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SMALL SCALE WASTE MANAGEMENT PROJECT

Effluent Distribution Designs Incorporating Flexibility for Easy Maintenance and Maximizing System Life and Reducing Failures

by

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EFFLUENT DISTRIBUTION DESIGNS INCORPORATING FLEXIBILITY FOR EASY MAINTENANCE AND MAXIMIZING SYSTEM LIFE AND REDUCING FAILURES

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All soil absorption systems used in on-site waste management incorporate some method of distributing the septic tank effluent. **All system designs should incorporate flexibility for easy maintenance and easy diagnosis of failures.** There are four categories of distribution: namely gravity, dosing, pressure distribution and pressure manifold distribution.

A. Gravity Distribution

Gravity distribution is by far the oldest and most popular distribution method as it is the least expensive and simplest. Typical design uses the 4" perforated pipe with two rows of holes with the ½" holes spaced about 3" apart. Converse (1974) showed that gravity distribution does not distribute the effluent uniformly along the length of the lateral, but the effluent will flow out several holes that are at the lowest elevations.

From a management perspective it is essential that the distribution design has management flexibility. With an in-ground trench unit, it is desirable to be able to rest a trench for an extended period by directing the flow to other trenches. In bed systems it may be desirable to direct the flow from one bed to another.

<u>Types of Gravity Distribution</u>: There are several types of gravity distribution which are:

1. Distribution Box

Fig. 1 shows a cross section and plan view of a distribution box serving a series of trenches. Distribution boxes work best on level or near level sites. The septic tank effluent enters the box and flows out one or more of the outlets. **Distribution boxes will not provide equal distribution through each outlet**. Devices are available that will allow more equal distribution out each outlet. However, using elbows on each outlet, the effluent can be directed to a given trench. All the effluent enters the trench causing a clogging mat to develop quickly resulting in ponding. If the ponded trench can not handle the flow the effluent goes out through the next highest elbow invert to the second trench. When it can not handle it, the effluent will back up and go out the next highest elbow invert. Once a year or so, the trench receiving the effluent for the

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longest time, can be shut off and allowed to rest. The resting will allow the trench to renovate itself by reducing the clogging mat. Distribution boxes can be made of concrete or plastic. **The cover must come to the ground service for easy maintenance and management.**

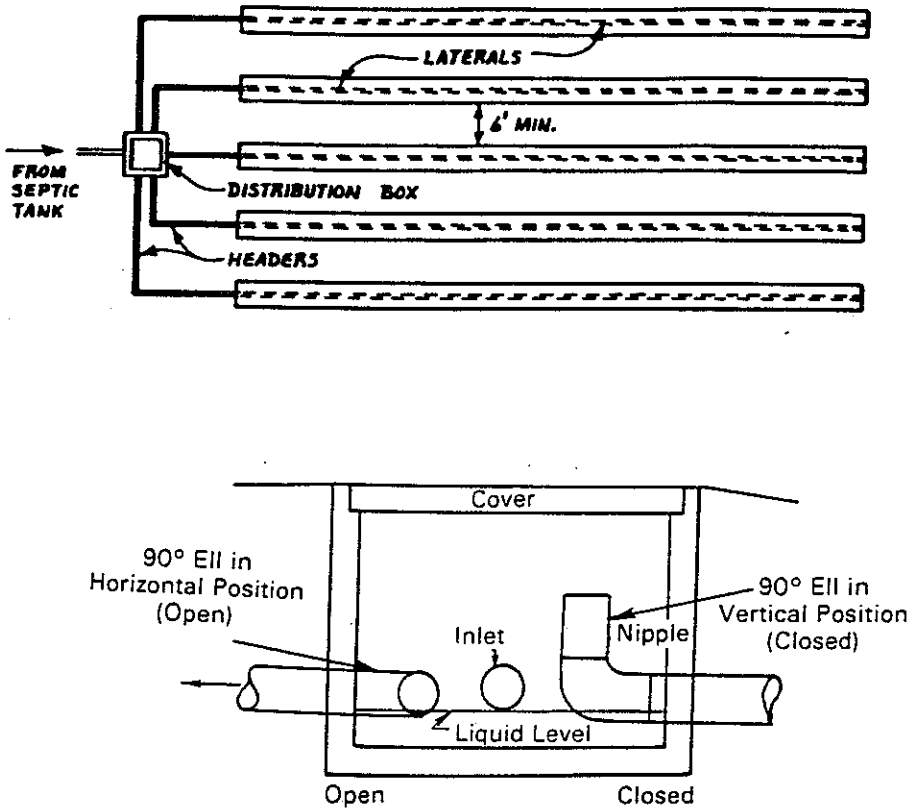

Fig. 1. Cross section and plan view of a distribution box. Boxes come in concrete and plastic. Elbows, not shown, can be attached to the outlet pipe and adjusted to direct flow to a given trench. There are flow equalization devices available to try to get uniform flow to each trench. The cover should extend to ground surface easy maintenance (MWPS-24, 1982).

2. Drop Box

Fig. 2 shows a cross section of a drop box assembly. Drop boxes are best for sloping sites. Septic tank effluent enters the first drop box where all the effluent enters the first trench. When it will no longer handle all the effluent, the liquid level increases

in the drop box and flows to the second drop box where the effluent enters the second trench. When the first and second trench can no longer handle the flow, the effluent enters the third drop box. After a year or so, the first drop box can be taken out of service to rest and renovate itself. Drop boxes are made out of concrete or plastic. **The cover must come to the ground service for easy maintenance and management.**

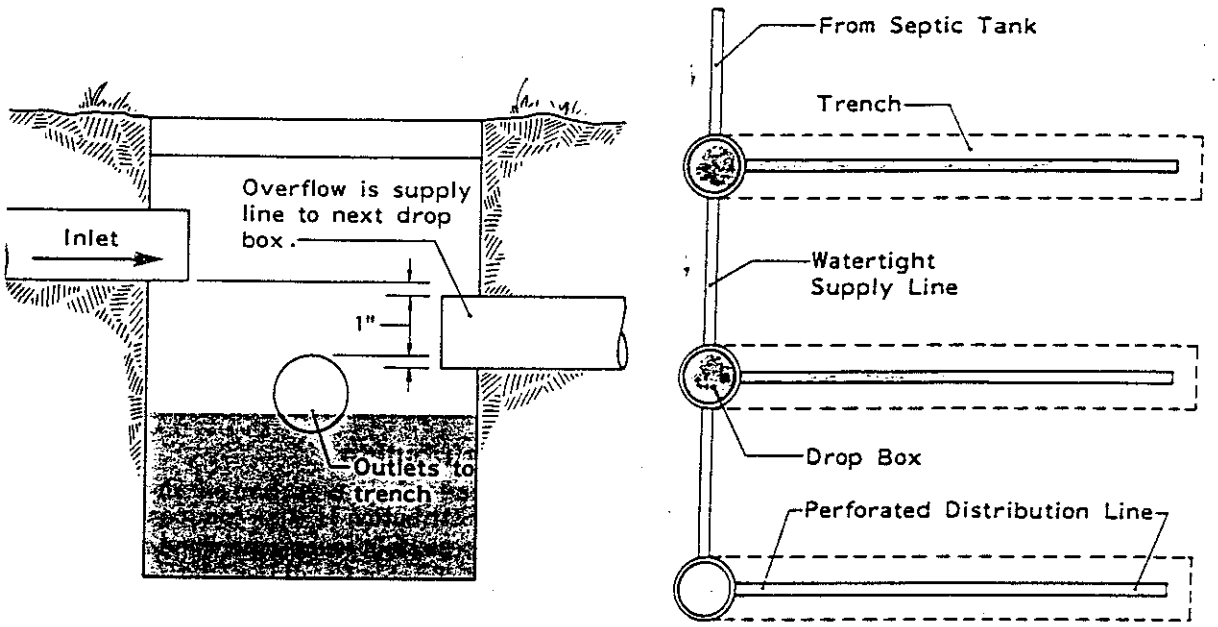

Fig. 2. Cross section and plan view of a drop box. Drop boxes come in concrete and plastic. The covers must must extend to the ground surface for easy maintenance (MWPS-24, 1982).

3. Header Pipe

Headed pipe distribution is shown in Fig. 3. A header distribution pipe is totally buried and connects several distribution pipes in parallel trenches or in beds. In trench systems, the septic tank effluent will flow into one trench. When that trench can no longer handle the flow, the effluent will back up and flow into another trench. Contractors like header systems as they are easy and inexpensive to install. **Header systems can not be managed and thus are not recommended for a well managed system.**

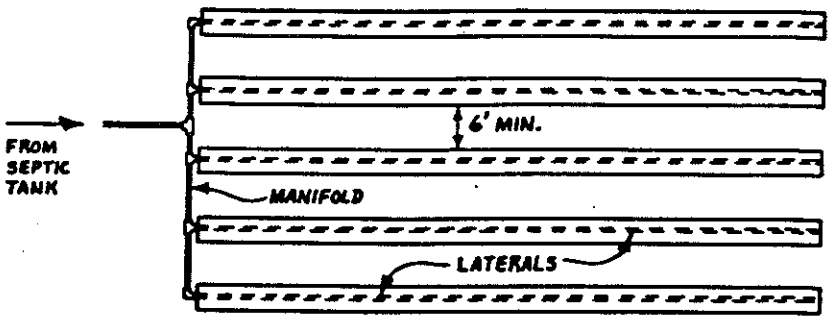

Fig. 3. Plan view of a header pipe distribution system. There is no opportunity to rest one of the trenches.

4. Serial Distribution

Figure 4 shows a serial distribution system. Serial distribution systems are used in trenches on sloping sites. The effluent enters the upper trench and flows to the end of the trench. When the trench becomes full, the effluent flows to the next down slope trench. When the second trench becomes full the effluent flows to the next down slope trench. **Trenches can not be taken out of service for resting and renovation and thus are not the desired system for good management practices.**

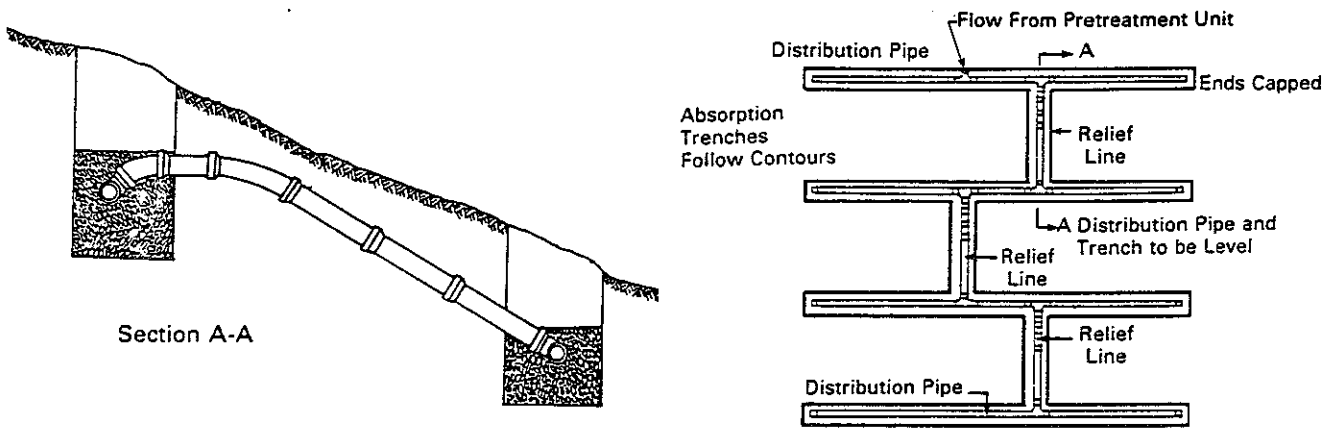

Fig. 4. Cross section and plan view of serial distribution. The relief lines can be at the end of the trenches. There is no opportunity to rest a trench (EPA, 1980).

B. Dosing

Dosing is a variation of gravity flow in which a pump or siphon pumps a large quantity of wastewater to the absorption area at one time. The distribution piping consists of the 4" diameter perforated pipe as used in typical gravity distribution. The purpose of the larger dose is to provide better distribution of effluent into the trenches or bed. The effluent may go through some of the some distribution devices as mentioned above such as drop box, distribution box and header.

C. Pressure Distribution

Pressure distribution uses a pump or siphon to pressurize the distribution network. Specially designed PVC pipe networks are used to uniformly distribute the effluent throughout the absorption area. The network will typically range in size from 1-3" diameter pipe with orifice openings of 1/8-1/2" spaced from 1- 5' apart. The purpose of pressure distribution is to provide as uniform a flow over the surface as possible so smaller holes more closely spaced is preferred. Each system will have its own custom designed pressure distribution network. The pump or siphon output must be matched to the orifice size and number so as to provide a head of at least 2.5 ft. Lateral and manifold pipe diameters must be matched to the flow to minimize friction loss within the network. Figure 5 shows a typical pressure distribution network for a home utilizing a trench or bed configuration for both in-ground or mounds.

It is much easier to design pressure distribution networks where all the laterals are at the same elevation. For sloping sites with the same trench configuration (length and width), the effluent flow going to the same trench must be equal resulting in different orifice spacing between trenches to account for different elevations. Valves should be installed at each

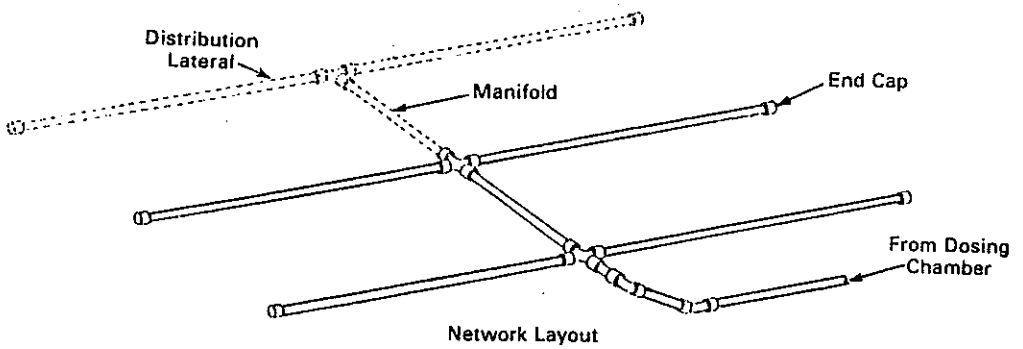

Fig. 5. Schematic of pressure distribution network using small diameter pipes and orifices.

lateral inlet so as to adjust flow to each trench based on pressure and allow the unit to be fine tuned. **The design must account for excess flow going to the lower trench when the pump shuts off as some of the effluent remaining in the network manifold and laterals may cause an overload to the lowest point (bottom trench).** Design information is available through various sources (Otis, 1981).

D. Pressure Manifold

A pressure manifold system delivers the same quantity of effluent to a trench where it is distributed within the trench by gravity through 4" perforated pipes. Fig. 6 shows a cross section of a pressure manifold. This system is most appropriate for small and large systems with trenches on sloping sites. It does not uniformly distribute the effluent along the trench but does easily provide equal flow to each trench. Pump size can be drastically reduced with this system over similar sized pressure distribution systems. Berkowitz (1985) provides design criteria. **Valves should be installed at the outlet of the manifold (not shown in diagram) so that trenches can be taken out of service for resting and renovation.**

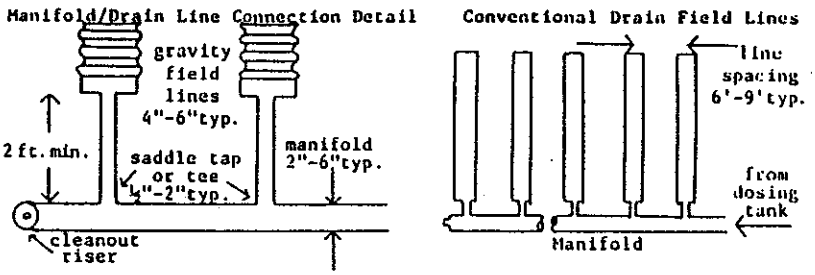

Fig. 2a Pressure Manifold For Level Site

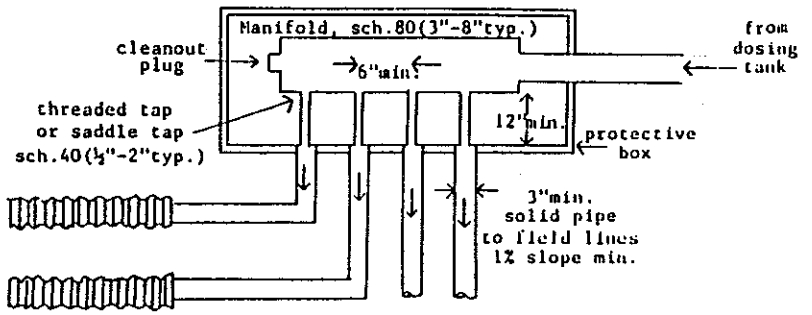

Fig. 2b Pressure Manifold for Sloping Site

Fig. 6. Cross section and plan view of a pressure manifold distribution where the same amount of effluent is delivered to each trench and then distributed by gravity. Valves should be installed so trenches can be rested. (Berkowitz, 1985).

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