Conditionally
APPROVED
DEPT. OF SAFETY AND PROFESSIONAL SERVICES
DIVISION OF INDUSTRY SERVICES

Joshua Rowley

SEE CORRESPONDENCE

AeroFin SYSTEM WISCONSIN IN-GROUND

COMPONENT MANUAL

August 2024

TABLE OF CONTENTS

Published by:
Infiltrator Water Technologies
4 Business Park Road
P.O. Box 768
Old Saybrook, CT 06475

This component manual was produced exclusively for use with AeroFin products. This manual is originally based upon the “In-Ground Soil Absorption Component Manual for Private Onsite Wastewater Treatment Systems” Ver. 2.1, May 2022, by the State of Wisconsin, Department of Safety and Professional Services, with periodic updates applied.

Infiltrator Water Technologies (Infiltrator) reserves the right to revise this component manual according to changes in regulations or AeroFin system installation instructions.

AEROFIN SYSTEM APPLICATIONS INFORMATION

AeroFin System Type[1]	Infiltrator AeroFin System Design Document	System Sand Depth (inches)	Effluent Distribution Method
Subsurface bed	AeroFin System In-Ground Component Manual	12 – with 24 inches soil to limiting layer	Gravity
Mound	AeroFin System Mound Component Manual	12 – with minimum 24 inches to limiting layer	Gravity

[1] If any part of the AeroFin distribution cell is above grade then the AeroFin System Mound Component Manual shall be used.

I. INTRODUCTION AND SPECIFICATIONS

This Private Onsite Wastewater Treatment System (POWTS) component manual provides design, construction, inspection, operation, and maintenance specifications for an AeroFin System in-ground soil absorption component. However, these items shall 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. SPS 383 and 384, Wis. Adm. Code. The AeroFin System in-ground soil absorption component shall 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 AeroFin System in-ground soil absorption component provides treatment and dispersal of domestic wastewater in conformance with ch. SPS 383 of the Wis. Adm. Code. Final effluent characteristics will comply with s. SPS 383.41, Wis. Adm. Code when inputs are within the range specified in Tables 1 to 3.

Note: Detailed plans and specifications shall be developed and submitted to be reviewed and approved by the governing unit having authority over the plan for the installation. Also, a Sanitary Permit shall 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)	≤ 5,000 gal/day
Dosing of Effluent required when DWF	> 1,500 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
Wastewater particle size	≤ 1/8 inch
Design loading rate of the basal area	= soil application rate of effluent with maximum monthly average values of BOD_5 and TSS of ≤ 30 mg/L as per SPS Table 383.44-2
Design loading rate of system sand.	Determined by conduit requirement and system layout. Not to exceed 2.0 gallons/square foot.
Design wastewater flow (DWF) from one- or two-family dwellings	Based on s. SPS 383.43 (3), (4), or (5), Wis. Adm. Code
Design wastewater flow (DWF) from public facilities	≥ 150% of estimated daily wastewater flow in accordance with s. SPS 383.43 (6), Wis. Adm. Code
Volume of a single dose to soil absorption component when pumps or siphons are used in the design	≤ 0.25 gallons per linear foot of AeroFin conduit

Table 2a SIZE AND ORIENTATION	
Minimum area of distribution cell	≥ Design wastewater flow ÷ design soil application rate for the in situ soil at the infiltrative surface or a lower horizon if the lower horizon adversely affects the dispersal of wastewater in accordance with s. SPS 383.44 (4) (a) and (c), Wis. Adm. Code
Distribution cell width (A)[a]	≤ 10 feet
Distribution cell depth	Product height of 12.75 inches + system sand of 12 inches = 24.75 inches
Depth of cover over top of distribution cell	≥ 12 inches and ≤ 4 feet

Table 2b MINIMUM DISTRIBUTION CELL WIDTH												
Number of Fin Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Each Add'l**
Minimum Width (ft)	1.88	2.57	3.25	3.94	4.63	5.32	6.00	6.69	7.38	8.07	8.75	0.69
Minimum Width (in)	22.5	30.8	39.0	47.2	55.5	63.8	72.0	80.2	88.5	96.8	105.0	8.3

Table 2c MINIMUM TOTAL LENGTH OF CONDUIT	
Number of Bedrooms	**Minimum Conduit Length Required (ft)**
1/2	160
3	240
4	320
5	400
Each Add'l	80

NOTES:

a. The conduit rows must be extended to within 6 to 12 inches of each end of the bed. The dimensions in Table 2b include 6 inches of system sand in between each of the conduit rows and 6 inches of system sand on each outside edge.
b. Maximum distribution cell width is 10 feet. Distribution cell width beyond the minimum is comprised of system sand extensions.
c. The conduits are manufactured in 8-foot lengths. Individual row lengths can be rounded up to the nearest 8-foot increment to eliminate cutting. Cutting is allowed at any point along the conduit length as needed.
d. Where site conditions or other considerations require multiple beds or multiple distribution cells, the minimum conduit length required in Table 2c may be equally distributed between all distribution cells.

Table 3 OTHER SPECIFICATIONS	
Slope of in situ soil	≤ 25% in area of component
Vertical separation between the bottom of the AeroFin conduit and seasonal saturation defined by redoximorphic features	≥ Depth required by s. SPS 383 Table 383.44-3, Wis. Adm. Code (36 inches from bottom of conduit) - 12 inches sand + 24 inches minimum unsaturated soil
Horizontal separation between AeroFin conduits	≥ 6 inches
Piping material for observation pipes	Meets requirements of s. SPS 384.30 Table 384.30-1, Wis. Adm. Code
Slope of gravity flow AeroFin conduits	Shall be installed level
Location of gravity flow AeroFin distribution conduit in distribution cell	On level sites: Centered in the distribution cell On site slopes > 5%: 6 in from upslope side of bed
Length of distribution pipe for components using gravity flow distribution	= length of AeroFin conduit per Table 2c
Distance between AeroFin rows and end of distribution cell	6 inch minimum, 12 inch maximum
Length of AeroFin	80 ft per bedroom per Table 2c
Number of observation pipes per distribution cell	≥ 2
Location of observation pipes	At opposite ends of the distribution cell.
Design and installation of observation pipes	1. Have an open bottom. 2. Have a nominal pipe size of 4 inches. 3. The lower 6 inches slotted and wrapped in geotextile. 4. Slots are ≥ ¼ inch and ≤ ½ inch in width and located on opposite sides. 5. Anchored in a manner that will prevent the pipe from being pulled out. 6. Extend from the infiltrative surface up to or above finish grade. 7. Terminate with removable watertight cap. 8. Terminate with a vent cap if ≥ 12 in. above finish grade.
Effluent application to the AeroFin system	Effluent may be applied by gravity flow; or dose to gravity to the AeroFin Manifold;
Septic tank effluent pump system	Meets requirements of s. SPS 384.10, Wis. Adm. Code and this manual
Dose tank or compartment volume employing one pump	≥ Volume of a single dose + reserve capacity[a] + drain back volume[b] + (6 inches x average gal/inch of tank)[c] Notes: a: Reserve capacity ≥ the estimated daily flow b: Drain back volume ≥ volume of wastewater that will drain into the dose tank from the distribution cell. c: Four inches of the dimension ≥ vertical distance from pump intake to bottom of tank. Two inches of the dimension ≥ vertical distance between pump on elevation and high water alarm activation elevation.

Table 3 OTHER SPECIFICATIONS (continued)	
Dose tank or compartment volume employing duplex pumps	≥ Volume of a single dose + drain back volume[a] + (6 inches x average gal/inch of tank)[b] Notes: a: Drain back volume ≥ volume of wastewater that will drain into the dose tank from the force main b: Four inches of the dimension ≥ vertical distance from pump intake to the bottom of tank. Two inches of this dimension ≥ vertical distance between pump on elevation and high water alarm activation elevation.
Siphon tank or compartment volume	≥ What is required to accommodate volumes necessary to provide dosing as specified in this manual.
Cover material over the AeroFin System	Soil that will provide frost protection, prevent erosion and excess precipitation or runoff infiltration and allow air to enter the distribution cell
Installation inspection	In accordance with ch. SPS 383, Wis. Adm. Code
Management	In accordance with ch. SPS 383, Wis. Adm. Code and this manual

II. DEFINITIONS

Definitions not found in this section, are in ch. SPS 381 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. “Conduit” means Infiltrator AeroFin System component made up 12.75-inch-tall by 2.25-inch-wide pipe, geonet mesh and geotextile fabric.

C. “Cover Material” means soil that will provide frost protection, prevent erosion and excess precipitation or runoff infiltration and allow air to enter the distribution cell. Clays are not recommended as they can restrict oxygen transfer.

D. “Distribution Cell” means the portion of the distribution system that contains the AeroFin components and the 6 inches of sand beside, between, and on the ends of the rows and the 12 inches of sand below the fin laterals.

E. “Fill Material” means soil that is free of organic material and stones over 3 inches and is used along the sides of the distribution cell and above system sand extensions.

F. “Limiting Factor” means high groundwater elevation or bedrock.

G. “Product” means one AeroFin conduit manufactured by Infiltrator.

H. “Sand Extension” means additional system sand 6 inches in depth that is added to the system sand footprint to meet the minimum basal area requirement.

I. “System Sand” means the sand material that is used along the sides of an under the AeroFin System Conduits to provide treatment of effluent. Acceptable system sand shall meet ATSM Specification C33.

J. “Vertical Separation” means the total depth of unsaturated soil that exists between the infiltrative surface of a distribution cell and limiting factor (as indicated by redoximorphic features, groundwater, or bedrock).

III. DESCRIPTION AND PRINCIPLE OF OPERATION

The AeroFin System in-ground soil absorption component operation is a two-stage process involving both wastewater treatment and dispersal. Treatment is accomplished within the AeroFin System by physical and biochemical processes within the product, the fill material, and the in-situ soil. The fill material and in-situ soil also provide dispersal and separation distance to limiting conditions.

Cover material consisting of material that provides erosion protection, a barrier to excess precipitation infiltration, and allows gas exchange is added. See Figure 1 for a typical in-ground system.

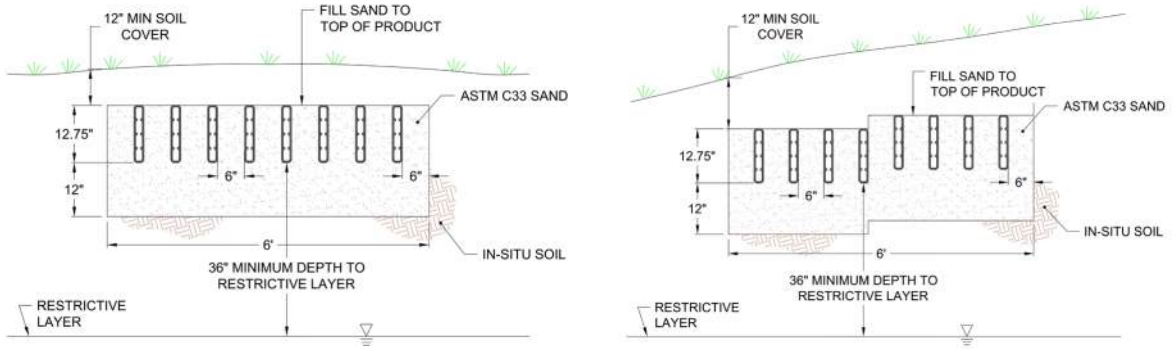

Figure 1. Example cross-sections of AeroFin System in-ground soil absorption component for POWTS (level and stepped)

Distribution Network

Effluent is conveyed to the AeroFin system by gravity or pump to gravity distribution. Systems containing only one distribution cell may be fed directly from the septic tank via a 4-inch Schedule 40 PVC pipe. The AeroFin Manifold accommodates drilling of the appropriately sized distribution piping up to 4 inch in diameter as depicted in Figure 2. Distribution piping shall be inserted into one of the upper manifold drill points. Each distribution cell in the system design requires a minimum of 1 distribution pipe. Systems containing more than one distribution cell will require the installation of a distribution box or drop box to ensure effluent is applied equally to each distribution cell.

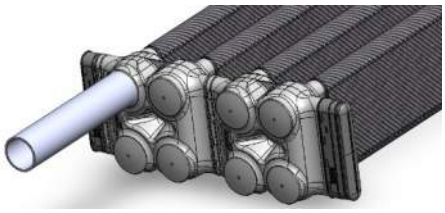

Figure 2. Attachment of distribution piping into the AeroFin Header.

System Dosing

Systems that are designed to receive a DWF greater than 1,500 gallons per day require effluent to be dosed to the distribution cells. The dose chamber shall be sized to accommodate sufficient volume to dose the distribution cells as required by its system design, retain drain back volume, contain a one day reserve zone, provide a minimum 2-inch separation between alarm activation and pump-on activation, and allow for protection of the pump from solids. System dosing volume is calculated at 0.25 gallons maximum multiplied by the total feet of AeroFin conduit in the system.

NOTE: It is acceptable to pump directly into the AeroFin Manifold header with an increase in pipe diameter for velocity reduction as shown in the following illustration:

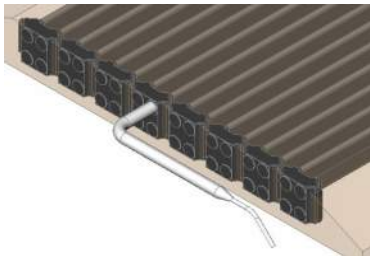

Figure 3. Illustration of an acceptable means of pump system velocity reduction.

Drain back volume may be calculated using the following equation:

$$\text{Drain Back Volume} = \frac{\pi\left(\frac{d}{2}\right)^2 \times \frac{12\ in}{ft}}{231\ \frac{in^3}{ft^3}}$$

d is equal to the nominal pipe size in inches.

A reserve capacity is required on a system with only one pump. The reserve volume must be equal to or greater than the estimated daily wastewater flow. Reserve capacity may be calculated using 100 gallons per bedroom per day for one and two-family residences or the values computed per A-383.43(6) Table A-383.43-1 Public Facility Wastewater Flows for commercial facilities.

The dose volume shall be included in the sizing of the dose chamber. (Volume of a septic tank effluent pump system is determined by department plumbing product approval.) 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 dose chamber. This can be accomplished by placing the pump on concrete blocks or other material that can form a pedestal. The pump manufacturer’s requirements shall be followed. This may include the “pump off” switch being located high enough to allow for complete immersion of the pump in the dose chamber.

IV. SOIL AND SITE REQUIREMENTS

The AeroFin System in-ground soil absorption component design shall be 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 AeroFin System in-ground soil absorption component performance are listed in the introduction and specification section of this manual.

Soil evaluations must be in accordance with ch. SPS 385 of the Wis. Adm. Code. In addition, soil application rates must be in accordance with ch. SPS 383 of the Wis. Adm. Code.

B. Other Site Considerations -

1. AeroFin System in-ground soil absorption component location - In open areas, exposure to sun and wind increases the assistance of evaporation and transpiration in the dispersal of the wastewater.
2. Sites with trees and large boulders Generally, sites with large trees, numerous smaller trees or large boulders are less desirable for installing an in-ground soil absorption component because of difficulty in preparing the distribution cell area. 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 distribution cell area must be removed.
3. Setback distances - The setbacks specified in ch. SPS 383, Wis. Adm. Code for soil subsurface treatment/dispersal component apply to AeroFin System in-ground soil absorption components. The distances are measured from the edge of the AeroFin System in-ground soil absorption component (distribution cell).

V. COVER MATERIAL

The cover material is a soil that will allow air exchange while promoting plant growth. The gas exchange will increase the treatment performance of the system by providing oxygen to the wastewater to help ensure aerobic conditions in the AeroFin System in-ground soil absorption component. The plant growth will protect the surface from soil erosion. Clays may not be used for cover material, as they will restrict oxygen transfer. Often, excavated soil from the site can be used. Seeding or other means must be done to prevent erosion of the AeroFin System soil cover material.

VI. DESIGN

A. Location, Size and Shape - Placement, sizing and shaping of the AeroFin System in-ground soil absorption component and the distribution cell within the AeroFin System in-ground soil absorption component must be in accordance with this manual.

B. Component Design - Design of the AeroFin System in-ground soil absorption component is based upon the design wastewater flow and the soil characteristics. It must be sized such that it can accept the design wastewater flow without causing surface seepage or groundwater pollution. Consequently, the basal area, which is the in-situ soil area beneath the fill, shall be sufficiently large enough to absorb the effluent into the underlying soil. The system shall also be designed to avoid encroachment of the water table into the required minimum unsaturated zone.

Design of the AeroFin System in-ground soil absorption component includes the following three steps: (A) calculating design wastewater flow, (B) design of the AeroFin System distribution cell within the fill, (C) design of the entire AeroFin System in-ground soil

absorption component. This includes calculating total width, total length, system height, distribution lateral location and observation pipes. Each step is discussed. A design example is provided in Section XI of this manual.

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 Formulas 1, 2 or 3. Formula 1 is for combined wastewater flows, which consist of blackwater, clearwater and graywater. Formula 2 is for only clearwater and graywater. Formula 3 is blackwater only.

Formula 1	Formula 2	Formula 3
Combined wastewater	Clearwater & Graywater	Blackwater
DWF = 150 gal/day/bedroom	DWF = 90 gal/day/bedroom	DWF = 60 gal/day/bedroom

Public Facilities. Distribution cell size for public facilities application is determined by calculating the DWF using Formula 4. Estimated daily wastewater flows are determined in accordance s. SPS 383.43(6), Wis. Adm. Code. Only facilities identified in Table A-383.43-1 are included in this manual. Facilities not listed in Table A-383.43-1 can be discussed with the plan reviewer to establish an acceptable daily flow rate volume. A detailed project description must be submitted with all commercial plans. Many commercial facilities have high BOD_5, TSS and FOG (fats, oils and grease), which shall be pretreated in order to bring their values down to an acceptable range before entering into the AeroFin System in-ground soil absorption component described in this manual.

Formula 4

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

Where 1.5 = Conversion factor to convert estimated wastewater flow to design wastewater flow

Step B. Design of the AES System 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.

Design of the AeroFin System distribution cell is a four-step process:

1. Determine the minimum total conduit length
2. Calculate the minimum basal area required
3. Design the system sand configuration
4. Make basal area adjustments as necessary

Step 1: Determine the minimum total conduit length
The minimum length of conduit per bedroom is 80 feet. Determine the minimum total length of conduit from Table 4 below, based on the number of bedrooms.

Table 4 MINIMUM TOTAL LENGTH OF CONDUIT	
Number of Bedrooms	Minimum Conduit Length Required (ft)
2	160
3	240
4	320
5	400
Each Add'l	80

Step 2: Calculate the minimum basal area required
Investigate the site in accordance with the Wisconsin Administrative Code to determine the design loading rate (DLR)per Table 383.44-2 of the basal area. Calculate the minimum basal area required by dividing the daily design flow (DWF) by this DLR.

Step 3: Design the system sand configuration
Use Table 5 below to determine the minimum system sand footprint using the minimum length of conduit (determined using Table 4 above) and the number of rows into which the total length of conduit will be divided. The system should be designed as long and narrow as site conditions allow.

Table 5 MINIMUM DISTRIBUTION CELL WIDTH												
Number of Fin Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Each Add'l**
Minimum Width (ft)	1.88	2.57	3.25	3.94	4.63	5.32	6.00	6.69	7.38	8.07	8.75	0.69
Minimum Width (in)	22.5	30.8	39.0	47.2	55.5	63.8	72.0	80.2	88.5	96.8	105.0	8.3

NOTES:

1. The conduit rows must be extended to within 6 to 12 inches of each end of the bed. The dimensions in Table 2b include 6 inches of system sand in between each of the conduit rows and 6 inches of system sand on each outside edge.
2. Maximum distribution cell width is 10 feet. Distribution cell width beyond the minimum is comprised of system sand extensions.
3. The conduits are manufactured in 8-foot lengths row lengths can be rounded up to the nearest 8-foot increment to eliminate cutting. Cutting is allowed at any point along the conduit length as needed.
4. Where site conditions or other considerations require multiple beds or multiple distribution cells, the minimum conduit length required in Table 2c may be equally distributed between all distribution cells.

Step 4: Make basal area adjustments as necessary
The minimum basal area required in Step 3 cannot be reduced. This area must be maintained to ensure adequate infiltration of treated effluent into the native soil.

Sand extensions are necessary as follows:

- If the minimum basal area determined in Step 3 is smaller than the area of the system sand footprint determined in Step 2, no sand extensions are necessary.
- If the minimum basal area determined in Step 3 is larger than the area of the system sand footprint determined in Step 2, sand extensions must be added to meet the minimum basal area footprint requirements.
    - When adding sand extensions in level system applications, additional width shall be evenly divided on each side of the Aerofin System.
    - When adding sand extension on sloping sites, additional width shall be placed on the downslope side of the bed.

The length of the bed area may be altered by extending the AeroFin rows. This method may be preferred over increasing the width of the system under certain site and system design considerations.

VII. SITE PREPARATION AND CONSTRUCTION

Procedures used in the construction of an AeroFin System in-ground soil absorption component are just as critical as the design of the component. A good design with poor construction results in system failure. It is emphasized that the soil only be worked when it is not frozen and the moisture content is low to avoid compaction and smearing. Consequently, installations are to be made only when the soil is dry enough to prevent compaction and smearing of the infiltrative surface. The construction plan to be followed includes:

A. Equipment – Proper equipment is essential. Tracked type equipment that will not compact the infiltrative surface. Minimize foot traffic and avoid equipment traffic over the infiltrative surface.

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(ss) shall also be made with the department or governmental unit issuing the sanitary permit.

C. Construction Procedures

1. Check the moisture content and conditions of the soil. If the soil at the infiltrative surface can be rolled into a ¼ inch wire, the site is too wet, smearing and compaction will result, thus reducing the infiltrative capacity of the soil. If the site is too wet, do not proceed until it dries out. If the soil at or below the infiltrative surface is frozen, do not proceed.
2. Set up a construction level or similar device and determine all relative elevations in relationship to the bench mark. It is necessary to determine the bottom elevation of the distribution cell, land surface contour lines, and approximate component elevations critical to the installation.
3. Lay out the absorption and/or basal area. Where possible lay out the absorption and/or basal area(s) on the site so that the distribution cell runs parallel with the land surface contours. Reference stakes offset from the corner stakes are recommended in case corner stakes are disturbed during construction.

4. Excavate the distribution cell(s) to the correct bottom elevation(s) making sure not to smear the infiltrative surface. If the infiltrative surface is smeared, loosen it with the use of a rake or similar device. The infiltration surface can be left rough and should not be raked smooth.
5. Install the observation pipe with the bottom 6 inches of the observation pipe slotted. It is recommended to wrap geotextile around the slots. Installation of the observation pipe includes a suitable means of anchoring (Figures 4 and 5).

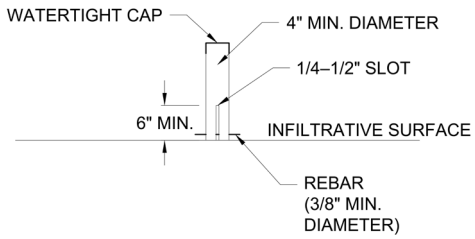

Figure 4. Observation pipe detail.

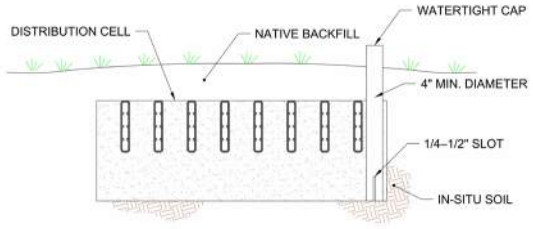

Figure 5. Cross section of distribution cell with observation port

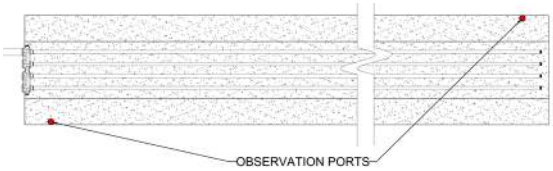

Figure 6. Level system observation port locations

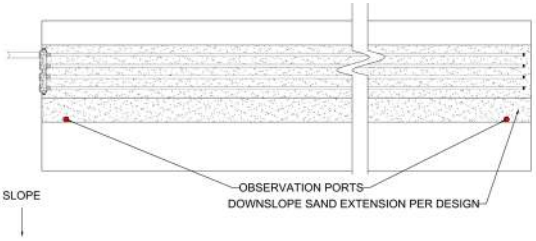

Figure 7. Sloping system observation port locations

6. Install the system sand over the entire system area as per design. System sand should be leveled and stabilized prior to introduction of the conduits.
7. Assemble the required manifold units and place at the inlet end of the treatment cell. Connect the AeroFin to the manifold then end-to-end to create rows of the required length using the integrated snap-lock feature on both products. Place components on the surface of the system sand arranged in the configuration shown on the system design. Use of temporary construction bracing, available from Infiltrator, may assist with conduit layout and spacing. Cap the end of the rows using the AeroFin endcaps.
8. Once the AeroFin conduit is in place on the surface of the system sand and distribution piping is connected to the manifold per design, additional system sand shall be ladled beside and between, and to the top of each of the conduit rows. System sand shall also be installed on each side and at each end of the backfilled conduit rows, per the design.
9. Backfill the system with the required 12-inch minimum cover as detailed in Section V above.
10. Complete final grading to divert surface water drainage away from the AeroFin System. Sod, seed or mulch system areas.

VIII. OPERATION, MAINTENANCE AND PERFORMANCE MONITORING

A. The AeroFin system in-ground soil absorption 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 with ch. SPS 383 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 AeroFin System in-ground soil absorption component performance are required at least once every three years. These inspections include checking the liquid levels in the observation pipe and examination for any seepage around the AeroFin System in-ground soil absorption component.

   3. Winter traffic on the AeroFin System in-ground soil absorption component is not permitted to avoid frost penetration and to minimize compaction.

   4. A good water conservation plan within the house or establishment as well as proper system care and maintenance will help assure that the AeroFin System in-ground soil absorption 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. Information on limited activities on reserve area if provided.

   5. Supply a copy of the Infiltrator users guide: *A Guide to the Proper Care and Maintenance of Your Onsite Wastewater Treatment System*.

E. Performance monitoring must be performed on AeroFin System in-ground soil absorption components 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 AeroFin System in-ground soil absorption components are:
    a. Type of use.
    b. Age of system.
    c. Nuisance factors, such as odors or user complaints.
    d. Mechanical malfunction within the system including problems with valves or other mechanical or plumbing components.
    e. Material fatigue or failure, including durability or corrosion as related to construction or structural design.
    f. Neglect or improper use, such as exceeding the design rate, poor maintenance of vegetative cover, inappropriate cover over the AeroFin in-ground soil absorption component, or inappropriate activity over the AeroFin in-ground soil absorption component.
    g. Installation problems such as compaction or displacement of soil, improper orientation or location.
    h. Pretreatment component maintenance, including dosing frequency, structural integrity, groundwater intrusion or improper sizing.
    i. Dose chamber maintenance, including improper maintenance, infiltration, structural problems, or improper sizing.
    j. Distribution piping network, including improper maintenance 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, breakdown, burnout, or cycling problems.
    m. Overflow/seepage problems, as shown by evident or confirmed sewage effluent, including backup if due to clogging.
3. Reports are to be submitted in accordance with ch. SPS 383, Wis. Adm. Code.

IX. REFERENCES

R.J. Otis, G.D. Plews and D.H. Patterson. “Design of Conventional Soil Absorption Trenches and Beds.” In: Home Sewage Treatment, Proceeding of the Second National Home Sewage Treatment Symposium, ASAE Publication 5-77.

United States EPA, EPA 625/1-80-012, October 1980. “Design Manual – Onsite Wastewater Treatment and Disposal Systems.”

X. AEROFIN SYSTEM IN-GROUND SOIL ABSORPTION COMPONENT WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

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

Slope - ____%
Occupancy – One or Two-Family Dwelling - ___(# of bedrooms)
Public Facility - _____ gal/day (Estimated wastewater flow)
Depth to limiting factor - _____inches
Minimum depth of unsaturated soil required by Table 383.44-3, Wis. Adm. Code -___ inches
System sand depth below AeroFin conduit: ☐ 12 inches
In-situ soil application rate used - _____ gpd/ft^2
FOG value of effluent applied to component - _____ mg/L
BOD_5 value of effluent applied to component - __mg/L
TSS value of effluent applied to component - ___mg/L
Fecal Coliform monthly geometric mean value of effluent applied to component > 10^4 CFU/100ml ___Yes __No

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling		
Combined wastewater flow: DWF = 150 gal/day/bedroom x # of bedrooms = 150 gal/day/bedroom x ____# of bedrooms = _____ gal/day	Clearwater and graywater only: DWF = 90 gal/day/bedroom x # of bedrooms = 90 gal/day/bedroom x___# of bedrooms = _____ gal/day	Blackwater only: DWF = 60 gal/day/bedroom x # of bedrooms = 60 gal/day/bedroom x___# of bedrooms = _____ gal/day
Public Facilities		
DWF = Estimated wastewater flow x 1.5 = _____ gal/day x 1.5 = _____ gal/day		

C. DESIGN OF THE AEROFIN SYSTEM DISTRIBUTION CELL

Step 1. Determine the minimum total AeroFin length

The minimum length of AeroFin per bedroom is 80 feet. Determine the minimum total length of conduit from Table 4, based on the number of bedrooms.

Table 4 MINIMUM TOTAL LENGTH OF CONDUIT	
Number of Bedrooms	**Minimum Conduit Length Required (ft)**
1/2	160
3	240
4	320
5	400
Each Add'l	80

Step 2: Calculate the minimum basal area required

Calculate the basal area by dividing the daily design wastewater flow (DWF) by the design loading rate (DLR).

Basal area = DWF ÷ DLR
Basal area = _____ gpd ÷ _____ gpd/ft^2
Basal area = _____ ft^2

Step 3: Design the system sand configuration

Use Table 5 below to determine the minimum system sand footprint using the minimum length of conduit (determined using Table 4) and the number of rows into which the total length of conduit will be divided. The system should be designed as long and narrow as site conditions allow.

Table 5 MINIMUM DISTRIBUTION CELL WIDTH												
Number of Fin Rows	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**Each Add'l**
Minimum Width (ft)	1.88	2.57	3.25	3.94	4.63	5.32	6.00	6.69	7.38	8.07	8.75	0.69
Minimum Width (in)	22.5	30.8	39.0	47.2	55.5	63.8	72.0	80.2	88.5	96.8	105.0	8.3

Step 4: Make area and width adjustments as necessary

First, verify the minimum AeroFin conduit length (160 ft) has been met.

The minimum areas required in Step 2 (basal area) and Step 3 (system sand configuration) cannot be reduced. These areas must be maintained to ensure adequate area for placement of the conduits and infiltration of treated effluent into the native soil.

Sand extensions are necessary as follows:

- If the minimum basal area determined in Step 2 is smaller than the area of the system sand footprint determined in Step 3, no sand extensions are necessary.
- If the minimum basal area determined in Step 2 is larger than the area of the system sand footprint determined in Step 3, sand extensions must be added to meet the minimum basal area footprint requirements. When adding sand extensions in level system applications, additional width shall be evenly divided on each side of the AeroFin System; and

- In sloped applications, additional width shall be placed entirely on the downslope side of the AeroFin system. For elevated or mound systems, this manual does not apply. See the Infiltrator AeroFin System Mound Component Manual.

Note: *The length of the bed area may be altered, but only by extending the conduit rows. This method may be preferred over increasing the width of the system under certain site and system design considerations.*

XI. EXAMPLE IN-GROUND SOIL ABSORPTION COMPONENT WORKSHEET

A. SITE CONDITIONS

Evaluate the site and soils report for the following:

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

Slope - 0 %
Occupancy – One or Two-Family Dwelling - 4 (# of bedrooms)
Public Facility - _____ gal/day (Estimated wastewater flow)
Depth to limiting factor - 60 inches
Minimum depth of unsaturated soil required by Table 383.44-3, Wis. Adm. Code - 36 inches.
System sand depth below AeroFin conduit: ☐ 12 inches
In-situ soil application rate used - 1.6 gpd/ft^2
FOG value of effluent applied to component - < 30 mg/L

Treated Effluent from Component
BOD_5 value of effluent applied to component - ≤ 30 mg/L
TSS value of effluent applied to component - ≤ 30 mg/L
Fecal Coliform monthly geometric mean value of effluent applied to component
> 10^4 CFU/100ml __Yes X No

B. DESIGN WASTEWATER FLOW (DWF)

One or Two-family Dwelling		
Combined wastewater flow: DWF = 150 gal/day/bedroom x # of bedrooms = 150 gal/day/bedroom x 4 # of bedrooms = 600 gal/day	Clearwater and graywater only: DWF = 90 gal/day/bedroom x # of bedrooms = 90 gal/day/bedroom x _____# of bedrooms = _____ gal/day	Blackwater only: DWF = 60 gal/day/bedroom x # of bedrooms = 60 gal/day/bedroom x _____# of bedrooms = _____ gal/day
Public Facilities		
DWF = Estimated wastewater flow x 1.5 = _____ gal/day x 1.5 = _____ gal/day		

C. DESIGN OF THE AEROFIN SYSTEM DISTRIBUTION CELL

Step 1. Determine the minimum total AeroFin length

The minimum length of AeroFin per bedroom is 80 feet. Determine the minimum total length of conduit from Table 4, based on 4 bedrooms is 320 linear feet.

Table 4
MINIMUM TOTAL LENGTH OF AeroFin Conduit

Number of Bedrooms	Minimum Fin Length Required (ft)
1/2	160
3	240
4	**320**
5	400
Each Add'l	80

Step 2: Calculate the minimum basal area required

Calculate the basal area by dividing the daily design wastewater flow (DWF) by the design loading rate (DLR).

Basal area = DWF ÷ DLR

Basal area = 600 gpd ÷ 1.6 gpd/ft^2

Basal area = 375 ft^2

Step 3: Design the system sand configuration

Using 4 rows of 80 ft long requires a treatment cell area of 266.5 ft^2 (3.25 ft wide by 82 ft long).

Table 5
MINIMUM DISTRIBUTION CELL WIDTH

Number of Fin Rows	2	3	4	5	6	7	8	9	10	11	12	Each Add'l
Minimum Width (ft)	1.88	2.57	**3.25**	3.94	4.63	5.32	6.00	6.69	7.38	8.07	8.75	0.69
Minimum Width (in)	22.5	30.8	39.0	47.2	55.5	63.8	72.0	80.2	88.5	96.8	105.0	8.3

Step 4: Make area and width adjustments as necessary

The minimum AeroFin conduit length required (160 ft) is met by the 320 lf of AeroFin conduit in this system design (Step 1).

As determined in Step 3, the minimum length of the system is 82 feet and the minimum width of the system is 3.25 feet, creating a system sand footprint of 266.5 ft^2 (3.25 ft x 82 ft) Since the 375 ft^2 minimum basal area (Step 2) is larger than the 266.5 ft^2 system sand footprint (Step 3), sand extensions must be added.

• *Divide the minimum basal area required by the length of the system sand footprint as designed.*	*375 ft^2 ÷ 82 ft = 4.57 ft*
• *Subtract the design system sand footprint width from the above adjusted system sand footprint width to determine the width of the sand extension required.*	*4.57 ft - 3.25 ft = 1.32 ft*
• *Divide the total width of the sand extension required as calculated above by 2 to determine the minimum width of the sand extension required on each side of the system.* ***NOTE:*** *Round up and convert to feet/inches for ease of installation.*	*1.32 ft ÷ 2 = 0.66 ft (Round up to 0.75 ft.)*
• *The system sand width must be widened by 1.5 ft. On a level site, this is accomplished by adding a 9-in-wide sand extension to the entire length of each side of the system. This results in a total basal area footprint width of 4.75 ft.*	*4.75 ft x 82 ft = 389.5 ft^2*

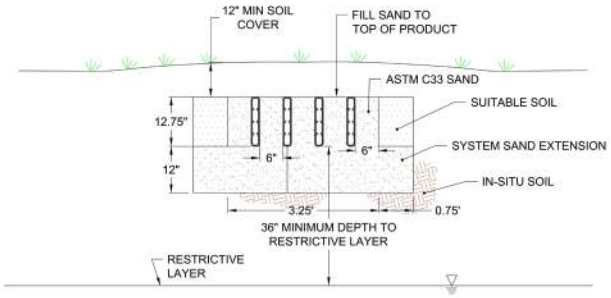

Figure 8. Detailed cross-section of an example in-ground AeroFin System

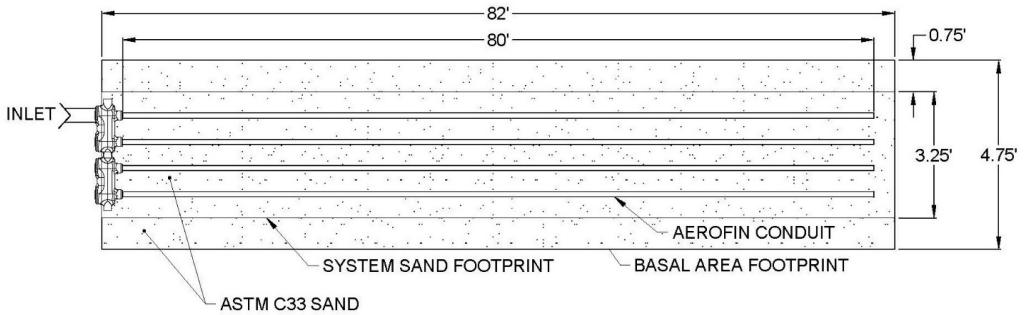

Figure 9. Detailed plan-view of an example in-ground AeroFin System

XII. PLAN SUBMITTAL AND INSTALLATION INSPECTION

A. Plan Submittal

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**. Not all needed information may be included in this list. Some of the information may not be required to be submitted due to the design of the system. 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 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.

General Submittal Information

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

Forms and Fees

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

Soils Information

1. Complete Soils and Site Evaluation Report (form # SBD-8330) for each soil boring described; signed and dated by a certified soil tester, with license number.
2. 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.

Documentation

1. 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.
2. 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.
3. A detailed project description must be submitted with all commercial plans. Any facility creating non-domestic wastewater may require concurrence approved from the WI DNR. Please check with a state plan reviewer if there are any questions.
4. 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.
5. Designs that are based on department approved component manual(s) must include reference to the manual by name, publication number and published date.

Plot Plan

1. Dimensioned plans or plans drawn to scale (scale indicated on plans) with parcel size or all property boundaries clearly marked.
2. Slope directions and percent in system area.

3. Bench mark and north arrow.
4. Setbacks indicated as per appropriate code.
5. Two-foot contours or other appropriate contour interval within the system area.
6. Location information; legal description of parcel must be noted.
7. Location of any nearby existing system or well.

Plan View

1. Dimensions for distribution cell(s).
2. Location of observation pipes.
3. Dimensions of AeroFin System in-ground soil absorption component.
4. Pipe lateral layout, which must include the number of laterals, pipe material, diameter and length.
5. Manifold and force main locations, with materials, length and diameter of each.

Cross Section of System

1. Include tilling requirement, distribution cell details, percent slope, side slope, and cover material.
2. Lateral elevation, position of observation pipes, dimensions of distribution cell, and type of cover material such as geotextile fabric, if applicable.

System Sizing

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

Tank and Pump or Siphon Information

1. All construction details for site-constructed tanks.
2. Size and manufacturer information for prefabricated tanks.
3. Notation of pump or siphon model, pump performance curve.
4. Notation of high water alarm manufacturer and model number.
5. Cross section of dose tank / chamber to include storage volumes; connections for piping, and power; pump “off” setting; dosing cycle and volume, high water alarm setting, and storage volume above the highwater alarm; and location of manhole.
6. 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 s. 145.20, Wis. Stats. and s. SPS 383.26, Wis. Adm. Code. The inspection form found on the DSPS POWTS website 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.