



Manual for On-Site Sewage Management Systems

SECTION E | EFFLUENT DISTRIBUTION AND DOSING DEVICES

Environmental Health Section

SECTION E - EFFLUENT DISTRIBUTION AND DOSING DEVICES

1) Preface

Distribution and dosing devices include distribution boxes, flow splitters, siphons, pumps and other flow diversion devices. These devices shall be of sound construction, water tight and not subject to excessive corrosion. They shall provide sufficient volume to accommodate expected flows.

2) Distribution Devices

A. *Precast Concrete Distribution Box Construction Criteria:*

1. *Load Bearing* - All precast concrete distribution boxes shall be designed and constructed to provide sufficient strength and structural integrity to withstand a vertical uniform load of 150 pounds per square foot on the top of the box.
2. *Concrete Strength* - A minimum end product strength of 4,000 pounds per square inch shall be used in the construction of the box and lid.
3. *Concrete Thickness and Reinforcement* - A minimum thickness of one and one-half inches shall be used in the construction of distribution box bottoms, sidewalls, and lids; all shall be reinforced by a minimum # 10 gauge six-inch welded steel reinforcing wire or equivalent.
4. *Lids* - Distribution box lids or covers shall meet the requirements of section 2.A.1 above and shall be provided with suitable handles for removal.
5. *Inlet and Outlet Hole Size* - Knockouts for inlet and outlet piping shall be of sufficient diameter to accept four-inch diameter piping.
6. *Inlet and Outlet Hole Elevations* - The invert of the inlet hole or knockout shall be a minimum of two inches to a maximum of three inches above the invert of the outlet hole.
7. *Inlet and Outlet Hole Dimensions* - The inlet hole or knockout shall be centered left to right. Where multiple outlets are used, they must be located not less than nine inches on center; the outlet (s) shall be not less than three inches from the corners of the box and at least three inches above the inside bottom surface of the box.
8. *Identification* - All distribution devices offered for sale or use in Georgia shall bear the manufacture's name by imprint, stencil or other acceptable means of marking.

B. *Molded Plastic and Fiberglass Distribution Box Construction Criteria:*

1. *Materials* - Distribution boxes shall be constructed of high-density polyethylene (type 3, 0.941 to 0.965 density as provided in ASTM D 3350), fiberglass or other materials acceptable to the Department.
2. *Material Strength* - Distribution boxes shall be constructed of durable watertight materials resistant to deterioration and designed to withstand a vertical uniform load of 150 pounds per square foot on the top of the box. The box shall accommodate a removable lid. The lids will be capable of being secured.

3. *Inlet and Outlet Hole Elevations* - The invert elevation of all outlets shall be the same and shall be at least 1.5 inches below the inlet invert.
4. *Sump Depth* - Each distribution box shall be provided with a sump extending at least two (2) inches below the invert of the inlet.
5. *Identification* - Distribution box covers shall be marked with the manufacturer's business name.
6. *Plans Required* - Each manufacturer shall provide the Department with complete plans and specifications for a given distribution box.

C. *Drop Box Construction Criteria:*

1. *Inlet and Outlet Hole Dimensions* - For concrete drop boxes, the invert of lateral outlet holes or knockouts shall be located with a minimum drop in elevation from the inlet invert of one-half inch; outlet inverts shall be located a minimum of three inches above the inside bottom surface of the box. The inlet or outlet holes or knockouts shall be located a minimum of three inches from adjacent sidewalls.

The requirements in paragraphs B.2 and B.3 below apply to concrete, molded plastic and fiberglass drop boxes.

2. *Inlet and Outlet Hole Elevations* - The centerline of the inlet hole or knockout of drop boxes in series shall be a minimum of five inches above the centerline of the inlet of each successive box.
3. *Design Criteria* - Drop boxes shall be designed to provide sufficient separation distance (12 inches or greater recommended) between the outlet sidewall and supply inlet sidewall of the next box in series.

D. *Molded Plastic and Fiberglass Drop Box Construction Criteria:*

1. *Materials* - Drop boxes shall be constructed of high-density polyethylene (type 3, 0.941 to 0.965 density as provided in ASTM D 3350), fiberglass or other materials acceptable to the Department.
2. *Material Strength* - Drop boxes shall be constructed of durable watertight materials resistant to deterioration, and designed to withstand a vertical uniform load of 150 pounds per square foot on the top of the box. The box shall have a removable lid.
3. *Inlet and Outlet Hole Elevations* - The invert of the inlet and overflow port shall be at the same elevation. The invert of the pipe port (s) leading to the disposal trench (es) shall be at least six (6) inches below the invert of the inlet.
4. *Identification* - Drop box covers shall be marked with the manufacturer's business name.
5. *Plans Required* - Each manufacturer shall provide the Department with complete plans and specifications for a given drop box.

- E. *Plastic Low-Pressure Pipe Manifold Construction Criteria* - All plastic pipe, fittings and connectors used in low-pressure pipe supply lines and manifolds shall be of NSF/ANSI schedule 40 PVC construction and materials.

F. *Alternating Valves and Devices Construction Criteria:*

1. *Design Criteria* - Alternating valves and devices shall meet the general design and construction standards listed previously in sections A.1 and A.4 and if constructed of precast concrete, also meet the standards of sections A.2 and A.3 of this subsection.
2. *Valve Requirements* - All alternating valves and devices shall be designed and constructed to provide a positive seal to each outlet when in a closed position. The valving device shall be constructed of corrosion resistant materials and be of sufficient strength to withstand normal operational stresses without damage or deformation resulting in valve malfunction.
3. *Risers Required* - All alternating valves and devices located beneath the soil surfaces shall be fitted with risers and watertight lids or covers, extending to grade, which will permit unobstructed access for maintenance, inspection and operation.

3) Dosing Devices

A. *Dosing Tanks*

1. *Description* – Dosing tanks are watertight tanks that store raw or pretreated wastewater for periodic discharge to subsequent treatment units or disposal areas. Pumps or siphons are mounted in the tank to discharge the accumulated liquid and they shall have appurtenant switches and alarms that notify the owner of a malfunction. The structure must be equal to a concrete septic tank in strength. Figure 12.E depicts a septic tank with a dosing tank and siphon. Figure 11.E shows a typical dosing tank with pump.
2. *Application* – Dosing tanks are used where it is necessary to elevate the wastewater for further treatment or disposal, where intermittent dosing of treatment units or subsurface absorption fields is desired or where pressure distribution networks are used. If the dosing tank is at a lower elevation than the discharge point, pumps must be used. If the dosing chamber is at a higher elevation, siphons may be used, but only if the settleable and floatable solids have been removed from the effluent. Dosing tanks shall meet the same setback requirements applicable to septic tanks.
3. *Factors Affecting Performance* – Factors that are to be considered in the design of dosing tanks are: (1) the dose volume; (2) the total dynamic head; (3) the desired flow rate and (4) the wastewater characteristics. When pumps are used, they must be selected based on all four factors. The desired flow rate and the discharge invert elevations determined from the total dynamic head will be the deciding factors for use of automatic siphons.
4. *Dosing Tanks for Conventional Septic Tank System* – A dosing tank shall be provided where more than 500 linear feet of absorption trench is required. The operating liquid capacity of the dosing tank shall be equivalent to 60 to 75 percent of the interior volume of the absorption lines to be dosed. For four-inch diameter absorption lines, the dosing tank operating liquid capacity should be based on one-half gallon per linear foot of absorption line. When more than five hundred linear feet and less than one thousand linear feet of absorption trench is required, a single siphon or pump shall be used (See Figure 13.E). Dosing shall be by automatic siphon or by sewage pump installed in the

- dosing tank. When more than 1000 linear feet of absorption trench is required, alternating siphons or pumps shall be used (See Figure 14.E).
5. *Design and Operation of Tank with Siphon* – The action of a siphon is as follows: as the water entering the tank rises above the sniff hole in the bell, it encloses the air within as the lower portion of the trap is being filled with water. As the water level of the tank rises, the pressure of the confined air gradually forces the water out of the long leg of the trap until a point is reached where the air just starts to escape around the lower bend. As the difference of water level in the two legs of the trap equals the difference of the levels between the water in the tank and the water within the bell, it will be seen that the column of water in the short discharge leg of the trap has practically the same depth as the head of the water in the tank above the level at which it stands in the bell. The two columns of water therefore counterbalance each other at a certain fixed depth in the tank. As soon as this depth is increased by a further supply of incoming water, however small, a portion of the confined air is forced around the lower bend; and by its upward rush, carries with it some of the water in the short leg, thus destroying the equilibrium, and the siphon is brought into full action immediately. The water is then drawn out of the tank to the bottom of the bell, the siphon vented by the admission of air through the sniff hole, and the operation automatically repeated. (See Figure 12.E)
 6. *Dosing frequency* – Dosing frequency should be determined on a site-specific basis according to the soil characteristics, site conditions, wastewater characteristics and on-site sewage management system design.
 7. *Design and Operation of Dosing Tank with Pump (s)* – A dosing tank with a pump (or pumps) consists of a tank, pump, pump controls and alarm systems. Figure 11.E shows a cross section of typical dosing tank used for pumping pretreated wastewater. The tank can be a separate unit as shown, or it can have common wall construction with the pretreatment unit, usually a septic tank. The dosing tank shall have sufficient volume to provide the desired dosing volume plus reserve volume. The reserve volume is the volume of the tank between the high water alarm switch and the invert of the inlet pipe. It provides storage during power outages or pump failure. A reserve capacity equal to the estimated daily wastewater flow is used for residential application. For a single-family residence, this shall mean a minimum of 150 gallons per bedroom. In large flow applications, duplex pump units with alternative power source can be used as an alternative to provide reserve capacity. No reserve capacity is necessary when siphons are used. Pump selection is based on the wastewater characteristics, the desired discharge rate and the total dynamic head. Raw wastewater requires a pump with solids-handling capabilities. While pneumatic ejectors may be used in other applications as well, submersible centrifugal pumps are best suited where large volumes are to be pumped in each dose. The pump size is determined from pump performance curves provided by the manufacturers. Selection is based on the flow rate needed and the total dynamic head. The specific application determines the flow rate needed. The total dynamic head is calculated by adding the elevation difference between the discharge outlet and the lowest water level in the dosing tank to the friction losses incurred in the discharge pipe. The velocity head can be neglected in most applications. If the liquid pumped is to be free of suspended solids, the pump may be set on a pedestal. This provides a quiescent zone below the pump where any solids

entering the tank can settle, thus avoiding pump damage or malfunction. These solids must be removed periodically. In cold climates, where the discharge pipe is not buried below the frost line, the pipe should be drained between doses. This may be done by sloping the discharge pipe to the dosing tank and eliminating the check valve at the pump. In this manner, the pipe is able to drain back into the dosing tank through the pump. The dosing volume is sized to account for this backflow. Weep holes may also be used if the check valve is left in place. The control system for the dosing tank consists of a “pump off” switch, a “pump on” switch and a “high water alarm” switch. The “pump off” switch is set several inches above the pump intake. The “pump on” switch is set above the “pump off” switch to provide the proper dosing volume. Several inches above the “pump on” switch, a high water alarm switch is set to alert the owner of a pump malfunction by activating a visual and audible alarm; this switch must be on a circuit separate from the pump switches (see Figure 11.E). The electrical connections should not be located inside the tank or riser. Pump failures can usually be traced to switch failures resulting in pump burnout; so high-quality switches are a good investment. Some types are: Mercury, Pressure Diaphragm, Weighted Float and Dual or Multiple Function.

4) Pumps and Ancillary Equipment

Pumping of sewage effluent can cause problems if the right pump is not used. The pump can burn or clog if it pumps the wrong substance. Therefore, choosing the right pumps for on-site sewage management operations is critical.

A. Pumps

1. *Submersibility* - The pump shall be submersible.
2. *Wastewater Capability* - The pump shall be designed to handle sewage effluent.
3. *Discharge Pipe Size* - The pump shall be capable of delivering the required flow at the design total dynamic head. The discharge pipe shall be the same size or larger than the discharge of the pump.
4. *Materials* - The pump shall be constructed of corrosion resistant materials.
5. *Performance Specifications* - Performance curves and specification sheets indicating the above criteria have been met shall be submitted with the plan review application when pumps are to be used in a system.
6. *Minimum Pipe Sizes* - In order to ensure sufficient fluid velocity to carry any solids present in the septic effluent (generally accepted velocity is at least two feet per second), the following pipe sizes are required: 1 ½” pipe with flows of at least 12 gallons per minute (gpm); 2” pipe with 21 gpm; 2 ½” pipe with 30 gpm; and 3” pipe with 46 gpm.
7. *Backflow Prevention* - A backflow prevention device shall be used on the discharge line where conditions allow, reducing wear on the system.

8. *Piping Materials* - Pipe materials must be schedule 40 PVC, all fittings shall be pressure fittings, and all connections shall be adequately cleaned with cleaning solvent and glued with PVC solvent cement.
9. *Valve Requirements* - If used, the gate or globe valve (s) and check valve shall be either bronze or PVC.
10. *Siphon Prevention* - The discharge line shall be designed and installed to drain after each use unless system design requires a check valve. See subsection 3) A.7 above.

B. Ancillary Equipment

1. *Quick Disconnect* - A quick disconnect device shall be included in the discharge piping to facilitate removal of the pump for inspection, repair or replacement.
2. *Pump Extraction Device* - A corrosion resistant rope or cable of adequate strength shall be affixed to the pump to facilitate installation and removal, so that personnel need not enter the chamber to disconnect the pump.
3. *Pump Control Devices* – A pump control device must be adjustable so that the desired dosing volume can be discharged during each pumping cycle. The control device may consist of one or more sealed float or diaphragm switches, which may cooperate with a relay or contactor. Separate control panels located outside the pump tank must be protected from the weather and must provide no air path between the panel and the pump tank.
4. *Security* – For safety, access covers for the pump tank must be lockable, heavy enough to prevent easy access or equipped with tamper-proof retainers. Access must be of adequate size and accessible from the surface to allow for installation and removal of equipment and to maintain the system. Foremost, the pump tank must not allow infiltration or exfiltration.
5. *Separate Circuits* - The alarm switch must be placed on a circuit separate from the pump switches.
6. *Electrical Requirements* - All wiring and components of the whole system shall conform to the National Electrical Code.

5) Tables, Figures and Forms

Figure 11.E Typical Dosing Tank with Pump

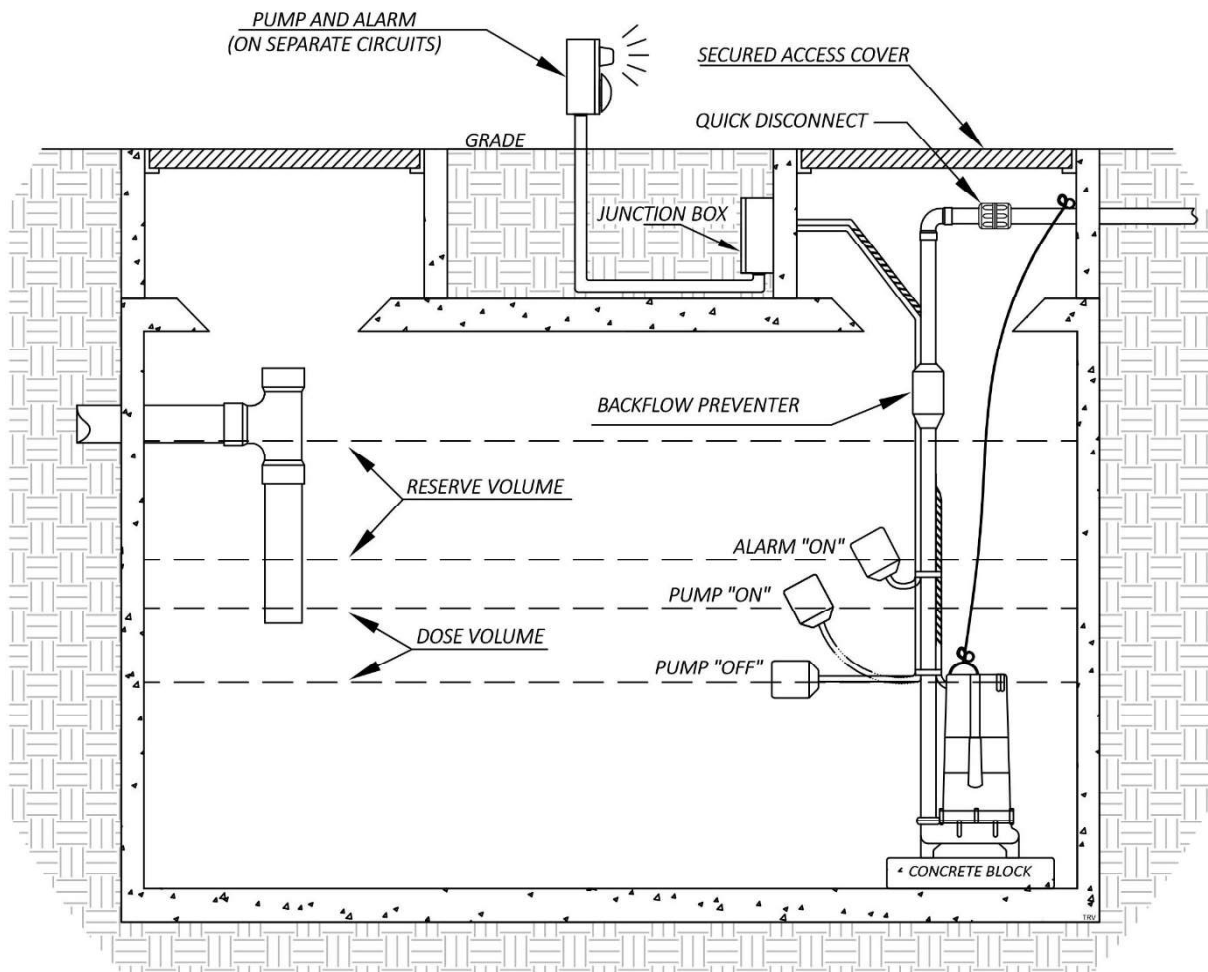
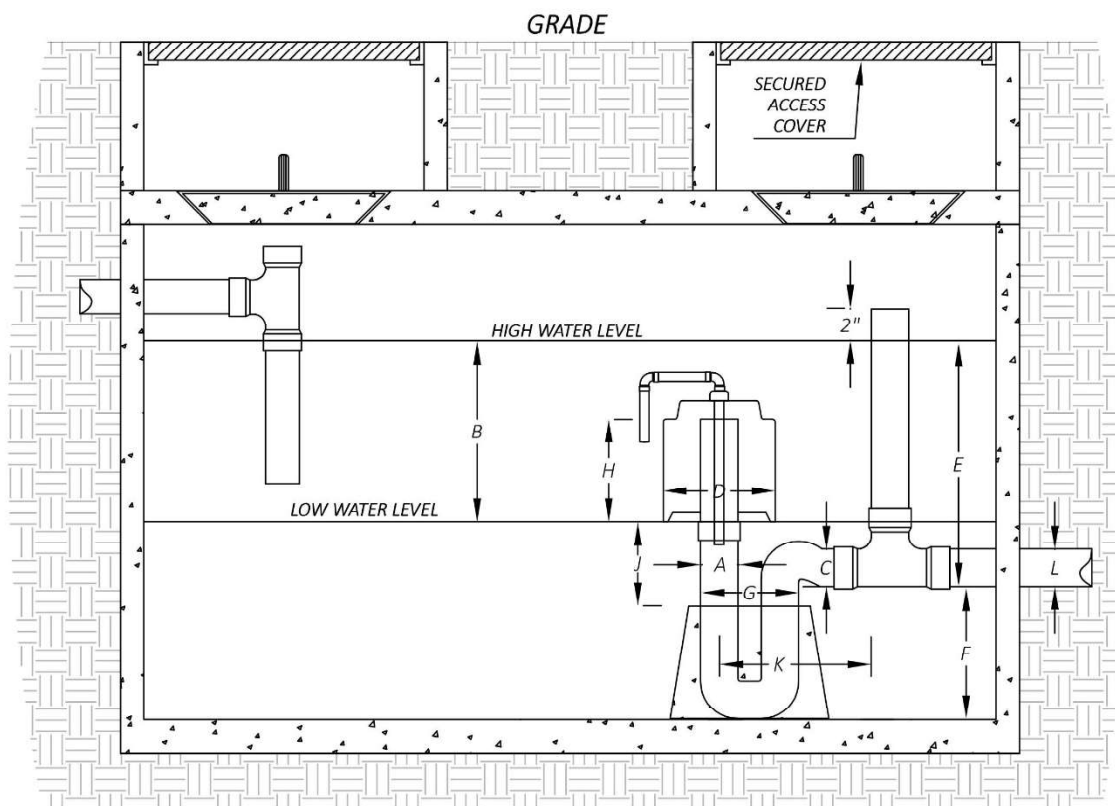


Figure 12.E Sewage Siphon

Sewage Siphon Dimensions (in inches)						
Diameter of Siphon	A	3	4	5	6	8
Draw Depth	B	13	17	23	30	35
Diameter of Discharge Head	C	4	4	6	8	10
Diameter of Bell	D	10	12	15	19	24
Invert Below Floor	E	4 ¼	5 1/8	7 1/8	10	12
Depth of Trap	F	13	14 ¼	23	30 ¼	35 ½
Width of Trap	G	10	12	14	16	22 ½
Height Above Floor	H	7 ¼	11 ¾	9 ½	11	13 ½
Invert to Discharge	I	20 ¼	25 ½	33 ½	44	52
Bottom of Bell to Floor	J	3	3	3	4	5
Center of Trap to End of Discharge	K	8 1/8	11 ¾	15 1/8	17 ½	23 1/8
Diameter of Carrier Pipe	L	4	4-6	6-8	8-10	12-15
Average Discharge Rate – GPM		72	165	328	472	950
Maximum Discharge Rate – GPM		96	227	422	604	1270
Minimum Discharge Rate – GPM		48	102	234	340	698

Figure 13.E Criteria for Drainfields 500 to 1000 Feet

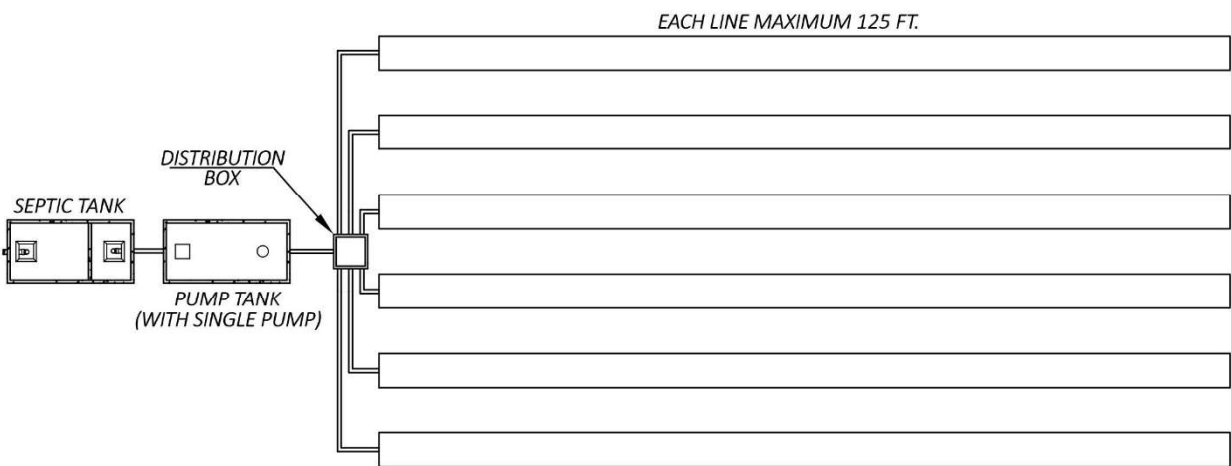


Figure 14.E Criteria for Drainfields >1000

