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SMALL SCALE WASTE MANAGEMENT PROJECT

Pressure Distribution Designs Based on Comm.83

by

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PRESSURE DISTRIBUTION DESIGNS BASED ON COMM. 83

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With the introduction of the new code comes change not only for new systems but for existing technology as well. As new information becomes available, changes are implemented to improve the current technology to provide an improved product/process. That is also the case with pressure distribution. **Pressured distribution was originally introduced in mound systems to distribute the effluent more evenly along the length of the mound.** The industry has done well in implementing this concept.

Another objective of pressure distribution is to distribute the effluent over a larger surface area. Smaller doses with more drop points provides lower instantaneous loading at the infiltrative area and more contact time for the bacteria to treat the effluent. Large doses with fewer drop points gives large instantaneous loading and drives effluent further downward resulting in less treatment as the contact time is shorter near the infiltrative surface. To reduce costs, in order to remain competitive, designers/installers may have lost view of this aspect by using larger doses and larger spacing of orifices and laterals to reduce the pump and pipe size, resulting in larger instantaneous loading rates and less contact time with the soil biota.

With a new code being implemented, it is time to make changes that will rectify the deficiencies of the previous code and improve upon the technology. However, it will not be without a price. Several changes are being implemented that will affect mound size and the pressure distribution network.

Mound Size:

The absorption area, or sand/aggregate infiltrative surface has been increased by reducing the design sand loading rate from 1.2 to 1.0 gpd/ft^2. This was done to reduce the potential of excessive clogging at the sand/aggregate interface which is the weak point of mounds. As we make this change, along with changes in pressure distribution, we need to keep in mind that we want to promote longer and narrower absorption areas within mounds and not short - wide absorption areas. This is important not only from the oxygen transfer but from a linear loading point of view. Placement of short - wide mounds on slowly permeable soils may cause toe leakage because of the larger linear loading rate. Thus, mounds have been sized differently depending on soil conditions.
The following can serve as equivalent to current design which will yield the larger absorption area. These examples are for 3 bedroom homes.

Current	New Equivalent
8 x 47	8 x 56 or 9 x 50
5 x 75	6 x 75
4 x 94	5 x 90 or 4 x 112

Pressure Distribution:

Network design is a function of the size of the mound. The current code is quite flexible in what can be designed with minimal regard for treatment and instantaneous loading rates with hole spacing up to 7 ft. A survey of the State plan reviewers indicates a wide range of designs with some typical designs appearing. For example, a 4' by 94' absorption area will typically have a single line with holes spaced 4 ft apart with each orifice serving 16 ft^2 of surface area while a 5 by 75 absorption area will typically have a single lateral with 3 ft spacing with each orifice serving 15 ft^2. Net dose volumes for these two designs are typically 150 and 118 g/dose respectively. Pressure distribution for sand filters (a mound is essentially a sand filter) typically has small frequent doses with each orifice serving 6 ft^2 of absorption area (the new designs are 4 ft^2 / orifice). Since mounds are basically sand filters incorporating the dispersal area, it makes sense to incorporate some of the sand filter technology into the mound technology. Thus, the component manuals recognized by the new code will incorporate the following changes in pressure distribution network design.

Pressure distribution design criteria:

- Each orifice will serve no more than 6 ft^2/ orifice of sand/aggregate interface
- A lateral will have to be within 1.5 ft of the edge of the absorption cell.
-Dose volume is > 5 times the lateral void volume

As the area/orifice decreases from 15 to 20 ft^2/orifice to 6 ft^2/orifice, the size of the orifices will need to be reduced or the lateral length will need be reduced, otherwise the dose volumes become very large. Unfortunately, the design manual does not limit the dose volume and the designer can continue to design systems with large dose volumes.

Based on various discussions, there appears to be a consensus that the dose volume will be limited to <20% of the design flow at some point in the near future via a code correction procedure. Thus, the dose volume will be limited to 90 gallons and 120 gallons per 3 and 4 bedroom house, respectively. If the design volume based on 5 times the lateral volume exceeds these respective numbers, than the network must be redesigned to accommodate both 1) the less than 90 or 120 gallon dose volume and 2) the 5 times the lateral void volume. This will result in using smaller orifices or shorter laterals or a combination of both. Using shorter laterals in a center feed or end feed results in short wide mounds which is just the opposite of what we have been promoting for some time which is long narrow mounds. Using a network of feeding at the 1/4 and 3/4 point will allow for shorter lateral lengths and smaller dose volumes.

As a result of these changes, orifice sizes will range from 1/4, 3/16 or 1/8" depending on the design. The shorter systems will be able to accommodate the 1/4" orifice and still maintain dose volumes below the maximum recommended dose of 90 or 120 gallons. Sand filters use 1/8" holes located upward. For the most part these are drilled very precisely in the shop. There is concern about using 1/8" orifices drilled in the field and located downward when receiving septic tank effluent. They have worked well for highly pretreated effluent. **All orifices must be drilled with a sharp bit with the burrs and filings removed.**

In some areas of the state end feed systems are very common. End feed systems will give very large dose volumes which is not desired. THERE IS NO NEED FOR END FEEDS. If the site dictates an end feed it can be converted to a center feed by simply entering the mound at the end and extending the force main in the sand to the center of the distribution network. This can be done on the up slope side or between the laterals.

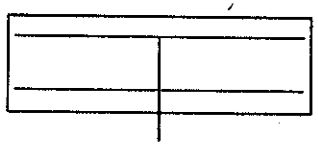
The new code also states that the size of particles entering the soil treatment/dispersal area will be less than 1/8". This can be done by septic tank effluent filters, filters on the pump discharge piping or use of other treatment units that are recognized to meet the maximum 1/8" particle size. It also requires that provisions be made to flush the lines periodically by installing turn-ups or other means of easy access to the lateral ends. The designer may also wish to consider installing a second filter on the pump discharge to avoid having any solids from the pump chamber enter the distribution network.

The following spreadsheet tables provide some insight into lateral lengths, spacings and dose volumes for 3 and 4 bedroom homes utilizing different absorption cell sizes. There are 2 tables for 3 bedroom and two tables for 4 bedroom size units. For each size unit there is a center feed configuration. For configurations where the dose volume is greater than 90 gal for 3 bedroom and 120 gallons for 4 bedroom units, the cell configurations were redone using a 1/4 and 3/4 feed points. This new configuration reduced the lateral lengths by half and reduced the lateral diameter and dose volume.

TABLE 1. PRESSURE DISTRIBUTION NETWORKS WITH CENTER FEED SERVING 3 BEDROOM HOMES. 450 SQ. FT. ABSORPTION CELLS.

1 Cell Length ft.	2 Cell Width ft.	3 No. of Laterals each side of center	4 Total No. Laterals	5 Lateral Length ft.	6 Lateral Spacing ft.	7 Orifice Spacing ft.	8 Lateral Diameter 1/4" hole in.	9 Lateral Diameter 3/16" hole in.	10 Lateral Diameter 1/8" hole in.	11 Dose Volume 1/4" hole gal.	12 Dose Volume 3/16" hole gal.	13 Dose Volume 1/8" hole gal.	14 Total Lateral Length ft.
45	10	4	8	22.50	2.50	2.40	1.25	1.00	0.75	58	37	21	180
50	9	3	6	25.00	3.00	2.00	1.25	1.00	1.00	48	31	31	150
56	8	3	6	28.00	2.67	2.25	1.50	1.25	1.00	77	54	34	168
65	7	3	6	32.50	2.33	2.57	1.50	1.25	1.00	90	62	40	195
75	6	2	4	37.50	3.00	2.00	2.00	1.50	1.00	122	69	31	150
90	5	2	4	45.00	2.50	2.40	2.00	1.50	1.00	147	83	37	180
113	4	2	4	56.50	2.00	3.00	2.00	1.50	1.25	184	104	72	226
150	3	1	2	75.00		2.00	3.00	2.00	1.50	282	122	69	150

End Feed Converted to Center Feed



Center Feed

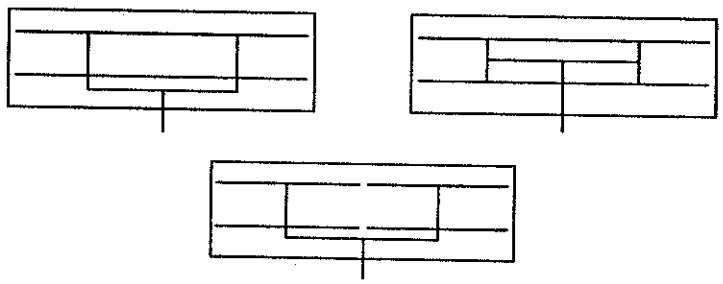
Note:

1. The dose volumes in columns 11-13 were calculated based on 5 times the lateral void volume.

2. The maximum dose volume should be 90 gallons and 120 gallons for systems serving 3 and 4 bedroom homes, respectively. The minimum dose volume required by code is equal to or greater than 5 times the void volume. It is recommended to limit it to 5 times. It is this calculated dose volume plus flowback that should be dosed to the treatment/dispersal unit. If this calculated dose volume exceeds the 90 and 120 gallon, respectively, the network should be redesigned so the calculated dose volume (5 times the lateral void volume) is less than 90 or 120 gallons depending on number of bedroom.

TABLE 2. PRESSURE DISTRIBUTION NETWORKS WITH FEED AT 1/4 AND 3/4 POINTS SERVING 3 BEDROOM HOMES. 450 SQ. FT. ABSORPTION CELLS.

1 Cell Length ft.	2 Cell Width ft.	3 No. of Laterals each side of center	4 Total No. Laterals	5 Lateral Length ft.	6 Lateral Spacing ft.	7 Orifice Spacing ft.	8 Lateral Diameter 1/4" hole in.	9 Lateral Diameter 3/16" hole in.	10 Lateral Diameter 1/8" hole in.	11 Dose Volume 1/4" hole gal.	12 Dose Volume 3/16" hole gal.	13 Dose Volume 1/8" hole gal.	14 Total Lateral Length ft.
75	6	2	8	18.75	3.00	2.00	1.25	1.00	0.75	48	31	17	150
90	5	2	8	22.50	2.50	2.40	1.25	1.00	0.75	58	37	21	180
113	4	2	8	28.25	2.00	3.00	1.25	1.00	0.75	72	46	26	226
150	3	1	4	37.50		2.00	2.00	1.50	1.00	122	69	31	150



Variations of 1/4 & 3/4 Point Feed Network

Note:

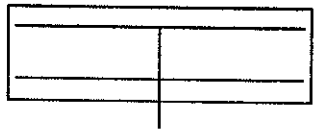
1. The dose volumes in columns 11-13 were calculated based on 5 times the lateral void volume.

2. The maximum dose volume should be 90 gallons and 120 gallons for systems serving 3 and 4 bedroom homes, respectively. The minimum dose volume required by code is equal to or greater than 5 times the void volume. It is recommended to limit it to 5 times. It is this calculated dose volume plus flowback that should be dosed to the treatment/dispersal unit. If this calculated dose volume exceeds the 90 and 120 gallon, respectively, the network should be redesigned so the calculated dose volume (5 times the lateral void volume) is less than 90 or 120 gallons depending on number of bedroom.

TABLE 3. PRESSURE DISTRIBUTION NETWORKS WITH CENTER FEED SERVING 4 BEDROOM HOMES
600 SQ. FT. ABSORPTION CELLS.

1 Cell Length ft.	2 Cell Width ft.	3 No. of Laterals each side of center	4 Total No. Laterals	5 Lateral Length 'ft.	6 Lateral Spacing ft.	7 Orifice Spacing ft.	8 Lateral Diameter 1/4" hole in.	9 Lateral Diameter 3/16" hole in.	10 Lateral Diameter 1/8" hole in.	11 Dose Volume 1/4" hole gal.	12 Dose Volume 3/16" hole gal.	13 Dose Volume 1/8" hole gal.	14 Total Lateral Length ft.
60	10	3	6	30	3	2	2	1	1	83	58	37	180
67	9	3	6	33.5	3	2	1.5	1.25	1	92	64	41	201
75	8	3	6	37.5	2.67	2.25	1.5	1.25	1	104	72	46	225
86	7	3	6	43	2.33	2.57	2	1.5	1	210	119	53	258
100	6	2	4	50	3	2	2	1.5	1.25	163	92	64	200
125	5	2	4	62.5	2.5	2.4	2	2	1.25	204	204	80	250
150	4	2	4	75	2	3	2	2	1.25	245	245	96	300

End Feed Converted to Center Feed



Center Feed

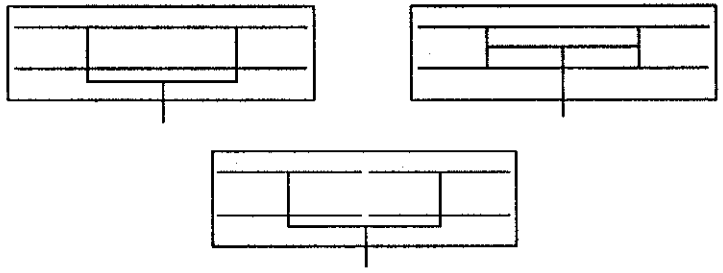
Note:

1. The dose volumes in columns 11-13 were calculated based on 5 times the lateral void volume.

2. The maximum dose volume should be 90 gallons and 120 gallons for systems serving 3 and 4 bedroom homes, respectively. The minimum dose volume required by code is equal to or greater than 5 times the void volume. It is recommended to limit it to 5 times. It is this calculated dose volume plus flowback that should be dosed to the treatment/dispersal unit. If this calculated dose volume exceeds the 90 and 120 gallon, respectively, the network should be redesigned so the calculated dose volume (5 times the lateral void volume) is less than 90 or 120 gallons depending on number of bedroom.

TABLE 4. PRESSURE DISTRIBUTION NETWORKS WITH FEED AT 1/4 AND 3/4 POINTS SEVING 4 BEDROOM HOMES
600 SQ. FT. ABSORPTION CELLS

1 Cell Length ft.	2 Cell Width ft.	3 No. of Laterals each side of center	4 Total No. Laterals	5 Lateral Length ft.	6 Lateral Spacing ft.	7 Orifice Spacing ft.	8 Lateral Diameter 1/4" hole in.	9 Lateral Diameter 3/16" hole in.	10 Lateral Diameter 1/8" hole in.	11 Dose Volume 1/4" hole gal.	12 Dose Volume 3/16" hole gal.	13 Dose Volume 1/8" hole gal.	14 Total Lateral Length ft.
86	7	3	6	21.5	2.33	2.57	1	1	0.75	26	26	15	129
100	6	2	4	25	3	2	1.25	1	0.75	32	21	12	100
125	5	2	4	31.25	2.5	2.4	1.5	1.25	1	58	40	26	125
150	4	2	4	37.5	2	3	1.5	1.25	1	69	48	31	150



Variations of 1/4 & 3/4 Point Feed Network

Note:

1. The dose volumes in columns 11-13 were calculated based on 5 times the lateral void volume.

2. The maximum dose volume should be 90 gallons and 120 gallons for systems serving 3 and 4 bedroom homes, respectively. The minimum dose volume required by code is equal to or greater than 5 times the void volume. It is recommended to limit it to 5 times. It is this calculated dose volume plus flowback that should be dosed to the treatment/dispersal unit. If this calculated dose volume exceeds the 90 and 120 gallon, respectively, the network should be redesigned so the calculated dose volume (5 times the lateral void volume) is less than 90 or 120 gallons depending on number of bedroom.