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GEOFLOW™
SUBSURFACE DRIP

GEOFLOW

Design, Installation and Maintenance Guidelines

Subsurface Drip for Onsite Wastewater Reuse and Dispersal

January 2004 v.II

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INTRODUCTION

Geoflow's WASTEFLOW®¹ drip system disperses effluent below the ground surface through 1/2" pressurized pipes. It is designed using the grid concept with supply and flush manifolds at each end creating a closed loop system. The grid design provides a complete subsurface wetted area.

The objective with effluent dispersal is usually to disperse the effluent using the minimum area as quickly and safely as possible at an approximately uniform rate throughout the year. If the main purpose of the Geoflow system is to irrigate, then please use the standard irrigation manual for landscape available from Geoflow, Inc.

Subsurface drip is a highly efficient method to dispose of effluent. Small, precise amounts of water are uniformly applied under the soil surface from multiple points.

The main advantages of Geoflow's subsurface drip system for effluent dispersal are:

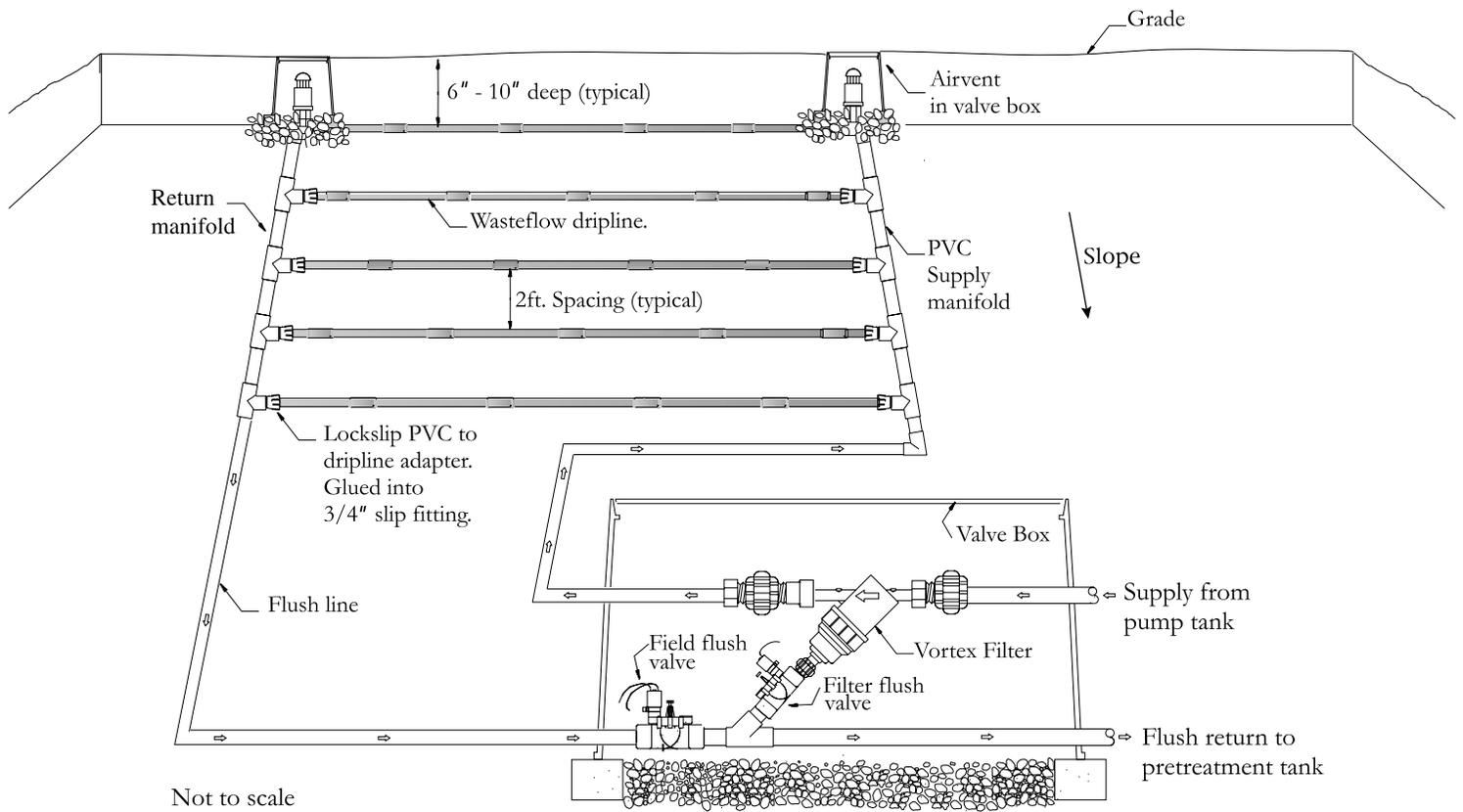
- Human and animal contact with effluent is minimized, reducing health risks.
- Correctly designed systems will not cause puddling or runoff.
- It can be used under difficult circumstances of high water tables, tight soils, rocky terrain, steep slopes, around existing buildings, trees or other vegetation, and on windy sites.
- Disposal of water is maximized by means of evapotranspiration.
- The system requires no gravel. It is easy to install directly into indigenous soils and the natural landscape can be maintained.
- Minimizes deep percolation.
- Consumption of nitrates by the plant material is increased.
- Invisible and vandal proof installations.
- Ten-year warranty for root intrusion, workmanship and materials. Systems are durable with a long expected life.
- Non intrusive. It allows use of the space while operating.
- Easily automated.
- Effluent can be re-used for irrigation.

NOTES

- These guidelines are for secondary treated effluent. When using primary treated effluent, Geoflow recommends automating all the self flushing valves, and increasing the number of emission points in the dispersal field. For more information on septic tank dispersal, please check our website at www.geoflow.com or telephone Geoflow at 800-828-3388.
- Please follow your State and County Regulations for onsite wastewater dispersal. This manual is intended to be a guide to users of the Geoflow drip system and should be used only as a supplement to your local regulations.

¹ WASTEFLOW® is a registered trademark of A.I. Innovations.

DIAGRAM 1: TYPICAL DRIPFIELD LAYOUT



SYSTEM COMPONENTS:

See Diagram 1 on page 3.

A typical drip system installation will consist of the elements listed below:

1. WASTEFLOW® DRIPLINE

(See Appendix 1 for product specification)

WASTEFLOW dripline carries the water into the dispersal/reuse area. The dripline is connected to the supply and return manifolds with Compression or Lockslip fittings. Typical spacing between each dripline and between drip emitters is 24" on center. 12" spacing is used regularly for soils with very low or high permeability. The pipe has no joints that may pull apart during installation and is ideal for tractor mounted burying machines. It is sold in 500-ft rolls. For export 400-m rolls are available. Rolls of alternative lengths, diameters and dripper spacings may be special ordered.

WASTEFLOW dripline features:

a) ROOTGUARD®²

The risk of root intrusion with an emitter slowly releasing nutrient rich effluent directly into the soil is well known to anyone who has observed a leaking sewer pipe. All Geoflow drip emitters are guaranteed to be protected against root intrusion with ROOTGUARD. This patented process fuses the root-growth inhibitor, TREFLAN®³ into each drip emitter during manufacturing. Treflan is registered with the United States EPA for this application. The ROOTGUARD technology slowly releases Treflan in minute quantities to prevent root cells from dividing and growing into the barrier zone. It is chemically degradable, non-systemic, and virtually insoluble in water (0.3 ppm). ROOTGUARD carries a 10 year warranty against root intrusion.

b) *UltraFresh*® Protection

Geoflow's WASTEFLOW has an inner lining impregnated with an antimicrobial, Tributyl tin maleate, to inhibit adhesion of biological growth on the inside walls of the tube and the emitters. It does not have any measurable biological effect on the effluent passing through the tube. This minimizes the velocity required to flush WASTEFLOW dripline. The velocity only needs to move out the fine particles that pass through the 100 micron filter that, if not flushed, will ultimately accumulate at the distal end of each lateral. It is not necessary to scour growth off the inside wall of WASTEFLOW tubing. Since all pumps deliver more volume given less resistance to flow, just opening the flush valve will usually achieve this degree of flushing. When a minimum flushing velocity is requested, 0.5 feet per second is used with Wasteflow dripline to get the settled particles at the bottom of the pipe back into suspension. This equates to 0.375 gpm per dripline.

c) Turbulent Flow Path

WASTEFLOW drip emitters are pre-inserted in the tube 6", 12" or 24" apart with 24" being the most popular. Angles in the emitter flow path are designed to cause turbulence in order to equalize flow between emitters and keep the emitters clean. Geoflow emitters boast large flow paths, which, coupled with turbulent flow, have proven over the years to be extremely reliable and dependable

² ROOTGUARD® is a registered trademark of A.I. Innovations

³ Treflan is a registered trademark of Dow Agro Sciences



WASTEFLOW Classic



WASTEFLOW PC

d) **WASTEFLOW Classic and WASTEFLOW PC Dripline**

Both WASTEFLOW Classic and WASTEFLOW PC have turbulent flow path emitters with ROOTGUARD and *UltraFresh*[®] protection. The WASTEFLOW PC has the added element of a silicone rubber diaphragm that moves up and down over the emitter outlet to equalize flows regardless of pressure between 7 and 60 psi. To ensure a long life the recommended operating range is 10 to 45 psi.

For WASTEFLOW Classic the flow rate delivered by the emitter is a function of the pressure at the emitter. The Classic dripline has the advantage of no moving parts or rubber that may degrade over time. Also, when minimum flushing velocities are required, the flows during a dosing cycle and flushing cycle are very similar with the Wasteflow Classic because when the flush valve is opened, the pressure is reduced, causing the flows from the emitters to decline. PC driplines require significantly higher flow for flushing than dosing as the emitter flow does not go down during the flushing cycle.

We recommend that WASTEFLOW PC be used when the advantages are of substantial economic value.

- i) WASTEFLOW PC can be run longer distances than WASTEFLOW Classic.
- ii) Steep slopes. Systems should be designed for the dripline lateral to follow the contour. When this is practical, the extra cost of installing pressure regulators required for WASTEFLOW Classic would likely be less than the incremental cost of WASTEFLOW PC.
- iii) Rolling terrain. If the difference in height from trough to peak exceeds six feet then WASTEFLOW PC should be used. Vacuum relief valves must be placed at the top of each rise.

2. CONTROLLERS

(See Appendix 3)

Controllers are used for time dosing and time flushing of the filter and dripfields. GEO controllers include a programmable logic control interface for field modifications. They can be used on systems ranging in size from one to eight zones at the time this manual was printed. All controllers include a surge arrestor, elapsed time meter and counter. For larger systems please inquire about our Wasteflow Manager controller which has monitoring and telemetry capabilities.

3. PUMPS AND PUMP TANKS

WASTEFLOW dripfields depend on pumps to dose effluent under pressure to the field. These must be sized according to flow and pressure requirements. Look for submersible effluent pumps from a dependable source. Geoflow does not endorse a single manufacturer, but does advocate you use a pump that is readily serviced in your area. Pump tanks should be sized according to your local rules and regulations.

4. FILTERS

Geoflow systems use a self-cleaning Vortex Filter with a stainless screen 150 mesh / 100 micron filter element. The self-cleaning action is efficient over a range of flow rates depending on the filter size. The clean-out port is at the base and can be opened and closed manually or automatically. If using a manual flush valve, please keep the valve cracked open slightly at all times for continuous flushing. Flush should be set at 1% of dosing flow but no less than 1 gallon per minute, whichever is greater. The controller will fully open automatic filter flush valves.

5. SUPPLY MANIFOLD

This carries the water from the dosing tank to the dispersal area. Rigid PVC is usually used and must be designed to slope back to the pump tank in freezing conditions. The velocity in the manifold should be between 2 feet per second and 5 feet per second (fps). Refer to PVC pipe sizing chart in the appendix to determine the best diameter for your application.

6. RETURN MANIFOLD

In order to help clean the system, the ends of the drip lines are connected together into a common return line, most often made of rigid PVC. This line will help equalize pressures in the system. Flushing should be done frequently during the installation period. Periodic flushing will help to keep the manifolds clean. The return manifold should be installed to self-drain back to the pump or pretreatment tank in freezing climates.

7. PRESSURE REGULATOR

(See Appendix 6 for product specification)

Pressure regulators fix the inlet pressure at a given rate and are recommended with WASTEFLOW Classic. Under normal operating conditions, pressure in the drip lines should be 10 psi to 45 psi.

8. AIR VACUUM BREAKER

(See Appendix 5 for product specification)

Air vacuum breakers are installed at the high points to keep soil from being sucked into the emitters due to back siphoning or backpressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in freezing conditions. One is used on the high end of the supply manifold and one on the high point of the return manifold. Additional air vents may be required in undulating terrain. Freezing conditions require the air vacuum breaker be protected with insulation.

9. FILTER FLUSH VALVES

(See Appendix 4 for product specifications)

Used to flush debris from the filter cleanout port back to the pretreatment tank, this can be an electronically activated solenoid valve or a manual valve. If manual, it should be opened for a full flushing at least every six months and left cracked open slightly to flush continuously. Cracking open a manual valve may be used to increase flow through the system to be within the efficient flow rate of the filter and/or pump, if necessary. Certain States may require automated electronic flushing. Please refer to your State codes.

10. FIELD FLUSH VALVES.

(See Appendix 4 for product specifications)

Used to flush out fine particles that have passed through the filter and accumulated on the bottom of the tube at the end of each lateral, the field flush valve can be manual or electronic. If manual, it should be opened for full flushing at least every six months and left cracked open slightly to flush continuously and provide for drainage of the flush line in freezing conditions. Cracking open a manual valve can also be used to; increase the flow through the system to be within the efficient flow rate of the filter and/or pump, or to set system pressure instead of a pressure regulator. Certain States do require automated electronic flushing. Please refer to your State codes.

11. ZONE VALVES

Used to divide single dispersal fields into multiple zones, these can be hydraulic activated index valves or solenoid valves.

12. WASTEFLOW HEADWORKS

(See Appendix 7 for product specifications)

WASTEFLOW Headworks is a pre-assembled unit including the filter, valves and pressure gauge in a jumbo box. It is installed between the pump and the field. Be sure to insulate the box in freezing climates.

DESIGN PARAMETERS:

1. SELECT AREA

Select the area with careful consideration of the soil, the terrain and your State and County regulations. Be sure the field is not in a flood plain or bottom of a slope where excessive water may collect after rain. Surface water should be directed away from the proposed field area.

2. WATER QUALITY

Determine the quality of the water entering the system. Is it secondary treated or primary treated? If using primary treated effluent, please refer to Geoflow's article for direct septic found at www.geoflow.com or call 800-828-3388 for a copy. Be aware of water conditions intrinsic to the area. If iron or iron bacteria is prevalent, please be sure to eliminate it upstream of the drip system with ozone, ultraviolet or chemical treatment. Iron can be recognized as orange stain on plumbing fixtures and may be treated prior to entering the facility.

3. SOIL APPLICATION DESIGN

Note: This section based on Subsurface Trickle Irrigation System for On-Site Wastewater Disposal And Reuse by B. L. Carlile and A. Sanjines. The basis of the information is from the Texas Health Department regulations. The rules in your County and State may vary.

The instantaneous water application rate of the system must not exceed the water absorption capacity of the soil. A determination of the instantaneous water absorption capacity of the soil is difficult, however, since the value varies with the water content of the soil. As the soil approaches saturation with water, the absorption rate reduces to an equilibrium rate called the "saturated hydraulic conductivity." Wastewater application rates should be less than 10 percent of this saturated equilibrium.

Even though the trickle irrigation system maximizes the soil absorption rate through the low rate of application, thus keeping the soil below saturation, there will be times when the soil is at or near saturation from rainfall events. The design must account for these periods and assume the worst case condition of soil saturation. *By designing for a safety factor of 10 or 12, based on the saturated hydraulic conductivity, the system will be under-loaded most of the time but should function without surface failure during extreme wet periods.*

By applying wastewater slowly for a few hours daily, particularly if applied in "pulses" or short doses several times per day near the soil surface where the soil dries the quickest would keep the soil absorption rate at the highest value and minimize the potential of water surfacing in poor soil conditions.

As stated previously, this design criterion will under-load the system at all times except when the soil is at or near saturation from rainfall. If designing for an efficient irrigation system, the water supply may not be sufficient to meet the demands of a lawn or landscaped area during peak water demand months. This problem can be overcome by either of two solutions: add additional fresh-water make-up to the system during the growing season to supply the needed water for plants in question; or split the system into two or more fields with necessary valves and only use one of the fields during the peak water demand months and alternate the fields during winter months or extremely wet periods, or use both fields simultaneously if the pump capacity will so allow.

TABLE 1. MINIMUM SURFACE AREA GUIDELINES TO DISPOSE OF 100 GPD OF SECONDARY TREATED EFFLUENT

Soil Class	Soil Type	Soil Absorption Rates		Design	Total
		Est. Soil Perc. Rate minutes/in	Hydraulic Conductivity inches/hr	Hydraulic Loading Rate gal/sq. ft. per day	Area Required sq. ft./100 gallons per day
I	Coarse sand	<5	>2	1.400	71.5
I	Fine sand	5 - 10	1.5 - 2	1.200	83.3
II	Sandy loam	10 - 20	1.0 - 1.5	1.000	100.0
II	loam	20 - 30	0.75 - 1.0	0.700	143.0
III	Clay loam	30 - 45	0.5 - 0.75	0.600	167.0
III	Silt - clay loam	45 - 60	0.3 - 0.5	0.400	250.0
IV	Clay non-swell	60 - 90	0.2 - 0.3	0.200	500.0
IV	Clay - swell	90 - 120	0.1 - 0.2	0.100	1000.0
IV	Poor clay	>120	<0.1	0.075	1334.0

Dispersal field area calculation:

Total square feet area of dispersal field = Design flow divided by loading rate

Table 1 shows the recommended hydraulic loading rates for various soil conditions, using a safety factor of at least 12 with regard to the equilibrium saturated hydraulic conductivity rate of the soil. These loading rates assume a treated effluent with BOD and TSS values of less than 30 mg/l is produced in the pre-treatment system and that any anomalies such as iron bacteria have been removed prior to dosing.

NOTES

- 1) The above chart is provided as a guide only. States and Counties may have regulations that are different. Check your State guidelines and consult with your local health department.
- 2) Problems with drip dispersal fields occur when soils are misinterpreted. If in doubt, choose the more restrictive soil type from the table above.
- 3) "Soil type" should be based on the most restrictive layer within two feet of the dripline. In many soils 1-ft. vertical separation from the limiting layer has proven successful with secondary treated effluent. Geoflow recommends you follow State and Local guidelines.
- 4) Table 1 above, with only minor modifications over the years, has served us well since 1990 with tens of thousands of systems operating successfully based upon this data. However, thanks to work by Jerry Tyler and his associates at the University of Wisconsin-Madison soil structure has become better understood and can now be used as a comprehensive tool to determine optimal hydraulic loading rates.

Soil Textures	Soil Structure	Maximum Monthly Average	
		BOD5> 30mg/L<220mg/L TSS>30 mg/L<150 mg/L (gallons/ft2/day)	BOD5<30mg/L TSS<30mg/L (gallons/ft2/day)
Course sand or coarser	N/A	0.4	1.6
Loamy coarse sand	N/A	0.3	1.4
Sand	N/A	0.3	1.2
Loamy sand	Weak to strong	0.3	1.2
Loamy sand	Massive	0.2	0.7
Fine sand	Moderate to strong	0.3	0.9
Fine sand	Massive or weak	0.2	0.6
Loamy fine sand	Moderate to strong	0.3	0.9
Loamy fine sand	Massive or weak	0.2	0.6
Very fine sand	N/A	0.2	0.6
Loamy very fine sand	N/A	0.2	0.6
Sandy loam	Moderate to strong	0.2	0.9
Sandy loam	Weak, weak platy	0.2	0.6
Sandy loam	Massive	0.1	0.5
Loam	Moderate to strong	0.2	0.8
Loam	Weak, weak platy	0.2	0.6
Loam	Massive	0.1	0.5
Silt loam	Moderate to strong	0.2	0.8
Silt loam	Weak, weak platy	0.1	0.3
Silt loam	Massive	0.0	0.2
Sandy clay loam	Moderate to strong	0.2	0.6
Sandy clay loam	Weak, weak platy	0.1	0.3
Sandy clay loam	Massive	0.0	0.0
Clay loam	Moderate to strong	0.2	0.6
Clay loam	Weak, weak platy	0.1	0.3
Clay loam	Massive	0.0	0.0
Silty clay loam	Moderate to strong	0.2	0.6
Silty clay loam	Weak, weak platy	0.1	0.3
Silty clay loam	Massive	0.0	0.0
Sandy clay	Moderate to strong	0.1	0.3
Sandy clay	Massive to weak	0.0	0.0
Clay	Moderate to strong	0.1	0.3
Clay	Massive to weak	0.0	0.0
Silty clay	Moderate to strong	0.1	0.3
Silty clay	Massive to weak	0.0	0.0

TABLE 2 DRIP LOADING RATES CONSIDERING SOIL STRUCTURE.
Table 2 (above) is taken from the latest State of Wisconsin code and reflects Jerry Tylers work.

4. DEPTH AND SPACING

WASTEFLOW systems usually have emitter lines placed on 2 foot (600 mm) centers with a 2 foot emitter spacing such that each emitter supplies a 4 sq. ft (0.36 m²) area. These lines are best placed at depths of 6-10 inches (150 - 250 mm) below the surface. This is a typical design for systems in sandy and loamy soils with a cover crop of lawn grass. Closer line and/or emitter spacing of 12 inches is used on heavy clay soils or very coarse sands where lateral movement of water is restricted. Using closer spacing should not reduce the size of the field.

5. SOIL LAYERS AND TYPES

The shallow depth of installation is an advantage of the subsurface dripfield since the topsoil or surface soil is generally the most biologically active and permeable soil for accepting water. The topsoil also dries the fastest after a rainfall event and will maintain the highest water absorption rate. The quality and homogeneity of the soil may present a problem. If the soil was not properly prepared and there are pieces of construction debris, rocks and non-uniform soils, it is very difficult to obtain uniform water spread. In many cases, particularly if the soil is compacted, soil properties can be greatly improved by ripping and disking.

6. ADDING FILL TO THE DISPERSAL FIELD

Some dispersal sites require additional soil be brought in for agronomic reasons or to increase separation distances from the restrictive layer. Restrictive layers stop or greatly reduce the rate of downward water movement, as a result surfacing may occur during part of the year. In soils with high water tables treatment is minimized due to a lack of oxygen.

Placing drip lines in selected fill material above the natural soil provides an aerated zone for treatment. Dispersal however still occurs in the natural soil and the field size must be based on the hydraulic capability of the natural soil to prevent hydraulic overload.

Any time fill material is to be used, the area to receive the fill should have all organic material removed or it must be incorporated into the natural soil to prevent an organic layer from forming and restricting downward water movement.

The fill material should be applied in shallow layers with the first 4 to 6 inches incorporated into the natural soil to prevent an abrupt textural interface. Continue this process until all fill has been incorporated.

The fill area should be left crowned to shed surface water and may need diversion ditches or some other devices to prevent surface water from infiltrating. The entire fill area should have a vegetative cover to prevent erosion. If possible allow the fill to set at least seven to ten days before installing WASTEFLOW dripline.

It is generally agreed that fill should not be used on slopes greater than 20%.

7. HIGH POINTS, SIPHONING AND SLOPES

A potential problem with buried drip lines is siphoning dirt into the emitters when the pump is switched off. For this reason:

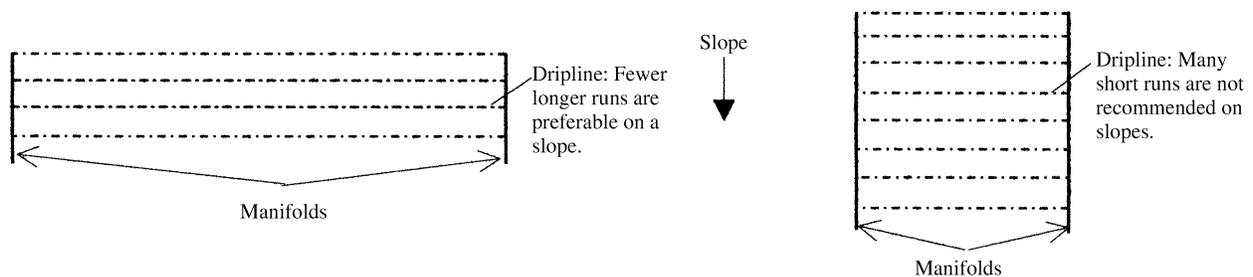
- a. Drip lines should have a fairly constant slope. Run dripline along a contour.
- b. At least one vacuum breaker should be installed at the highest point in each zone.
- c. Avoid installing lines along rolling hills where you have high and low points along the same line. If this is the case, connect all the high points together and install a vacuum breaker on the connecting line. (See Geoflow detail 602).
- d. Drip lines should be connected at the end to a common return line with a flush valve.

8. EXCESSIVE ELEVATION DIFFERENCES

WASTEFLOW Classic If the level variation within a WASTEFLOW Classic zone exceeds six feet, individual pressure regulators should be placed for each six-foot interval.

WASTEFLOW PC WASTEFLOW PC can tolerate very large height variations provided the pressure remains within the 7 to 60 psi range, and preferably within 10 to 45 psi.

At the end of each dosing cycle, water in the dripline will flow down to the bottom lines within the drip zone. This is called “lowhead drainage”. On a slope site Geoflow recommends installing short manifolds with fewer lines and longer dripline runs. If unsure, a maximum of 1500 ft of Geoflow dripline within each zone or sub-zone can be used as a rule of thumb. Do not exceed 5 lines in a single zone or sub-zone with a slope greater than 10%. Be sure to open valves fully so manifolds drain rapidly.



9. HILLY SITE

Concentrate drip lines at the top of the hill with wider spacing towards the bottom. In the case of compound slopes consult a professional irrigation designer or engineer.

10. MULTIPLE ZONES

Drip dispersal fields can be divided into multiple zones or subzones with solenoid valves or index valves for the following reasons:

- Steep slopes with a risk of lowhead drainage can be subdivided to distribute the water at system shut-down more uniformly in the field.
- Smaller zones reduce the required flow per minute which consequently reduces the size of the pump, valves, filters, supply and return lines.
- Subdividing the field is a tool used to achieve the optimum ranges required to efficiently operate the Vortex filters.
- If the dispersal field is located in multiple areas on the property.
- To accommodate varying soils or vegetation on a single site.

Note. On multiple zones, a single Wasteflow Headworks can be used for filtration and flushing by placing zone valves downstream of the Headworks box. All zones would require a check valve on the individual flush lines upstream of each line joining a common flush line to keep flush water from one zone entering any other zone during the flush cycle. (See Geoflow Design Detail No. 588)

If the effluent has not been through secondary treatment, then each zone should have a dedicated filter or Wasteflow Headworks.

11. REUSE FOR IRRIGATION

A good vegetative cover is an advantage to prevent erosion from the field and utilize water applied to the rooting zone. Sites should be planted or seeded immediately after installation. Grasses are particularly suitable for this application. Most lawn grasses will use 0.25" to 0.35" (6.3-8.9mm) of water per day during the peak growing season. This calculates to be about 0.16 to 0.22 gal/ft²/day. By over-seeding lawns with winter ryegrass, this use efficiency can be continued through much of the year. For vegetation using 0.16 to 0.22 gal/ft²/day by evapotranspiration, a sewage flow of 1000 gallons per day would supply the water needs of a landscaped area of 4600 to 6400 sq. ft. without having to add fresh water. For areas larger than this, the plants will suffer water stress during the hot months unless additional fresh water is applied.

12. WATER APPLICATION FORMULA

To determine the rate of application for various drip irrigation designs, use the following formula:

Water application (inches per hour) = (231 x (emitter flow rate gph)) / ((Emitter spacing inches) x (dripline spacing inches))

Example: Dripline with 1.3 gph flow rate emitters spaced 24" apart and dripline spaced 24" apart.

Water application = (231x1.3)/(24x24) = 0.52 inches of water per hour.

WORKSHEET:

The following worksheet is available on an Excel spreadsheet and can be downloaded from Geoflow’s homepage at www.geoflow.com. If you would like a copy sent to you at no charge phone 800-828-3388.

To calculate the area required for your drip dispersal system you must know:

1. the quantity of effluent to be disposed of (in gallons per day) and
2. the soil acceptance rate (i.e. gallons per day per square foot).

Make a sketch of the dispersal area with contour lines.

WORKSHEET 1 - DISPERSAL FIELD DESIGN FOR SINGLE ZONE SYSTEM

Worksheet	Formula
A) Quantity of effluent to be dispersed per day _____ <i>gpd</i>	
B) Soil type or hydraulic loading rate _____ <i>loading rate (gal/sq. ft./day)</i>	<i>Based on soil analysis</i>
C) Determine the total area required _____ <i>square ft</i>	<i>Refer to State or Local regulations. If none, refer to Table 1, page 8 and Divide gpd by loading rate. (A)/(Bii)</i>
D) Choose the spacing between each WASTEFLOW line and each WASTEFLOW emitter i) _____ <i>ft. between WASTEFLOW lines</i> ii) _____ <i>ft. between WASTEFLOW emitters</i>	<i>Standard spacing is 2 ft.</i>
E) How many linear feet of dripline in the total area? _____ <i>ft</i>	<i>(Area / 2) for 2ft. line spacing. (C)/2.0 or (Area / 1) for 1 ft. line spacing. (C)/1.0 or (Area / 0.5) for 6" line spacing. (C)/0.5</i>
F) Calculate the number of emitters _____ <i>emitters</i>	<i>(Linear ft. of dripline/2) for 2 ft emitter spacing. (E)/2 or (Linear ft. of dripline/1) for 1 ft emitter spacing. (E)/1 or (Linear ft. of dripline/0.5) for 6" emitter spacing (E)/0.5</i>

<p>G) Choose pressure compensating or Classic dripline</p> <p><input type="checkbox"/> WASTEFLOW Classic dripline or</p> <p><input type="checkbox"/> WASTEFLOW PC dripline</p>	<p><i>See page 4 and Appendix 1, page 28</i></p>
<p>H) Determine dripfield pressure</p> <p>_____ psi</p>	<p><i>Standard pressure is 20 psi.</i></p> <p><i>WASTEFLOW Classic systems need between 15 and 45 psi (34.7 and 104 ft.) at the start of the dripfield.</i></p> <p><i>WASTEFLOW PC systems need between 10 and 45 psi (23.1 ft. to 104 ft.) at the start of the dripfield.</i></p>
<p>I) Determine feet of head required at dripfield</p> <p>_____ ft. of head</p>	<p><i>Multiply pressure above by 2.31 to get head required.</i></p> <p><i>(H) x 2.31</i></p>
<p>J) What is the flow rate per emitter? _____ gph / emitter</p>	<p><i>See WASTEFLOW flow rates in Appendix 1.</i></p>
<p>K) Determine total flow for the area</p> <p>_____ gph</p> <p>_____ gpm</p>	<p><i>Number of emitters multiplied by the emitter flow rate at the design pressure.</i></p> <p><i>Gph = (F)x(J) Gpm = gph/60</i></p>
<p>L) Select pipe diameters for manifolds and submains</p> <p>_____ inches</p>	<p><i>Based on total flow from (K) above, in gpm.</i></p> <p><i>See schedule 40 friction loss charts on page 44</i></p> <p><i>Optimum velocity is between 2 and 5 ft. per second.</i></p>
<p>M) Select size of Vortex filter or WASTEFLOW Headworks</p> <p>_____ Vortex filter or</p> <p>_____ WASTEFLOW Headworks</p>	<p><i>Based on total flow from (K) above, in gpm. See minimum and maximum flow requirements for each filter in Appendix 2.</i></p>
<p>N) Sketch a layout of the WASTEFLOW lines in the dispersal plot to make sure that the maximum lateral length of each WASTEFLOW line is not exceeded.</p>	<p><i>See Maximum Length of Run table in Appendix 1</i></p>

WORKSHEET 2 - SELECT PUMP

Worksheet	Formula	
O) Minimum pump capacity	_____ gpm	<i>From (K) above</i>
P) Header pipe size	_____ inches	<i>From (L) above</i>
Q) Pressure loss in 100 ft. of pipe	_____ psi	<i>Refer to PVC charts on page 34.</i>
R) Friction head in 100 ft. of pipe	_____ ft. of head	<i>Multiply psi from (Q) above by 2.31</i>
S) Static head		
i) Height from pump to tank outlet.	_____ ft.	<i>Number of ft.</i>
ii) Elevation increase or decrease	_____ ft.	<i>Height changes from pump to dripfield.</i>
T) Total static head	_____ ft.	<i>Add (Si) + (Sii)</i>
U) Friction head		
i) Equivalent length of fittings	_____ ft.	<i>Estimate loss through fittings - usually inconsequential for small systems.</i>
ii) Distance from pump to field.	_____ ft.	<i>Measure length of sub-main</i>
iii) Total equivalent length of pipe.	_____ ft.	<i>Add (Ui) + (Uii)</i>
iv) Total effective feet.	_____ ft.	<i>(Uiii) / 100 x (R)</i>
v) Head required at dripfield	_____ ft.	<i>See line (I) in Worksheet 1 above.</i>
vi) Head loss through filter or Headworks	_____ ft.	<i>See pressure loss for filters in Appendix 2 or see pressure loss for Headworks box in Appendix 7. Multiply pressure by 2.31 to get head loss.</i>
vii) Head loss through zone valves	_____ ft.	<i>See pressure loss in Appendix 4 for electric valves. For manual or index valves check with the manufacturer. Multiply pressure loss in psi by 2.31 to get head loss.</i>
V) Minimum Total friction head	_____ ft.	<i>Add (Uiv) + (Uv) + (Uvi) + (Uvii)</i>
W) Minimum Total Dynamic Head	_____ ft.	<i>Add (T) + (V) From line item (O) above</i>
X) Minimum pump capacity	_____ gpm	
NOTE: Some States and Counties require additional flow for flushing. Please check your local regulations. If you need help on flushing design, see Geoflow's flushing worksheet at www.geoflow.com or call Geoflow at 800-828-3388.		
Y) Choose the pump.	<i>Based on pressure from line (W) above and flow from line (X) above.</i>	
_____ Model Number		
_____ Manufacturer		

SYSTEM INSTALLATION

1. INSTALLATION GUIDELINES

All Geoflow drip systems require:

100 micron / 150 mesh filter

Filter flush valve

Field flush valve and

Air vent in each zone

All Wasteflow Classic drip systems require pressure regulation

Handle your dripline and components with care. ROOTGUARD® is temperature sensitive. To assure a long life store the drip line out of direct sunlight in a cool place. This should be a consideration when installing the system in very hot and sunny areas. Your system life span will be increased if it is buried an extra two or three inches below the soil surface, to avoid the warm temperature extremes.

- a) All dripfield construction shall be done in accordance with Local rules and regulations.
- b) No utilities, cable wire, drain tile, etc shall be located in dripfield.
- c) Fence off entire dripfield prior to any construction.
- d) System is not to be installed when ground is wet or frozen.
- e) Divert all downspouts and surface waters away from dripfield or into curtain drains.
- f) Excavation, filling and grading should have been finished before installation of the subsurface drip system.
- g) Be sure you have everything required for the installation before opening trenches. Pre-assemble as many sets of components as practical above ground and in a comfortable place. Compression or Lockslip adapters should be glued to PVC tees, riser units should be pre-assembled, the sub-main manifold with tees can be pre-assembled and used to mark the beginning and end of WASTEFLOW lines.
- h) For particularly tough soil conditions moisten the soil the day before opening trenches or installing WASTEFLOW. Remember it is much easier to install the system in moist soil. The soil should be moist but still should allow the proper operation of the installation equipment and not cause smearing in the trenches. The soil surface should be dry so that the installation equipment maintains traction.
- i) Mark the four corners of the field. The top two corners should be at the same elevation and the bottom two corners should be at a lower elevation. In freezing conditions the bottom dripline must be higher than the supply and return line elevation at the dosing tank.
- j) Install a watertight dosing tank. In freezing conditions the dosing tank should be at the lowest elevation of the entire system. Install a watertight riser on the dosing tank if necessary.
- k) Determine the proper size for the supply and return manifolds. See Worksheet line (L).
- l) Install the PVC supply line from the dosing tank, up hill through one lower and one upper corner stake of the dispersal field. Please refer to your State guidelines for depth of burial.
- m) Paint a line between the two remaining corner stakes.

- n) Install the Geoflow WASTEFLOW dripline from the supply line trench to the painted line, approximately 6" to 10" deep as specified. Upon reaching the painted line, pull the plow out of the ground and cut the dripline 1' above the ground. Tape the end of the dripline to prevent debris from entering. Continue this process until the required footage of pipe is installed. Geoflow dripline must be spaced according to specification (2 ft. is standard). Depth of burial of dripline must be consistent throughout the field. Take care not to get dirt into the lines.
- o) Install the supply header with tees lined up at each Geoflow line. Hook up the Geoflow lines to the supply header. Do not glue WASTEFLOW dripline.

Installing Lockslip fittings

- a) Hold the fitting in one hand and position the tubing with the other hand.
 - b) Move the sleeve back, and push the tubing onto the exposed stem as far as possible.
 - c) Push the sleeve out over the tubing and thread the sleeve onto tubing, as though tightening a nut to a bolt. Hand tighten. Do not use tools.
- p) Install the Vortex filter and filter flush valve, or install the pre-assembled Headworks between the field and the pump tank on the supply line. *Insulate the box in freezing conditions.
 - q) If using a pressure regulator, install it downstream of the filter or Headworks, just ahead of the dispersal field, on the supply line. Although the pressure regulator can be buried directly into the soil, it is preferable to install it inside a small valve box for easy access. *Insulate the box in freezing conditions.
 - r) Install the floats in the dosing tank and wire up to the timer control. The timer control should be set to pump no more than the design flow, do not set to match the treatment capacity.
 - s) Install the pump. Fill the dosing tank with fresh water and turn on the pump. Check for flow out the ends of all of the Geoflow lines. Let the pump run for about five minutes to flush out any dirt. Shut off the pump and tape the ends of the lines.
 - t) Dig the return header ditch along the line painted on the ground and back to the pre-treatment tank. Start the return header at the farthest end from the dosing tank. The return line must have slope back to the treatment tank or septic tank.
 - u) Install the return header and connect all of the Geoflow lines. Care must be taken not to kink the dripline.
 - v) Install air vacuum breakers at the highest points in the dispersal field. Use pipe dope or Teflon tape and hand tighten.
 - w) Install a ball or solenoid field flush valve on the return line to the pretreatment or pump tank unless a pre-assembled Wasteflow Headworks is being used. If a Headworks was installed on the supply line, connect the return line back through the Headworks box. Open the field flush valve and turn on the pump to flush lines then close the valve and check the field and all piping and connections for leaks. Turn off the system
 - x) Turn on the pump and check the pressure at the air vacuum breaker(s). It should be between 15 to 45 PSI. Check the pressure in the WASTEFLOW Headworks if used. It should be five psi or higher. If using a manual valve for field flushing, crack it open until at least one PSI is lost or design pressure is reached and leave in that position.
 - y) Check the filter for construction debris and clean.
 - z) Provide owner with final as-built diagrams, flow measurements and pressure readings at startup.

Valve Installation and Operation

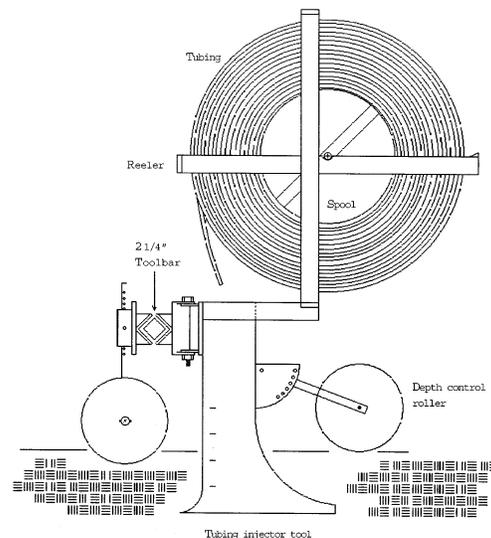
- a) Wrap male adapters with 2 wraps of Teflon tape and thread the adapters into the valve inlet and outlet 1 turn past hand tight. CAUTION: over tightening may cause damage to the valve. The solenoid is located on the downstream side of the valve.
- b) Using watertight connectors, connect the valve common and an individual output wire to the solenoid leads.
- c) Flush the laterals by opening the internal manual bleed lever on the downstream side of the solenoid. Turn the flow control stem fully open (counterclockwise) for flow control models.
- d) Close the internal manual bleed after flushing the system.

TABLE 3. SUBSURFACE DRIP INSTALLATION METHODS

NOTE: Disturbing the soil may effect the pore structure of the soil and create hydraulic conductivity problems. Please consult with your soil scientist or professional engineer before making the installation technique decision.

INSERTION METHOD	ADVANTAGES	DISADVANTAGES
a) Hand Trenching	<ul style="list-style-type: none"> • Handles severe slopes and confined areas • Uniform depth 	<ul style="list-style-type: none"> • Slow • Labor intensive • Disrupts existing turf and ground • Back fill required
b) Oscillating or vibrating plow. Use the type that inserts the dripline directly in place, not one that pulls the dripline through the soil.	<ul style="list-style-type: none"> • Fast in small to medium installations • Minimal ground disturbance • No need to back fill the trench 	<ul style="list-style-type: none"> • Depth has to be monitored closely • Cannot be used on steeper slopes(>20%) • Requires practice to set and operate adequately • Tends to “stretch” pipe. Shorter runs are required
c) Trenching machine	<ul style="list-style-type: none"> • Faster than hand trenching • May use the 1" blade for most installations • Uniform depth 	<ul style="list-style-type: none"> • Slower, requires labor • Disrupts surface of existing turf • Back fill required
d) Tractor with dripline insertion tool - see diagram 2. below.	<ul style="list-style-type: none"> • Fast • Little damage to existing turf because of the turf knife • Minimal ground disturbance • Does not stretch drip line • Adaptable to any tractor 	<ul style="list-style-type: none"> • The installation tool is designed specifically for this purpose.
e) Tractor mounted 3-point hitch insertion implement	<ul style="list-style-type: none"> • Fastest. Up to four plow attachments with reels • A packer roller dumps back soil on top of the pipe 	<ul style="list-style-type: none"> • Suitable for large installations only

Diag. 2 Installation Tool



WORKSHEET 3- AS BUILT SYSTEM DESCRIPTION.

1. Site name: _____
2. Site address including State: _____
3. Dripfield designed by: _____
4. Dripfield installed by: _____
5. Date of installation: _____
6. Daily design flow: _____ gpd.
7. Soil percolation rate: _____
8. Is there secondary treatment on this job site? _____ Yes _____ No
If "Yes" to question 8 above, please name manufacturer and model number: _____
9. Number of zones in dripfield: _____. If more than one zone, please describe valve (size, manufacturer, part number, type): _____
10. Amount of dripline installed in each zone:
Zone 1 _____ ft. Zone 2 _____ ft. Zone 3 _____ ft. Zone 4 _____ ft.
11. Wasteflow dripline model number &/or description: _____
12. Flow rate per zone:
Zone 1 _____ gpm. Zone 2 _____ gpm. Zone 3 _____ gpm. Zone 4 _____ gpm.
13. Depth dripline installed below grade: _____ inches
14. Pump manufacturer, model number and number of pumps: _____
15. Vortex filter model number &/or description: _____
If more than one zone, do the zones (a) share one filter or (b) each have their own filter? _____
16. Pressure in each zone:
Zone 1 _____ psi Location pressure measured: _____
Zone 2 _____ psi Location pressure measured: _____
Zone 3 _____ psi Location pressure measured: _____
Zone 4 _____ psi Location pressure measured: _____
17. Size (diameter) of feed manifold: _____ inches. Depth of feed manifold: _____ inches.
18. Size (diameter) of flush manifold: _____ inches. Depth of flush manifold: _____ inches.
19. Size of filter flush valve: _____ inches. Is filter flush valve manual or automatic? _____
20. Size of field flush valve: _____ inches. Is the field flush valve manual or automatic? _____
If more than 1 zone, do the zones (a) share 1 flush valve or
(b) does each zone have it's own flush valve? _____
21. Was any fill material supplied on the dripfield? _____
If "yes" to 21 above describe fill quality and quantity added. _____
22. Please provide owner with as-built drawings, including but not limited to direction of drip lines, location of air vents, pressure regulators if applicable, Headworks (filter and valves) and pump tank.

2. WINTERIZATION

Buried drip systems are not prone to frost damage because, in their design, vacuum release and drain valves are provided. The dripline itself is made of polyethylene and not susceptible to freezing. It drains through the emitters so will not be full of water after pumps are turned off. Please follow these precautions:

- a) Manifolds, supply lines and return lines must be sloped back to their respective dosing or treatment tanks. These lines need to drain rapidly. Under extreme conditions return and supply manifolds must be insulated or buried below frost-line. Be sure drain valve on flush line remains open long enough for entire field to drain.
- b) Remove the check valve at the pump.
- c) Insulate equipment boxes, including Headworks box or filter and field flush valve boxes as well as zone dosing valves, pressure regulator and air vacuum relief valves. Use closed-cell insulation such as Perlite in a plastic bag.
- d) In severe freezing conditions, use heat tape or small heater in the Headworks box.
- d) The top of air vacuum relief valves must be no higher than soil surface.
- e) If using an index valve to split field zones, be sure it is capable of self-draining.
- f) WASTEFLOW lines will self-drain through the emitters into the soil. If the cover crop over the dripfield is not yet adequately established, add hay or straw over the field for insulation.
- g) Mark the valve box with a metal pin so you can find it in the winter when covered in snow.
- h) If using manual filter flush valves or manual field flush valves, they should be left cracked open slightly to provide for rapid drainage of the flush line in freezing conditions.
- i) Fields dosed with relatively small quantities of effluent are more likely to freeze than those dosed with design quantities. If winter use is less than summer use, then only use proportional number of fields to maintain water application rates in the field being dosed.

SYSTEM MAINTENANCE:

The best way to assure years of trouble free life from your system is to continuously monitor the system and to perform regular maintenance functions. For large systems or systems with a BOD > 30 mg/l automation of maintenance is essential. For smaller systems with a BOD < 30 mg/l inspection and maintenance should be performed every six months.

ROUTINE AND PREVENTATIVE MAINTENANCE

- 1) Remove the spin filter and install a clean cartridge. Clean the used filter cartridge back at the shop with a pressure hose. The filter cartridge should be cleaned from the outside inwards. If bacteria buildup is a problem we advise first trying lye, and if the problem persists, soak the filter cartridge in a chlorine bath - a mixture of 50% bleach and 50% water.
- 2) Open the field flush valve and flush the field for 3-5 minutes by activating the pump in "manual" position. Close the flush valve. On automatic solenoid valves the manual bleed lever should always be in the horizontal position and the dial on top should be free spinning. Clockwise rotation closes valve
- 3) With the pump in the "manual" position, check the pressure in the drip field by using a pressure gauge on the schraeder valve located on the air vents and by reading the pressure gauge located in the Wasteflow Headworks box. The pressure should be the same as shown on the initial installation records. On systems with manual flush valves, close the field flush valve completely and then open the valve slightly until there is a 1-2 psi drop or design pressure is reached. This will allow the field to drain after each dose to prevent the manifold lines from freezing.
- 4) Remove the lids on the vacuum breaker and check for proper operation. If water is seen leaking from the top of the vacuum breaker, remove the cap of the vacuum breaker and press down on the ball to allow any debris to be flushed out. Be careful not to come in contact with the effluent.
- 5) Turn off the pump and reset the controller for auto mode.
- 6) Periodically remove and clean the air vents, field flush and filter flush valves.
- 7) Visually check and report the condition of the drip field, including any noticeable wetness.
- 8) Treatment and distribution tanks are to be inspected routinely and maintained when necessary in accordance with their approvals.
- 9) Record the elapsed time meter, pump counter, override counter, high-level alarm and power failures. This information can be obtained from the controller.

HOME OWNERS GUIDE FOR CARE AND MAINTENANCE OF GEOFLOW DRIP DISPERSAL FIELD

A drip dispersal system has been installed on your property for the subsurface dispersal of the effluent from your home.

The drip dispersal system consists of a series of 1/2" diameter drip tubing installed at a shallow depth of 8-10" below the ground surface. It is designed to effectively disperse of the treated effluent in the ground with a combination of soil absorption and plant uptake. Your drip dispersal system will function for many years with only minimal maintenance being required, provided the following recommendations are followed:

- Establish landscaping (preferably a grass cover) immediately. This will stabilize the soil and allow for the vegetation to take up the water.
- Do not discharge sump pumps, footing drains or other sources of clear water to the system, except for the effluent discharge from your treatment system.
- Maintain all plumbing fixtures to prevent excess water from entering the dispersal system.
- Do not drive cars, trucks or other heavy equipment over the drip dispersal field. This can damage the drip components or the soil and cause the system to mal-function. Lawn mowers, rubber wheeled garden tractors and light equipment can be driven over the drip field.
- Do not drive tent stakes, golf putting holes, croquet hoops etc., into the dispersal field
- Contact your service company if your high water alarm should sound. The pump chamber is sized to allow additional storage after the high water alarm sounds but you should refrain from excessive water usage (i.e., laundry) until the system has been checked.
- After a temporary shut down due to a vacation or other reason, the treatment plant ahead of the drip field filter, initially may not function effectively, resulting in the filter blocking.

Contact your service company if you notice any areas of excessive wetness in the field. In most cases, this is usually caused by a loose fitting or a nicked dripline and can be easily repaired. Note: There may be some initial wetness over the driplines following the system's installation. This should cease once the ground has settled and a grass cover is established

TROUBLE SHOOTING GUIDE:

Symptom: High water alarm activates periodically (1-2 times/week). During other times the water level in the pump chamber is at a normal level.

Possible cause: Peak water usage (frequently laundry day) is causing a temporary high water condition to occur.

Remedy: Set timer to activate the pump more frequently. Be sure to not exceed the total design flow. To avoid this, reduce the duration of each dose.

Remedy: Provide a larger pump tank to accommodate the peak flow periods.

Symptom: High water alarm activates during or shortly after periods of heavy rainfall.

Possible cause: Infiltration of ground/surface water into system.

Remedy: Identify sources of infiltration, such as tank seams, pipe connections, risers, etc. Repair as required.

Symptom: High water alarm activates intermittently, including times when it is not raining or when laundry is not being done.

Possible cause: A toilet or other plumbing fixture may be leaking sporadically but not continuously. Check water meter readings for 1-2 weeks to determine if water usage is unusually high for the number of occupants and their lifestyle. Also determine if water usage is within design range.

Remedy: Identify and repair fixture.

Symptom: High water alarm activates continuously on a new installation (less than 3 months of operation). Inspection of the filter indicates it is plugged with a gray colored growth. Water usage is normal.

Possible cause: Slow start-up of treatment plant resulting in the presence of nutrient in the effluent sufficient to cause a biological growth on the filter. This is typical of lightly loaded treatment plants that receive a high percentage of gray water (i.e., from showers and laundry).

Remedy: Remove and clean filter cartridge in a bleach solution. Add a gallon of household bleach to pump tank to oxidize organics. Contact treatment plant manufacturer for advice on speeding up the treatment process possibly by “seeding” the plant with fresh activated sludge from another treatment plant.

Symptom: Water surfaces continuously at one or more isolated spots, each one foot or more in diameter.

Possible cause: Damaged drip line or a loose connection is allowing water be discharged under pressure and therefore at a much greater volume than intended.

Remedy: Dig up drip line. Activate pump and locate leak. Repair as required.

Possible cause: If water is at base of slope, can be caused by low-head drainage.

Remedy: Install check valves and airvents in the manifolds to redistribute water in the system after pump is turned off. This is not advised for freezing climates where manifold drainage is required.

Symptom: A portion of the drip field closest to the feed manifold is saturated while the rest of the field is dry.

Possible cause: Insufficient pump pressure. A pressure check at the return manifold indicates pressure of less than 10 psi.

Remedy: Check filter and pump intake to insure they are not plugged. If they are, clean as required.

Remedy: Leaks in the system may be resulting in loss of pressure. Check for water leaks in connections and fittings or wet spots in the field. Also check air vents to insure they are closing properly. Repair as necessary.

Remedy: Pump is worn or improperly sized. Pressure at feed manifold is less than 15 psi. Verify pressure requirements of system and provide a new or larger pump. As an alternate approach, the drip field may need to be divided into two or more zones.

Possible cause: The duration of each dose is of insufficient length to allow the drip field to become pressurized before the pump shuts off (or runs for only a brief time before turning off).

Remedy: Increase the pump run time and decrease the frequency of doses. Always calculate (or observe during field operation) how long the system takes to fully pressurize and add this time to the design dosing duration.

Symptom: High water alarm begins to activate continuously after a long period (1-2 years) of normal operation. Inspection of the filter indicates it is plugged with a heavy accumulation of sludge.

Possible cause: A buildup of solids in the pump tank due to carryover from the treatment plant.

Remedy: Replace the filter cartridge with a clean cartridge. Check the pump tank and if an accumulation of solids is noted, pump the solids out of the pump tank. Also, check the operation of the treatment plant to insure it is operating properly.

Symptom: Water surfaces at several spots in drip field during dosing periods. Installation is recent, less than 6 months of usage and the soil is a moderate to heavy clay. Possibly, the installation was completed using a non-vibratory plow.

Possible cause: Smearing of the soil may have occurred during installation of drip line. Also, the "cut" resulting from the installation allows an easy path for the water to surface during dosing.

Remedy: In most cases the sod will compact naturally around the drip line and the surfacing will diminish and ultimately cease. To help, reduce the duration of each dose and increase the number of doses/day. Also, it will help to seed the area to encourage the development of a good root zone.

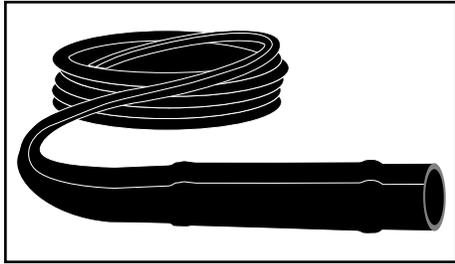
- Symptom:** Entire area of drip field is wet, soft and spongy. It appears to be totally saturated with water. Situation occurs during dry season when there is little rainfall.
- Possible cause:** Water being discharged to drip field exceeds design. Excess water may be a result of infiltration, plumbing leaks or excessive water usage.
- Remedy:** Check water meter, elapsed time meter, pump counter, override counter or high level alarm counter to determine if water usage is in excess of design. Check for leaks or infiltration. Repair leaks as required. Reduce water usage by installing water saving fixture.
- Remedy:** If water usage cannot be reduced, enlarge drip field as required.
- Possible cause:** Area of drip field was inadequately sized and is too small.
- Remedy:** Provide additional soil analysis to verify sizing and enlarge as required.

Valve Troubleshooting

- Symptom:** Valve will not open manually
 Check water supply and any possible master or gate valves to insure they are open.
 Check that the valve is installed with the arrow pointing in the downstream direction.
 Check that the flow control is fully open, counterclockwise.
 Turn off the water supply. Remove the solenoid and check for debris blocking the exhaust port.
 Turn off the water supply. Remove the cover. Inspect the diaphragm for damage and replace if necessary.
- Symptom:** Valve will not open electrically
 Check voltage at controller for 24 VAC station.
 Check voltage across the solenoid lead wires for minimum 21 VAC.
 Make sure handle on top of valve is free spinning. Not all the way open or all the way closed.
 If the valve still does not operate electrically, replace the solenoid.
- Symptom:** Valve will not close
 Insure the manual bleed lever is in the closed position.
 Check for leaks around the flow control, solenoid or between valve cover and body.
 Turn off the water supply. Remove the solenoid and check for debris or damage to the exhaust port.
 Turn off the water supply. Remove valve cover and inspect for debris under diaphragm or debris in diaphragm ports.
- Symptom:** Slow leak
 Check for dirt or gravel embedded in the diaphragm seat.
 Check actuator and exhaust fitting for proper seating.

APPENDIX

Appendix 1	Page 28	Wasteflow Dripline
	Page 29	Wasteflow Classic
	Page 30	Wasteflow PC 0.53 gph
	Page 31	Wasteflow PC 1 gph
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Appendix 3	Page 35	Controllers
Appendix 4	Page 39	Valves
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Appendix 8	Page 44	PVC 40 Friction Loss Chart



WASTEFLOW DRIPLINE

DESCRIPTION

The flexible 1/2" polyethylene dripline has large emitters regularly spaced in the line. With the dripline hidden about six inches below ground effluent is distributed slowly and uniformly, reducing ponding, even in difficult soils and hilly terrain.

WASTEFLOW is built to last. It is guaranteed to be trouble-free from root intrusion with built-in *ROOTGUARD*[®] protection, and the dripline wall is protected from organic growth with *UltraFresh*[®] lining.

WASTEFLOW provides uniform distribution. The emitters have a Coefficient of variation (Cv) of less than .05.

Different flow rates, dripline diameters and emitter spacings can be special ordered.

Use 600 series compression adapters or lockslip fittings to connect the dripline to PVC pipe.

ROOTGUARD[®] PROTECTION

WASTEFLOW dripline features patented *ROOTGUARD*[®] technology to prevent roots from clogging the emission points. The pre-emergent, Treflan[®], is bound into *WASTEFLOW* emitters when they are molded to divert roots from growing into the emitter outlet. The system is guaranteed against root intrusion for 10 years.

UltraFresh[®] PROTECTION

UltraFresh[®] DM50 is an antimicrobial incorporated into the inner lining and emitters of *WASTEFLOW* dripline to inhibit adhesion of biological growth on the inside of the tube and the emitters. It eliminates the need to scour the tubing. It is a tin based formula that defeats the energy system of microbial cells.

WHEN TO USE WASTEFLOW PC VS. WASTEFLOW CLASSIC

Geoflow, Inc. offers *WASTEFLOW* dripline in both pressure compensating (*WASTEFLOW PC*) and non-compensating (*WASTEFLOW Classic*) models.

We recommend that *WASTEFLOW PC* be used when the advantages are of substantial economic value.

- a) Very long runs.
- b) Steep slopes. Systems should be designed for the dripline lateral to follow the contour. If this is possible, the extra cost of pressure regulators required for *WASTEFLOW Classic* would likely be less than the incremental cost of *WASTEFLOW PC*.
- c) Rolling terrain. If the difference in height from trough to peak exceeds six feet then *WASTEFLOW PC* should be used. Vacuum relief valves must be placed at the top of each rise.

WASTEFLOW PC and *WASTEFLOW Classic* can be interchanged to meet filter and zone flow requirements.

WASTEFLOW dripline is available in 20mm diameter. Please see Geoflow website for specifications.

-
- *WASTEFLOW* is manufactured under US Patents 5332160, 5116 414 and Foreign equivalents.
 - *WASTEFLOW* is a registered trademark of A.I. Innovations.
 - *TREFLAN* is a registered trademark of Dow Agro Chemicals.

WASTEFLOW Classic

Available in 2 standard models:

WF16-4-24 WASTEFLOW Classic 24"/ 1.3gph

WF16-4-12 WASTEFLOW Classic 12"/ 1.3gph

Alternate flow rates, diameters and spacing available upon request.

Flow Rate vs. Pressure (+/- 5%)

Wasteflow Classic

Pressure	Head	WF16-4-24	WF16-4-12
10 psi	23.10 ft	0.90 gph	0.90 gph
15 psi	34.65 ft.	1.13 gph	1.13 gph
20 psi	46.20 ft.	1.30gph	1.30gph
25 psi	57.75 ft.	1.47 gph	1.47 gph
30 psi	69.30 ft.	1.62 gph	1.62 gph
35 psi	80.85 ft.	1.76 gph	1.76 gph
45 psi	103.95 ft	1.89 gph	1.89 gph

Maximum Length of Run vs. Pressure

Wasteflow Classic

Flow variation +/- 5%

Total loss taken in dripline. No allowance for loss in the manifolds.

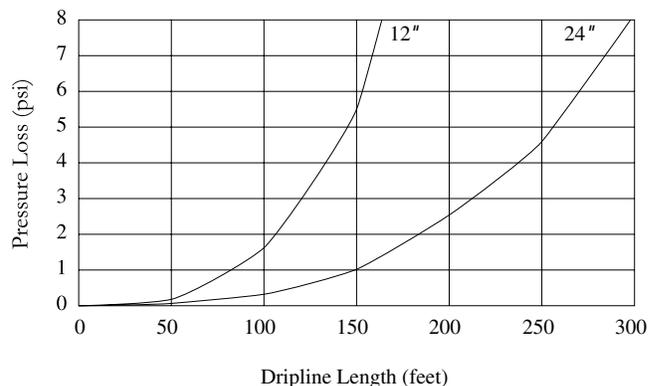
Pressure	Head	WF 16-4-24	WF 16-4-18	WF 16-4-12
10-45 psi	23 - 104 ft.	210 ft.	208 ft.	120 ft.

Allows 25% of loss in manifold

Pressure	Head	WF 16-4-24	WF 16-4-18	WF 16-4-12
10-45 psi	23 - 104 ft.	170 ft.	165 ft.	100 ft.

Kd = 0.9

Wasteflow Classic
Pressure Loss vs. length of Dripline



WASTEFLOW Classic Specification

The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow, drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.053" x 0.053" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a *UltraFresh*[®] protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 12") apart. The turbulent flow emitters shall be molded from virgin polyethylene resin. The turbulent flow emitters shall have nominal discharge rates of 1.3 gallons per hour at 20 psi. The emitters shall be impregnated with Treflan[®] to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. WASTEFLOW Classic dripline shall be Geoflow model number WF16-4-24 (or WF16-4-12).

WASTEFLOW PC 0.53 GPH

WFPC16-2-24 WASTEFLOW PC 24" / .53gph

WFPC16-2-18 WASTEFLOW PC 18" / .53gph

WFPC16-2-12 WASTEFLOW PC 12" / .53gph

Alternative spacing, flow rates and diameters available upon request

Pressure	Head	WFPC16-2-24 WPFPC16-2-18 WFPC16-2-12
7-60 psi*	16 -139 ft.	0.53 gph

Maximum Length of Run vs. Pressure

Wasteflow PC

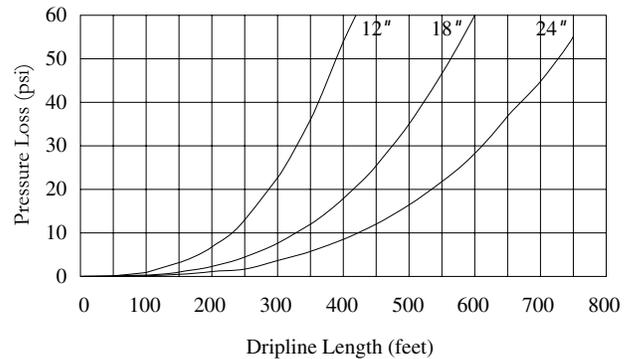
Allows a minimum of 10 psi at the end of the line

*Recommended operating pressure is 10-45 psi

Pressure	Head	WFPC 16-2-24	WFPC 16-2-18	WFPC 16-2-12
10 psi	23.10 ft.	—	—	—
15 psi	34.65 ft.	321 ft.	260 ft.	174 ft.
20 psi	46.20 ft.	423 ft.	330 ft.	228 ft.
25 psi	57.75 ft.	478 ft.	377 ft.	260 ft.
30 psi	69.30 ft.	535 ft.	415 ft.	288 ft.
35 psi	80.85 ft.	576 ft.	448 ft.	313 ft.
40 psi	92.40 ft.	613 ft.	475 ft.	330 ft.
45 psi	103.95 ft.	651 ft.	501 ft.	354 ft.
50 psi *	115.50 ft.	675 ft.	523 ft.	363 ft.
55 psi *	127.50 ft.	700 ft.	544 ft.	377 ft.
60 psi *	138.60 ft.	727 ft.	563 ft.	403 ft.

Kd = 2.070

**Wasteflow PC 0.53 gph.
Pressure Loss vs. length of Dripline**



WASTEFLOW PC Specification

The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow, drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.032" x 0.045" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a *UltraFresh*[®] protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 18" or 12") apart. The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. The pressure compensating emitters shall have nominal discharge rates of 0.53 gallons per hour. The emitters shall be impregnated with Treflan[®] to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. 0.53 gph WASTEFLOW PC pressure compensating dripline shall be Geoflow model number WFPC16-2-24 (or WFPC16-2-18 or WFPC16-2-12)

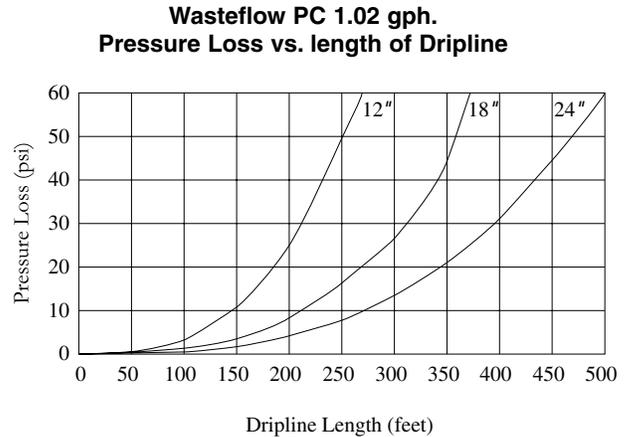
WASTEFLOW PC 1.02 GPH

WFPC16-4-24 WASTEFLOW PC 24"/ 1.02gph

WFPC16-4-12 WASTEFLOW PC 12"/ 1.02gph

Alternate spacing available upon request.

Flow Rate vs. Pressure		
		Dripline
Pressure	Head	WFPC16-4-24 WFPC16-4-12
7 - 60 psi*	16 - 139 ft.	1.02 gph



Maximum Length of Run vs. Pressure

Allows a minimum of 10 psi at the end of the line

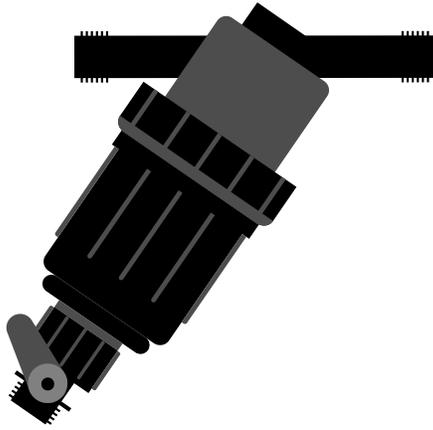
*Recommended operating pressure is 10 - 45 psi

Pressure	Head	WFPC 16-4-24	WFPC 16-4-18	WFPC 16-4-12
10 psi	23.10 ft.	—	—	—
15 psi	34.65 ft.	211 ft.	172 ft.	115 ft.
20 psi	46.20 ft.	265 ft.	210 ft.	146 ft.
25 psi	57.75 ft.	315 ft.	242 ft.	171 ft.
30 psi	69.30 ft.	335 ft.	266 ft.	180 ft.
35 psi	80.85 ft.	379 ft.	287 ft.	199 ft.
40 psi	92.40 ft.	385 ft.	305 ft.	211 ft.
45 psi	103.95 ft.	429 ft.	321 ft.	222 ft.
50 psi*	115.50	431 ft.	334 ft.	232 ft.
55 psi*	127.05	449 ft.	347 ft.	240 ft.
60 psi*	138.60	465 ft.	360 ft.	249 ft.

Kd = 2.070

WASTEFLOW PC 1.02 GPH Specification

The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow, drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.032" x 0.045" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a *UltraFresh*[®] protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 12") apart. The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. The pressure compensating emitters shall have nominal discharge rates 1.02 gallons per hour. The emitters shall be impregnated with Treflan[®] to inhibit root intrusion for a minimum period of ten years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. 1.02 gph WASTEFLOW PC pressure compensating dripline shall be Geoflow model number WFPC16-4-24 (or WFPC16-4-12).



VORTEX FILTERS

Description

The filters are placed between the pump and dripfield to screen out any debris.

Body - Two-piece threaded housing with O-ring seal. Molded from high heat ABS and chemical resistant glass reinforced plastic.

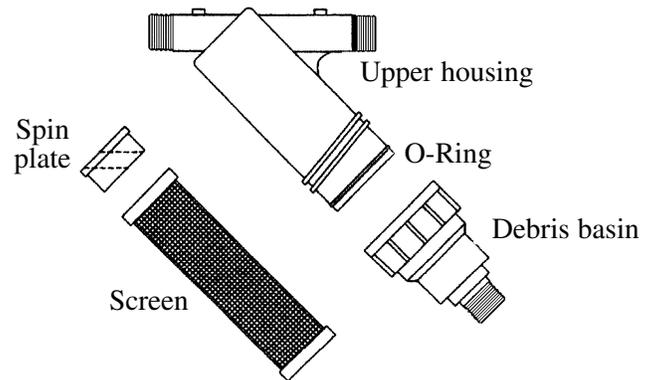
Screen - Sintered stainless steel. Sintering is a process in which three pieces of stainless steel mesh are transformed into one; a perforated plate, 30m then 150 mesh. Screen collars molded from vinyl for long life and durability.

Spin Plate and drain - Directional spin plate is molded of PVC or fiberglass.

Vortex Spin Action - Incoming water is forced through a directional nozzle plate onto the inside of the stainless steel screen. A centrifugal motion starts inside the screen chamber, throwing organic and inorganic particles outward against the screen. Gravity, moves the debris down the screen wall to the 3/4" flush outlet at the base of the Vortex Filter.

To stay clean, two criteria must be met:

- a. Flow into the filter must be within the specified range to produce a 5 to 8 psi pressure differential across the filter.
- b. The filter flush valve must be partially to fully open allowing debris to flush away.



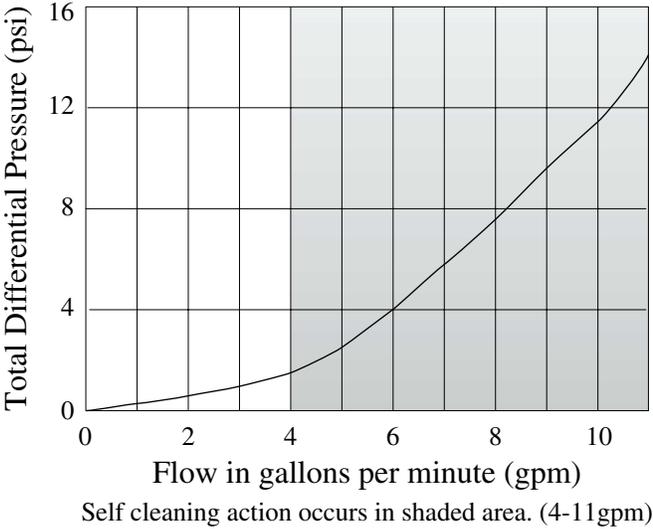
ITEM NUMBER	SIZE (MIPT)	FLOW (GPM)	MAX. PRESSURE	WIDTH (thread to thread)	HEIGHT (with flush port)	SIZE OF FLUSH PORT	AREA OF FILTRATION
AP4E-.75F	3/4"	04 - 11	80 psi	6.0"	12.0"	3/4" MPT	23.4 inches ²
AP4E-1F	1.0"	07 - 28	80 psi	6.5"	13.0"	3/4" MPT	28.4 inches ²
AP4E-1.5F-3	1.5"	34 - 42	100 psi	12.0"	15.5"	3/4" MPT	60.8 inches ²
AP4E-1.5F-4	1.5"	45 - 55	100 psi	12.0"	15.5"	3/4" MPT	60.8 inches ²
AP4E-2F-3	2.0"	68 - 84	80 psi	12.0"	16.0"	3/4" MPT	60.8 inches ²
AP4E-2F-4	2.0"	90 - 110	80 psi	12.0"	16.0"	3/4" MPT	60.8 inches ²

3/4" Filter

Specification

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 3/4 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4 inch MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 23.4 square inch filtration area. The screen collar shall be molded from vinyl. The 3/4" filter shall be Geoflow Vortex Filter model number AP4E-.75F.

Flow vs. Pressure

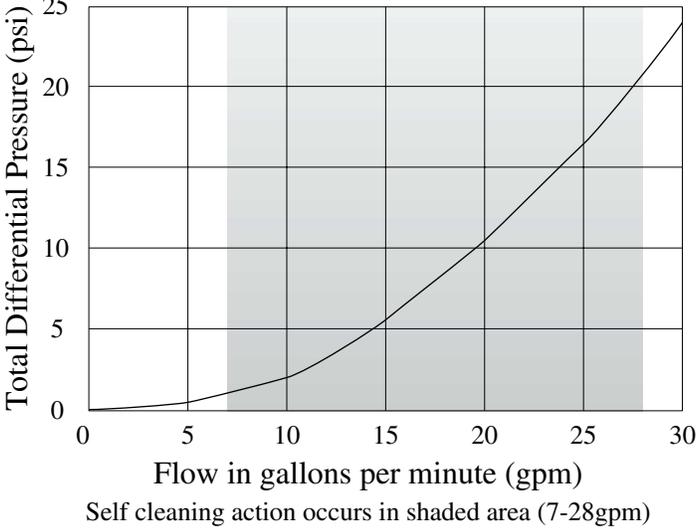


1" Filter

Specification

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4 inch MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless steel, providing a 28.4 square inch filtration area. The screen collar shall be molded from vinyl. The 1" filter shall be Geoflow Vortex Filter model number AP4E-1F.

Flow vs. Pressure



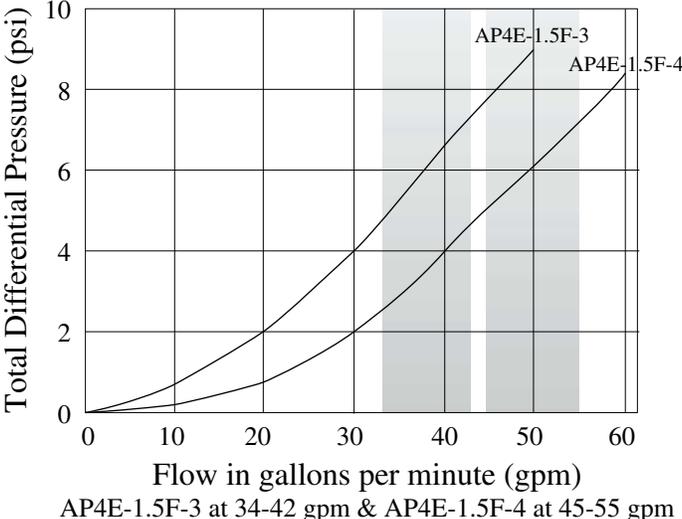
Note: Two or three 1" Vortex filters can be used side by side to deliver higher flow rates or to decrease pressure loss through the filters.

1.5" Filter

Specification

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1.5 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by unscrewing and shall include an O-ring seal. An additional 3/4" MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless, providing a 60.8 square inch filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 1 1/2" filter shall be Geoflow model number AP4E-1.5F-3 or AP4E-1.5F-4

Flow vs. Pressure

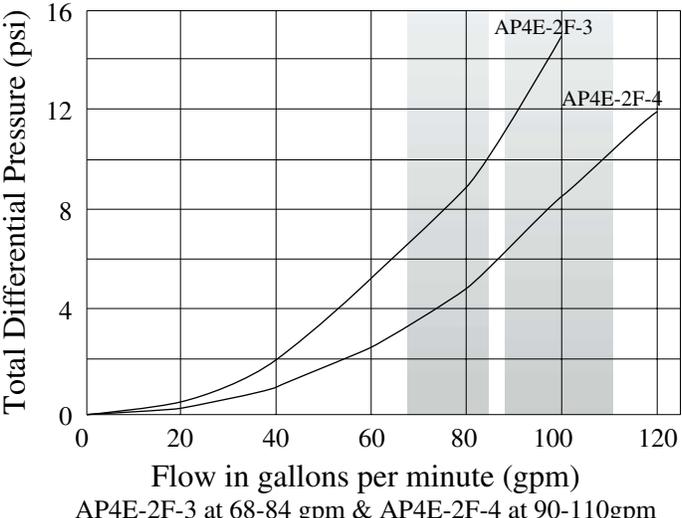


2" Filter

Specification

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 2 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by unscrewing and shall include an O-ring seal. An additional 3/4" MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless, providing a 60.8 square inch filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 2" filter shall be Geoflow model number AP4E-2F-3 or AP4E-2F-4.

Flow vs. Pressure





GEO CONTROLLERS

Geo controllers are the brain in the system, utilizing a programmable logic controller (PLC) to activate the pumps cycles, zone valves and flush valves when needed. See the table below for the control panel that fits your application.

All Geo controllers have the following built-in log functions:

- Elapsed time meter (ETM)
- Pump events
- Peak timer events
- High level alarm events
- Power failure events

Note: ETM and pump events are recorded whenever contactor is energized.

Float Functions GEO Controllers

Floats	Functions
<p>High Level Alarm Float</p>	<p>Float raised - Alarm enable.</p> <p>Activates the audible and visual alarm when lifted. Audible alarm may be silenced by pressing the illuminated "PUSH TO SILENCE" button. The audible alarm reactivates after 12 hours if the alarm condition is not resolved. The alarm light will remain on until the float is lowered.</p>
<p>Secondary Timer On/Off Float</p>	<p>Float raised - Peak Timer enable.</p> <p>The Peak timer will cycle the pump(s) more frequently. The Peak Timer function will remain active until the Primary Timer enable float lowers. When the Peak Timer function has been completed and the Primary Timer enable float is reactivated, normal timer operation will resume.</p>
<p>Primary Timer On/Off Float</p>	<p>Float raised - Timer enable.</p> <p>The Primary Timer will control pump cycles, beginning with the off cycle. Note: On duplex panels the pumps will alternate with each timer cycle.</p>
<p>Redundant Off & Low Level alarm float</p>	<p>Float raised - Pump enable.</p> <p>Float lowered - Pump disable. Flashing visual & audible alarm enable.</p> <p>This is a secondary off float that will prevent the operation of the pump if the water level in the tank gets too low. Pumping will be disabled in both the automatic and manual modes. This float also activates the visual and audible alarms. Audible alarm may be silenced by pressing the illuminated "PUSH TO SILENCE" button. The audible alarm reactivates after 12 hours if the alarm condition is not resolved. The flashing alarm light will remain on until the float is raised. When raised, this float will enable operation of the pump.</p>

Choose a GEO controller:

Step 1: Number of zones in dispersal field.

- Single zone. - Go to GEO1 table below.
- Two to four zones. - Zones activated hydraulically with indexing valves. Go to GEO1 table.
- Zones activated electrically with solenoid valves. Go to GEO4 table.
- Five to eight zones. - Zones activated hydraulically with indexing valves. Go to GEO1 table.
- Zones activated electrically with solenoid valves. Go to GEO8 table.
- More than 8 zones. - Zones activated hydraulically with indexing valves. Go to GEO1 table.
- Zones activated electrically with solenoid valves. Special order.
- Zones activated with index & solenoid valve combinations can be accommodated. Please call Geoflow, Inc.

Step 2: Voltage.

Determine the required pump voltage.
115vac (max 3/4hp; 1phase pump) or 230vac (max 2hp; 1phase pump).
Pumps must have internal capacitors. Any pumps requiring external capacitor kits will be special order. Capacitor kits and dimensions must be provided by pump manufacturer.

Step 3: Number of pumps.

Choose one pump (simplex) or two pumps (duplex).

Step 4: Flushing operation.

Choose manual or electronic field and filter flushing. Geoflow requires all direct septic systems use electronic flushing. (Manual flushing not available on GEO4 or GEO8 panels).

GEO 1 Table

Step 1	Step 2	Step 3	Step 4	Part Number
GEO1	115vac	Simplex	Manual	Geo1-115v-Sim-Man
			Auto	Geo1-115v-Sim-Aut
		Duplex	Manual	Geo1-115v-Dup-Man
			Auto	Geo1-115v-Dup-Aut
	230vac	Simplex	Manual	Geo1-230v-Sim-Man
			Auto	Geo1-230v-Sim-Aut
		Duplex	Manual	Geo1-230v-Dup-Man
			Auto	Geo1-230v-Dup-Aut

GEO 4 Table

Step 1	Step 2	Step 3	Step 4	Part Number
GEO4	115vac	Simplex	Auto	Geo4-115v-Sim-Aut
		Duplex	Auto	Geo4-115v-Dup-Aut
	230vac	Simplex	Auto	Geo4-230v-Sim-Aut
		Duplex	Auto	Geo4-230v-Dup-Aut

GEO 8 Table

Step 1	Step 2	Step 3	Step 4	Part Number
GEO8	115 vac	Simplex	Auto	Geo8-115v-Sim-Aut
		Duplex	Auto	Geo8-115v-Dup-Aut
	230 vac	Simplex	Auto	Geo8-230v-Sim-Aut
		Duplex	Auto	Geo8-230v-Dup-Aut

GEO1 MANUAL CONTROLLERS

The Primary Timer (float 2-activated) controls the pump dose cycle during normal operating conditions. During high flow conditions the pump dosing cycles will be controlled by the Peak Timer (float 3 - activated). The Peak Timer off is typically set to trigger more frequent flow than the Primary Timer off setting.

If *duplex pump* option is chosen, the pumps are alternated every pump cycle and never operate simultaneously. There is a selection switch for pump 1, pump 2 or alternation. This allows one pump to be taken out of service for maintenance without affecting the operation of the system.

Pump dosing cycles are controlled by the timers when the H-O-A switch is in the auto position. Under normal conditions the Primary Timer (float 2) will control the pump(s). During high flow conditions, the Peak Timer (float 3) will control the pump(s). The Peak Timer will cycle the pump more frequently than the Primary Timer (field adjustable). The pump will dose for the same amount of time as it does when operated by the Primary Timer but the time in between doses, or the Peak timer “off time”, will be 75% of that of the Primary Timer “off time”. Factory settings (field adjustable) are 1 hr 55 minutes off and 5 minutes on for Primary Timer and Peak Timer is set to 1 hr 25 minutes off (1 hr 55 mins x 75%) and 5 minutes on. Consequently peak doses are more frequent than normal.

Hydraulically activated zone valve(s) will index each time the PLC calls for a dose. Each time the pump is called for another zone is dosed. The controller does not dose all zones sequentially as “one” dose and ignores the fact that there are multiple zones for the purpose of dosing. For example if the Primary Timer is programmed to be off for 1 hour, on for 5 minutes and there are four zones, each zone will get 6 doses - five minutes in length - in a 24-hour period. The controller will dose a single zone every hour and will not dose all zones every hour.

GEO AUTOMATIC CONTROLLERS

The Primary Timer (float 2 activated) controls the pump dose cycle during normal operating conditions. During high flow conditions the pump dosing cycles will be controlled by the Peak Timer (float 3 activated).

If *duplex pump* option is chosen, the pumps are alternated every pump cycle and never operate simultaneously. There is a selection switch for pump 1, pump 2 or alternation. This allows one pump to be taken out of service for maintenance without affecting the operation of the system. *The Vortex Filter flush* valve will open for 15 seconds (field adjustable) at the end of the pump cycle to allow the filter to self-flush. When the vortex filter flush is complete, the filter flush valve will close and the system drain function will begin.

Pump dosing cycles are controlled by the timers when the H-O-A switch is in the auto position. Under normal conditions the Primary Timer (float 2) will control the pump. During high flow conditions, the Peak Timer (float 3) will control the pump. The Peak Timer will cycle the pump more frequently than the Primary Timer . The pump will dose for the same amount of time as it does when operated by the Primary Timer but the time in between doses, or the Peak Timer “off time”, will be 75% that of the Primary Timer “off time”. Factory settings (field adjustable) are 1 hr 55 minutes off and 5 minutes on for Primary Timer and Peak Timer is set to 1 hr 25 minutes off (1 hr 55 mins x 75%) and 5 minutes on.

Zone valve(s) will open when the PLC calls for a dose or flush. These can be electrically operated solenoid valves (requires GEO4 or GEO8) or hydraulically activated index valves (used with GEO1). Each time the pump is called for another zone is dosed. The controller does not dose all zones sequentially as “one” dose but rather ignores the fact that there are multiple zones for the purpose of dosing. The total doses of all zones in a 24-hour period must be considered when setting the “off” timer(s). After the pump is deactivated the electrically activated solenoid flush valve will remain open for five minutes (field adjustable) to allow for drainage of the supply line and return line.

If hydraulically activated index valve is used, be sure to drain the supply line in freezing climates.

If hydraulically activated index valves are used in combination with a solenoid field flush valve, a field setting for number of zones and number of zone valves is available.

Field flush valve will open at the end of the dosing cycle. The pump will continue to run for 5 seconds (field adjustable) to accommodate the opening of this valve. After the pump is deactivated the field flush valve will remain open for five minutes (field adjustable) to allow for drainage of the return line in freezing conditions. It is best to clock the length of time it takes the return flush line to drain and use this to set your drain time.

The activated zone valve remains open at the end of the dose for same “ # ” minutes as return flush and filter flush valves to accommodate drainage of supply line.

To periodically *flush the dripfield*, after 10 dosing cycles (field adjustable) the pump will operate for 5 minutes (field adjustable) with the field flush valve open. The field flush cycle will repeat until all zones have been flushed. This operation will also occur after a power outage. This is achieved by correctly inputting number of zone valves (if applicable) and number of zones during setting of the controller values.

GEO Panel Components:

- Siemen’s Logo programmable logic module for timing and controls.
- Contactor and circuit breaker for pump (115VAC; max 3/4hp; 1 phase pump or 230VAC; max 2hp; 1 phase pump). Pumps must have built in capacitors. (External capacitor kits are special order).
- Hand-Off-Auto (H-O-A) switches for pump(s) and valve(s) operation.
- Connections/contacts for normally closed 24 VAC valves. (Contacts for normally open valves may be special ordered.)
- Elapsed time meter and cycle counter for pump monitoring built in to PLC.
- Circuit breaker for control power.
- Surge arrestor.
- NEMA 4 X fiberglass enclosure.
- UL listed control panel.

GEO Wiring

- Control voltage input is 115 VAC for all GEO1 and GEO4 panels.
- Output to valve(s) is 24 VAC.

Telemetry and SCADA control systems available. Please contact Geoflow for custom panel information.



SOLENOID VALVES

Description

The Solenoid Valve is electrically operated and used as zone valves and to flush the dripfield and Vortex filter. It is normally closed, and in the event of a power failure the valve closes.

Features

Unique Dual Ported Diaphragm greatly minimizes clogging. In operation, the diaphragm ports constantly flex, inhibiting sand, silt and debris from blocking the valve action.

The porting design also permits equal pressure on both sides of the diaphragm wall, regardless of line pressure when valve is not operating, and nearly equal pressure across the wall when operating. This feature prevents diaphragm "stretching", a common cause of valve failure in valves that are ported through the seat.

The DW Valve diaphragm is made of nylon fabric reinforced Buna-N rubber; a grooved rib interlocks with cover and body to prevent leakage.

Nylon exhaust orifice is non-corrosive and has an opening sized larger than the diaphragm ports so that any pieces of sand or silt passing through the diaphragm will not be trapped beneath the solenoid actuator.

Solenoid is constructed of molded epoxy resin having no carbon steel components exposed thereby eliminating possible external corrosion and deterioration. Solenoid is completely waterproof, with an O-ring seal, and complies with NEC Class II circuit requirements for 24V a.c. operation (also operates on 12 volts d.c. up to 75 psi).

The actuator is teflon coated stainless steel and brass with a molded-in place rubber exhaust port seal; a stainless steel spring assures positive seating.

High strength plastic glass-filled body and cover designed to operate in heavy duty commercial applications. Stainless steel 1/4 inch cover bolts and mating brass body inserts make re-assembly easy.

Shock cone on diaphragm seat eliminates water hammer in all except extreme cases.

Flow control. A brass, non-rising type flow control stem for throttling the valve from full open to close positions.

Manual bleed lever. An easy-to-use, hand operated control bleeds valve to downstream; has stops for open and closed positions.

Operating Data

Cold water working pressure: 150 psi

The DW Valve has excellent low flow characteristics ideally suited for dripfield and Vortex filter applications.

Installation

Teflon tape is recommended. 1 inch FIP can be bushed to 3/4 inch. 1-1/2 inch FIP can be bushed to 1-1/4 inch. International threads. (Specify ISO).

The manual bleed lever should always be in the horizontal position and the dial on top should be free spinning for valve to operate automatically. Clockwise rotation closes valve.

ELECTRICAL

Wiring requires a single lead from the controller to each solenoid valve, plus a common neutral to all solenoids. Type UF wire, UL listed, is recommended for all hookups.

24 VAC/60 Hz
Inrush: 9.86 VA
Holding: 5.69 VA

24 VAC/50 Hz
Inrush: 10.7 VA
Holding: 7.5 VA

Pressure loss through Valves (in psi)

GPM	SVLV-100	SVLV-150	SVLV-200
0-4	1.2 max.		
6	1.4 psi		
8	1.6		
10	1.7		
12	1.8		
14	1.9		
16	2.0		
18	2.1		
20	2.3	1.3 psi	
22	2.5	1.4	
24	2.8	1.5	
26	3.2	1.6	
28	3.7	1.7	
30	4.3	1.9	
32	4.9	2.1	
34	5.6	2.3	
36	6.3	2.5	
38	7.0	2.8	
40	7.7	3.0	2.3 psi
42	8.4	3.3	2.3
44	9.1	3.6	2.4
46	9.9	3.9	2.4
48	10.7	4.2	2.5
50	11.5	4.6	2.6
52		5.0	2.6
54		5.4	2.7
56		5.8	2.7
58		6.2	2.8
60		6.7	2.9
70		9.5	3.3
80		13.0	3.4
90			4.2
100			5.2
110			6.7
120			7.7
130			8.8

Note. Wire sizes that are too small can cause voltage to drop below the minimum required to operate controllers and valves.

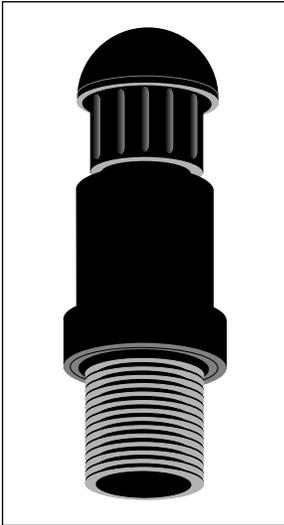
Do not use nominal voltage ratings listed above for sizing of valve wire. See wire-sizing tables below based on operating pressure and wire length.

Wire Size—1 valve per station.
Input to controller is 115 V.a.c.

Maximum length of wire run in feet from control to valve

AWG size		Static pressure not exceeding				
Diameter No.	In.	75 psi	85 psi	100 psi	125 psi	160 psi
18	0.040'	2200'	2000'	1600'	1,100'	700'
16	0.051'	3600'	3200'	2500'	1800'	1100'
14	0.064'	5700'	5000'	4000'	3000'	1700'
12	0.081'	9000'	8000'	6400'	4700'	2800'
10	0.102'	14000'	12700'	10200'	7400'	4400'
8	0.129'	22700'	20200'	16200'	11800'	7000'
MULTIPLYING FACTOR: 2 valves per station *		0.43	0.40	0.41	0.38	0.31

* Use this multiplying factor only in the event two valves will be operating simultaneously.

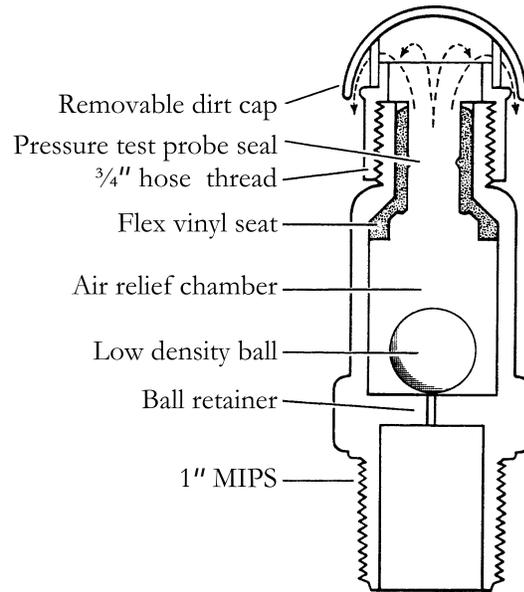


AIR VACUUM BREAKERS

Description

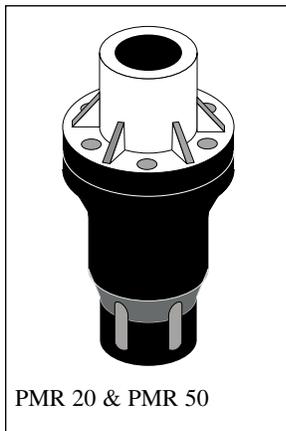
Air Vacuum Breakers are installed at the high points of the WASTEFLOW dripfield to keep soil from being sucked into the drip emitters due to back siphoning or backpressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in freezing conditions. Use one on the high end of the supply manifold and one at the high point of the flush manifold and any other high points in the system.

- Instant and continuous vacuum relief
- Non-continuous air relief
- Seals tight at 5 psi
- Durable, weather resistant
- Readily accessible pressure test point
- Easy to install
- Removable dirt cover
- Maximum flow of 50 gpm



Air Vacuum Specification

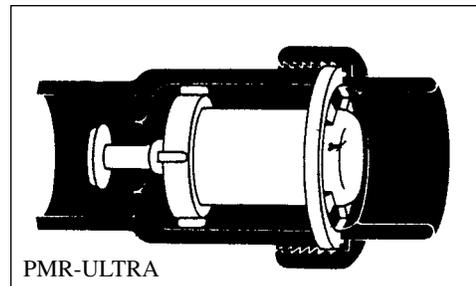
The air vacuum relief valve provides instant and continuous vacuum relief and non-continuous air relief. Both the body and the removable dirt cover shall be constructed of molded plastic. The body and the dirt cover shall be connected with a 3/4 inch hose thread. The ball shall be constructed of low density plastic and the internal seat shall be constructed of vinyl. The air vacuum relief valve shall seal at 5 psi. Inlet size shall be a 1 inch male pipe thread. The air vent shall be Geoflow item number APVBK-1.



Description

The regulators are preset to regulate pressure to the field. These are recommended with Wasteflow Classic and optional with Wasteflow PC. This is the first component of the supply manifold. Under normal operating conditions, pressure in the drip lines should be:

10 psi to 45 psi for WASTEFLOW Classic and WASTEFLOW PC Dripline.



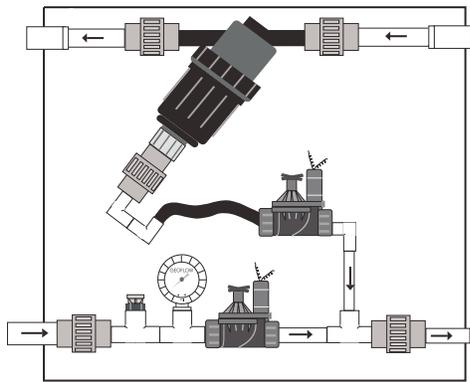
ITEM NUMBER	OUTLET PRESSURE	FLOW RANGE	MAX. INLET PRESSURES	INLET SIZE	OUTLET SIZE
PMR-20LF	20 psi	1/10 - 8 gpm	150 psi	3/4" FIPT	3/4" FIPT
PMR-20MF	20 psi	2 - 20 gpm	150 psi	1" FIPT	1" FIPT
PMR-20HF	20 psi	10 - 32 gpm	150 psi	1.25" FIPT	1" FIPT
PMR-50MF	50 psi	2 - 20 gpm	150 psi	1" FIPT	1" FIPT
PMR-50HF	50 psi	10 - 32 gpm	150 psi	1.25" FIPT	1" FIPT
PMR-ULTRA	20 psi	12 - 75 gpm	20 - 75 psi	1.5" socket	1.5" socket

PMR 20 and PMR 50 Specification

Pressure regulator shall be designed to handle steady inlet pressures of 150 psi and withstand severe water hammer extremes. It shall handle flow rates between ___ and ___ gpm. Flow restriction shall be negligible until the factory preset operating pressure of ___psi is reached. Regulating accuracy shall be within +/- 6%. Inlet size shall be ___ FIPT. Outlet size shall be ___FIPT. Pressure regulator shall be constructed of high impact engineering grade thermoplastics. Regulator shall be accomplished by a fixed stainless steel compression spring enclosed in a chamber separate from the normal water passage. Each regulator shall be water tested for accuracy. Preset pressure regulators shall be Geoflow model no. PMR - ___.

PMR ULTRA Specification

Pressure regulator shall be designed to handle steady inlet pressures of 150 psi and withstand severe water hammer extremes. It shall handle flow rates between 12 and 75 gpm. Flow restriction shall be negligible until the factory preset operating pressure of 20 psi is reached. Regulating accuracy shall be within +/- 6%. Inlet and outlet size shall be 1.5" socket. Pressure regulator shall be constructed of high impact ABS and delrin materials. Each regulator shall be water tested for accuracy. Pressure regulators shall be Geoflow model number PMR-ULTRA.



Automatic Headwork

HEADWORKS

Description

Geoflow accessory parts are now available pre-assembled with either manual or automatic flush configurations. Each headwork box includes the following:

- Vortex filter
- Filter flush valve
- Field flush valve
- Pressure gauge
- Headwork air vent
- Headwork box

Wasteflow Headworks Ultra includes flow meter and pressure gauges across the filter and can be special ordered with zone valves pre-assembled in the box.

Note: Air vents, dripline, and fittings are required to complete the Geoflow disposal system. Pressure regulators are recommended with Wasteflow Classic.

Operation

Field and filter flushing can be done manually or automatically.

Manual Headworks

Both valves should be cracked open slightly at all times to allow a constant flush. Make sure pressure at the Headwork gauge is at least 3 psi, and if not, close the valves slightly to increase pressure. The valves need to be open fully for a complete system flush twice a year.

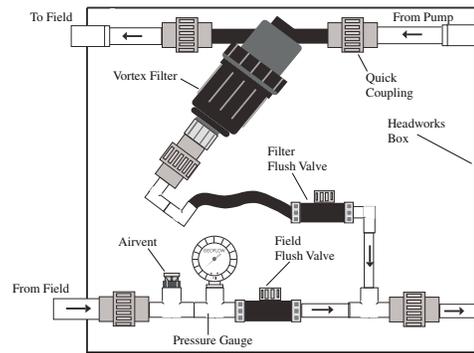
Automatic Headworks

Both valves are activated electrically. Geoflow recommends using a GEO controller to activate your flush cycles in the Automatic Headworks.

Flow Rates

Wasteflow Headworks and Wasteflow Headworks Ultra

Model No.	Min. Flow	Max. Flow
WHW-.75F-Aut/Man	4 gpm	11 gpm
WHW-1F-Aut/Man	10 gpm	28 gpm
WHW-1.5F-3-Aut	34 gpm	42 gpm
WHW-1.5F-4-Aut	45 gpm	55 gpm
WHW-2F-3-Aut	68 gpm	84 gpm
WHW-2F-4-Aut	90 gpm	110 gpm



Manual Headwork

HEADWORKS

Pounds per square inch (psi) per 100 ft. of pipe

Flow GPM	1/2"		3/4"		1"		1 1/4"		1 1/2"	
	Velocity FPS	Pressure Drop PSI								
1	1.05	0.43	0.60	0.11	0.37	0.03				
2	2.11	1.55	1.2	0.39	0.74	0.12	0.43	0.03		
3	3.17	3.27	1.8	0.83	1.11	0.26	0.64	0.07	0.47	0.03
4	4.22	5.57	2.41	1.42	1.48	0.44	0.86	0.11	0.63	0.05
5	5.28	8.42	3.01	2.15	1.86	0.66	1.07	0.17	0.79	0.08
6	6.33	11.81	3.61	3.01	2.23	0.93	1.29	0.24	0.95	0.11
8	8.44	20.10	4.81	5.12	2.97	1.58	1.72	0.42	1.26	0.20
10	10.55	30.37	6.02	7.73	3.71	2.39	2.15	0.63	1.58	0.30
15			9.02	16.37	5.57	5.06	3.22	1.33	2.36	0.63
20					7.42	8.61	4.29	2.27	3.15	1.07
25					9.28	13.01	5.36	3.42	3.94	1.63
30					11.14	18.22	6.43	4.80	4.73	2.27
35							7.51	6.38	5.52	3.01
40							8.58	8.17	6.30	3.88
45							9.65	10.16	7.09	4.80
50							10.72	12.35	7.88	5.83
60									9.46	8.17
70									11.03	10.87

Flow GPM	2" Pipe		2 1/2" Pipe		3" Pipe		4" Pipe		6" Pipe	
	Velocity FPS	Pressure Drop PSI								
6	0.57	0.03								
8	0.76	0.06	0.54	0.02						
10	0.96	0.09	0.67	0.04						
15	1.43	0.19	1.01	0.08	0.65	0.03				
20	1.91	0.32	1.34	0.13	0.87	0.05				
25	2.39	0.48	1.67	0.20	1.08	0.07				
30	2.87	0.67	2.01	0.28	1.30	0.10				
35	3.35	0.89	2.35	0.38	1.52	0.13	0.88	0.03		
40	3.82	1.14	2.64	0.48	1.73	0.17	1.01	0.04		
45	4.30	1.42	3.01	0.60	1.95	0.21	1.13	0.05		
50	4.78	1.73	3.35	0.73	2.17	0.25	1.26	0.07		
60	5.74	2.42	4.02	1.02	2.60	0.35	1.51	0.09		
70	6.69	3.22	4.69	1.36	3.04	0.47	1.76	0.12		
80	7.65	4.13	5.36	1.74	3.47	0.60	2.02	0.16		
90	8.60	5.13	6.03	2.16	3.91	0.75	2.27	0.20		
100	9.56	6.23	6.70	2.63	4.34	0.91	2.52	0.24	1.11	0.03
125	11.95	9.42	8.38	3.97	5.42	1.38	3.15	0.37	1.39	0.05
150			10.05	5.56	6.51	1.93	3.78	0.51	1.67	0.07
175					7.59	2.57	4.41	0.68	1.94	0.09
200					8.68	3.40	5.04	0.90	2.22	0.12

Optimum velocity is 2 - 5 ft. per second.

The pipe is Schedule 40

ASTM D 1785, D2672, D1784 Cell Class 12454-A

PVC 40 FRICTION LOSS CHART

GEOFLOW'S WASTEFLOW® DRIP SYSTEM DISPERSES EFFLUENT BELOW THE GROUND SURFACE THROUGH 0.5" PRESSURIZED PIPES. PUT EFFLUENT

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REQUIRES NO GRAVEL. IT IS EASY TO INSTALL DIRECTLY INTO INDIGENOUS SOILS AND THE NATURAL LANDSCAPE CAN BE MAINTAINED

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CAN BE RE-USED 💧 PUT EFFLUENT IN IT'S PLACE UNDERGROUND GEOFLOW'S WASTEFLOW® DRIP SYSTEM DISPERSES EFFLUENT BELOW T

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SPACE WHILE NO **UPDATED JANUARY 2004 VERSION II** EFFLUENT CAN BE RE-USED 💧 GEOFLOW'S WASTEFLOW® DRIP SYSTEM DISPERS

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