Design, Installation and Operation Manual For Subsurface Drip Irrigation Systems Utilizing Aerobically Treated Wastewater

January 28, 2004

Prepared by B.L. Carlile, PhD, P.E. for Clearstream Wastewater Systems, Inc.

Design, Installation and Operation Manual
Subsurface Drip Irrigation System

Introduction……………………………………………………………………………………3

Components of the Aerobic Drip Irrigation System…………………………………3

Pretreatment System……………………………………………………………….3

Drip Irrigation Field Components …………………………………………….4

Drip Field Sizing and Design...4

Using Fill Material in the Drip Field……………………………………………..5

Complex Slopes………………………………………………………………………6

Design and Calculation Worksheets……………………………………………………7

Example Calculation ……………………………………………………………….8

Table 1……………………………………………………………………………………9

Examples 1-3……….. ………………………………………………………. ………10

Examples 4-6…………………………………………………..………………………11

Examples 7……………………………………………………………………………..12

Typical Drip Field Layout Drawing ………………………………………………………13

Typical Drip Field Layout Drawing w/Slope In Excess of 8% ……………………………14

Typical Drip Field Layout Drawing w/ 3% to 8% Slope………………………… ……….15

System Installation…………………………………………………………………………16

Operation, Inspection and Maintenance ……………………………………………………17

Pretreatment System ………………………………………………………………18

Drip Irrigation System ……………………………………………………...…19

Owners Guide for Maintenance and Operation ……………………………………………20

Trouble Shooting Guide ……………………………………………………………………21

Introduction

The Aerobic Drip Irrigation System disperses treated effluent through small drip irrigation tubing and emitters placed some six to twelve inches below the soil surface. A small trickle of treated wastewater is pumped through the system every one to four hours and discharged uniformly over a specified area to facilitate soil absorption of the water and allow maximum reuse of the water by lawn and landscape plants.

The Aerobic Drip Irrigation System has found its most favorable use on small lots with problem soil conditions such as high water tables, shallow depth to impervious layers, low-perc soils and steep slopes. For properties where surface irrigation of treated effluents is not acceptable, drip irrigation is a very viable alternative for homeowners who wish to reuse all of their water for landscape watering, or for lots where preservation of trees is a high priority.

It has been demonstrated that a well-designed Aerobic Drip Irrigation System with pretreatment to Class I effluent quality along with disinfection, separation distances to groundwater can be reduced to one foot and still achieve prescribed groundwater protection. A one and one-half foot separation will certainly meet any prescribed groundwater specifications. For sites where a two-foot separation to groundwater can be achieved, disinfection is normally not necessary.

This now allows the homeowner the availability of a system that can be installed at grade or with a minimum of a few inches of fill and still meet the regulatory standards without the eyesore or cost of construction of a mound system on problem soils.

Components of an Aerobic Drip Irrigation System

Pretreatment System

The wastewater pretreatment system must be designed to provide a high quality water to the field disposal system, including BOD_5 and TSS values of under 30 mg/l, fats, oils and grease values of under 20 mg/l and particulate material of less that 100 microns in size.

The components of the pretreatment system are:

1. Class I NSF Aerobic Treatment System with pretreatment tank not less than 50% of treatment unit's rated capacity. Treatment system must include an air compressor feeding an aeration tank with a fine bubble diffuser and clarification chamber with a flow equalization weir.
2. Pump Tank.
3. Dosing pump and timer to allow small frequent doses of effluent throughout the day at two to four hour intervals.
4. Audio and visual alarm system activated upon high water levels in both the aeration tank clarifier and pump tank.
5. 100 micron (150 mesh) screen spin filter of ¾ inch or 1 inch in size with the screened solids returned to the pre-treatment tank.

Drip Irrigation Field Components

The field irrigation system includes:

1. A supply line - to carry water from the dosing tank to the supply header connected to each drip line in the field disposal area and a return line from the return footer connected to each drip line to return flushed water back to the pump tank. The drip lines are automatically flushed continually during each pump cycle then returning the flushed water back to the pump tank. The returned flushed water keeps the water in the pump tank in motion during the pumping cycle.
2. The spin filter assembly - will have a pressure gauge and a ball valve on the pump supply line to regulate the pressure to the spin filter between 30 to 35 psi. A pressure gauge and control valve installed on the discharge end of the flush line to measure and set pressure at a normal operating pressure of 15 to 20 psi in the drip lines.
3. Drip lines – the Aerobic Drip Irrigation System uses large passage, turbulent flow drip emitters for application of the wastewater to the field application area. The dripline emitters are pre-inserted in the tubing on 24 inch spacing. The emitters also have an EPA approved herbicide such as Rootguard® impregnated into the emitter to prohibit root intrusion into the emitter orifice.
4. Air vacuum breaker – to be installed at the high point of the drip field to prevent back-pressure in the lines when the system drains. The vacuum breakers are installed at or below grade level and **<u>must</u>** be in-closed inside a valve cover box with grade level lid access.
5. Check valves – may be required on the supply header and/or return manifold lines to prevent drainage to lower driplines when the system is de-pressurized. The check valve installed on the supply header will be a standard in-line flapper valve. Any check valve installed on the return flush line must be a pressure activated check valve that opens at 10 psi but shuts off flow when pressure is reduced. Check valves are recommended when the elevation between the lower and upper emitter lines exceeds five (5) feet. Wherever valves are installed a valve box to grade **<u>must</u>** also be installed to facilitate maintenance.
6. Alternating valves – a mechanical alternating valve may be necessary to divide very large fields into smaller equally sized fields for improved distribution. These valves may also be used to divide fields when elevation differences are greater than five feet within the field. Wherever valves are installed a valve box to grade **<u>must</u>** also be installed to facilitate maintenance.

Examples 1 – 7 (pages 10, 11 & 12) and the drawings entitled “Typical Drip Field Layout” (pages 13, 14 & 15) show the typical system components of the pretreatment system and the drip field layout for various conditions.

Drip Field Sizing and Design

Aerobic Drip Irrigation Systems have been successfully used for over the ten years based on the design hydraulics given in Table I (page 9) for natural soils. These values were initially developed by the author for Geoflow, Inc, an internationally recognized drip irrigation company and they have successfully used these values in their wastewater drip irrigation designs. These values also compare similarly to the latest State of Wisconsin code values, which were developed from the research of Dr. Jerry Tyler, a nationally recognized research scientist in the on-sit wastewater field.

While the loading values in Table I (page 9) may not agree in total with the dripfield sizing chart of all states, the values in Table I are based on basic soil principals and offer a very significant safety factor, even under the worst case conditions. The premise of the proposed soil loadings is that the instantaneous water application rate must not exceed the water absorption capacity of the soil. This minimum capacity of the soil is when the soil is saturated and is defined as the "saturated hydraulic conductivity". Wastewater application rates are then designed at approximately 8 percent of this saturated equilibrium.

By designing for a safety factor of 10 to 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.

The loading rates designated in Table I for irrigation guidelines are in general agreement with rates proposed for aerobic effluents, as developed by Dr. Tyler. Highly treated secondary effluents, as typical of a Class I aerobic treatment unit, can be applied at significantly higher rates without creating any clogging around the emitter orifice. By applying the low strength wastewater in short doses, six to twelve times per day near the soil surface, the soil dries quickly and the absorbed water percolates downward, minimizing the potential for effluent to surface.

The Aerobic Drip Irrigation system will generally have emitter lines installed on 2 foot centers with a 2 foot emitter spacing. Thus each emitter supplies a 2' x 2' area with a small dose of water each dosing cycle. Since the total run time of the pump is generally less than one hour per day for drip systems and this time is divided into six or more dosing cycles per day, each emitter, which discharges about 1 gallon per hour, will be applying a pint or less of water during each dose cycle

Using Fill Material in the Dripfield

Drip lines are generally installed at depths of 6 to 10 inches below the soil surface. Sometimes, due to soil limitations such as shallow depth to rock or other restrictive zones, additional fill material may be added to the site to facilitate installation of the drip lines and/or increase separation distances.

When fill material is used to create an aerobic zone for applied effluent, this soil material should be of the type identified as either of the first two soils shown in Table I. The natural soil surface should be prepared by removing all organic material from the surface and the first two or three inches of fill material applied should be incorporated into the natural soil. The loading rate of the drip field should be based on the soil hydraulic capacity of the natural soil, not the fill material. If the natural soil has less than a 12 inch depth to an impervious zone, then the soil loading rate should be reduced to the next lower loading rate.

The final shaping of the fill material should be to develop a slight convex or crowned shape to the surface such that water does not pond or pool anywhere in the field. The field should be seeded or sodded immediately following completion and watered to develop a vegetative cover as quickly as possible.

Complex Slopes

Drip lines should always be run parallel to the contour of the land. Each line should be installed near level or at least on a constant slope.. Avoid installing lines with high and low points along the same line. Where high points cannot be avoided in a single line, install a vacuum breaker at the highest point in the line.

When installing drip lines on steeper slopes where the level variation within a drip line zone exceeds six feet (greater than 8%), fewer longer lines are preferable over many short lines. Concentrate the most water at the top of the slope and use wider line spacing at the bottom of the slope. In the case of compound slopes steeper than 12% please consult Clearstream Wastewater Systems, Inc. or your local Professional Engineer for recommendations.

Always document the location on drip lines, headers, footers, check valves, alternating valves for facilitation of future repair efforts. All alternating valves and check valves **must** be placed in valve boxes that are visible at grade so that they can be reached for repair or replacement. Allow area for expansion of drip line field in event of drip field failure.

Design and Calculation Worksheet
(See next two pages)

Example Calculation

As an example calculation, the following parameters are provided:

Wastewater discharge (Q) – 450 GPD

Soil Conditions – silty clay loam, hydraulic conductivity of 0.4 in/hr
Percolation rate of 45-60 min/in

Design loading rate (DLR) – 0.3 gal / ft^2 / day (see Table 1 page 9)

A. Field area required = (Q / DLR)
450 GPD / 0.3 GPD / ft^2 = 1,500 ft^2

B. Emitter line spacing = 2 feet (standard spacing, but 6” or 12” is possible)

C. Emitter line required (A / B) = 1,500 ft^2 / 2 = 750 ft
(If C is greater than 900’ it is recommended that the fields be divided into equal zones using an alternating valve between them)

D. Emitter spacing = 2 feet

E. Total number of emitters = (C / D) = 750 / 2 = 375 emitters

F. Emitter flow rate @ 20 psi = 1.30 GPH
(Ex. Geoflow Wasteflow Classic Drip line)

G. Total emitter flow = (E x F) = 375 emitters x 1.30 GPH = 488 GPH / 60 minutes = 8.1 GPM

H. Total pumping time = (Q / G) = 450 GPD / 8.1 GPM = 55.6 min (use 56 min)

I. Doses per day = 12 (every 2 hours)

J. Gallons per dose = (Q / I) = 450 GPD / 12 doses/day = 37.5 gallons per dose

K. Pumping time per dose = (J / G) = 37.5 gallons / 8.1 GPM = 4.6 min (use 5.0 min)

L. Set control box cycle timer for 5.0 minutes “ON” and 2 hours “OFF”.

Note: There is a brief time after the timer activates and the pump is running and the field has not totally pressurized. It may be necessary to adjust the cycle dose time upward slightly to compensate for this delay. This amount of time should be checked during the first test run after completing installation

Design and Calculation Worksheet

As an example calculation, the following parameters are provided:

Wastewater discharge (Q) – ______________________

Soil Conditions – ________________________________

Design loading rate (DLR) – ______________________ (see Table 1 page 9)

A. Field area required (Q/DLR) ___________________

B Emitter line spacing = 2 feet (standard spacing, but 6" or 12" is possible)

C. Emitter line required (A / B) = __________________
(If C is greater than 900' it is recommended that the fields be divided into equal zones using an alternating valve between them)

D. Emitter spacing = 2 feet

E. Total number of emitters = (C/ D) = ___________________ emitters

F. Emitter flow rate @ 20 psi = _________ GPH
(Ex. Geoflow Wasteflow Classic Drip line)

G. Total emitter flow = (E x F) = ____ emitters x 1.30 GPH = _____ GPH / 60 minutes = ____ GPM

H. Total pumping time = (Q / G) = ____ GPD / ____ GPM = ____ min (use a rounded up number)

I. Doses per day = ___ (every ___ hours)

J. Gallons per dose = (Q / I) = ____ GPD / ____ doses/day = _____ gallons per dose

K. Pumping time per dose = (J / G) = ____ gallons / ____ GPM = ___ min (use rounded up minutes)

L. Set control box cycle timer for ___ minutes "ON" and ___ hours "OFF".

Note: There is a brief time after the timer activates and the pump is running and the field has not totally pressurized. It may be necessary to adjust the cycle dose time upward slightly to compensate for this delay. This amount of time should be checked during the first test run after completing installation

Table 1. Recommended Soil Loading Rates for Surface and Sub Surface Irrigation Systems using Class I Aerobic Effluent

	Hydraulic Conductivity	Estimated Percolation rate	Design Loading Rate		Total Area Required	
			Natural Soil	Disturbed Soil	Natural Soil	Disturbed Soil
Soil Type	Inches/hour	Minutes/inch	Gal/ft²/day		ft²gal/day	
Sands and Loamy Sands	>1.2	<10	1.2	1.2	83	83
Sandy Loams and Loams	0.75-1.2	10-30	0.8	0.6	125	167
Clay Loams	0.5-0.75	30-45	0.5	0.3	200	333
Silty Clay Loams	0.3-0.5	45-60	0.3	0.15	333	667
Clays-Low to Moderate Shrink-Swell Potential	0.2-0.3	60-90	0.15	0.07	500	1000
Clays-Moderate to High Shrink-Swell Potential	0.06-0.2	90-120	0.08	0.04	1250	2500
Clays-High to Very High Shrink-Swell Potential	0.02-0.06	>120	0.04	0.02	2500	5000

Notes:

1. **Soil types shall be based on the most restrictive layer in the top two feet of the soil profile.**
2. **Disturbed soil includes sites with little or no vegetative cover, sites compacted by heavy equipment, sites with numerous ruts from vehicular traffic and sites where or more inches of topsoil has been removed.**
3. **If fill material is to be placed over the disposal area, it should be only of the soil types 1 and 2 and should be incorporated into the top few inches of the natural soil.**
4. **These recommended loading rates assume a treated effluent with BOD5 and TSS values of less than 30mg/l.**

Example #1:

Spin Filter Assembly Clearstream Model 1100

Example #2:

Return Footer Control Assembly Clearstream Model 1100

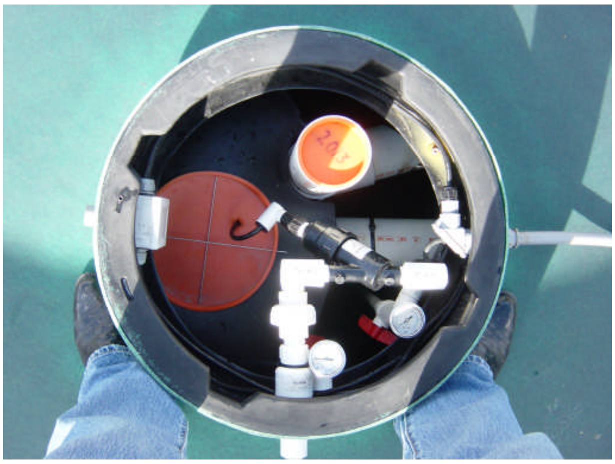
Example #3:

Drip line connection to Tee Clearstream Model #P4110 & P4552

Drip line coupling installation Clearstream Model #P4551

Example #4:

Vacuum Breaker w/Street El
Clearstream Model #P4113



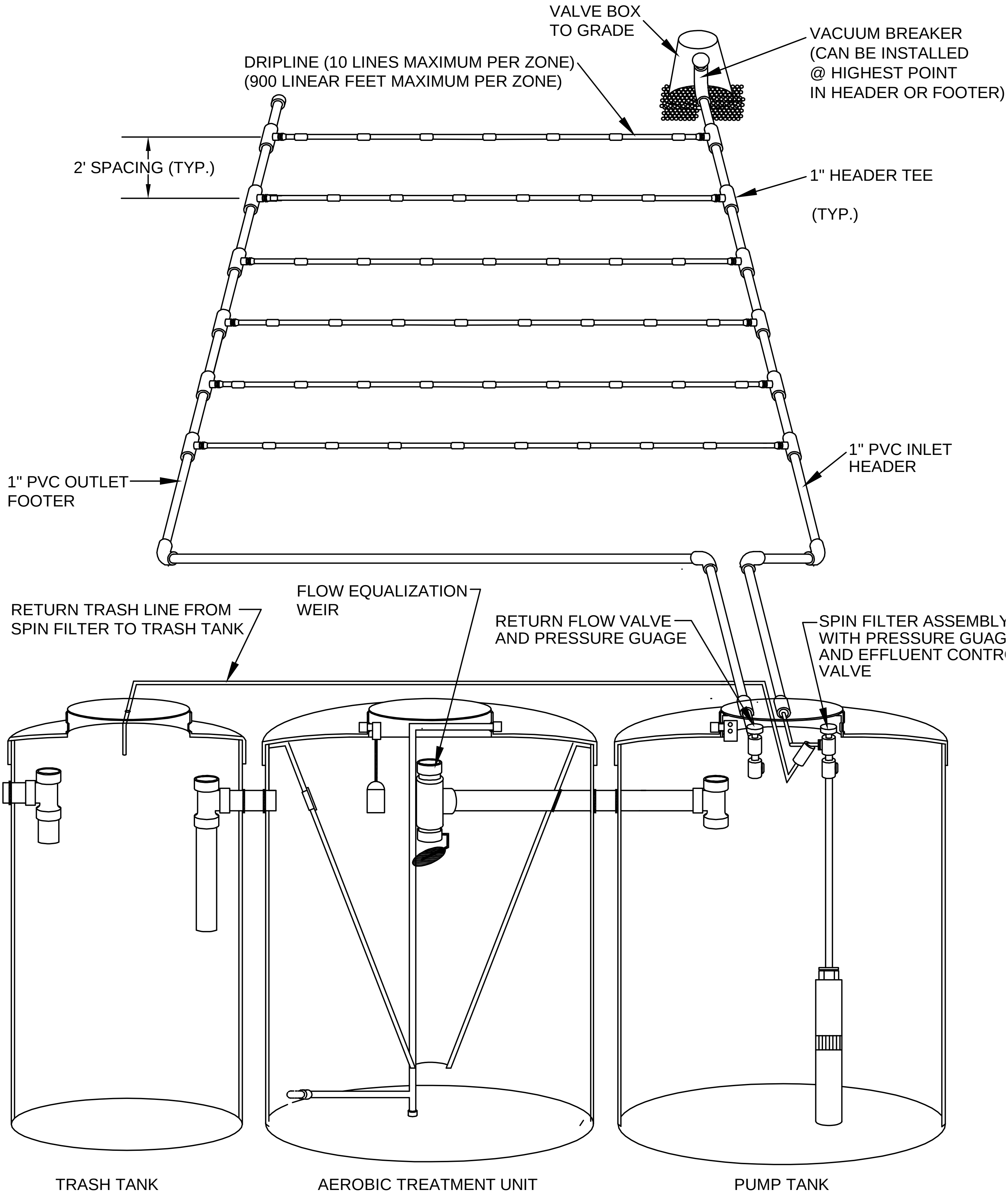
Example #5:

Drip System Assembly
Installation in System Riser
Clearstream Model #1100

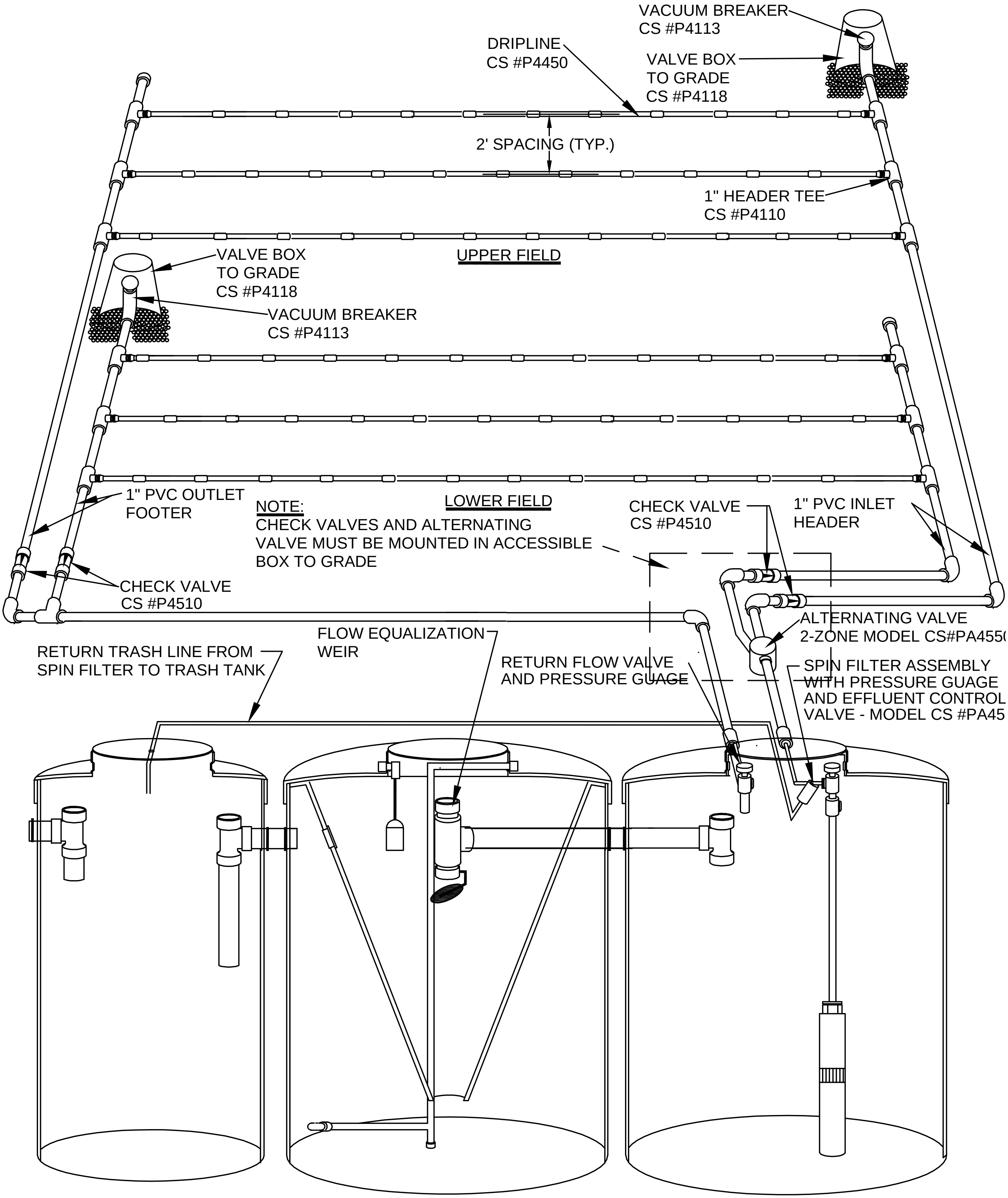
Example #6

Drip Line w/ Turbulent Path Emitter
Clearstream Model # P4450

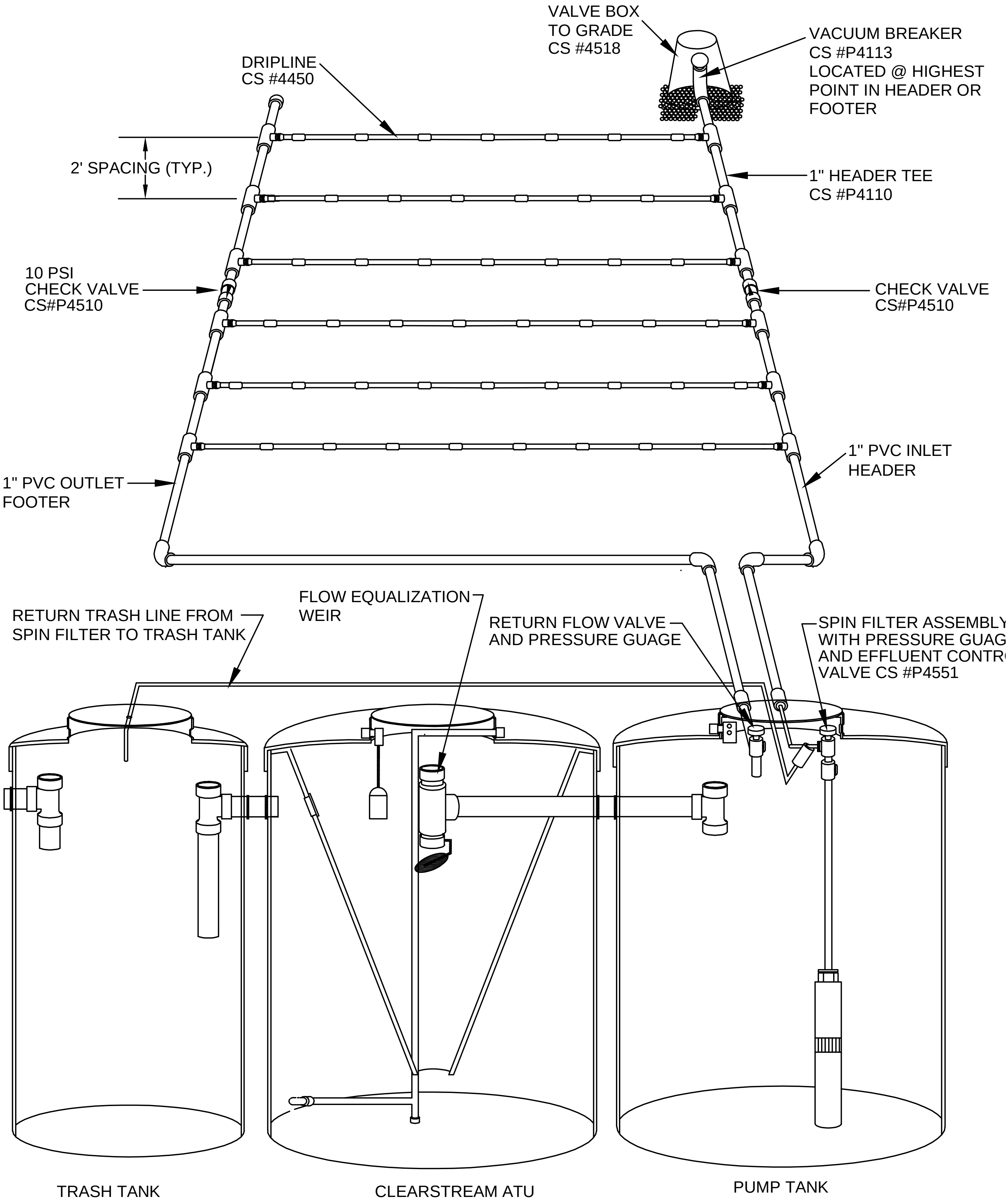
Example #7:
Mechanical Alternating Valve
Clearstream Model #P4524



TYPICAL DRIPFIELD LAYOUT



DRAWING #2 TYPICAL DRIPFIELD LAYOUT W/ SLOPE IN EXCESS OF 8%



DRAWING #3 TYPICAL DRIPFIELD LAYOUT W/3% - 8% SLOPE

System Installation

All Aerobic Drip Irrigation Systems require:

A properly sized and installed pretreatment system, including a primary treatment tank sized at least 50% of the rated capacity of the aerobic tank; a properly sized aerobic treatment unit and a pump tank that has a storage capacity adequate to store the disposal water daily until dosing to field.

The aerobic unit is to be installed according to the installation instructions provided by the manufacturer.

Once the treatment unit and pump tank are installed, proceed as follows: (the following pertains to installation of Clearstream NSF aerobic treatment systems)

a) Install the P-20 irrigation pump in the tank. Connect the pump to a one inch PVC Sch 40 discharge pipe by using a 11/4 to 1 inch reducing bushing in the pump discharge outlet.

b) Attach the high-water alarm float and the on-off float at the proper locations on the discharge pipe and carefully place the pump on the bottom of the pump tank. Insure that the low-water cutoff float is above the pump intake screen to prevent dry-running and the alarm float is located at an elevation that provides adequate storage to comply with the State's regulations after the alarm is activated.

c) The black high-water alarm float and the on-off float are then connected to the appropriate terminals in a Clearstream Model P5616 control box mounted in the vicinity of the pump tank. The wiring should be installed by a certified electrician in accordance with the National Electrical Code.

d) A Clearstream Model CS-1100 spin filter with a 150 mesh filter screen is installed on the pump discharge line inside the tank riser. A 100 psi pressure gauge and control valve in installed between the pump and spin filter. Typically, the line pressure is set @ 30 psi going into the filter, but the pressure may be higher or lower after balancing between this valve and the return valve. The return line pressure is typically set @ 20 psi. The unfiltered discharge from the spin filter is plumbed back into the trash tank and the filtered effluent is sent to the drip irrigation field.

e) In the Aerobic Drip Irrigation System, a return line is installed from the manifold at the discharge end of each drip line back to the pump tank and the drip lines flushed continuously during each pump cycle. A control valve and 100 psi pressure gauge is installed on the return line at the pump tank and the pressure set at 15 to 20 psi in the drip field. It is appropriate to return this water to the pump tank since it is the same quality water being supplied to the field.

f) Installation of the drip field is best facilitated by staking the four corners of the field to the design size with the top two corners at or near the same elevation. For best results, lay-out a field where the upper corners are no more than 5-foot elevation above the lower corners. Insure that no single line is longer than 150 feet, no more than 10 lines and no field larger than a total of 900 linear feet of drip pipe. If a field is designed that has more than 900 linear feet of pipe, an alternating valve should be used to divide the field into two or more equal fields

g) Install the properly sized PVC supply line from the dosing tank, up hill through one lower and one upper corner stake of the application field. Mark a line between the two remaining corner stakes. Install the manifold for the flush line at the other end of the drip field and run this line back to the pump tank (see Typical Drip Field Layout – page 12).

h) Install the drip lines from the supply line trench to the marked line at the other end on 2-foot centers and at a depth as specified in the design plans but no deeper than 6 to 12 inches. Tape the ends of the drip lines until they are installed to prevent debris from entering the lines

i) Install tees in the supply line header lined up with each drip line. Connect the drip lines to the header using lockslip fittings as provided by the manufacturer. Install tees in the manifold at the other end of the drip lines and connect the lines to the manifold in a similar fashion as described above

j) Install a air vacuum breaker in the header line or in the discharge line at the highest point in the dripper lines zone and place a valve cover box over the breaker so that the cover box lid is at grade level.

k) Fill the pump tank with clean water, open the return flush valve, close the valve of the pump discharge re-circulation line and turn on the pump to flush the lines. Close the return flush valve with the pump on and open the valve of the pump discharge re-circulation line until 30 psi pressure shows on the discharge gauge then check the field and supply line connections for leaks. Open the return flush valve until 20 psi pressure is measured on the pressure gauge. To achieve 20 psi on this return gauge, close the valve on the pump discharge re-circulation line to allow it to increase pressure in the field until 20 psi is achieved on the return gauge. This balancing between the two valves will take only a short time, then run the system until the on-off float shuts off the pump and replace all tank covers and fasten with tamper resistant bolts.

l) Provide owner/operator with final as-built diagrams, flow measurements and pressure readings at startup.

Operation, Inspection and Maintenance

Pretreatment System

The pretreatment system, consisting of a trash tank and a Class I Aerobic Wastewater Treatment Plant, provides a high quality effluent for safe and reliable application in the drip irrigation system. While state regulatory requirements specify the pretreatment system to provide wastewater with a maximum of 30 mg/l BOD_5 and TSS, systems such as the Clearstream treatment unit, when coupled with the Model 1100 Spin Filter Assembly in the drip system, averaged 5 mg/l for BOD_5 and 6 mg/l TSS in the NSF Standard 40 test program.

Every homeowner or business owner who installs an Aerobic Wastewater Treatment System on their property will receive an Owner's Manual, which outlines the operation and maintenance requirements of the pretreatment system. This Manual also provides the name, address and phone number of the local service person that can provide service for the system.

Drip Irrigation System

Routine and Preventative Maintenance

To insure long-term, trouble free operation of the drip irrigation system, a routine and regularly scheduled maintenance program should be carried out according to the requirements of the State regulatory policies.

The maintenance program, as a minimum, should consist of the following activities:

1) Remove the spin filter and clean or install a new screen cartridge. The filter cartridge should be washed with a pressure hose from the outside toward the inside. If all bacterial scum is not removed by washing, then replace the cartridge.
2) Record the depth of water in the pump tank and turn on the pump and check the pressure on both the return line from the field and on the discharge line from the pump. The pressures should be the same as initially set when installed. If not, reset pressures on both gauges by use of the control valves.
3) While the pump is running, remove the lid from the valve cover boxes over the vacuum breakers and check for leaks. If the vacuum breaker is leaking, remove the cap of the vacuum breaker and press down on the ball to flush debris from the ball seat.
4) Check the drip field area for leaks or wet areas. If a leak is evident, repair as soon as possible. Note the condition of the field and any repairs made.
5) Turn off the pump and reset the control box for auto mode.
6) If a disinfection system is part of the drip system, check the chlorine level in the supply reservoir and replenish if low.
7) Inspect and maintain the pretreatment system as specified in the Owner's Manual.

Owner's Guide for Maintenance and Operation of the Drip Irrigation Field

The drip irrigation system is a grid design layout that disperses treated effluent below the ground through small pressurized ½" polyethylene pipes, installed at a shallow depth of 6 to 12 inches below the soil surface. The grid concept utilizes a supply and flush manifold at each end, creating a closed loop system. The emitters and pipe are placed on two- foot centers and provides an almost complete wetted subsurface area in most soil types.

Subsurface drip irrigation is a highly efficient method to dispose of effluent. Small, precise amounts of water are uniformly applied just under the soil surface from multiple points in the grid. This creates a most efficient system for both soil absorption of the water and transpiration by the growing vegetation.

Your drip irrigation system will provide for many years service in disposing of your generated wastewater while providing water for growing plants on the property. Some minimal maintenance and operation procedures should be followed, however, to allow the system to function most efficiently. Some of these recommendations are as follows:

- Establish a vegetative cover, either lawn grass or other ground cover immediately following installation. This will protect and stabilize the soil and enhance evapo-transpiration of the water.
- Do not drive any heavy equipment, including cars of trucks, over the drip irrigation field. Light equipment, such as lawn mowers and garden tractors can be safely driven over the field.
- Do not drive stakes or any sharp objects into the ground greater than 5-inch depth anywhere in the drip field.
- Do not discharge any roof drains, sump pumps or other sources of extraneous water into the system. Fix all plumbing leaks to prevent excess water form entering the system.
- Try to equalize water usage in the house by spreading out laundry loads throughout the week instead of concentrating them in one or two days.
- If you have a garbage grinder, try to eliminate non-bio-degradable materials, such as bones, egg shells, grease, etc., from the system.
- If your high-water alarm should sound, call your service company immediately. You have approximately one day of storage in the pump tank after the high water alarm sounds, so you should minimize water usage in the home or business (i.e., laundry) until the system has been checked.
- If the air supply pump serving the aerobic treatment unit is out of service for any extended period of time (one or more days) solids may build up in the unit and pass into the pump tank and clog the fine screen filter. If this occurs, call your service company.

If you notice any areas of excess wetness in the field, contact your service company. Such problems are usually minor in nature and easily repaired. Some initial wetness over the driplines when the system is first installed in normal and should clear-up once the soil has settled and a grass cover established over the field.

Troubleshooting Guide

Drip irrigation systems have been successfully used for over 10 years based on the design loadings given in Table I (page 9) for natural soils. Any problems that have occurred with hydraulic overloading can be categorized as follows:

Problem: Disturbed soil conditions which greatly reduced the natural soil permeability of the site.

Remedy: If this problem is not recognized up front and the design loadings adjusted at that time, add additional drip lines in an adjacent area and install a mechanical index alternating valve to alternately dose each field.

Problem: Sloping lots with upper lines draining to lower lines resulting in hydraulic overload of the lower lines.

Remedy: Install a check valve in the header line between the upper drip lines and the lower drip lines that are being overloaded. A valve box **must** be installed @ grade to facilitate maintenance of the check valve.

Problem; Water is surfacing in lower lines even with a check valve in place.

Remedy: Check pressure of highest drip lines to insure at least 15 psi on the top line. If not, increase pressure at pump by opening valve at the supply pressure gauge.

Problem: Water is surfacing at most emitters.

Remedy: Pressure gauge with ball valve not properly installed or adjusted in the supply line allowing high pressure discharge. Adjust pressure gauge to 30 psi or less by closing the ball valve slightly. Also check water leakage or over-use in the home for excess water entering the system. If the problem persists, insure the dosing timer is functioning and increase the number of doses per day to reduce the volume per dose cycle.

Problem: Water surfaces continuously at one or more isolated spots in the field.

Remedy: This is probably a loose connection or damaged drip line. Dig up the drip line at the spot of surfacing, locate leak and repair.

Problem: Erosion in the field has exposed some drip line.

Remedy: Bring in enough fill material of similar soils to cover all drip lines with at least 6 inches of fill. Seed with a fast-growing lawn grass immediately or bring in sod to cover the bare spots.

Problem: High water alarm activates continuously.

Remedy: Inspect spin filter to determine if it is clogged with bacterial slime. Remove and clean by pressure washing the outside of the screen and replace.
If problem persists, check discharge pipe from treatment tank to pump tank for possible stoppage. Check alarm float for malfunction.

Problem: High water alarm activates periodically.

Remedy: High water usage in the home, such as laundry day or excessive use of the bathrooms, may be causing a temporary high water condition in the pump tank. Spread out the water usage in the home so that wastewater discharge is distributed more evenly throughout the day.

Problem: High water alarm activates during heavy rainfall.

Remedy: Surface water (or groundwater) may be infiltrating into the system. The source of infiltration must be identified and repaired. Immediately after a heavy rain, turn on the pump and pump the tank down to the cut-off point and check the pump tank inside with a flashlight try to determine where water is entering. If the excess water flow is entering the tank from the inlet pipe from the treatment tank, all tanks must be checked for leaks including the cleanout tee at the house.

Problem: The screen filter clogs frequently.

Remedy: Solids are being carried over from the treatment tank to the pump tank. The aeration in the pump tank has probably been restricted by either clogging of the filters on the aerator serving the treatment unit or the diffuser on the aerator line in the treatment tank has plugged or broken thus reducing the air flowing to an inadequate level (see Owner's Manual for desired SCFM level). Pump any solids out of the pump tank. Then insure the treatment tank is getting adequate air flow (see Owner's Manual for desired SCFM level) and the diffuser is functioning, replace the clogged filter screen in the pump tank and check the system again after a few days operation. Also verify the flow rate through the spin filter to insure that the flow is within the range as specified by guidelines of that particular size filter.