of Supplies

- Rain Bird
  - Compression fittings
  - TLF Twist Lock Fittings
- Dripworks
  - EZ Lock Fittings
- Not interchangeable – ½" branch tubing has different inside diameter

Glossary of Terms

- Flow: 1) The amount of water available for the drip system expressed in gallons per hour (GPH) or gallons per minute (GPM). Flow is a determining factor in how many plants (or how large an area) can be watered at one time.

  2) The total amount of water moving through the system as it exits emission devices.
- Pressure: Measured in pounds per square inch, or PSI, pressure is the force pushing the flow of water. Your pressure can be determined by using a pressure gauge.

Glossary of Terms

- Constant Pressure: In a drip irrigation system, the condition that occurs when the spigot or valve is left open, leaving any downstream devices – timers, filters, regulators, tubing, fittings, and emitters – under constant pressure.
- Dynamic Pressure: The fluctuating pressure that occurs within a drip irrigation system when valves are opened and closed and emitters turned on and off.

Glossary of Terms

- Water Source: Where the water originates. This can be a municipal system, a well, a pond, spring or stream.
- Point of Connection: Also known as a POC, your point of connection will be a spigot, hydrant, gate valve, or other connection that brings the water into your watering area.
- Filter: A device used to remove particles from the water that might otherwise clog your emitters. Many water sources, especially municipal systems, are relatively free of debris. However, I recommend filtration to ensure consistent, trouble-free operation of your system.

Glossary of Terms

- Zoning: The division of a drip irrigation system into areas that require similar watering rates or that would exceed the available flow of the system if watered together.
- Mainline: Polyethylene tubing used to carry water from your POC to and throughout your drip system.
- Branch Line: Polyethylene tubing that attaches to the mainline to bring water to an individual plant or to a zone. Branch tubing is generally ¼" or ½" tubing.

Glossary of Terms

- Pressure Compensating: (PC) Emitters distribute water equally throughout the whole system regardless of row length (within limits) and elevation changes. PC products are available in drippers, sprayers or sprinklers.

Soaker Hose

- Soaker hoses are made from 70% recycled rubber and 30% recycled polyethylene products.
- They should be used with a pressure regulator reducing the pressure to 10 psi.
- They should be kept level.
- Use of a timer, filter, and pressure regulator will improve their performance.
- They should not be longer than 100'.

Gather Information

- What is the POC? In most backyard gardens it will be some type of hose thread faucet, tap, or hydrant. If it's a ball valve or gate valve it may be a pipe thread. You'll need to know.
- What areas do you want to water? Make a sketch. Make some measurements. This will help you determine the amount of mainline and number of branch lines you need.

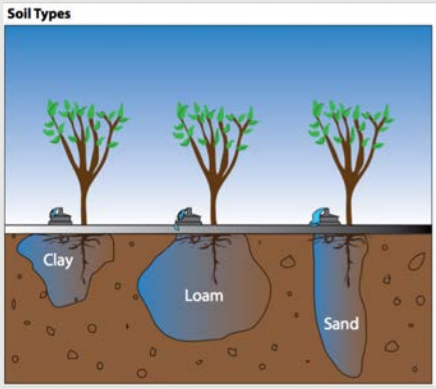
Gather Information

What is your flow rate?

- To determine the flow in gallons per minute, place a 1 or 5 – gallon container beneath the water source outlet, open valve completely, and time the number of seconds it takes to till the container.
- (60 seconds per minute/number of seconds to fill) x (number of gallons) = GPM

Seconds to fill a 1 gallon container	5	6	7	8	9	10	11	12	13	14
GPH	720	600	514	450	400	360	327	300	277	257
If filling a 5 gallon container multiply x 5										

Soil Types



Soil Types

Clay .5GPH Emitters spaced farther at lower flow rates
- Holds more water
- Slow to absorb water
- Slow to release water

Loam .5 – 1GPH
- Very porous
- Retains moisture
- Is the optimal soil type

Sand 1GPH – 2GPH Emitters are closer spaced – Shorter more frequent watering
- Extremely porous
- Allows quick water flow

Select Products

- Basic Drip Emitters: low cost, flow varies with pressure, at low pressure will flow more consistently than PC emitters, used to water individual plants
- Pressure Compensating (PC) Emitters: self-flushing, less likely to clog, use to water individual plants
- ¼" Soaker Dripline: non-pressure compensating, emitters spaced at 6, 9, or 12 inches. Use in shorter garden beds and containers. Use for square foot gardening or in densely planted areas.
- ½" Inline Emitter Tubing: ½" poly tubing with built-in PC emitters in a variety of spacing. Use in long rows, on uneven ground, hillsides, densely planted areas or circle around root zones to water trees.

Select Products

- Drip Tape: aka T-Tape is best for long, straight row crops. Most economical way to water plants. Easy to install and maintain.
- Sprayers, sprinklers, and misters are used to distribute water over larger areas and work best for ground covers and densely planted beds.

Sprayers, sprinklers, and misters

Take-apart Emitters, Shrubblers, Pot Drippers



These emitters are not pressure-compensating. At very low pressure (15 – 20 PSI), they work better than pressure compensating emitters.

Design Your System

Drip Irrigation Components

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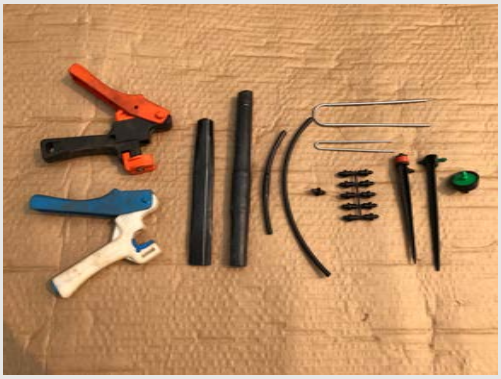

Drip Irrigation Components

Drip-pers

Sprayers

Sprinklers

Drip Irrigation Components

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Don't bury polyethylene tubing. If you must get it out of sight, put it in ¾" schedule 40 PVC pipe. Otherwise, leave it on the surface or partially buried under mulch. Bury it, you will cut it.

Two-Station Setup

This setup uses a Galcon 4 station battery operated timer and two Galcon DC valves.

Determine Duration

- Most irrigation directions specify one inch of water per week.
- Bed dimensions: 3 ft x 25 ft = 75 SF
- 1 inch of water x 75 SF = 6.25 CF
- 1 CF = 7.48 gal
- Therefore, this bed requires (6.25 CF) x (7.48 gal/CF) = 46.75 gal/week
- Using ½" emitter tubing, 9" spacing of emitters dripping water at 0.5 GPH
- 25 ft of tubing contains (25 ft x 12 in/ft)/9 in = ~33 emitters
- 33 emitters @ 0.5 GPH ~ 17GPH
- 47 gal/week/17GPH = 2h 45m

Design for Trees

- Most irrigation directions specify one inch of water per week.
- Tree dripline dimensions: circle 6 ft diameter = $\pi*(d/2)^2$=28.3 SF
- 1 inch of water x 28.3 SF = 2.36 CF
- 1 CF = 7.48 gal
- Therefore, this circle requires (2.36 CF) x (7.48 gal/CF) = 17.64 gal/week
- Using ½" emitter tubing, 12" spacing of emitters dripping water at 0.5 GPH
- 10 ft of tubing with 12" spacing contains = 9 emitters
- 9 emitters @ 0.5 GPH ~ 4.5 GPH
- 17.6 gal/week/4.5 GPH = 3h 55m per week

Design for Landscapes

- Use ½” mainline to develop the skeleton for the system.
- Turn corners with ½” elbow EZ Loc fittings.
- Make branch lines with ½” tee EZ Loc fittings.
- For shrubs close to the mainline, start ¼” dripline with ¼” barb and close end with ¼” end fitting. Loop dripline around shrub one or more times. Hold in place with staples.
- For shrubs too far, bring water to the driplines with ¼” mainline.
- For small plants use ¼” mainline to a single cobra head or shrubbler emitter.

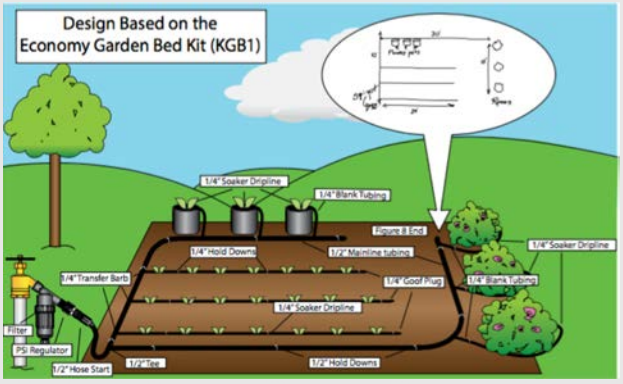
Determine Emitter Tubing Length

Emitter Spacing ½” Tubing	Emitter Flow	Flow/100’ @ 10-50 PSI	Max Row Length
9”	0.5 GPH	67 GPH	300’
9”	1.0 GPH	133 GPH	190’
12”	0.5 GPH	50 GPH	450’
12”	1.0 GPH	100 GPH	250’
18”	1.0 GPH	67 GPH	350’
24”	1.0 GPH	50 GPH	400’
36”	1.0 GPH	33 GPH	550’

Soaker Dripline Flow per 100’

Emitter Spacing ¼” Tubing	Max Row Length	Flow (GPH)		
		10 PSI	20 PSI	30 PSI
6”	18’	84	120	160
9”	25’	56	80	107
12”	34’	42	60	80
Flow per emitter		0.42	0.60	0.80

Landscape Plan



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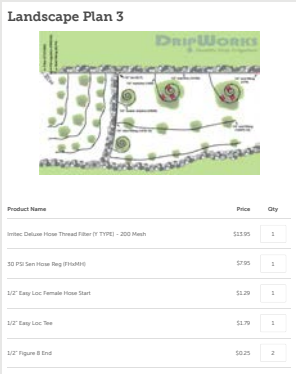
Landscape Plan 3

Product Name	Price	Qty
Irritec Deluxe Hose Thread Filter (Y TYPE) – 200 Mesh	$15.95	1
30 PSI Sen Hose Reg (FHxMH)	$7.95	1
1/2" Easy Loc Female Hose Start	$1.29	1
1/2" Easy Loc Tee	$1.79	1
1/2" Figure 8 End	$0.25	2

Winterizing

- Shut off and drain system
  - Remove timer, filter, and pressure regulator and bring inside.
  - Remove batteries
  - Open all manual valves and remove end fittings to drain the system.
- If possible, blow out lines with compressed air.
- After lines are drained, replace end fittings but leave caps loose.
- Use a hose thread plug (or plastic bag) to seal the female hose start fittings.
- Spring start-up
  - Flush lines.
  - Tighten all end caps and check for leaks.
  - Install fresh batteries.