

# TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE

Portland, Oregon

SOIL CONSERVATION SERVICE

Forestry No.22

November 1988

## Temporary Drip Irrigation System for Farmstead and Feedlot Windbreak Establishment

The majority of windbreaks in Oregon occur in a semi-arid to arid environment. Often the available precipitation is adequate for tree and shrub survival, however, establishment often requires two to five years of supplemental irrigation. The following is a simple, inexpensive design for a drip irrigation system to supply establishment irrigation needs. The system will operate on gravity feed if sufficient elevation change is available to produce 7 psi at emitters, (approximately 20 feet). If gravity feed is not an option, a small electric motor and pump will produce adequate pressure.

The following assumptions were used to design this system. Changes in any of the stated conditions will require an evaluation of the adequacy of the system and adjustments to the design where needed.

### ASSUMPTIONS:

Precipitation	14"+
Clean water source	
Soil water holding capacity	5" minimum in the profile
Other soil limitations	None
Supplemental water needs yr.1	1 gallon/plant/week
" " yr.2	2 gallons/plant/week
" " yr.3+	4 gallons/plant/week
Windbreak length	200 feet
Number of tree rows	2 - 17 trees/row @ 12' spacing
Number of shrub rows	1 - 50 shrubs/row @ 4' spacing
Between row spacing	12'
Tree and shrub seedlings	2-0 planting stock
Efficiency of water use	90%

All other aspects of Farmstead and Feedlot Windbreak Specification #380 and Trickle Irrigation System #441 will be followed.

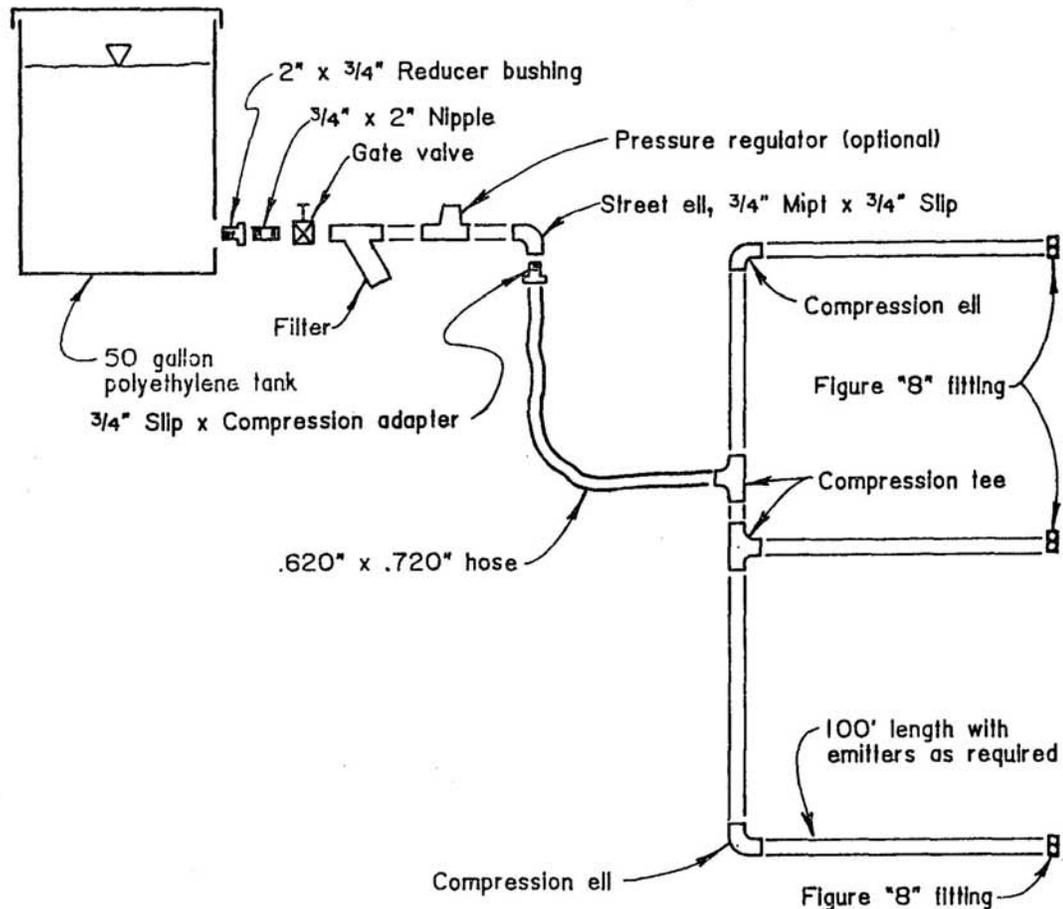
Technical Note No. 22  
Forestry

USDA Soil Conservation Service  
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# INSTALLATION INSTRUCTIONS

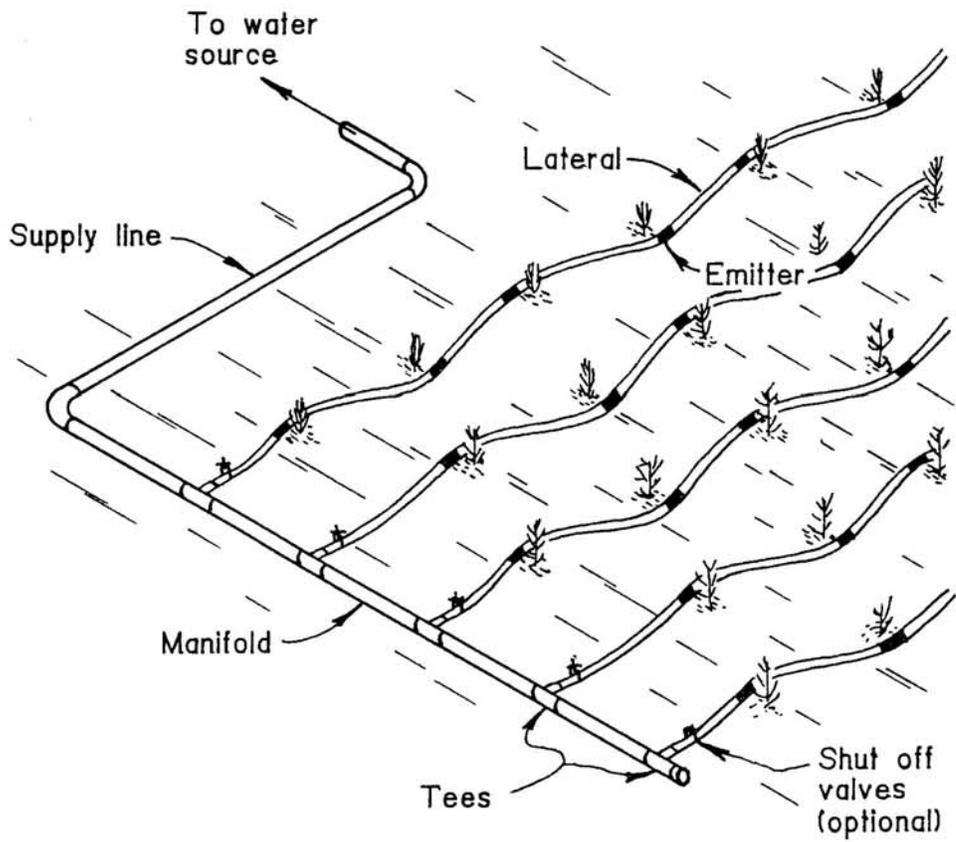
## Water Source Layout

Install a pressure regulator (if needed), filter, and pressure gauge near the water source. This equipment allows for checking the operating pressure and filters. When only one pressure gauge is used, it should be placed at the filter discharge. Shrader valves (air valves for car tires) may be installed at necessary locations to allow pressure monitoring with a portable gauge. The illustration below shows the arrangement of the components at the water source. If the system is connected to a potable water source or if chemicals are injected in a system connected to a well, check local regulations pertaining to backflow prevention devices.



## Manifold

The manifold is the section of pipe to which the lateral lines are connected. The illustration below shows the components of the manifold.

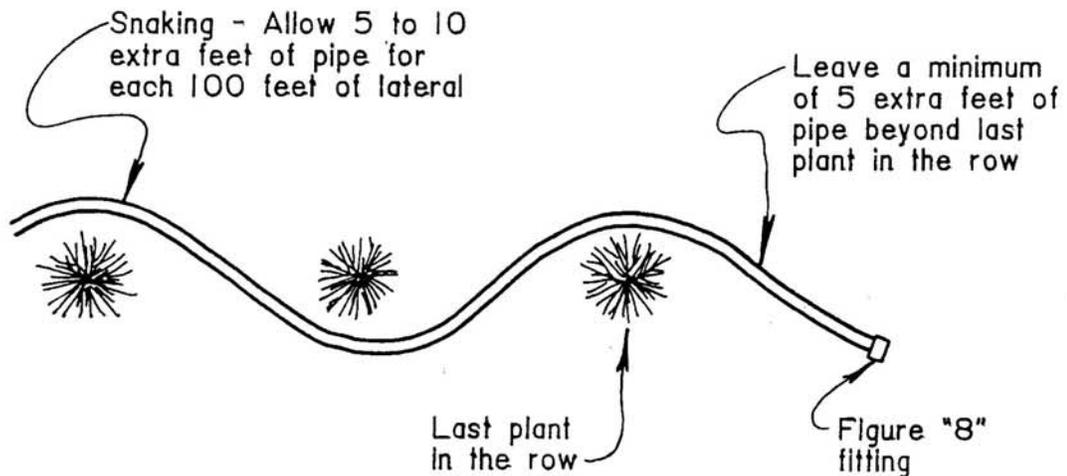


## Pipe Layout

Polyethylene (plastic) hose or pipe is easier to handle if it has been unrolled a day or two prior to installation. This will reduce the risk of kinks and the amount of coils in the line.

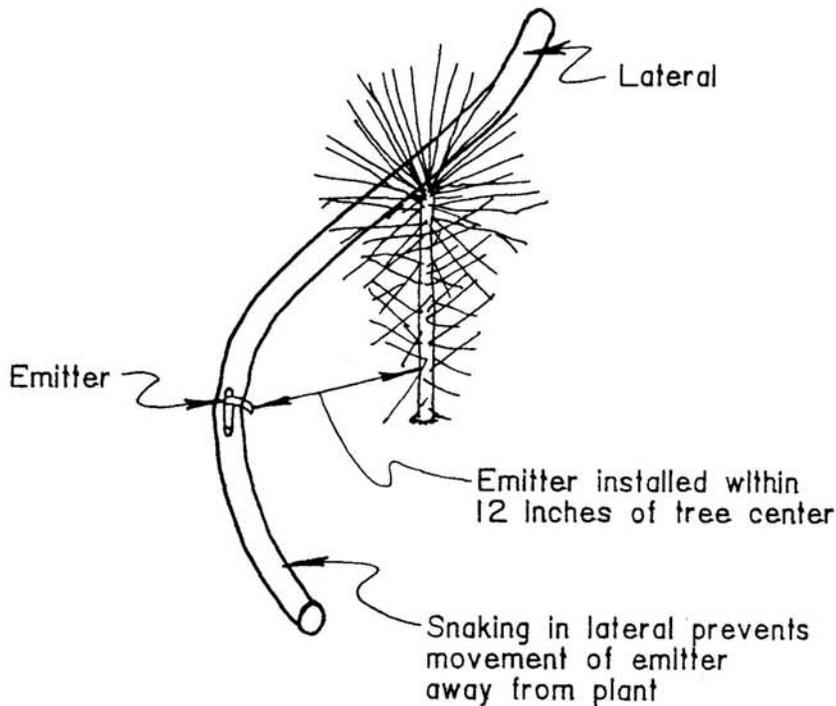
Lateral pipe lines from the main supply line should be cut at a length which allows for five to ten extra feet for each 100 feet of row. The extra length will allow the line to be snaked through the tree and shrub rows. The snaking is required to prevent displacement of hose by wind, and the creeping of emitters away from plants when pipe shrinkage occurs. The lines may also be stapled in place with a piece of bent wire at every tree to prevent displacement.

In addition, at least five feet of each lateral line should extend beyond the last plant in the row. A figure "8" fitting should be installed at the end of each lateral to provide for the periodic manual flushing of the lines. The illustration below shows the snaking, and flushing figure "8" fitting after installation within the planting.



## Installation of Emitters

After the pipe and other components are in place and before the emitters are installed, the system should be flushed to eliminate any debris which may have accumulated in the lines. Emitters should be installed within 12 inches of the plant. The illustration below shows the relationship between the placement of the emitter in the lateral line and the plant. A single emitter should be installed for each plant the first year. At the beginning of the second year an additional emitter should be installed at each plant. All emitters should be of the same flow rating. When the second emitter is added, the lines can be moved so that the emitters are two feet from the trees. This will encourage a more widespread root system for better anchoring and drought resistance.



## RECOMMENDATIONS FOR MAINTENANCE

Treating water with chemicals is a necessary part of trickle irrigation systems. The extent of treatment needed will depend upon the water quality. Consult with an Irrigation Specialist anytime chemicals are to be used in the system.

Inspect emitters during the first three waterings and periodically thereafter to assure that they are functioning properly. Drain the system prior to the onset of freezing temperatures. Consider storing the regulator, filters, and pressure gauge inside, over winter, to minimize the risk of damage.

Mineral or sediment deposits must be removed if they interfere with the operation of the emitters. Flush lateral lines periodically to prevent sediment buildup.

Algae and bacteria growth is a potential problem, especially with water from surface sources. Algae and bacteria will clog hoses and emitters if not controlled. Intermittent treatment with one part per million (ppm) of free chlorine in the system will control algae and bacteria growth without adversely effecting windbreak plants. Achieving a specified free chlorine content in trickle irrigation water is done by trial and error.<sup>1</sup>

If a storage tank is being used as the water source add one ounce (two tablespoons) of household bleach (sodium hypochlorite, NaOCl) per 500 gallons of water. Allow the treated water to sit in the lines for one hour. Test water from the end of the system with a swimming pool test kit to determine if a one ppm chlorine concentration is being achieved. If needed, adjust the amount of bleach added for the next treatment. Do not adjust by more than one half ounce without retesting. An opaque, covered storage tank will reduce algae growth.

Accurate amounts of chemicals can be added to the system, regardless of the water source, using a proportional mixer tank with injector. However, injection is relatively expensive on small systems. Injection of chemicals should be done upstream of the filter.

<sup>1</sup> F.S. Nakayama, "Water Analysis and Treatment Techniques to Control Emitter Plugging", Technical Conference Proceedings, The Irrigation Association, Silver Springs, MD., 1982, p. 97-112.

## RECOMMENDATIONS FOR WATERING

It is nearly impossible to give a standard recommendation on watering rates or water requirements because of the wide variety of soil types, local weather and general climatic conditions.

Usually, during the first year of the planting when the young plants are shallow rooted, it is important to keep the top 12 inches of the soil moist. When this area starts to dry down, it is time to apply enough water to rewet this zone and the zone below it. After the first year the soil profile should be soaked to a depth of three to five feet during each watering. Normally, this results in a decrease in the frequency of watering and an increase in the amount of watering as the planting gets older. It is always important to check or probe the wetted areas adjacent to some of the plants to determine whether you should alter the amount of water applied or change the frequency of application.

Watering should be discontinued in the late summer to allow the trees and shrubs to "harden off" before winter. The windbreak should be watered thoroughly in the fall after the plants have gone dormant, and just prior to the onset of freezing temperatures to reduce the risk of winter injury.

The designed system will supply approximately 1 gallon per hour (gph) to each tree and shrub during the first year. After the first year the trees and shrubs will receive 2 gph.

Based on the assumptions stated on page one (windbreak length of 200 feet, 3 rows, etc.) and various storage tank sizes, the chart below will provide the landowner with an idea of how long to operate the irrigation system, and how often the water storage tanks will need to be refilled during the irrigation season (April-August).

Year of Operation	Windbreak Irrigation Requirements	Hours per Week	Days Between Tank Refills		
			Tank Capacity (gallons) 500	750	1000
1	84 gal/week	1	41	62	83
2	168 gal/week	1	20	31	41
3+	336 gal/week	2	10	15	20

Refer to the Windbreak Handbook Appendix A for the List of Adapted Tree and Shrub Species. To access the list the planner must know the MLRA, Effective Moisture Subgroup, and Windbreak Suitability Group of the soil on which the windbreak is to be established.

MATERIALS LIST FOR EXAMPLE (200 Feet - 3 Row Windbreak)

Item	Description	Quantity	Unit	
			Price	Cost
Water tank	500 gal. molded polyethylene	1	\$450.00	\$450.00
Reducer bushing	2" x 3/4" (MPT x FPT), polyethylene	1	\$5.00	\$5.00
Nipple	3/4" x 2" (polyethylene or PVC)	1	\$0.75	\$0.75
Gate valve	3/4" PVC	1	\$9.00	\$9.00
Filter	3/4" Wye, 140 mesh	1	\$35.00	\$35.00
Street ell	3/4" MPT x 3/4" slip, PVC	1	\$0.75	\$0.75
Compression adapter	3/4" PVC slip x 0.720" polyethylene	1	\$0.75	\$0.75
Hose	0.620" I.D. x 0.720", O.D., polyethylene	1000'	\$0.10	\$100.00
Compression tee	0.710"	1	\$2.00	\$2.00
Compression tee	0.710" w/shrader pressure valve	1	\$4.00	\$4.00
Pressure gauge	0 to 30 psi	1	\$9.00	\$9.00
Shrader chuck	to fit pressure gauge	1	\$8.00	\$8.00
Compression ell	0.710"	2	\$2.00	\$4.00
Emitters	1 gph @ 7psi, barbed	168	\$0.30	\$50.40
Goof plugs	Emitter hole plugs	40	\$0.20	\$8.00
Hand punch	Emitter hole punch	1	\$5.00	\$5.00
Figure eights	End closure for 0.720" O.D. hose	3	\$0.25	\$0.75
TOTAL				\$692.40

Optional Items

Proportional mixer tank with injector	\$300.00
Pressure regulator - pre set	\$8.00
Pump & electric motor (1/3 hp)	\$200.00

NOTE: All compression fittings are for 0.720" hose.

See "Irrigation Systems and Equipment" in the Yellow Pages for list of equipment suppliers.