Revised August, 2003
Now includes fertigation

CHEMIGATION & FERTIGATION:

ANTI-POLLUTION DEVICES FOR IRRIGATION SYSTEMS

Chemigation: The application of pesticides through an irrigation system to land, crops, and/or plants indoors or outdoors.

North Carolina Department of Agriculture and Consumer Services

North Carolina Cooperative Extension Service

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Sketches: The sketches in this brochure focus on anti-pollution devices. A properly designed irrigation system may require additional equipment.

Disclaimer: The use of brand names and any mention of commercial products in this brochure does not imply endorsement by the state of North Carolina or discrimination against similar products not mentioned.

FOR ADDITIONAL INFORMATION

For a copy of regulation 2 NCAC 9L .2000 – Chemigation, visit our web site at http://www.ncagr.com/fooddrug/pesticid/Authorit.htm. Then, (1) Click on Subchapter 9L Pesticide Section; (2) click on Subchapter L Rules under Chapter 9; (3) go to page 41. You may also call the North Carolina Department of Agriculture and Consumer Services Pesticide Section at 919-733-3556.

For information on fertigation, contact the Agronomic Division of the North Carolina Department of Agriculture and Consumer Services at 919-733-2655.

CHEMIGATION & FERTIGATION

The North Carolina Pesticide Board has adopted regulations covering chemigation. The purpose of these regulations is to protect water resources from pesticide pollution by reducing the potential for backsiphoning or direct injection of pesticides into water sources.

- These regulations apply to any individual, including, but not limited to, farmers, greenhouse operators, nurserymen, golf course operators, and turf growers.
- The types of irrigation equipment covered by these regulations include, but are not limited to, drip or trickle, center pivot, lateral move, traveler gun, and solid set systems. The regulations do not apply to hand-held hose-end sprayers that are constructed so that an interruption in water flow automatically prevents any backflow to the water supply.
- Water resources protected by these regulations include, but are not limited to, lakes, rivers, streams, canals, wells, public water systems, and private ponds.

SECTION 1. SYSTEM INSPECTIONS

One of the requirements of the regulations is that the system operator must inspect the antisiphon devices and the functional systems interlock during periods of chemigation to ensure that they are functioning properly. If components of the system are defective, they must be repaired or replaced before any chemigation is employed with a pesticide.

Representatives of the North Carolina Department of Agriculture and Consumer Services Pesticide Section may inspect an irrigation system utilized for chemigation at any time. If the system is not in compliance with the regulations, a stop-use order will be issued by the Department, and the system must be inspected again by the Departmental representative before the stop-use order can be removed.

Chemicals can be precision applied to vegetables through a drip system using a stationary chemigation/fertigation system (as shown) or a trailer-mounted system (not pictured).

— Public Water System Precautions —

- **When a public water system is used, the water must first be discharged into a reservoir tank.**
- **An air gap at least twice the inside diameter of the fill pipe must exist between the end of the fill pipe from the public water system and the top rim of the reservoir tank.**

SECTION 2. ILLEGAL TECHNIQUES

1. Some pesticide product labels prohibit application of the product by any irrigation system. Others prohibit applications through certain specific irrigation systems.
2. It is illegal to inject a pesticide into an irrigation system on the suction (or inlet) side of the irrigation pump.
3. It is illegal to connect an irrigation system directly to a public water system when applying any pesticide.

SECTION 3. HAND-HELD SPRAYERS

Hand-held hose-end sprayers are allowed on the outlet side of a water hose. This device must contain a check valve that will prevent any backsiphoning from the pesticide reservoir into the water hose.

Use of devices connected to a faucet or spigot that siphon pesticide from a reservoir or container is not permitted in North Carolina.

The following anti-pollution devices must be installed and maintained on an irrigation system that is applying any pesticide (see Figures 1-5).

1. Automatic low pressure drain—located on the bottom of the horizontal irrigation pipeline between the discharge side of the irrigation pump and the inlet side of the double check valves. This device shall be level and have an orifice size at least 3/16 the diameter of the irrigation pipe. The top of the drain shall not extend beyond the inside surface of the bottom of the irrigation pipeline and shall be at least 2 inches above grade.**The drain shall discharge at least 20 feet from any water supply. Furthermore, the discharge must be controlled to prevent it from reentering the water supply.** In the event that the mainline check valves leak slowly, solution will drain away from, rather than flow into, the water supply.

2. Inspection port—located between the irrigation pump discharge side and the inlet side of the mainline check valves. The inspection port may be part of the vacuum relief valve. The purpose of the inspection port is to allow an individual to observe whether or not the mainline check valves are leaking.

3. Vacuum relief valve—located on the top of the horizontal irrigation pipeline between the discharge side of the irrigation pump and the inlet side of the double check valves. The orifice size of the valve shall be 3/16 the diameter of the irrigation pipe. The purpose of the vacuum relief valve is to allow air into the pipeline when the water flow stops, preventing the creation of a vacuum that could lead to backsiphoning.

4. Double check valves—located between the irrigation pump discharge (or pressure side) and the point of pesticide injection ino the irrigation pipeline. These valves must be within 10 degrees of horizontal. The purpose of the double check valve is to prevent solution from draining or backsiphoning into the irrigation water source and polluting the groundwater or surface water. These check valves must have positive closing action and a watertight seal. NOTE: For irrigation systems that contain media filters, refer to Section 5.

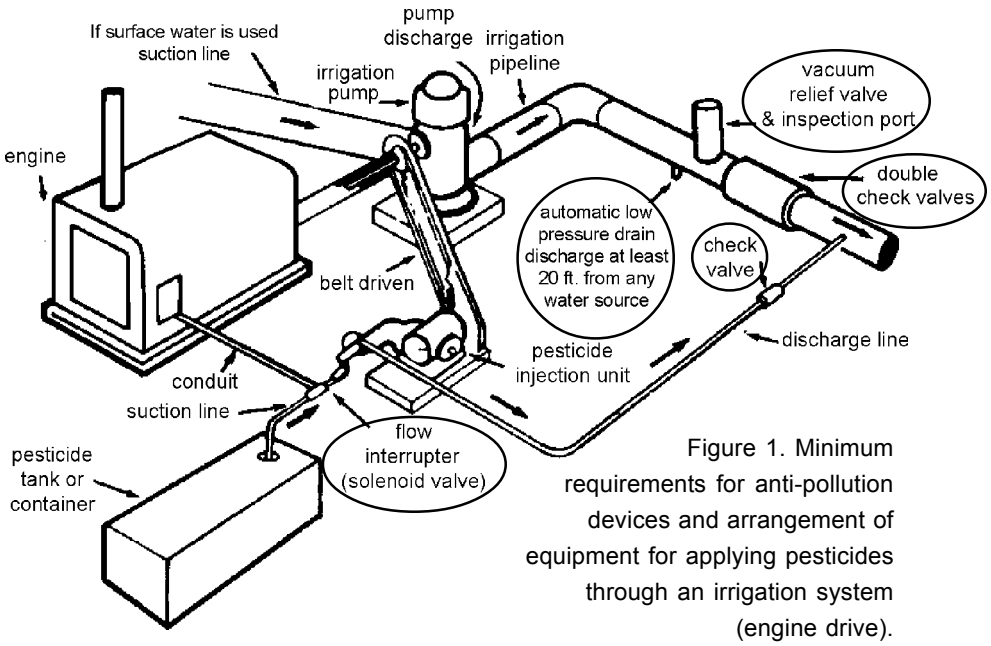


Figure 1. Minimum requirements for anti-pollution devices and arrangement of equipment for applying pesticides through an irrigation system (engine drive).

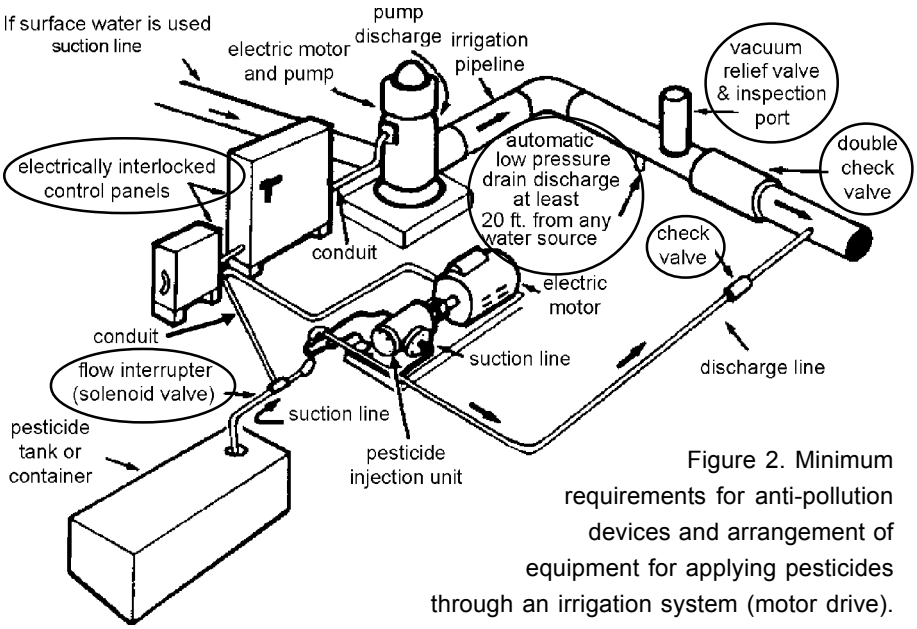


Figure 2. Minimum requirements for anti-pollution devices and arrangement of equipment for applying pesticides through an irrigation system (motor drive).

5. Check valve—located on the pesticide line between the point of pesticide injection into the irrigation system and the pesticide injection unit. The purpose of the check valve is to stop flow of water from the irrigation system into the chemical supply tank. It should be constructed of chemically-resistant materials. This check valve should always be flushed with clean water after injecting a chemical to prevent the deposition of

chemical precipitates. Whenever a Dosatron, DosmaticPlus, or a similar metering device is used, the check valve needs to be positioned near the metering device on its outlet side. If this metering device is on a bypass line, this check valve must be located on the main irrigation line immediately downstream of the bypass line (Figure 4).

6. Flow interruption device, solenoid valve—located in the pesticide supply line between the pesticide injection unit and the pesticide supply tank or container. The purpose of the solenoid valve is to provide a positive shut off on the chemical injection line. This prevents both chemical and water from flowing in either direction if the chemical pump is stopped. Because this valve will be subjected to different chemicals, it must be compatible with the chemicals being injected. The valve should be inspected often to assure that it is performing properly. A solenoid valve is not required with the Dosatron, DosmaticPlus, or a similar hydraulic injection device.

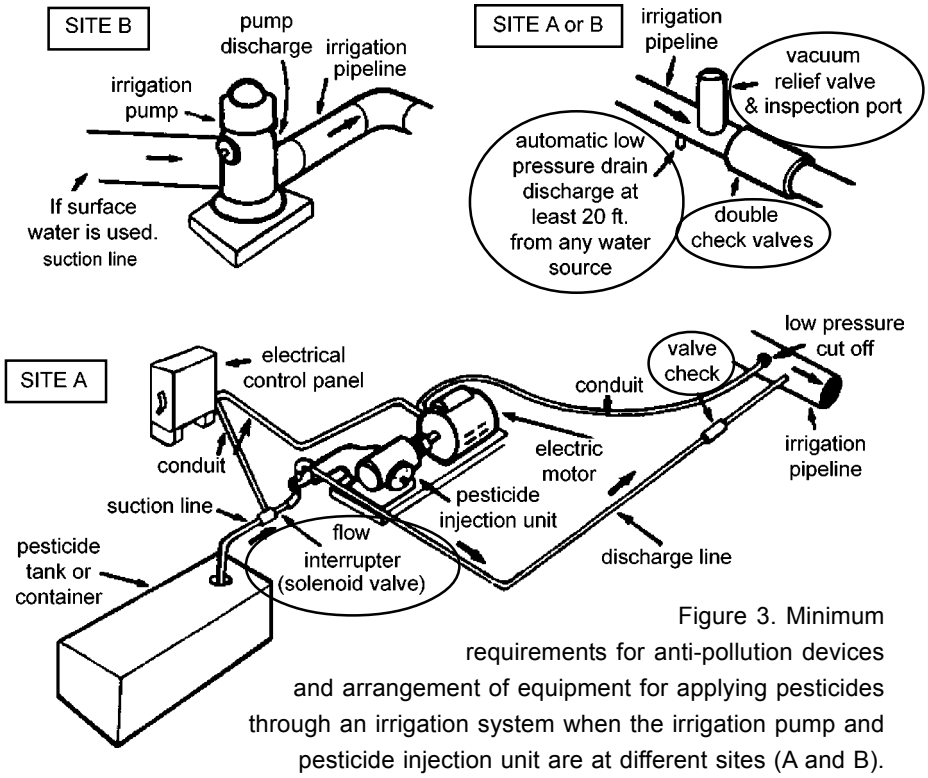


Figure 3. Minimum requirements for anti-pollution devices and arrangement of equipment for applying pesticides through an irrigation system when the irrigation pump and pesticide injection unit are at different sites (A and B).

7. Functional systems interlock—The irrigation pump and the chemical injection pump must be interlocked or connected so that if the irrigation pump stops, the chemical injection pump will stop. This functional systems interlock ensures that a pesticide is applied with water through the irrigation system. The Dosatron, DosmaticPlus or a similar hydraulic injection device does not require the functional systems interlock.

SECTION 5. CHEMIGATION SYSTEMS THAT CONTAIN MEDIA FILTERS

Some chemigators are using chemigation systems that have one or more sand-containing media filters (Figures 4 and 5). Surface water, and in some cases, groundwater, flows through these filters to remove debris that would clog the small orifices of the emitters on drip irrigation systems. **The injection of pesticides into the irrigation line must be on the outlet side of all media filters.** This prevents pesticide from passing through the media filters and contaminating the debris, which will be discharged into the environment whenever the media filters are backflushed.

Any water dumping or open dumping of pesticides or pesticide dilutions is an illegal discharge of a pesticide in violation of NC Pesticide Board Rule 2 NCAC 9L .0604. Further, pesticide product labels have enforceable language on the illegal disposal of pesticides.

Additionally, **a check valve is required between the outlet side of all media filters and the point of pesticide injection into the irrigation line** (refer to Figure 4). If the injection system has bypass piping, a check valve would be positioned between the outlet side of all media filters and the inlet side of the bypass on the irrigation pipeline.

The purpose of the check valve mentioned in the above paragraph is to reduce the risk of media filter contamination if a backsiphonage occurs. Systems operating without this safeguard could dispose of pesticides unintentionally during a backflush cycle. This would be illegal. The chemigator can be fined for any illegal disposals.

Any chemigation system that is not in compliance with pesticide regulations will be issued a stop-use order. This order can only be released when a follow-up inspection indicates that the appropriate anti-pollution devices have been installed.

Figure 4. Minimum requirements for anti-pollution devices and arrangement of equipment for applying pesticides through an irrigation system using a water-driven proportional injector and media filtration system.

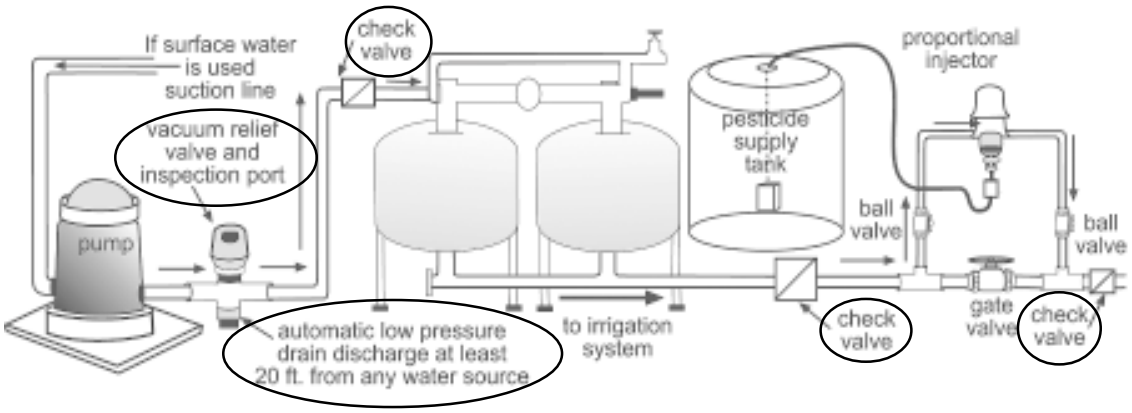
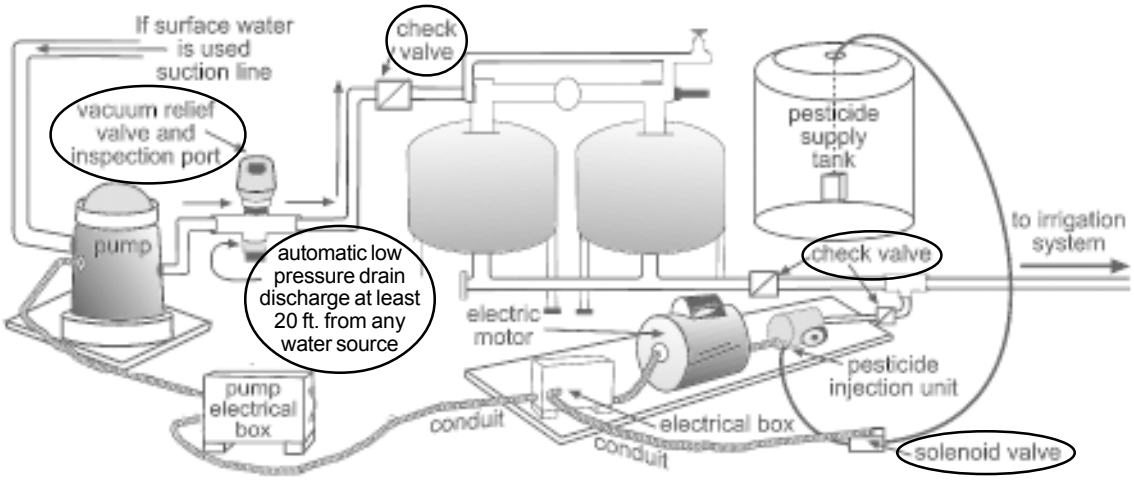


Figure 5. Minimum requirements for anti-pollution devices and arrangement of equipment for applying pesticides through an irrigation system using a pesticide injection unit powered by an electric motor and a media filtration system. (The same safety devices would be used by a system operating with an engine drive.)



SECTION 6. FERTIGATION RECOMMENDATIONS

Fertigation is the simultaneous application of plant nutrients (soluble fertilizers) and water through an irrigation system (drip, trickle, sprinkler, furrow, or flood). Most plant nutrients can be applied through an irrigation system.

Currently, nitrogen is the nutrient most commonly used in fertigation. In good practice, soil fertility analysis is used to determine which of the more stable nutrients to apply preplant instead of through the irrigation system. Then fertigation is used to "spoon feed" additional nutrients or to correct nutrient deficiencies detected with plant tissue analysis.

Use of fertigation is increasing in North Carolina as producers strive to be more efficient with production inputs and practice good environmental stewardship. It is usually practiced with high value crops such as vegetables (strawberries, tomatoes, cucumbers, melons, etc.), turf, fruit trees, vines, and ornamentals.

The main advantage of fertigation is the application of nutrients at the precise time they are needed and at the rate they are utilized. Yields are optimized and fertilizer costs are reduced because the nutrients are applied when, where, and in the soluble form needed. Overall, fertigation conserves water and nutrients.

Factors to consider with fertigation are

- water quality (especially in drip/trickle systems),
- soil type/leaching potential,
- daily plant nutrient consumption,
- potential nutrient precipitation and volatilization, and
- appropriate nutrient materials.

Fertigation systems have been developed for many crops to provide nutrient management guidelines. In addition, plant, soil, and water analyses provide information to optimize the whole program.

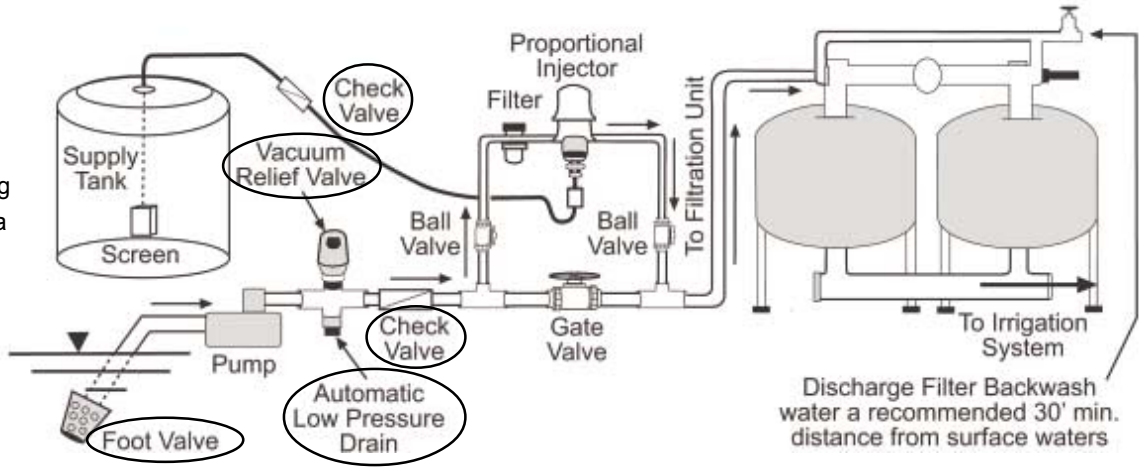


Figure 6. Recommended anti-pollution equipment and layout for applying fertilizer through a drip irrigation system using a water-driven proportional injector and media filtration system.

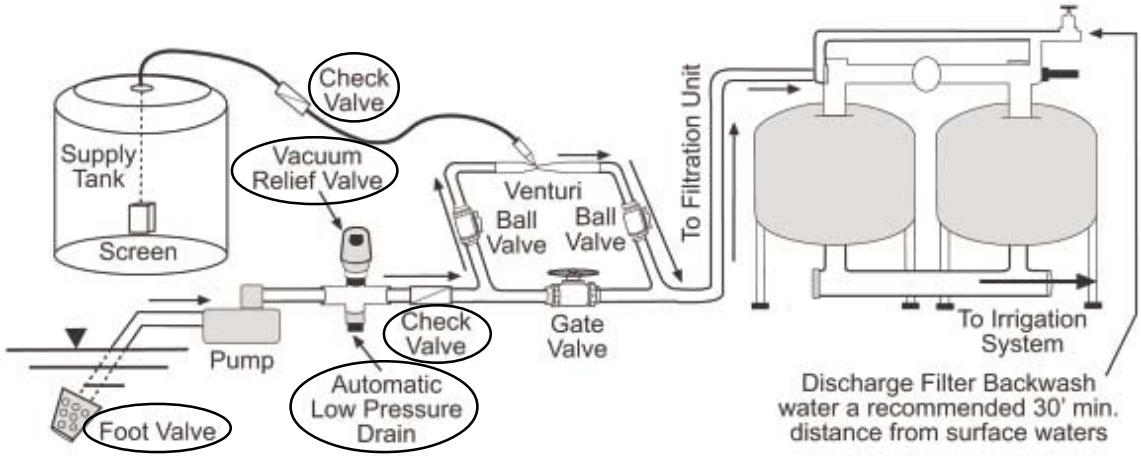


Figure 7. Recommended anti-pollution equipment and layout for applying fertilizer through a drip irrigation system using a venturi injector and media filtration system.

The following anti-pollution devices should be installed and maintained on any irrigation system that is applying fertilizer (refer to Figures 6 and 7 for layout).

1. Foot valve–located at the inlet of the suction line of the pump.

2. Automatic low pressure drain–located on the bottom of the horizontal irrigation pipeline between the discharge side of the irrigation pump and the inlet side of the check valve. This device shall be level and have an orifice size at least 3/16 the diameter of the irrigation pipe. The top of the drain shall not extend beyond the inside surface of the bottom of the irrigation pipeline and shall be at least 2 inches above grade. The drain shall discharge at least 20 feet from any water supply. Furthermore, the discharge must be controlled to prevent it from reentering the water supply. If the mainline check valve leaks slowly, the solution will drain away from the water supply, rather than flow into it.

3. Vacuum relief valve–located on the top of the horizontal irrigation pipeline between the discharge side of the irrigation pump and the inlet side of the double check valves. The orifice size of the valve shall be 3/16 the diameter of the irrigation pipe. The vacuum relief valve allows air into the pipeline when the water flow stops, preventing the creation of a vacuum that could lead to backsiphoning.

4. Check valve–located between the irrigation pump discharge (or pressure side) and the point of fertilizer injection into the irrigation pipeline. This valve must be within 10 degrees of horizontal. The purpose of the check valve is to prevent solution from draining or backsiphoning into the irrigation water source and polluting groundwater or surface water. This check valve must have positive closing action and a watertight seal.

5. Additional check valve–located between the fertilizer supply tank and the injector device. The purpose of this valve is to prevent water from backsiphoning into the fertilizer supply tank and causing it to overflow.

— Backwash Precautions—

- **The backwash from the media filters should be discharged a minimum of 30 feet from the water source.**
- **The fertilizer injector should be turned off at all times during the backwash cycle.**

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