25.50 m

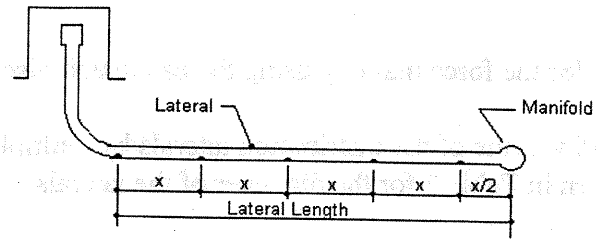


Figure 2 – Number of Orifices in a Lateral

5. Determine the number of orifices in a distribution line. The number of orifices is determined by using the following equation. See figure 3.

$$n = d/x + 1$$

Where: n = number of orifices
d = distribution line length
x = orifice spacing

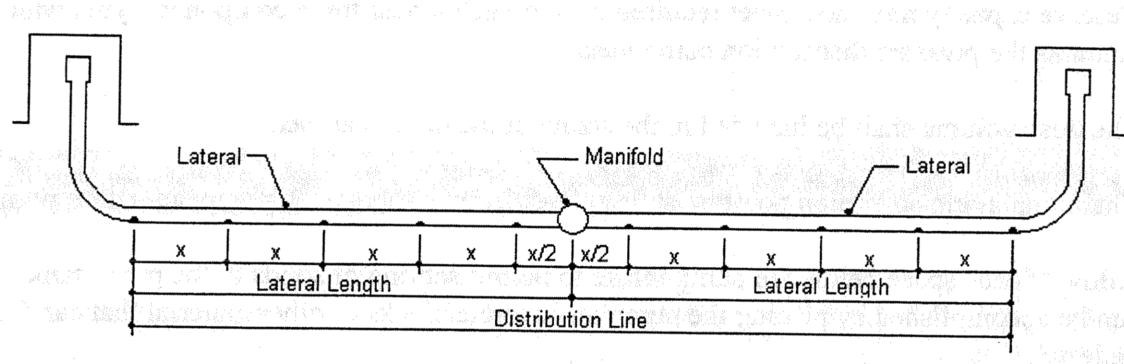


Figure 3 – Number of Orifices in a Distribution Line

6. Select orifice size of 1/8, 3/16, or 1/4 inch.

7. Determine lateral diameter - Using Graphs 1 through 6.

8. Select distal pressure - A design option based on site specific elevations and effluent delivery preferences and requirement of Tables 1 through 3.

9. Calculate lateral discharge rate using Table 4. (orifice discharge rate at selected distal pressure multiplied by the number of holes per lateral).

10. Determine manifold diameter - Determined by using Table 5.

11. Calculate component discharge rate - By multiplying the lateral discharge rate by the number of laterals.

12. Select a pipe size for the force main by using the calculated discharge rate and Table 6.

13. Determine the void volume of the distribution laterals by multiply the total length of the laterals by the volume given in Table 7 for the diameter of the laterals.

    If a pump is selected follow step #14.

    If a siphon is selected proceed to step # 16

14. Determine volume of dose chamber for components pressurized by a pump.

    The dose chamber shall contain sufficient volume to dose the distribution cell as required by its system design, retain drain back volume, contain a one day reserve zone, and allow for protection of the pump from solids.

    A reserve capacity is required on a system with only one pump. Other reserve capacities may also be required by the manual for the component type the dose chamber serves.

    The reserve volume is at least a one day holding capacity for the building. Reserve capacity may be calculated based using 100 gallons per bedroom per day for one and two family residences. Reserve capacity must also meet requirements in the manual for a component type, which contains the pressure distribution component.

    The dose volume shall be included in the sizing of the dose chamber.

    The pump alarm activation point must be at least 2 inches above the pump activation point.

    Allow "dead" space below the pump intake to permit settling of solids in the pump tank. This can be accomplished by placing the pump on concrete blocks or other material that can form a pedestal.

    The pump manufacturer requirements shall be followed. This may include the "pump off" switch located high enough to allow for complete immersion of the pump in the tank.

15. Select a pump that will provide an average flow equal to or greater than the total discharge rate of the orifices at a pressure equal to or greater than the operational pressure, plus the friction loss of the manifold and force main. If the perforation discharge rate is greater than the pump discharge rate, the system head will be insufficient.

16. Select a siphon that will provide an average flow equal to or greater than the total discharge rate of the orifices at a pressure equal to or greater than the operational pressure plus the friction loss of the manifold and the force main. The system head for components using automatic siphons must be developed in the force main. The difference in the elevation from the bottom of the siphon bell to the lateral must be greater than or equal to the force main friction loss plus the system head required. If the perforation discharge rate is greater than the siphon discharge rate, the system head will be insufficient.

17. Determine volume of dose chamber for components pressurized by a siphon.

    The dose chamber shall contain sufficient volume to allow the siphon to dose the component as required by the soil treatment and/or dispersal component design and allow for protection of the siphon from solids.

V. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of a pressure distribution component are just as critical as the design of the treatment and/or dispersal component. A good design with poor construction results in failure. Construction procedures for a pressure distribution component are as follows:

1. Review design and installation requirements for the type of treatment and/or dispersal component for which the pressurized system is to be installed.

2. Drill holes for the orifices at the locations required by the design. Remember to remove all burrs from the pipe and orifices.

3. Assemble the distribution network as determined by the pressure distribution component design, making sure to solvent cement all joints in the system.

4. Extend the end of each lateral up with the use of long turn or 45° fitting to a point within six inches of the final grade. Terminate the ends of the laterals with a valve, threaded cap or threaded plug. Provide access from final grade for the valve, threaded cap or threaded plug.

5. Install the pump or siphon as required by ch. 83 of the Wis. Admin. Code.

VI. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. The component owner is responsible for the operation and maintenance of the component. The county, department or POWTS service contractor may make periodic inspections of the components, checking for sludge accumulation in the dose chamber, condition of electrical components, alarms, dose rate, dose volume and frequency, etc.

   The owner or owner's agent is required to submit maintenance records routinely to the county or other appropriate jurisdiction and/or the department.

B. Design approval and site inspections before, during, and after the construction is accomplished by the county or other appropriate jurisdictions in accordance with ch. Comm 83 of the Wis. Admin. Code.

C. Other routine and preventative maintenance aspects are:

1. Dose chambers are to be inspected routinely and maintained when necessary in accordance with their approvals.
2. Inspection of the component performance is required at least every three years. Inspection includes checking the dose rate, volume and frequency.
3. Partial plugging of the distribution network may be detected by extremely long dosing times. The ends of the distribution laterals should be exposed and the pump activated to flush out any solid material. The liquid that is flushed out of the laterals is to be directed back into the distribution cell or into an acceptable container. If necessary, the laterals can be cleaned.

D. User's Manual: A user's manual is to accompany the pressure distribution component. The manual is to contain the following as a minimum:

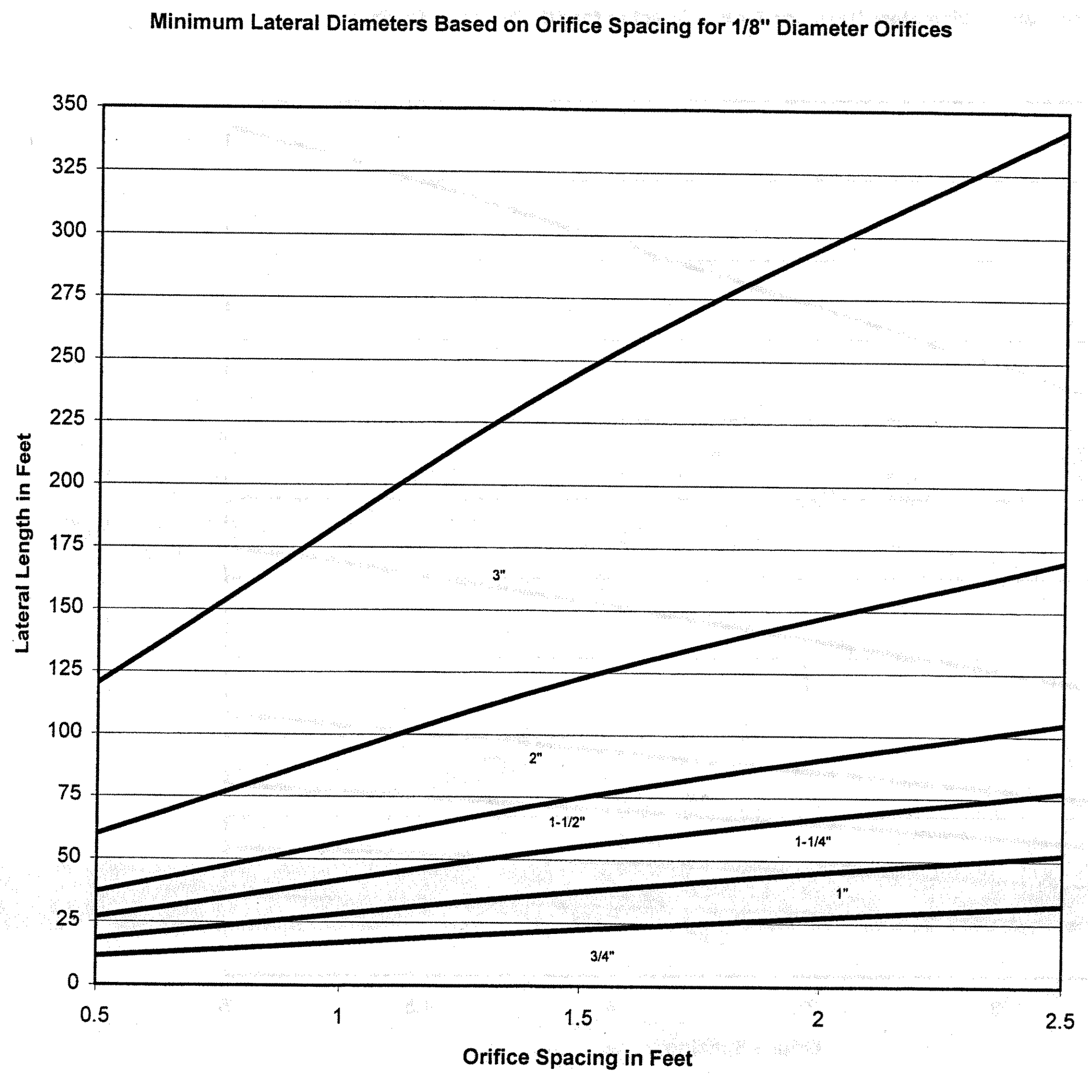
1. Diagrams of all components and their location. This should include the location of the access ports for cleaning and/or flushing the component.
2. Specifications for all electrical and mechanical components.
3. Names and phone numbers of local health authority, component manufacturer or management entity to be contacted in the event of a failure.
4. Information on the periodic maintenance of the component, including electrical/mechanical components.
5. Notice that the dose chamber may fill due to flow continuing during pump malfunction or power outages. One large dose when the power comes on or when the pump is repaired may cause the dispersal system to have problems. In this situation, the pump chamber should be pumped by a licensed pumper before pump cycling begins or other measures shall be used to dose the component with only the proper amount of influent. This may include manual operation of the pump controls until such time the pump chamber has reached its normal level.

E. Performance monitoring must be performed on pressure distribution systems installed under this manual.

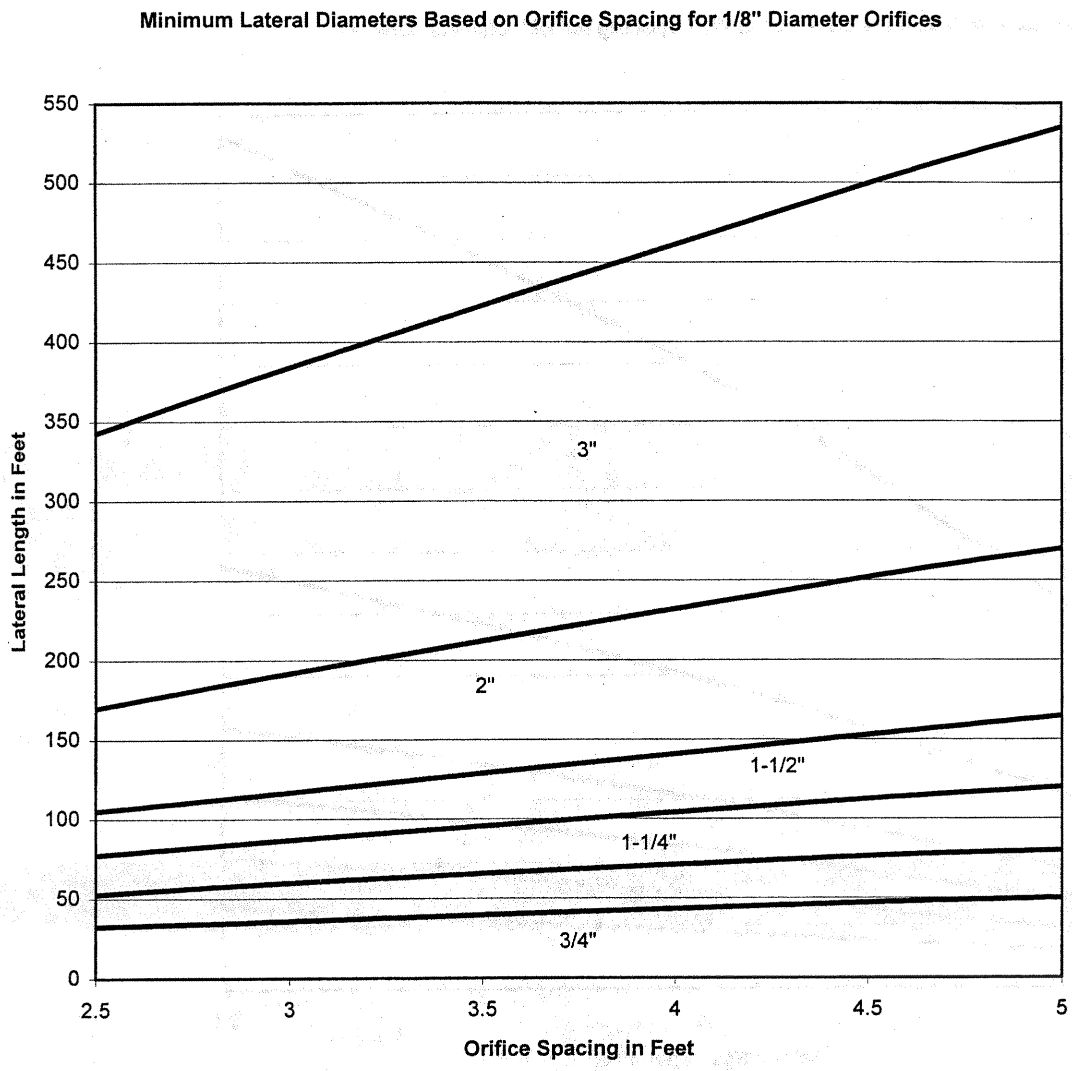
1. The frequency of monitoring must be:
   a. At least once every three years following installation and,
   b. At time of problem, complaint, or failure.
2. Reports are to be submitted in accordance with ch. Comm 83, Wis. Admin. Code.

VII. GRAPHS

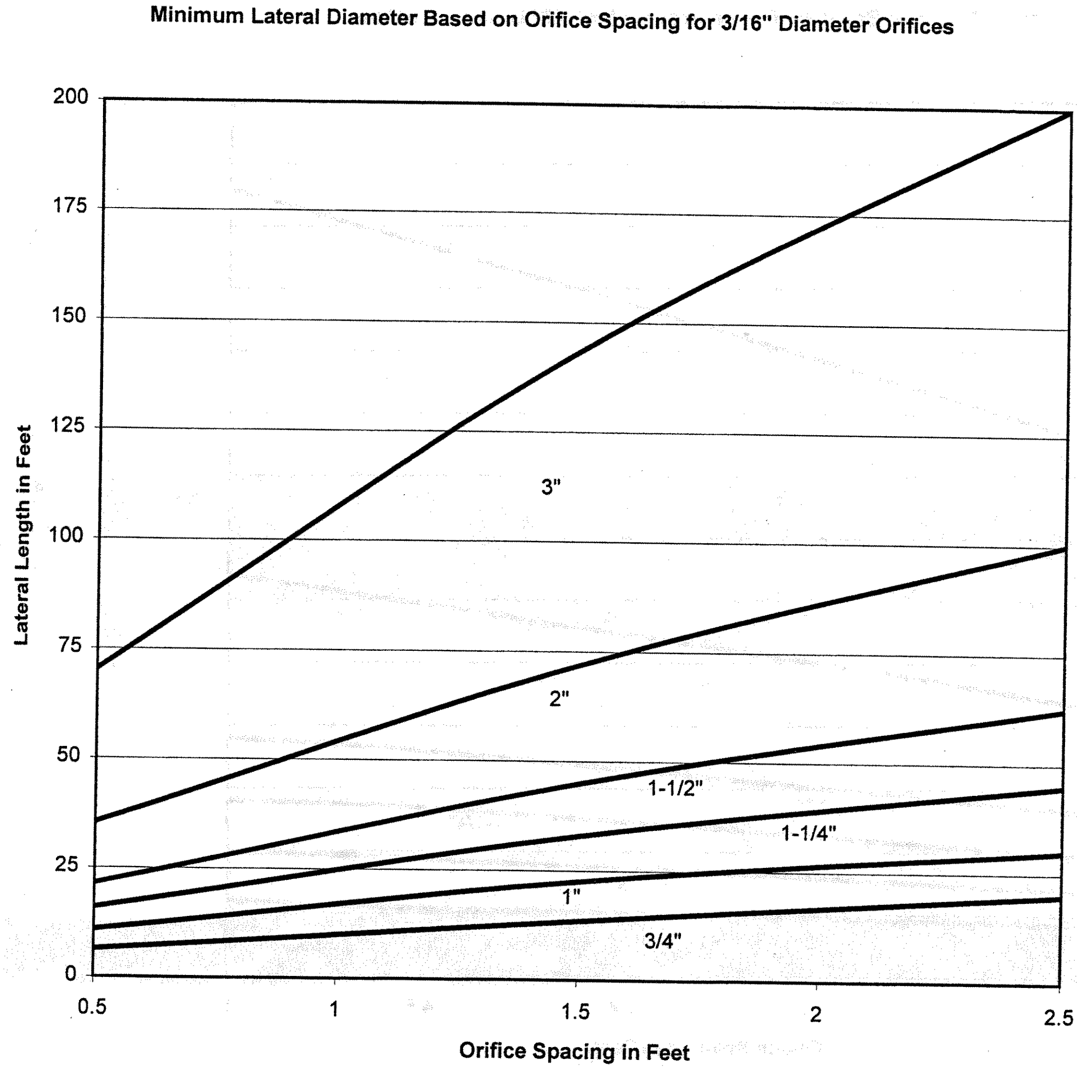
Graph 1



Graph 2

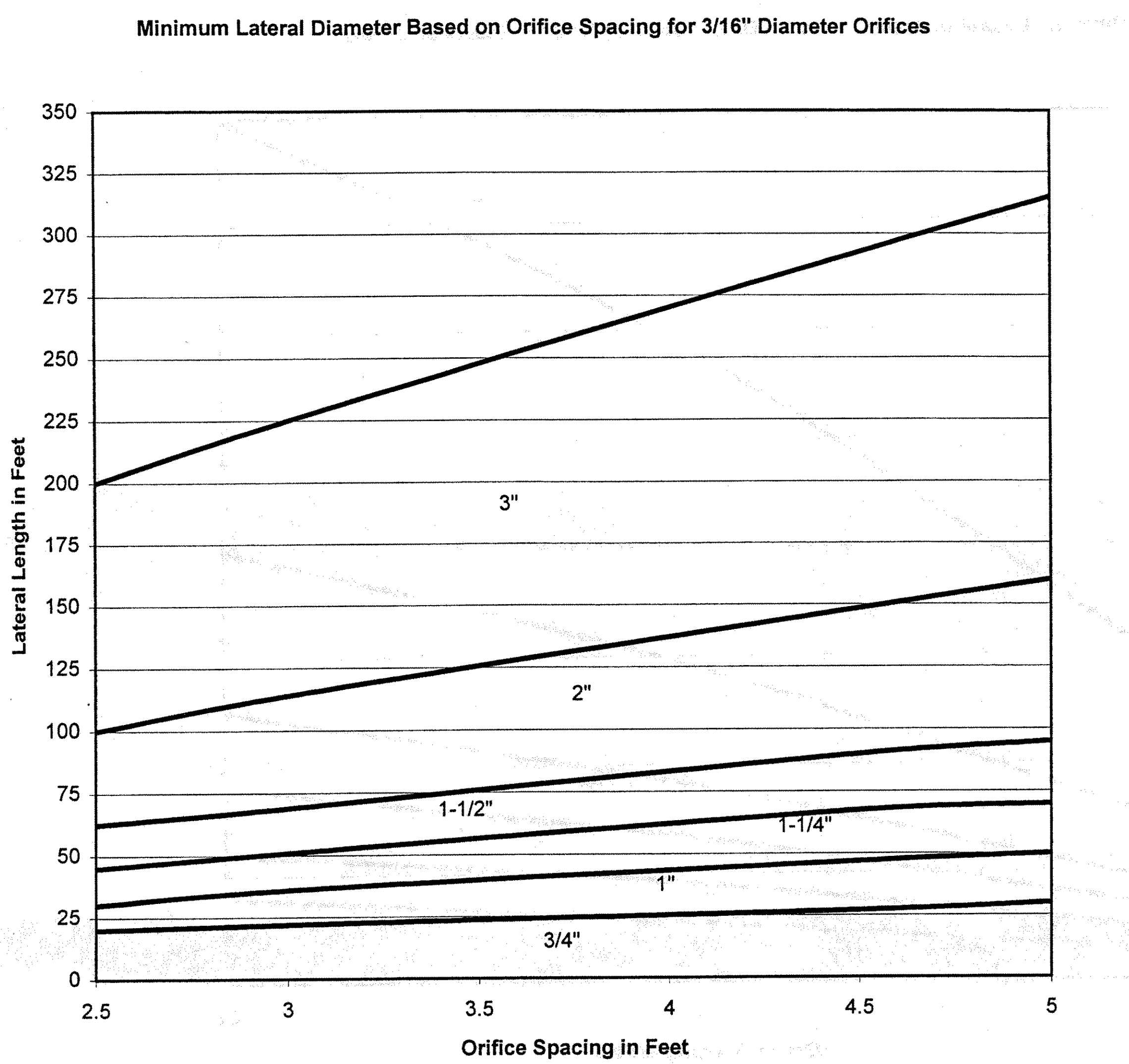

Minimum Lateral Diameters Based on Orifice Spacing for 1/8" Diameter Orifices
Lateral Length in Feet
550
500
450
400
350
300
250
200
150
100
50
0
3"
2"
1-1/2"
1-1/4"
3/4"
2.5
3
3.5
4
4.5
5
Orifice Spacing in Feet

Graph 3

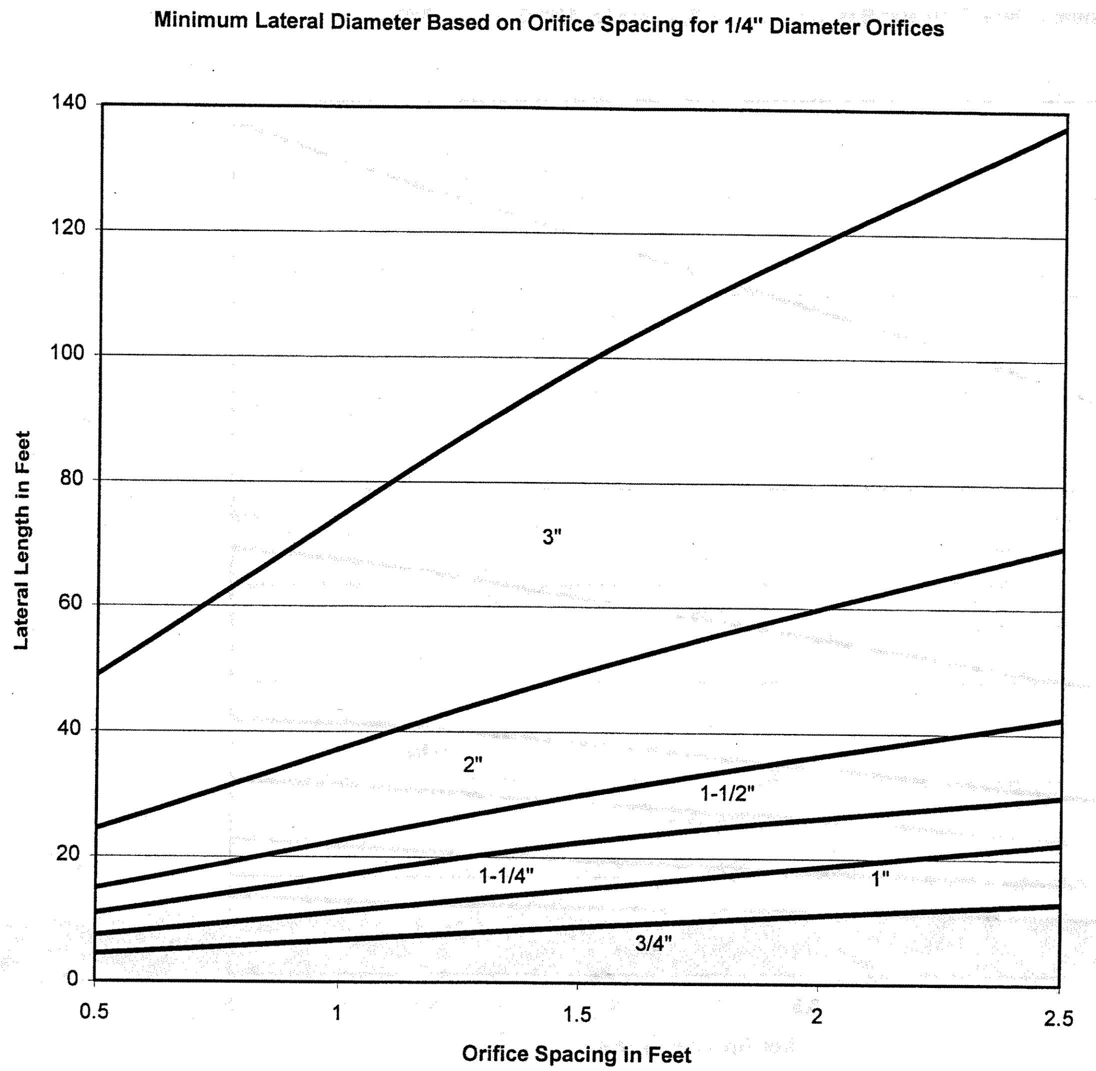


Minimum Lateral Diameter Based on Orifice Spacing for 3/16" Diameter Orifices
200
175
150
125
100
75
50
25
0
Lateral Length in Feet
3"
2"
1-1/2"
1-1/4"
1"
3/4"
0.5
1
1.5
2
2.5
Orifice Spacing in Feet

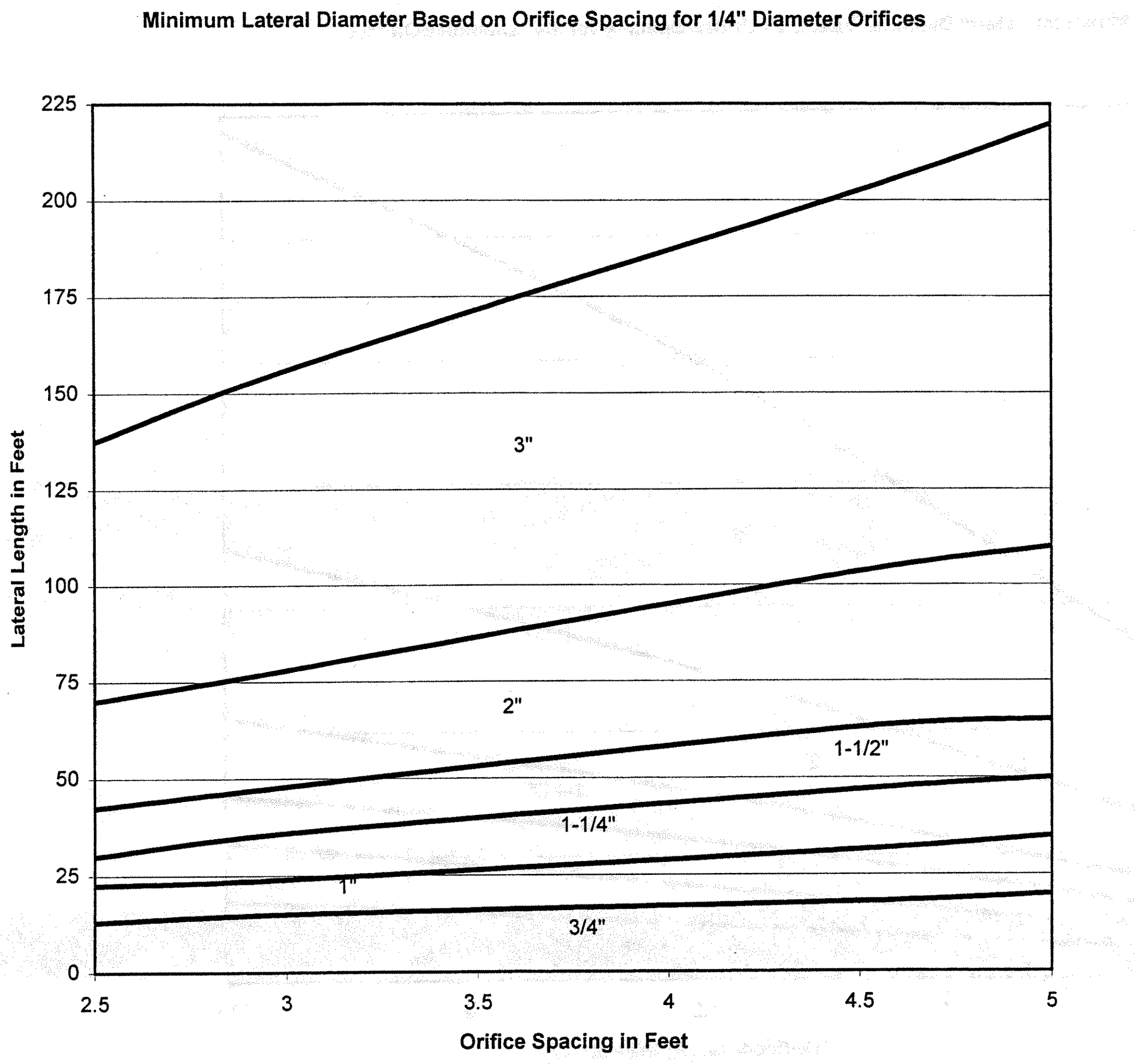
Graph 4


Minimum Lateral Diameter Based on Orifice Spacing for 3/16" Diameter Orifices
Lateral Length in Feet
350
325
300
275
250
225
200
175
150
125
100
75
50
25
0
2.5
3
3.5
4
4.5
5
Orifice Spacing in Feet
3"
2"
1-1/2"
1-1/4"
1"
3/4"

Graph 5


Minimum Lateral Diameter Based on Orifice Spacing for 1/4" Diameter Orifices
140
120
100
80
60
40
20
0
Lateral Length in Feet
3"
2"
1-1/2"
1-1/4"
1"
3/4"
0.5
1
1.5
2
2.5
Orifice Spacing in Feet

Graph 6


Minimum Lateral Diameter Based on Orifice Spacing for 1/4" Diameter Orifices
Lateral Length in Feet
225
200
175
150
125
100
75
50
25
0
2.5
3
3.5
4
4.5
5
Orifice Spacing in Feet
3"
2"
1-1/2"
1-1/4"
1"
3/4"

VIII. TABLES

Table 4
Discharge Rates in Gallons per Minute from Orifices[a]

Pressure in feet	Orifice Diameter		
	1/8	3/16	1/4
2.5	NP	0.66	1.17
3	NP	0.72	1.28
3.5	NP	0.78	1.38
4	NP	0.83	1.47
4.5	NP	0.88	1.56
5	0.41	0.93	1.65
5.5	0.43	0.97	1.73
6	0.45	1.02	1.80
6.5	0.47	1.06	1.88
7	0.49	1.10	1.95
7.5	0.50	1.14	2.02
8	0.52	1.17	2.08
8.5	0.54	1.21	2.15
9	0.55	1.24	2.21
9.5	0.57	1.28	2.27
10	0.58	1.31	2.33

Note a: Table is based on - Discharge in GPM = 11.79 x Orifice Diameter^2 in inches x (Pressure in Feet)$^{1/2}$
NP means not permitted

Table 5

Maximum Manifold Length Based on Individual Lateral Flow Rates and Lateral Spacing

Individual Lateral Discharge Rate		1-1/4" Diameter Manifold						1-1/2" Diameter Manifold					
End	Center	Lateral Spacing						Lateral Spacing					
Manifold	Manifold	1.5	2	2.5	3	3.5	4	1.5	2	2.5	3	3.5	4
10	5	4.5	6	7.5	9	10.5	8	7.5	8	10	12	14	12
20	10	3	4	5	6	7	8	4.5	6	7.5	6	7	8
30	15	3	4					3	4	5	6	7	8
40	20							3	4	5	6		
50	25							3	4				
60	30							3					

Individual Lateral Discharge Rate		2" Diameter Manifold						3" Diameter Manifold					
End	Center	Lateral Spacing						Lateral Spacing					
Manifold	Manifold	1.5	2	2.5	3	3.5	4	1.5	2	2.5	3	3.5	4
10	5	12	14	15	18	21	20	22.5	28	32.5	36	38.5	44
20	10	7.5	8	10	12	14	12	15	18	20	24	24.5	28
30	15	6	6	7.5	9	10.5	12	12	14	15	18	21	20
40	20	4.5	6	7.5	6	7	8	9	12	12.5	15	17.5	16
50	25	4.5	4	5	6	7	8	7.5	10	12.5	12	14	16
60	30	3	4	5	6	7	8	7.5	8	10	12	14	12
70	35	3	4	5	6	7	8	6	8	10	9	10.5	12
80	40	3	4	5	6	7		6	8	7.5	9	10.5	12
90	45	3	4	5	6			4.5	6	7.5	9	10.5	12
100	50	3	4	5				4.5	6	7.5	9	10.5	12
110	55	3	4					4.5	6	7.5	9	10.5	8
120	60	3						4.5	6	7.5	6	7	8
130	65	3						4.5	6	5	6	7	8
140	70							4.5	6	5	6	7	8
150	75							4.5	6	5	6	7	8
160	80							4.5	4	5	6	7	8
170	85							4.5	4	5	6	7	8
180	90							3	4	5	6	7	8
190	95							3	4	5	6	7	8
200	100							3	4	5	6	7	8

Table 6

FRICTION LOSS (FOOT/100 FEET) IN PLASTIC PIPE[a]

Flow in GPM	Nominal Pipe Size 3/4	1	1-1/4	1-1/2	2	3	4	6
1								
2								
3	3.24							
4	5.52							
5	8.34							
6	11.68	2.88						
7	15.53	3.83						
8	19.89	4.91						
9	24.73	6.10						
10	30.05	7.41	2.50					
11	35.84	8.84	2.99					
12	42.10	10.39	3.51					
13	48.82	12.04	4.07					
14	56.00	13.81	4.66	1.92				
15	63.62	15.69	5.30	2.18				
16	71.69	17.68	5.97	2.46				
17	80.20	19.78	6.68	2.75				
18		21.99	7.42	3.06				
19		24.30	8.21	3.38				
20		26.72	9.02	3.72				
25		40.38	13.63	5.62	1.39			
30		56.57	19.10	7.87	1.94			
35			25.41	10.46	2.58			
40			32.53	13.40	3.30			
45			40.45	16.66	4.11			
50			49.15	20.24	4.99			
60				28.36	7.00	0.97		
70				37.72	9.31	1.29		
80					11.91	1.66		
90					14.81	2.06		
100					18.00	2.50	0.62	
125					27.20	3.78	0.93	
150						5.30	1.31	
175						7.05	1.74	
200						9.02	2.23	
250						13.64	3.36	0.47
300							4.71	0.66
350							6.27	0.87

Velocities in this area (upper right) are below 2 feet per second

Velocities in this area (lower left) exceed 10 feet per second, which is too great for various flow rates and pipe diameter

Note a: Table is based on – Hazen-Williams formula: $h = 0.002082L \times (100/C)^{1.85} \times (gpm^{1.85} \div d^{4.8655})$

Where: h = feet of head

L = Length in feet

C = Friction factor from Hazen-Williams (145 for plastic pipe)

gpm = gallons per minute

d = Nominal pipe size

Table 7 VOID VOLUME FOR VARIOUS DIAMETER PIPES BASED ON NOMINAL I.D.[a]	
Nominal Pipe Size	Gallons per Foot
¾	0.023
1	0.041
1-1/4	0.064
1-1/2	0.092
2	0.163
3	0.367
4	0.65
6	1.469

Note a: Table is based on - πr^2 x 12"/ft ÷ 231 cu.in./cu.ft.
Where: r = nominal pipe size in inches

VIII. RREFERENCES

Department of Industry, Labor and Human Relations 1994, "Pressure Distribution Manual"

Small Scale Waste Management Project, University of Wisconsin – Madison, 1981, R.J. Otis, "Design of Pressure Distribution Networks for Septic Tank-Soil Absorption Systems."

X. PRESSURE DISTRIBUTION WORKSHEET

Information needed for Pressure Distribution Design:

Daily wastewater flow = _________ **gal/day**

Design loading rate = ___________ **gal/day**

System Configuration:

1. _______ **ft.** system width

2. _______ **ft.** system length

Proposed Lateral Layout:

3. _______ number of laterals

4. _______ central or end manifold

5. _______ **ft.** manifold length

6. _______ **ft.** distal pressure requirement (Based on orifice diameter, see Table 1)

7. _______ **in.** orifice diameter

8. _______ **ft.** estimated lateral length

Choose the Orifice Spacing:

9. _______ **in.** orifice spacing divided by 12 to convert to feet.

10. ______ number of orifices per lateral

$$n = L/x + .5$$

Where: n = number of orifices
L = lateral length, in feet
x = orifice spacing, in feet

Note: Networks with central manifold have laterals on each side of the manifold. Therefore the number of laterals are two times as many as a network with an end manifold.

Re-evaluate the Lateral Length:

11. ______ **ft.** final lateral length
(# of orifices x orifice spacing - 1/2 orifice spacing = optimal length)

Choose the Lateral Diameter:

12. ______ **in.** (Graphs 1-6)

Calculate the Lateral Discharge Rate:

13. ______ **gpm** lateral discharge rate.
Discharge rate per orifice x # of orifices per lateral = lateral discharge rate.

Choose the Manifold Diameter:

14. _______ **in.** (Table 5)

Calculate the System Discharge Rate:

15. _______ **gpm** (# of laterals x lateral discharge rate)

Calculate the Force Main Friction Loss:

16. _______ **ft.** force main length

17. _______ **in.** force main diameter (Table 6)

18. _______ **gpm** system discharge rate (from #15)

19. _______ **ft.** friction loss in ft/100 ft. x length ÷ 100 ft. (Table 6)

Calculate the Total Dynamic Head:

20. _______ **ft.** system head. (Distal pressure #6 x 1.3 ft.)

21. _______ **ft.** vertical lift (pump off to lateral elevation)

22. _______ **ft.** friction loss (in the force main in feet #19)

23. _______ **ft.** Total Dynamic Head (TDH) (sum of #20 through #22)

Calculate the Dose Volume:

24. _______ **gal.** based on system type.

25. _______ **gal.** - drain back

26. _______ **gal.** - actual dose volume (#24 + #25)

Pump Selection:

27. _______ **gpm** pump discharge rate at TDH (#23)
(not less than system discharge rate, #15)

Dose Chamber Sizing: (Sizing of dose chamber serving a sand filter may have different requirements. See component manual or manufacturer's or designer's specifications for sizing criteria.)

28. _______ **in.** tank bottom to "off" switch _________ gal.

29. _______ **in.** dose volume (from #26) _________gal.
("off" to "on" switch)

30. _______ **in.** "on" switch to alarm switch _________gal.

31. _______ **in.** reserve capacity _________gal.
(residential = 100 gal/BR)

32. _______ **in.** dose chamber capacity _________gal.

XI. PLAN SUBMITTAL AND INSTALLATION INSPECTION

A. Plan Submittal

In order to install a system correctly, it is important to develop plans that will be used to install the system correctly the first time. The following checklist may be used when preparing plans for review. The checklist is intended to be a general guide. Conformance to the list is not a guarantee of plan approval. Additional information may be needed or requested to address unusual or unique characteristics of a particular project. Contact the reviewing agent for specific plan submittal requirements, which the agency may require that are different than the list included in this manual.

<u>General Submittal Information</u>

- Photocopies of soil reports forms, plans, and other documents are acceptable. However, an original signature is required on certain documents.
- Submittal of additional information requested during plan review or and questions concerning a specific plan must be referenced to the Plan Identification indicator assigned to that plan by the reviewing agency.
- Plans or documents must be permanent copies or originals.

<u>Forms and Fees</u>

- Application form for submittal, provided by reviewing agency along with proper fees set by reviewing agent.
-

<u>Soils Information</u>

- Complete Soils and Site Evaluation Report (form # SBD-8330) for each backhoe pit described; signed and dated by a certified soil tester, with license number.
- Separate sheet showing the location of all borings. The location of all borings and backhoe pits must be able to be identified on the plot plan.

<u>Documentation</u>

- Architects, engineers or designers must sign, seal and date each page of the submittal or provide an index page, which is signed, sealed and dated.
- Master Plumbers must sign, date and include their license number on each page of the submittal or provide an index page, which is signed, sealed and dated.
- Three completed sets of plans and specifications (clear, permanent and legible); submittals must be on paper measuring at least 8-1/2 by 11 inches.

Plot Plan

- Dimensioned plans or plans drawn to scale (scale indicated on plans) with parcel size or all property boundaries clearly marked.
- Slope directions and percent in system area.
- Benchmark and north arrow.
- Setbacks indicated as per appropriate code.
- Two-foot contours to 25ft. on all sides of system area or include elevations at all four corners of proposed system.
- Location information; legal description of parcel must be noted.
- Location of any nearby existing system.

Plan View

- Dimensions for distribution cell(s).
- Location of observation pipes.
- Dimensions for fill for mound.
- Pipe lateral layout, which must include the number of laterals, pipe material, diameter and length; and number, location and size of orifices.
- Manifold/force main locations, with materials, length and diameter of each.

Cross Section Of System

- Include tilling requirement, depth and size of aggregate, percent slope, side slope, and cover material.
- Lateral elevation, position of observation pipes, dimensions and depths of aggregate, and type of cover material such as geotextile fabric, and depth, if applicable.

System Sizing

- For one- and two-family dwellings, the number of bedrooms must be included.
- For public buildings, the sizing calculations must be included.

Tank And Pump / Siphon Information

- All construction details for site-constructed tanks.
- Size and manufacturer information for prefabricated tanks.
- Notation of pump or siphon model, pump performance curve, friction loss for force main and calculation for total dynamic head.
- Cross section of tank / chamber to include storage volumes; connections for piping, vents, and electricity; pump "off" setting; dosing cycle and volume; and location of vent and manhole.
- Cross section of two compartments tanks or tanks installed in a series must include information listed above.

B. Inspections.

Inspection shall be made in accordance with ch. 145.20, Wis. Stats and s. Comm 83.26, Wis. Adm. Code. The inspection form on the following two pages may be used. The inspection of the system installation and/or plans is to verify that the system at least conforms to specifications listed in Tables 1 - 3 of this manual.

POWTS INSPECTION REPORT

(ATTACH TO PERMIT)

GENERAL INFORMATION

Permit Holder's Name	☐ City ☐ Village ☐ Town of	County	Sanitary Permit No.
State Plan ID No.	Tax Parcel No.	Property Address if Available	

TANK INFORMATION			**SETBACKS**				
TYPE	MANUFACTURER	CAPACITY	P/L	WELL	BLDG.	VENT TO AIR INTAKE	ROAD
SEPTIC							
DOSING							
AERATION							
HOLDING							

PUMP / SIPHON INFORMATION

Manufacturer:	Model No.	Demand in GPM	Vert. Lift

FORCE MAIN INFORMATION			**FRICTION LOSS**		
Length	Diameter	Dist. To Well	Component Head	TDH - As Built	TDH - Design

SOIL ABSORPTION COMPONENT

TYPE OF COMPONENT				COVER MATERIAL		
Cell Width	Cell Length	Cell Diameter	Cell Depth	Horizontal Separation	Liquid Depth	No. of Cells

LEACHING CHAMBER OR UNIT	Manufacturer	Model No.

SETBACK INFO.	Property Line	Bldg.	Well	Lake/Stream

DISTRIBUTION COMPONENT / Elevation data on back of form

Header / Manifold		Distribution Pipe(s)			Hole size	Hole Spacing	Obsv. Tubes Inst. & No.
Length	Dia.	Length	Dia.	Spacing			

SOIL COVER

Depth over center of cell:	Depth over edge of cell:	Depth of Cover material	Seeded / Sodded	Mulched

DEVIATIONS FROM APPROVED PLAN

DATE OF INST. DIRECTIVE:	DATE OF ENFORCEMENT ORDER:
DATE OF REFERRAL TO LEGAL COUNSEL:	

COMMENTS (Persons present, discrepancies, etc.)

COMPONENTS NOT INSPECTED

Plan Revision Required ☐ Yes ☐ No	Date:	Signature of Inspector:	Cert. Number

Sketch on other side

ELEVATION DATA

Point	Back sight	Height of instrument	Foresight	Elevation	Comments
Bench mark					
Bldg. sewer					
Tank inlet					
Tank outlet					
Tank inlet					
Tank outlet					
Dose tank inlet					
Bottom of dose tank					
Dist. lateral 1					
System elev. 1					
Dist. lateral 2					
System elev. 2					
Dist. lateral 3					
System elev. 3					
Grade elev. 1					
Grade elev. 2					
Grade elev. 3					

SKETCH OF COMPONENT & ADDITIONAL COMMENTS

MOUND COMPONENT MANUAL

FOR PRIVATE ONSITE

WASTEWATER TREATMENT SYSTEMS

State of Wisconsin
Department of Commerce
Division of Safety and Buildings

SBD-10572-P (R.6/99)

TABLE OF CONTENTS

Published on June 11, 1999 by
Dept. of Commerce
Division of Safety and Buildings
Safety and Buildings Publication SBD-10572-P (R.6/99)

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I. INTRODUCTION AND SPECIFICATIONS

This Private Onsite Wastewater Treatment System (POWTS) component manual provides design, construction, inspection, operation, and maintenance specifications for a mound component. However, these items must accompany a properly prepared and reviewed plan acceptable to the governing unit to help provide a system that can be installed and function properly. Violations of this manual constitute a violation of chs. Comm 83 and 84, Wis. Adm. Code. The mound component must receive influent flows and loads less than or equal to those specified in Table 1. When designed, installed and maintained in accordance with this manual, the mound component provides treatment and dispersal of domestic wastewater in conformance with ch. Comm 83 of the Wis. Adm. Code. Final effluent characteristics will comply with s. Comm 83.43 (8) and 83.44 (2), Wis. Adm. Code when inputs are within the range specified in Tables 1 to 3.

Note: Detailed plans and specifications must be developed, and submitted for reviewed and approved by the governing unit having authority over the plan for the installation. Also, a Sanitary Permit must be obtained from the department or governmental unit having jurisdiction. See Section XII for more details.

Table 1
INFLUENT FLOWS AND LOADS

Design Wastewater flow (DWF)	≤ 5000 gal/day
Monthly average value of Fats, Oil and Grease (FOG)	≤ 30 mg/L
Monthly average value of five day Biochemical Oxygen Demand (BOD_5)	≤ 220 mg/L
Monthly average value of Total Suspended Solids (TSS)	≤ 150 mg/L
Design loading rate of fill	≤ 1.0 gal/ft^2/day if BOD_5 or TSS > 30 mg/L or ≤ 2.0 gal/ ft^2/day if BOD_5 or TSS ≤ 30 mg/L
Volume of a single dose	≥ 5 times void volume of the distribution lateral (s)
Design daily wastewater flow (DWF) from One and two-family dwellings	≥ 150 gal/day/bedroom
Design daily wastewater flow (DWF) from public facilities	≥ 150% of estimated daily wastewater flow in accordance with Table 4 of this manual or s. Comm 83.43 (6), Wis. Adm. Code.
Linear loading rate for systems with in situ soils having an effluent application rate of ≤ 0.3 gal/ft^2/day within 12 inches of fill material	≤ 4.5gal/ft
Wastewater particle size	≤ 1/8 inch
Distribution cell area per orifice	≤ 6 ft^2

Table 2 **SIZE AND ORIENTATION**	
Distribution cell width (A)	≤ 10 feet
Total distribution cell area (A)(B)	≥ Design daily flow rate ÷infiltrative rate of fill material
Fill material depth (D) at up slope edge	1. ≥ 6 inches when fill is placed on in situ soil listed in Table 83.44-3, Wis. Adm. Code, having fecal coliform treatment capabilities of ≤ 36 inches, or 2. ≥ 12 inches when fill is placed on in situ soil listed in Table 83.44-3, Wis. Adm. Code, having fecal coliform treatment capabilities of > 36 inches.
Distribution cell depth (F)	≥ 8 inches + outside diameter of distribution pipe
Depth of cover material at top center of distribution cell (H)	≥ 12 inches
Depth of cover material at top outer edge of distribution cell (G)	≥ 6 inches
Basal area (A+I) (B) or (A+I+J)(B)	≤ Design daily flow rate ÷ Infiltrative rate of in situ soil
Orientation	Longest dimension parallel to surface grade contours on sloped sites. System is not allowed on concave slopes.
Bottom of distribution cell	Level

Table 3 **OTHER SPECIFICATIONS**	
Slope of original grade	≤ 25% in area of mound
Depth of in situ soil to high groundwater elevation and bedrock under basal area	≥ 6 inches of which 4 inches is below an “A” horizon, if an “A” horizon exists.
Vertical separation between distribution cell and seasonal saturation defined by redoximorphic features, groundwater, or bedrock	≥ Equal to depth required by s. Comm 83 Table 83.44-3, Wis. Adm. Code
Horizontal separation between distribution cells	≥ 3 ft.
Fill material	Meets ASTM Specification C-33 for fine aggregate

Table 3 **OTHER SPECIFICATIONS** (continued)	
Size for basal area (for level sites)	≥ The area measured from center of distribution cell and extends in all directions to create an area equal to the infiltrative rate of the in situ soil ÷ design daily flow rate
Size for basal area (for sloping sites)	≥ The area measured from up slope side of distribution cell and extends from end to end of distribution cell down slope to create an area equal to the infiltrative rate of the in situ soil ÷ total design daily flow rate
Effluent application	By use of pressure distribution network conforming to **sizing methods** of either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" or Dept. of Commerce publication SBD-10573-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems"
Piping Material	Meets requirements of s. Comm 84.30 (2), Wis. Adm. Code for its intended use
Distribution cell aggregate material	Meets requirements of s. Comm 84.30 (6) (i), Wis. Adm. Code
Fabric cover over distribution cell when aggregate is used	Geotextile fabric meeting s. Comm 84.30 (6) (g), Wis. Adm. Code
Number of observation pipes per distribution cell	≥ Two extending from distribution cell infiltrative surface to finished grade
Location of observation pipes	At opposite ends of the distribution cell at a distance approximately equal to 1/6 of the distribution cell length .
Maximum final slope of mound surface	≤ 3:1
Cover material	Soil that will promote plant growth
Grading of surrounding area	Graded to divert surface water around mound system
Limited activities	Unless otherwise specifically allowed in this manual, vehicular traffic, excavation, and soil compaction are prohibited in the basal area and 15 feet down slope of basal area, if there is a restrictive horizon that effects treatment or dispersal
Erosion and frost protection	Graded to divert surface water around Component and sodded or seeded and mulched

Table 3 **OTHER SPECIFICATIONS** (continued)	
Installation inspection	In accordance with ch. Comm 83, Wis. Adm. Code
Management	In accordance with ch. Comm 83, Wis. Adm. Code and this manual

II. DEFINITIONS

Definitions not found in this section, are located in ch. Comm 81 of the Wisconsin Administrative Code or the terms use the standard dictionary definition.

A. "Basal Area" means the effective in situ soil surface area available for infiltration of partially treated effluent from the fill material.

B. "Fill Material" means that material used along the sides of and under the distribution cell.

C. "Limiting Factor" means high groundwater elevation or bedrock.

D. "Mound" means an on-site wastewater treatment and dispersal component. The structure contains a distribution component surrounded by, and elevated above, the original land surface by suitable fill material. The fill material provides a measurable degree of wastewater treatment and allows effluent dispersal into the natural environment under various soil permeability.

E. "Permeable Soil" means soil with textural classifications according to the U.S. Department of Agriculture, Natural Resource Conservation Service, classification system of silt loam to gravely medium sand.

F. "Slowly Permeable Soil" means soil with textural classifications according to the U.S. Department of Agriculture, Natural Resource Conservation Service, classification system of clay loam and silty clay loams that exhibit a moderate grade of structure; and loams, silt loams, and silts with weak grades of structure; or soils with weak to moderate grades of platy structure.

G. "Unsaturated flow" means liquid flow through a soil media under a negative pressure potential. Liquids containing pathogens and pollutants come in direct contact with soil/fill material microsites, which enhances wastewater treatment by physical, biological, and chemical means.

H. "Vertical Flow" means the effluent flow path downward through soil or fill material, which involves travel along soil surfaces, or through soil pores.

I. "Vertical Separation" means the total depth of unsaturated soil that exists between the infiltrative surface of a distribution cell and seasonal saturation defined by redoximorphic features, groundwater or bedrock.

III. DESCRIPTION AND PRINCIPLE OF OPERATION

POWTS mound component operation is a two-stage process involving both wastewater treatment and dispersal. Treatment is accomplished predominately by physical and biochemical processes within the fill material and in situ soil. The physical characteristics of the influent wastewater, influent loading rate, temperature, and the nature of the receiving fill material and in situ soil affect these processes.

Physical entrapment, increased retention time, and conversion of pollutants in the wastewater are important treatment objectives accomplished under unsaturated conditions. Pathogens contained in the wastewater are eventually deactivated through filtering, retention, and adsorption by the fill material. In addition, many pollutants are converted to other chemical forms by oxidation processes.

Dispersal is primarily affected by the depth of the unsaturated receiving soils, their hydraulic conductivity, land slope, and the area available for dispersal.

The mound consists of fill material, a distribution cell, and cover material. Influent is dispersed into the distribution cell where it flows through the fill material and undergoes biological, chemical and physical treatment and then passes into the underlying soil for further treatment and dispersal to the environment.

Cover material consisting of soil provides frost protection and moisture retention sufficient to maintain a good vegetative cover. See Figure 1, for a typical mound system.

The in situ soil serves in combination with the fill, as treatment media and it also disperses the treated effluent.

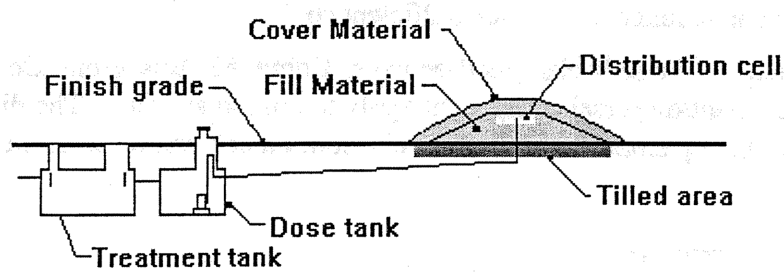

Figure 1 - A cross-section-of a mound system for POWTS.

IV. SOIL AND SITE REQUIREMENTS

Every mound design is ultimately matched to the given soil and site.

The design approach presented in this manual is based on criteria that all applied wastewater is successfully transported away from the system, that it will not affect subsequent wastewater additions, and that the effluent is ultimately treated.

A. Minimum Soil Depth Requirements - The minimum soil factors required for successful mound system performance are listed in the introduction and specification section of this package.

Soil evaluations must be in accordance with ch. Comm 85 of the Wis. Adm. Code. In addition, soil application rates must be in accordance with ch. Comm 83 of the Wis. Adm. Code.

B. Other Site Considerations -

1. Slopes - The slope on which a mound is to be installed may not indicate the direction of groundwater movement. If there is documentation that the direction of groundwater movement is different than the slope of the land, the direction of groundwater movement must be considered during mound design.

On a crested site the fill can be situated such that the effluent can move laterally down both slopes. A level site allows lateral flow in all directions, but may present problems as the water table could rise higher beneath the fill in slowly permeable soils. The sloping site allows the liquid to move in one direction away from the fill. Figure 3 shows a cross-section of a mound and the effluent movement in a slowly permeable soil on a sloping site.

Mound components rely on lateral effluent movement through the upper soil horizons. Lateral movement becomes more important as soil permeability decreases.

2. Mound location - In open areas, exposure to sun and wind increases the assistance of evaporation and transpiration in the dispersal of the wastewater.
3. Sites with trees and large boulders - Generally, sites with large trees, numerous smaller trees or large boulders are less desirable for installing a mound system because of difficulty in preparing the surface and the reduced infiltration area beneath the mound. As with rock fragments, tree roots, stumps and boulders occupy area, thus reducing the amount of soil available for proper treatment. If no other site is available, trees in the basal area of the mound must be cut off at ground level. A larger fill area is necessary when any of the above conditions are encountered, to provide sufficient soil.
4. Setback distances - The setbacks specified in ch. Comm 83, Wis. Adm. Code for soil subsurface treatment/dispersal component apply to mound systems. The distances are measured from the up slope and end of the distribution cell and down slope of the toe of the mound.

V. FILL AND COVER MATERIAL

A. Fill Material - The fill material and its placement are one of the most important components of the mound system. Quality control of the fill material is critical to system performance, each truckload of material must meet specifications for fill.

Determining whether a proposed fill material is suitable or not requires that a textural analysis be performed. The standard method to be used for performing this analysis conforms to ASTM C-136, Method for Sieve Analysis of Fine and Coarse Aggregates, and ASTM E-11, Specifications for Wire-Cloth Sieves for Testing Purposes, Annual Book of ASTM Standards, Volume 04.02. Information concerning these methods can also be obtained from Methods of Soils Analysis Part 1, C. A. Black, ed., ASA, Monograph #9, American Society of Agronomy, Inc., 1975.

B. Cover material - The cover material is a finer textured soil to allow (1) plant growth due to a higher water holding capacity and (2) increased runoff due to its more dense nature. Sands are not recommended, as they drain rapidly and allow more infiltration of precipitation into the distribution cell. Also, clays are not recommended as they can restrict oxygen transfer. Often, excavated soil from the site can be used. Seeding or other means must be done to prevent erosion of the mound.

VI. DESIGN

A. Location, Size and Shape - Placement, sizing and shaping of the mound and the distribution cell within the mound must be in accordance with this manual. The means of pressurizing the distribution network must provide equal distribution of the wastewater. A pressurized distribution network using a **method of sizing** as described in either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption System" or Dept. of Commerce publication SBD-10573-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" is acceptable.

B. Component Design - Design of the mound system is based upon the expected daily wastewater volume and the soil characteristics. It must be sized such that it can accept the daily wastewater flow without causing surface seepage or groundwater pollution. Consequently, the basal area, which is the in situ soil area beneath the fill, must be sufficiently large enough to absorb the effluent into the underlying topsoil. The system must also be designed to avoid encroachment of the water table into the fill.

Design of the mound includes three steps that are: (A) calculating daily wastewater load, (B) design of the distribution cell within the fill, (C) design of the entire mound. This includes sizing the total width and length of the basal area and fill, system height, location of the effluent distribution lateral, and observation pipes. Each step is discussed. A design example is provided in section XI of the manual. The letters for the various dimensions correlate with those in figures 2 and 3.

Step A. Design Wastewater Flow Calculations

One and two-family dwellings. Distribution cell size for one and two-family dwelling application is determined by calculating the design wastewater flow (DWF). To calculate DWF use formula 1.

Formula 1

DWF = 150 gallons/day/bedroom

Public Facilities. Distribution cell size for public facilities application is determined by calculating the DWF using formula 2. Public facility estimated daily wastewater flows are listed in Table 4. Facilities that are not listed in Table 4 are not included in this manual. Many commercial facilities have high BOD_5, TSS and FOG (fats, oils and grease), which must be pretreated in order to bring their values down to an acceptable range before entering into the mound component described in this manual.

Formula 2

DWF = Sum of each wastewater flow per source per day (from Table 4) x 1.5

Table 4 Public Facility Wastewater Flows		
Source	**Unit**	**Estimated Wastewater Flow (gpd)**
Apartment or Condominium	Bedroom	100
Assembly hall (no kitchen)	Person (10 sq. ft./person)	1.3
Bar or cocktail lounge (no meals served)	Patron (10 sq. ft./patron)	4
Bar or cocktail lounge* (w/meals - all paper service)	Patron (10 sq. ft./patron)	8
Beauty salon	Station	90
Bowling alley	Bowling lane	80
Bowling alley (with bar)	Bowling lane	150
Camp, day and night	Person	25
Camp, day use only (no meals served)	Person	10
Campground or Camping Resort	Space, with sewer connection and/or service building	30
Campground sanitary dump station	Camping unit or RV served	25
Catch basin	Basin	65
Church (no kitchen)	Person	2
Church* (with kitchen)	Person	5
Dance hall	Person (10 sq. ft./person)	2
Day care facility (no meals prepared)	Child	12
Day care facility* (with meal preparation)	Child	16
Dining hall* (kitchen waste only without dishwasher and/or food waste grinder)	Meal served	2
Dining hall* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Meal served	5
Dining hall* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Meal served	7
Drive-in restaurant* (all paper service with inside seating)	Patron seating space	10
Drive-in restaurant* (all paper service without inside seating)	Vehicle space	10
Drive-in theater	Vehicle space	3
Employees (total all shifts)	Employee	13
Floor drain (not discharging to catch basin)	Drain	25
Gas station / convenience store	Patron (minimum 500 patrons)	3
Gas station (with service bay) Patron Service bay	 Patron Service bay	 3 50
Hospital*	Bed space	135
Hotel, motel or tourist rooming house	Room	65
Medical office building Doctors, nurses, medical staff Office personnel Patients	 Person Person Person	 50 13 6.5
Migrant labor camp (central bathhouse)	Employee	20
Mobile Home (Manufactured home) (served by its own POWTS)	Bedroom	100
Mobile home park	Mobile home site	200

* = May be high strength waste

Table 4 **Public Facility Wastewater Flows** (continued)		
Source	**Unit**	**Estimated Wastewater Flow (gpd)**
Nursing, Rest Home, Community Based Residential Facility	Bed space	65
Outdoor sport facilities (toilet waste only)	Patron	3.5
Parks (toilets waste only)	Patron (75 patrons/acre)	3.5
Parks (toilets and showers)	Patron (75 patrons/acre)	6.5
Public shower facility	Shower taken	10
Restaurant*, 24-hr. (dishwasher and/or food waste grinder only)	Patron seating space	4
Restaurant*, 24-hr. (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	12
Restaurant, 24-hr. (toilet waste)	Patron seating space	28
Restaurant*, 24-hr. (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	40
Restaurant*, 24-hr. (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	44
Restaurant* (dishwasher and/or food waste grinder only)	Patron seating space	2
Restaurant* (kitchen waste only without dishwasher and/or food waste grinder)	Patron seating space	6
Restaurant (toilet waste)	Patron seating space	14
Restaurant* (toilet and kitchen waste without dishwasher and/or food waste grinder)	Patron seating space	20
Restaurant* (toilet and kitchen waste with dishwasher and/or food waste grinder)	Patron seating space	22
Retail store	Patron (70% of total retail area ÷ 30 sq. ft. per patron)	1
School* (with meals and showers)	Classroom (25 students/classroom)	500
School* (with meals or showers)	Classroom (25 students/classroom)	400
School (without meals or showers)	Classroom (25 students/classroom)	300
Self-service laundry (toilet waste only)	Clothes washer	33
Self-service laundry (with only residential clothes washers)	Clothes washer	200
Swimming pool bathhouse	Patron	6.5

* = May be high strength waste

Step B. Design of the Distribution cell - This section determines the required infiltrative surface area of the distribution cell/fill interface, as well as the dimensions of the distribution network within the fill.

1. Sizing the distribution cell - The minimum bottom area of the distribution cell is determined by dividing the design wastewater flow per day by the design loading rate of the fill material. As specified Table 1, the design loading rate of the infiltration surface between the distribution cell and fill is:

   <1.0 gal/ft^2/day if BOD_5 or TSS > 30 mg/L or ≤ 2.0 gal/ft^2/day if BOD_5 or TSS ≤ 30 mg/L

   Using the above information, the infiltrative surface area between the distribution cell and the fill area is:

   Area = Design wastewater flow ÷ design loading rate of the fill material.

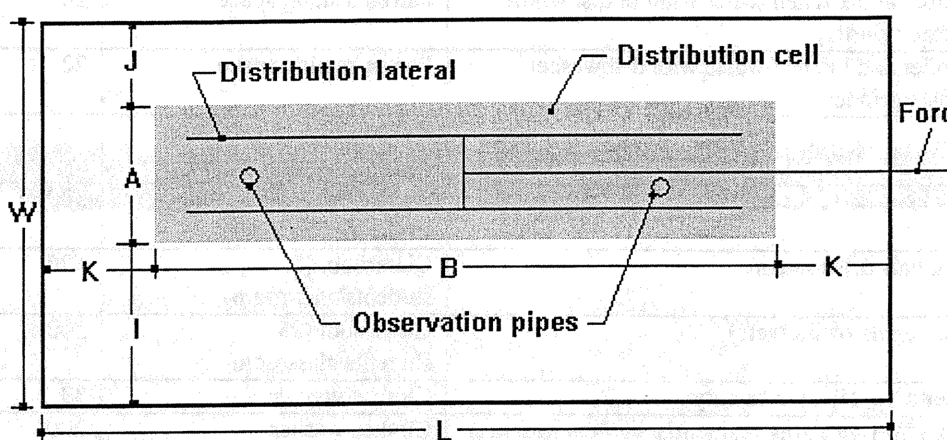

Figure 2 - Detailed plan view of a mound.

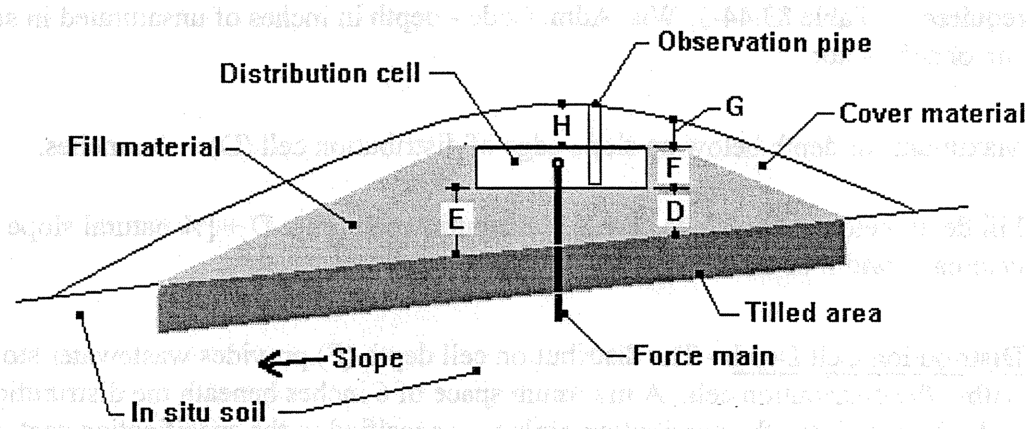

Figure 3 - Detailed cross-section of a mound.

2. System Configuration - The distribution cell must be longer than it is wide. Maximum width of the distribution cell is 10 feet. The maximum length of the distribution cell is dependent on setback requirements and soil evaluation.

   On sloping sites, the distribution cell is aligned with its longest dimension parallel to the contours as required by the specifications of this package so as not to concentrate the effluent into a small area as it moves laterally down slope.

   The bottom of the distribution cell is level so one area of the distribution cell is not overloaded.

   The dimensions for distribution cell are calculated as follows:

   Area of distribution cell = distribution cell width (A) x distribution cell length (B). However, the maximum linear loading rate for the system can not be exceeded and the width can not exceed 10 ft.

Step C. Sizing the Mound

1. Mound Height - The mound height on sloping sites is calculated using the following equation where: sand fill depth (D), the down slope fill depth (E), the distribution cell depth (F), and the cover material depth (H).

   Mound Height = (D + E) ÷2 + F + H

2. Fill Depth - The depth of fill is based on the specification section of this package and slope for a given site. The minimum depth of fill is 6 inches when the fill is placed on in situ soil listed in table 83.43-3,Wis. Adm. Code, having fecal coliform treatment capabilities of unsaturated soil depth of 36 inches or less. Systems placed on in situ soil listed in table 83.43-3,Wis. Adm. Code, having fecal coliform treatment capabilities of unsaturated soil depth of greater than 36 inches, requires a minimum 12 inches of fill depth. A minimum unsaturated flow depth required for proper treatment of the wastewater is as required by Table 83.44-3, Wis. Adm. Code.

Minimum fill depth below up slope edge of distribution cell (D) = 6 or 12 inches + depth required by Table 83.44-3, Wis. Adm. Code - depth in inches of unsaturated in situ soil to site or soil factor

Maximum fill depth below up slope edge of distribution cell (D) = 36 inches.

Fill depth below down slope edge of distribution cell (E) ≥ D + [% natural slope as a decimal x width of distribution cell (A)]

3. Distribution Cell Depth - The distribution cell depth (F) provides wastewater storage within the distribution cell. A minimum space of 6 inches beneath the distribution pipe and 2 inches above the distribution piping, as specified in the specification section of this package. This space may be provided with the use of aggregate or leaching chambers. This provides an distribution cell depth (F) of at least 8 inches + diameter of the distribution pipe.

   Distribution cell depth (F) ≥ 9 inches [minimum diameter lateral = 1-inch]

4. Cover Material - The cover material (G & H) provide frost protection and a suitable growth medium for vegetation. For design purposes, use a depth of 12 inches above the center of the distribution cell (H) and 6 inches above the outer edge of the distribution cell (G).

   Cover material depth at distribution cell center (H) ≥ 12 inches

   Cover material depth at distribution cell edges (G) ≥ 6 inches

5. Fill Length and Width - The length and width of the fill are dependent upon the length and width of the distribution cell, fill depth and side slopes of the fill. Side slopes may not be steeper than 3:1 over the basal area, i.e. 3 feet of run to every 1 foot of rise. Soil having textures other than those specified for the fill media may be used to make the slopes gentler than the required 3:1 slopes, once the 3:1 slope exists with the fill material. On slopes, the distribution cell length is perpendicular to the slope so the effluent is spread out along the slope.

   The fill length consists of the end slopes (K) and the distribution cell length (B). The fill width consists of the up slope width (J), the distribution cell width (A), and the down slope width (I). On sloping sites the up slope width (J) is less while the down slope width (I) is greater than on a level site to maintain the 3:1 side slope. (see Fig.2) To calculate the up slope and down slope widths when 3:1 side slope is maintained on a sloping site multiply the calculated width by the correction factor found by using the following equations or the correction factor listed in Table 5.

   Up slope correction factor = 100 ÷ [100 - (3 x % of slope)]
   Down slope correction factor = 100 ÷ [100 + (3 x % of slope)]

Table 5 Down slope and up slope width correction factors		
Slope %	Down slope correction factor	Up Slope correction factor
0	1.00	1.00
1	1.03	0.97
2	1.06	0.94
3	1.10	0.915
4	1.14	0.89
5	1.18	0.875
6	1.22	0.85
7	1.27	0.83
8	1.32	0.80
9	1.38	0.785
10	1.44	0.77
11	1.51	0.75
12	1.57	0.73
13	1.64	0.72
14	1.72	0.705
15	1.82	0.69
16	1.92	0.675
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.50	0.625
21	2.70	0.61
22	2.94	0.60
23	3.226	0.59
24	3.57	0.58
25	4.00	0.57

The most critical dimensions of the fill are: fill depths (D) & (E), distribution cell length (B), distribution cell width (A), and the down slope width (I).

End slope width (K) = Total fill at center of distribution cell {[(D + E) ÷2]+ F + H} x horizontal gradient of selected side slope (3 if 3:1 side-slope)

Fill Length (L) = Distribution cell length (B) + 2 x end slope width (K)

Up slope width (J) = Fill depth at up slope edge of distribution cell (D+F+G) x horizontal gradient of side slope (3 if 3:1) x slope correction factor {100 ÷ [100 - (3 x % of slope)] if 3:1}

Down slope width (I) = Fill depth at down slope edge of distribution cell (E+F+G) x horizontal gradient of side slope (3 if 3:1) x slope correction factor {100 ÷ [100 + (3 x % of slope)] if 3:1}

Fill Width (W) = Up slope width (J) + down slope width (I) + width of distribution cell (A)

These calculations result in the fill material extending at least 6 inches horizontally from the top edges of the distribution cell as noted in Figure 4.

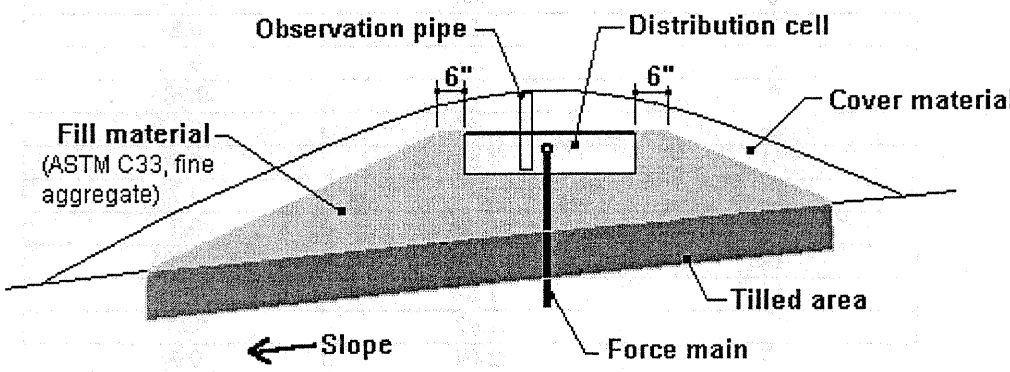

Figure 4. Cross-section of a Mound System

6. Basal Area - The basal area is the in situ soil/fill interface between the soil and the fill material. Its function is to accept the effluent from the fill, assist the fill in treating the effluent, and transfer the effluent to the subsoil beneath the fill or laterally to the subsoil outside of the fill.

   The soil infiltration rate of the in situ soil determines how much basal area is required.

   For level sites, the total basal area, excluding end slope area [length of distribution cell (B) x width of fill (W)] beneath the fill is available for effluent absorption into the soil. See Figure 5a. For sloping sites, the available basal area is the area down slope of the up slope edge of the distribution cell to the down slope edge of the fill (A + I) times the length of the distribution cell (B). It includes the area enclosed by [B X (A + I)]. See Figure 5b. The up slope and end slopes are not included as part of the total basal area.

   It is important to compare the required basal area to the available basal area. The available basal area must equal or exceed the required for the basal area.

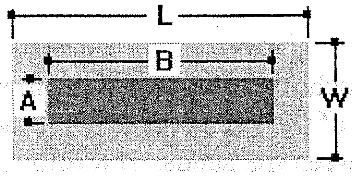

Figure 5a. Level site

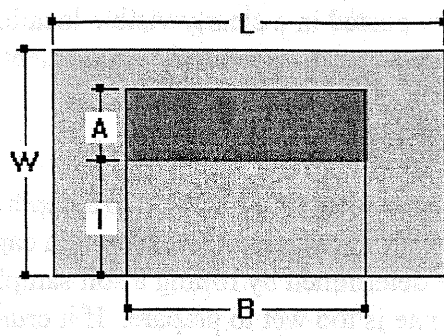

Figure 5b. One direction slope

Basal area required = Daily design flow ÷ Infiltration rate of in situ soil

Basal area available = B x W on level site or = B x (A+I) on sloping site.

If sufficient area is not available for the given design and site conditions, corrective action is required to increase J and I on level sites and I on sloping sites.

7. Location of the observation pipes.

- Systems using stone aggregate have two observation pipes, each is located at a distance equal to approximately 1/6 of the distribution cell length from each end of distribution cell along the center of the cells width.
- Systems using leaching chambers have two observation pipes located at a distance equal to 1/6 of the distribution cell length from each end of the cell.

Step D. Distribution Network and Dosing System A pressurized distribution network based on a **method of sizing** as described in either Small Scale Waste Management Project publication 9.6, entitled "Design of Pressure Distribution Networks for Septic Tank – Soil Absorption Systems" or Dept. of Commerce publication SBD-10573-P, entitled "Pressure Distribution Component Manual for Private Onsite Wastewater Treatment Systems" is acceptable.

VII. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of a mound system are just as critical as the design of the system. A good design with poor construction results in system failure. It is emphasized that the soil only be tilled when it is not frozen and the moisture content is low to avoid compaction and puddling. Consequently, installations are to be made only when the soil is dry as required. The construction plan to be followed includes:

A. Equipment - Proper equipment is essential. Track type tractors or other equipment that will not compact the mound area or the down slope area are required.

B. Sanitary Permit - Prior to the construction of the system, a sanitary permit, obtained for the installation must be posted in a clearly visible location on the site. Arrangements for inspection(s) must also be made with the department or governmental unit issuing the sanitary permit.

C. Construction Procedures

1. Check the moisture content of the soil to a depth of 8 inches. Smearing and compacting of wet soil will result in reducing the infiltration capacity of the soil. Proper soil moisture content can be determined by rolling a soil sample between the hands. If it rolls into a 1/4-inch wire, the site is too wet to prepare. If it crumbles, site preparation can proceed. If the site is too wet to prepare, do not proceed until it dries.

2. Lay out the fill area on the site so that the distribution cell runs perpendicular to the direction of the slope.

3. Measure the average ground elevation along the up slope edge of the distribution cell. A maximum of 6 inches of sand fill may be tilled into the surface, before the average ground elevation along the up slope edge of the distribution cell is measured. The average elevation is referenced to a benchmark for future use. This is necessary to determine the bottom elevation of the distribution cell.

4. Determine where the force main from the dosing chamber will connect to the distribution system in the distribution cell. Place the pipe either before tilling or after placement of the fill. If the force main is to be installed in the down slope area, the trench for the force main may not be wider then 12 inches.

5. Cut trees flush to the ground and leave stumps, remove surface boulders that can be easily rolled off, remove vegetation over 6 inches long by mowing and removing cut vegetation. Prepare the site by breaking up, perpendicular to the slope, the top 7-8 inches so as to eliminate any surface mat that could impede the vertical flow of liquid into the in situ soil. When using a Moldboard plow, it should have as many bottoms as possible to reduce the number of passes over the area to be tilled, to minimize the compaction of the subsoil. Tilling with a Moldboard plow is done along contours. Chisel type plowing is highly recommended especially in fine textured soils. Rototilling or other means that pulverize the soil is not acceptable. The important point is that a rough, unsmeared surface be left. The sand fill will intermingle between the clods of soil, which improves the infiltration rate into the natural soil.

   Immediate application of at least 6 inches of fill material is required after tilling. All vehicular traffic is prohibited on the tilled area. For sites where the effluent may move laterally, vehicle traffic is also prohibited for 15 ft. down slope and 10 ft. on both sides of level sites. If it rains after the tilling is completed, wait until the soil dries out before continuing construction, and contact the local inspector for a determination on the damage done by rainfall.

6. Place the fill material, which has been properly selected, around the edge of the tilled area. Work from the end and up slope sides. This will avoid compacting the soils on the down slope side, which, if compacted, affects lateral movement away from the fill and could cause surface seepage at the toe of the fill on slowly permeable soils.
7. Move the fill material into place using a small track type tractor with a blade or a large backhoe that has sufficient reach to prevent compaction of the broken up area. Do not use a tractor/backhoe having tires. Always keep a minimum of 6 inches of fill material beneath tracks to prevent compaction of the in situ soil.
8. Place the fill material to the required depth.
9. Form the distribution cell. Hand level the bottom of the distribution cell. If using leaching chambers, compact fill where chambers will be located.

NOTE: If using leaching chambers go to step 15.

10. Install the required observation pipes with the bottom 6 inches of the observation pipe perforated. Installations of all observation pipes include a suitable means of anchoring. See figure 6.
11. Place the aggregate in the distribution cell. Level the aggregate to the design depth.

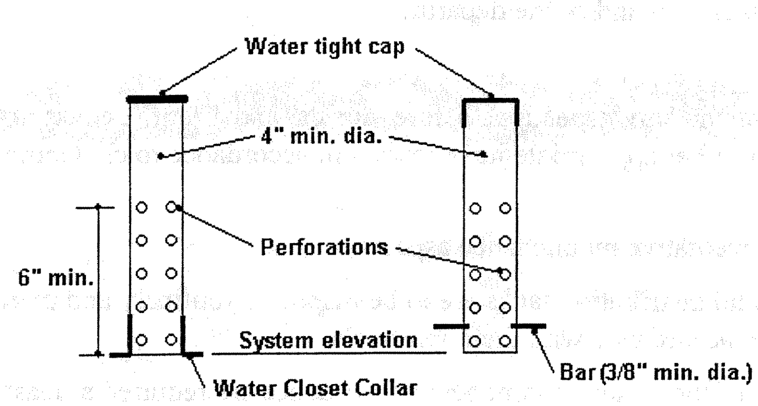

Figure 6 – Observation Pipes

12. Shape the sides with additional fill to the desired slopes.
13. Place the effluent distribution lateral(s), as determined from the pressure distribution design, on the aggregate. Connect the lateral(s) using the needed connections and piping to the force main pipe from the dosing chamber. Slope the piping from the lateral(s) to the force main pipe. Lay the effluent distribution lateral(s) level. All pipes must drain after dosing.

14. Place at least 2 inches of aggregate over the distribution network.

NOTE: If using aggregate go to step 17.

15. Install the leaching chambers and pressure distribution piping as instructed by the leaching chamber manufacture's instructions, pressure distribution design and applicable sections of ch. Comm 82, 83 and 84, Wis. Adm. Code.
16. Install an observation pipe in each row or leaching chambers.
17. If aggregate is used, place geotextile fabric conforming to requirements of ch. Comm 84, Wis. Adm. Code, over the aggregate.
18. Place cover material on the top of the geotextile fabric and extend the soil cover to the boundaries of the overall component..
19. Complete final grading to divert surface water drainage away from mound, sod or seed and mulch the entire mound component.

VIII. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. The component owner is responsible for the operation and maintenance of the component. The county, department or POWTS service contractor may make periodic inspections of the components, checking for surface discharge, treated effluent levels, etc.

The owner or owner's agent is required to submit necessary maintenance reports to the appropriate jurisdiction and/or the department.

B. Design approval and site inspections before, during, and after the construction are accomplished by the county or other appropriate jurisdictions in accordance to ch. Comm 83 of the Wis. Adm. Code.

C. Routine and preventative maintenance aspects:

1. Treatment and distribution tanks are to be inspected routinely and maintained when necessary in accordance with their approvals.
2. Inspections of the mound component performance are required at least once every three years. These inspections include checking the liquid levels in the observation pipes and examination for any seepage around the mound component.
3. Winter traffic on the mound is not permitted to avoid frost penetration and to minimize compaction.
4. A good water conservation plan within the house or establishment will help assure that the mound component will not be overloaded.

D. User's Manual: A user's manual is to accompany the component. The manual is to contain the following as a minimum:

1. Diagrams of all components and their location. This should include the location of the reserve area, if one is provided.

2. Names and phone numbers of local health authority, component manufacturer or POWTS service contractor to be contacted in the event of component failure or malfunction.
3. Information on periodic maintenance of the component, including electrical/mechanical components.
4. Notice that the dose chamber, if one is utilized, may fill due to flow continuing during pump malfunction or power outages. One large dose when the power comes on or when the pump is repaired may cause the mound component to have problems. In this situation, the pump chamber should be pumped by a licensed pumper before pump cycling begins or other measures shall be used to dose the mound component with only the proper amount of influent. This may include manual operation of the pump controls until such time the pump chamber has reached its normal level.

E. Performance monitoring must be performed on mound systems installed under this manual.

1. The frequency of monitoring must be:
   a. At least once every three years following installation and,
   b. At time of problem, complaint, or failure.
2. The minimum criteria addressed in performance monitoring of mound systems are:
   a. Type of use.
   b. Age of system.
   c. Type of fill material used.
   d. Nuisance factors, such as odors or user complaints.
   e. Mechanical malfunction within the system including problems with valves or other mechanical or plumbing components.
   f. Material fatigue or failure, including durability or corrosion as related to construction or structural design.
   g. Neglect or improper use, such as exceeding the design rate, poor maintenance of vegetative cover, inappropriate cover over the mound, or inappropriate activity over the mound.
   h. Installation problems such as compaction or displacement of soil, improper orientation or location.
   i. Pretreatment component maintenance, including dosing frequency, structural integrity, groundwater intrusion or improper sizing.
   j. Dose chamber maintenance, including improper maintenance, infiltration, structural problems, or improper sizing.
   k. Ponding in distribution cell, prior to the pump cycle, is evidence of development of a clogging mat or reduced infiltration rates.

l. Siphon or pump malfunction including dosing volume problems, pressurization problems, breakdown, burnout, or cycling problems.

m. Overflow/seepage problems, as shown by evident or confirmed sewage effluent, including backup if due to clogging.

4. Reports are to be submitted in accordance with ch. Comm 83, Wis. Adm. Code..

IX. REFERENCES

"Wisconsin Mound Soil Absorption System: Siting, Design and Construction." Converse, J.C., and E. J. Tyler. Publication 15.22, Small Scale Waste Management Project., 1 Agriculture Hall, University of Wisconsin, Madison, WI.

X. MOUND WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

- Surface water movement.
- Measure elevations and distances on the site so that slope, contours and available areas can be determined.
- Description of several soil profiles where the component will be located.
- Determine the limiting conditions such as bedrock, high groundwater level, soil permeability, and set backs.

Slope - ___%

Occupancy – One or Two-Family Dwelling # of bedrooms ____.

Public Facility - _____ Daily wastewater flow

Depth to limiting factor - _____inches

In situ soil application rate used - _____ gal/ft^2/day

BOD_5 value of effluent applied to component - _____ mg/L

TSS value of effluent applied to component - _____ mg/L

Type of distribution cell - __ Aggregate or __ Leaching chamber

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling.

DWF = 150 gal/day/bedroom x # of bedrooms

= 150 gal/day/bedroom x _____# of bedrooms

= ___________ gal/day

Public Facilities.

DWF = Sum of each wastewater flow per source per day x 1.5

= _________ gal/day x 1.5

= _________ gal/day

C. DESIGN OF THE DISTRIBUTION CELL

1. Size the Distribution Cell

   a. Infiltration rate of fill material = ≤ 1.0 gal/ft^2/day if BOD_5 or TSS > 30 mg/L or ≤ 2.0 gal/ft^2/day if BOD_5 or TSS ≤ 30 mg/L

   b. Bottom area of distribution cell = Design wastewater flow ÷ 1.0 or 2.0 gal/ft^2/day

   = ________ gal/day ÷ _____ gal/ft^2/day

   = ____________ft^2

2. Distribution Cell Configuration

   a. Distribution cell width (A) = _____ feet ($\leq$ 10 ft.)

   b. Distribution cell length (B) = Bottom area of distribution cell ÷ Width of distribution cell

   B = ______ ft^2 (Distribution cell area) ÷ ____ ft(A)

   B = ________ft

   c. Check Distribution Cell Length (B)

   Design Wastewater Flow ÷ Cell length (B) $\leq$ Maximum Linear Loading Rate

   _______ gal/day ÷ _____ feet = ______ gal/ft (Linear Loading Rate)

   Linear loading rate for systems with in situ soils having an effluent application rate of ≤ 0.3 gal/ft^2/day within 12 inches of fill is less than or equal to 4.5 gal/ft/day

   Is the linear loading rate $\leq$ what is allowed? __ yes ___ no If no, then the length and/or width of the distribution cell must be changed so it does.

   Distribution cell length (B) = Design Wastewater Flow ÷ Maximum Linear Loading Rate

   Distribution cell length (B) = _____ gal/day ÷ _____ gal/ft/day

   Distribution cell length (B) = ______ ft

   Distribution cell width (A) = _____ ft^2 (Distribution cell area) ÷ _______ ft(B)

   Distribution cell width (A) = _________ ft

D. DESIGN OF ENTIRE FILL

1. Fill Depth

a. Fill depth below distribution cell (At least 6 inches if the in situ soil beneath the tilled area requires a minimum depth of 36 inches or less for treatment of fecal coliform. At least 12 inches if the in situ soil beneath the tilled area requires a depth greater than 36 inches for treatment of fecal coliform.)

1) Depth at up slope edge of distribution cell (D) = distance required by Table 83.44-3 - distance in inches to limiting factor

D = _____ inches - ____ inches

D =_____ inches (≥ 6 or 12 inches, but not greater than 36 inches)

2) Depth at down slope edge of distribution cell (E)

E = Depth at up slope edge of distribution cell (D) + (% natural slope expressed as a decimal x distribution cell width (A))

E = D + (% natural slope expressed as decimal x A)

E = ___inches + (_____x_______feet x 12 inches/ft)

E = ___________inches

b. Distribution cell Depth for Aggregate Distribution cell.

Distribution cell depth (F) for aggregate distribution cell = amount of aggregate below distribution laterals (6 inches min.) + nominal outside diameter of largest lateral + amount of aggregate over distribution laterals (2 inches min.).

F = ____(≥6) inches + _____inches + ____(≥2) inches

F = _____ inches

c. Distribution cell depth (F) for distribution cell with leaching chambers = total height of leaching chamber.

F = ________ inches

d. Cover material

1) Depth at distribution cell center (H) ≥ 12 inches

2) Depth at distribution cell edges (G) ≥ 6 inches

2. Fill length

   a. End slope width (K)= Total fill at center of distribution cell x horizontal gradient of side slope

      K = {([(D + E) ÷ 2] + F + H) x horizontal gradient of side slope} ÷ 12 inches/foot

      K = {([(____inches + ______ inches) ÷ 2] + _____inches + ____inches) x ___ } ÷ 12 inches/ft

      K = ________ft

   b. Fill length (L) = Distribution cell length + (2 x end slope width)

      L = B + 2K

      L = ______ft + (2 x ____ft)

      L = _______ feet

3. Fill width

   a. Up slope width (J) = Fill depth at up slope edge of distribution cell (D + F + G) x Horizontal gradient of side slope x Slope correction factor {100 ÷ [100 + (gradient of side slope x % of slope) or (value from Table 5)]}

      J = (D + F + G) x horizontal gradient of side slope x slope correction factor 100 ÷ [100 + (gradient of side slope x % of slope) or (value from Table 5)]

      J = (_____ in + _____ in + _____ in) ÷ 12 in/ft x __ x 100 ÷ [100 + (___ x ____)] _______

      J = ___________ feet

   b. Down slope width (I) = Fill depth at down slope edge of distribution cell (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope) or (value from Table 5)]}

      I = (E + F + G) x Horizontal gradient of side slope x Down slope correction factor {100 ÷ [100 - (gradient of side slope x % of slope) or (value from Table 5)]}

      I = (_______ in + _____in + ___in) ÷ 12 in/ft x __ x 100 ÷ [100 - (___ x ____)]

      I = ______ in ÷ 12 in/ft x 3 x 100 ÷ _____

      I = ____________feet

c. Fill width (W) = Up slope width (J) + Distribution cell width (A) + Down slope width (I)

W = J + A + I

W = _____ ft + _____ ft + _____ ft

W = _____________ feet

4. Check the basal area

a. Basal area required _____ = Daily wastewater flow ÷ infiltration rate of in situ soil

= _____ gal/day ÷ ____ gal/ft^2/day

= _____ ft^2

b. Basal area available

1) Sloping site = Cell length x (Distribution cell width + Down slope width)

= B x (A + I)

= ______ ft x (_____ ft + _____ ft)

= _______ ft x ______ ft

= _______ ft^2

2) Level site = Distribution cell length x Fill width

= B x W

= ______ ft x ______ ft

= _______ ft^2

c. Is available basal area sufficient? ___ yes _____ no

Basal area required < Basal area available

_______ ft^2 < _______ ft^2

b. Basal area available

1) Sloping site = Cell length x (Distribution cell width + Down slope width)

= B x (A + I)

= _____ ft x (_____ ft + ______ft)

= _____ ft x _______ ft

= _______ ft^2

5. Determine the location of observation pipes along the length of distribution cell.

Distance from end of distribution cell to <u>end</u> observation pipes = B ÷ 6

Distance from end of distribution cell to <u>end</u> observation pipes = _____ft. ÷ 6

Distance from end of distribution cell to <u>end</u> observation pipes = _____ft.