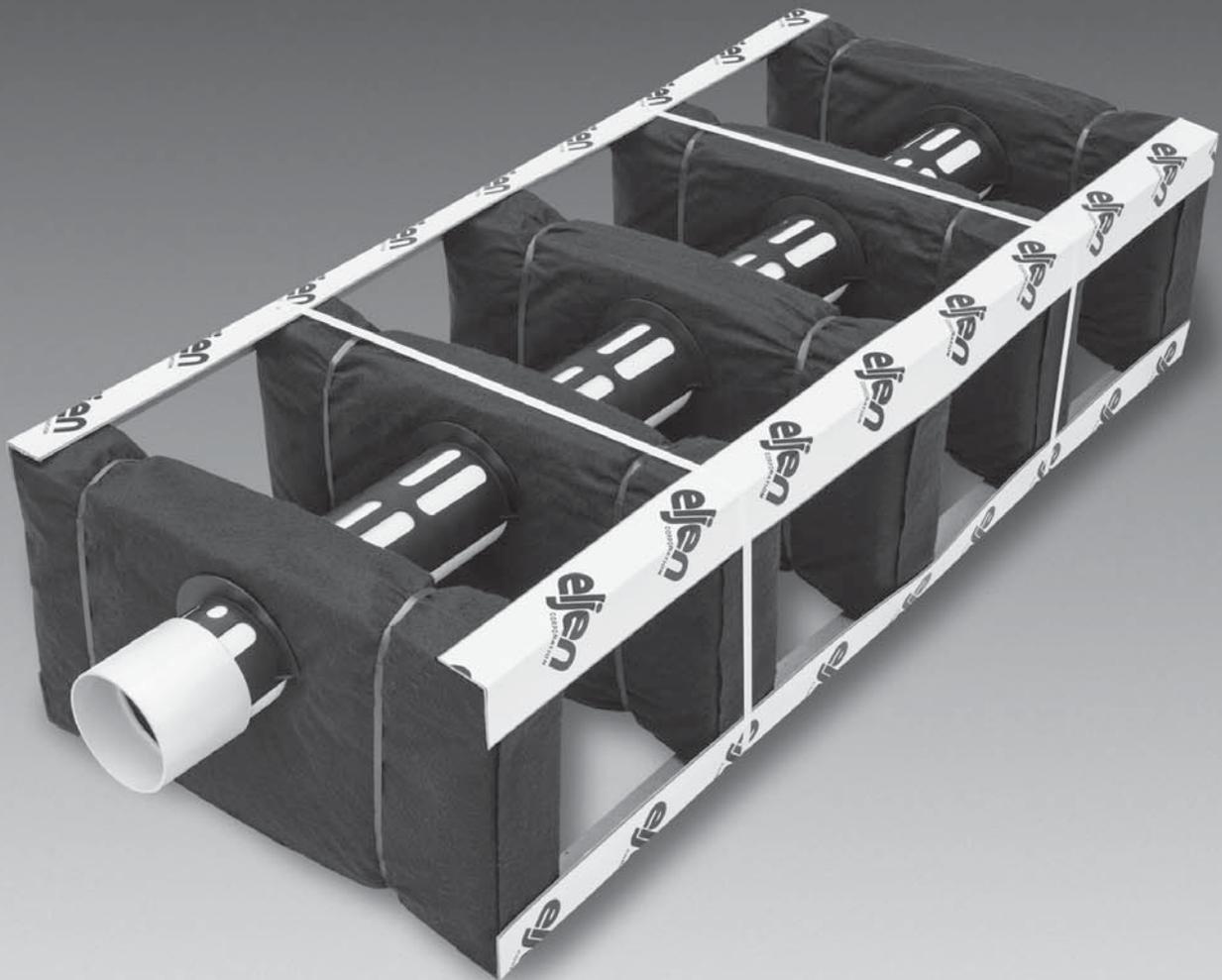


**Mantis**<sup>®</sup>  
Wastewater Systems



Vermont

# System Design & Installation Manual



**eljen**  
CORPORATION

*Innovative Environmental Products & Solutions Since 1970*

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[www.eljen.com](http://www.eljen.com)

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# Glossary of Terms

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## Mantis M<sup>5</sup> Series Units

The Mantis M<sup>5</sup> Series units come preassembled and are 5 feet in length (as measured from the Support Distribution Pipe) and 12" high. 12" and 24" wide models are available. The 12" wide model is designated the Mantis M5.1, and the 24" wide model is the Mantis M5.2. All models have 6" of specified sand under and to the sides of the product. 1" of specified sand is placed over the units prior to backfill.

## Support Distribution Pipe

The Mantis M<sup>5</sup> Series Support Distribution Pipe is 5 feet in length and constructed from crush resistant PVC Pipe. The pipes provide 3 pre-drilled one inch holes at specified spacing located at the 12, 5 and 7 o'clock position.

## Filter Support Module

There are 5 Filter Support Modules for each M<sup>5</sup> unit. All Filter Support Modules are 4" thick. The 5.1 model is 12" wide and the 5.2 model is 24" wide.

## Specified Sand

The Specified Sand envelope around the Mantis M<sup>5</sup> Series (6" minimum underneath, 6" minimum on the sides, 1" minimum on the top, and 8" in-between the Support Modules) shall meet the requirements as indicated in the Specified Sand Requirements chart listed in Table 1 listed below. This sand is a **WASHED CONCRETE SAND OR VERMONT 1-913(C)2 SAND FROM THE REGULATIONS, WITH LESS THAN 10% PASSING #100 SIEVE AND LESS THAN 5% PASSING A #200 SIEVE.**

*Note: Specified Sand under the Mantis M<sup>5</sup> units must be stabilized so differential settling does not occur over time. This can be accomplished by using a mechanical or hand methods. Specified Sand between the modules must be stabilized using a tamping rod. Please contact Eljen Corporations Technical Services Department if more information is needed.*

Ask your material supplier for a sieve analysis to verify that your material meets the required specifications.

**Table 1: SPECIFIED SAND SIEVE REQUIREMENTS**

Eljen Mantis M <sup>5</sup> Series Specified Sand Requirements		
Sieve Size	Sieve Square Opening Size	Specification Percent Passing (Wet Sieve)
0.375"	9.5 mm	100.0
#4	4.75 mm	95.0 – 100.0
#8	2.36 mm	80.0 – 100.0
#16	1.18 mm	50.0 – 85.0
#30	600 µm	25.0 – 60.0
#50	300 µm	5.0 – 30.0
#100	150 µm	< 10.0
#200	75 µm	< 5.0
Request a sieve analysis from your material supplier to ensure that the system sand meets the specification requirements listed above.		

## Design Flow

The estimated design flow used to size a system is 70 gallons per day per person. For the first 3 bedrooms of a home, it is assumed that there are 2 people per bedroom. For each additional bedroom, there is 1 person per bedroom. Minimum design is a 2 bedroom home or 280 gpd for residential systems.

# Mantis M<sup>5</sup> General Description

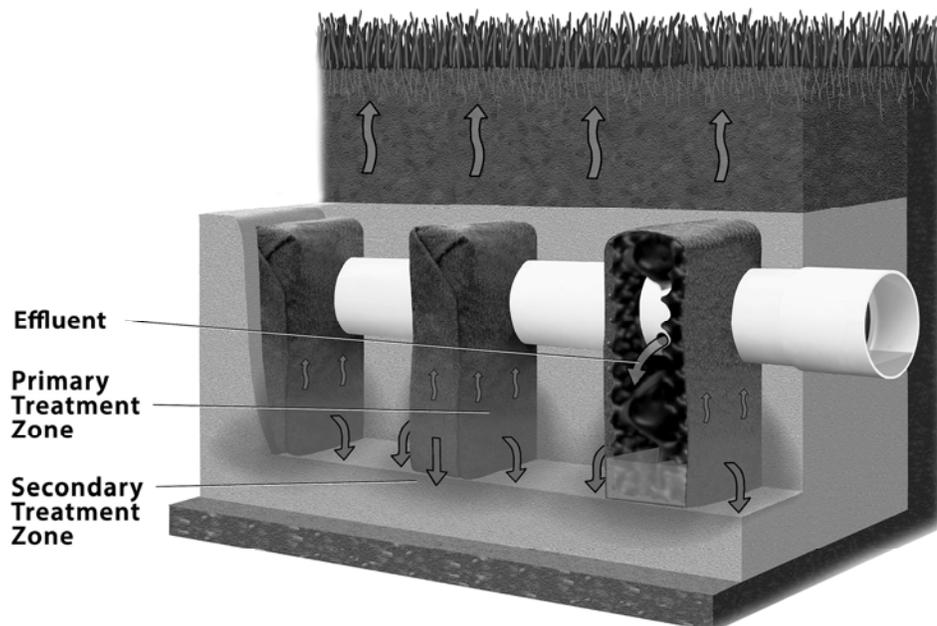
*Note: To receive design standards for specially engineered dosing systems or commercial systems, contact Eljen's Technical Resource Department at 1-800-444-1359. Mantis M<sup>5</sup> series systems must be designed and constructed according to this Design & Installation Manual and the State of Vermont Environmental Protection Rules, Chapter 1, effective September 29, 2007 (hereinafter the Regulations).*

## How the Mantis M<sup>5</sup> Series System Works

The Eljen Mantis M<sup>5</sup> Series is a wastewater disposal technology comprised of a proprietary filtering process that applies clarified effluent to the soil. The Mantis M<sup>5</sup> Series performance is based on accepted industry principals of increasing the receiving soils long term acceptance rate by keeping the biological growth off the native soils and within the system. This technology utilizes 3 dimensional surface areas to improve effluent quality, resulting in greater reliability and ease of operation.

- The Support Distribution Pipe provides internal distribution, a venting conduit for the system and secures the five Filter Support Modules in place. This distribution pipe is centered within the Filter Support Module to distribute septic effluent.
- Septic effluent is filtered through the Filter Support Modules. Each module consists of a cusped core surrounded by Bio-Matt geo-textile fabric. Its unique design provides increased surface area within each module. This area is known as the Internal Surface Optimization envelope, ISO for short. The ISO envelope provides an increased surface area that greatly exceeds the Filter Support Module's footprint, a traditional gravel footprint or that of a gravelless replacement technology.
- Open air channels within the modules support aerobic bacterial growth on the Filter Support Modules geotextile fabric interface, surpassing the surface area provided by traditional absorption systems.
- Effluent is transferred into the Specified Sand layer which supports unsaturated flow into the native soil. This Specified Sand and soil interface maintains soil structure while maximizing the available absorption of the native soil.
- The Specified Sand layer also protects the soil from compaction and helps maintain existing pore spaces in the soil. This preserves the soil's natural infiltration capacity which is critical for long-term performance, especially in finer textured soils.

**FIGURE 1: MANTIS M<sup>5</sup> COMPONENTS**



# Mantis M<sup>5</sup> Series Sizing

**TABLE 2: Mantis M<sup>5</sup> Trench Sizing Table**

Texture	Structure Type <sup>1</sup>	Application Rate GPD/ft <sup>2</sup>	Minimum Trench Area Required (ft <sup>2</sup> )				
			2 Bedroom 280 GPD	3 Bedroom 420 GPD	4 Bedroom 490 GPD	Add'l Bedrooms 70 GPD	Commercial Rate 100 GPD
Very Coarse Sand or Coarser	SG	See §1-919(b)					
Coarse Sand, Sand	SG	3.0	144	204	240	48	48
Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	SG	2.0	144	210	245	48	50
	MA/PL	1.0	280	420	490	90	100
	PR/SBK/ABK/GR	1.4	200	300	350	65	72
Sandy Loam, Coarse Sandy Loam	MA/PL	1.0	280	420	490	90	100
	PR/SBK/ABK/GR	1.4	200	300	350	65	72
Fine Sandy Loam, Very Fine Sandy Loam	MA/PL	1.0	280	420	490	90	100
	PR/SBK/ABK/GR	1.2	234	350	409	75	84
Loam	MA/PL	1.0	280	420	490	90	100
	PR/SBK/ABK/GR	1.2	234	350	409	75	84
Silt Loam, Silt	MA/PL	0.6	467	700	817	150	167
	PR/SBK/ABK/GR	0.8	350	525	613	113	125
Sandy Clay Loam, Clay Loam, Silty Clay Loam	MA/PL	0.5	560	840	980	180	200
	PR/SBK/ABK/GR	0.6	467	700	817	150	167
Sandy Clay, Clay, Silty Clay		See §1-926					

**Notes:**

1. Number of Mantis M<sup>5</sup> Series units is determined on the current application rates defined in the regulations.
2. For number of Mantis M<sup>5</sup> 5.2 & Mantis M<sup>5</sup> 5.2 LowPro units, divide by 15 ft<sup>2</sup> per unit and round up to the nearest whole number of units.
3. For number of Mantis M<sup>5</sup> 5.1 & Mantis M<sup>5</sup> 5.1 LowPro units, divide by 10 ft<sup>2</sup> per unit and round up to the nearest whole number of units.
4. The minimum number of bedrooms for residential designs shall be 2 bedrooms unless otherwise dictated by the regulations.

# Mantis M<sup>5</sup> Series Sizing

**TABLE 3: Mantis M<sup>5</sup> Bed Sizing Table**

Texture	Structure Type <sup>1</sup>	Application Rate GPD/ft <sup>2</sup>	Minimum Bed Area Required (ft <sup>2</sup> )				
			2 Bedroom 280 GPD	3 Bedroom 420 GPD	4 Bedroom 490 GPD	Add'l Bedrooms 70 GPD	Commercial Rate 100 GPD
Very Coarse Sand or Coarser	SG	See §1-919(b)					
Coarse Sand, Sand	SG	2.4	144	204	240	48	48
Fine Sand, Very Fine Sand, Loamy Fine Sand, Loamy Very Fine Sand	SG	1.6	175	263	307	57	63
	MA/PL	0.8	350	525	613	113	125
	PR/SBK/ABK/GR	1.2	234	350	409	75	84
Sandy Loam, Coarse Sandy Loam	MA/PL	0.8	350	525	613	113	125
	PR/SBK/ABK/GR	1.2	234	350	409	75	84
Fine Sandy Loam, Very Fine Sandy Loam	MA/PL	0.8	350	525	613	113	125
	PR/SBK/ABK/GR	1.0	280	420	490	90	100
Loam	MA/PL	0.8	350	525	613	113	125
	PR/SBK/ABK/GR	1.0	280	420	490	90	100
Silt Loam, Silt	MA/PL	0.4	700	1050	1225	225	250
	PR/SBK/ABK/GR	0.6	467	700	817	150	167
Sandy Clay Loam, Clay Loam, Silty Clay Loam	MA/PL	0.4	700	1050	1225	225	250
	PR/SBK/ABK/GR	0.4	700	1050	1225	225	250
Sandy Clay, Clay, Silty Clay		See §1-926					

**Notes:**

1. Number of Mantis M<sup>5</sup> Series units is determined on the current application rates defined in the regulations
2. For number of Mantis M<sup>5</sup> 5.2 & Mantis M<sup>5</sup> 5.2 LowPro units, divide by 15 ft<sup>2</sup> per unit and round up to the nearest whole number of units.
3. For number of Mantis M<sup>5</sup> 5.1 & Mantis M<sup>5</sup> 5.1 LowPro units, divide by 10 ft<sup>2</sup> per unit and round up to the nearest whole number of units.
4. The minimum number of bedrooms for residential designs shall be 2 bedrooms unless otherwise dictated by the regulations.

## 1.0 General System Information

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**1.1 TREATMENT FIELD SIZE AND NUMBER OF UNITS:** System size will vary depending on design flow and soil analysis. Tables 2 - 3 indicate the minimum number of Mantis units required for various soil percolation rates and design flows.

Groundwater mounding and linear loading rate analyses are required when designing a wastewater system in Vermont. Please refer to the Vermont Wastewater System & Potable Water Supply Rules for more information.

**1.2 NON-RESIDENTIAL BUILDINGS & RESIDENTIAL INSTITUTIONS:** Commercial systems require different sizing and design criteria as compared to residential systems. Please contact Eljen's Technical Resource Department at 1-800-444-1359 for more information on commercial systems.

**1.3 DEPTH TO GROUND WATER OR RESTRICTIVE LAYER:** As required by state regulations; a minimum of 3 feet of separation distance from the bottom of the Mantis M<sup>5</sup> unit to the seasonal high water table and 4 feet separation from the bottom of the Mantis M<sup>5</sup> unit to bedrock. This distance is measured from the bottom of the Mantis M<sup>5</sup> unit and not from the bottom of the sand layer.

**1.4 SPECIFIED SAND SPECIFICATION FOR TRENCH AND BED SYSTEMS:** The first 6 inches of Specified Sand immediately under, between Filter Support Modules, between unit rows and around the perimeter of the Mantis M<sup>5</sup> Series system must be a **WASHED CONCRETE SAND (meeting the requirements of Table 1 of this Manual) OR VERMONT 1-913(C)2, WITH LESS THAN 10% PASSING A #100 SIEVE AND LESS THAN 5% PASSING A #200 SIEVE.**

*Note: Specified Sand under the Mantis M<sup>5</sup> units must be stabilized so differential settling does not occur over time. This can be accomplished by using a mechanical or hand methods. Specified Sand between the modules must be stabilized using a tamping rod. Please contact Eljen Corporations Technical Services Department if more information is needed.*

**1.5 VEHICULAR TRAFFIC AND PAVED AREAS OVER SYSTEM:** All vehicular traffic is prohibited over the Mantis system. This is due to the compaction of material required to support traffic loading. Compaction greatly diminishes absorption below the system and reduces the void space that naturally exists in soils for oxygen transfer and water migration. For shallow installations, light-weight track-mounted machines are best for setting the final grade. It is also permissible to back-blade the soil to set final minimum cover.

**1.6 INGROUND TRENCHES & BEDS:** Distribution methods permitted for use with these Mantis M<sup>5</sup> systems are:

- Gravity
- Pump to d-box with timed dosing
- Pipe-in-Pipe Pressure Distribution

**1.7 SHALLOW PLACEMENT, ELEVATED, OR MOUND SYSTEMS:** Distribution methods permitted for use with these Mantis M<sup>5</sup> systems are:

- Pump to d-box with timed dosing
- Pipe-in-Pipe Pressure Distribution

Pump to d-box distribution: The d-box shall be placed to center feed the laterals so that no lateral would exceed 50' (100' total).

A maximum of 500 lf total is permitted for pump to d-box distribution. Pipe-in-pipe pressure distribution has no maximum length.

Shallow placement, elevated or mound systems with a design flow of greater than 1000 gpd must utilize pipe-in-pipe pressure distribution.

**1.8 SYSTEM AREA SLOPE:** The maximum ground slope shall not exceed 30% for wastewater systems on subdivided lots in existence before June 14, 2002. The maximum ground slope shall not exceed 20% for wastewater systems on lots that are subdivided on or after June 14, 2002. The limitation on maximum slope shall not apply to replacement systems that are subject to the variance provisions of Section 1-806 of these Rules.

## 1.0 General System Information

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**1.9 SYSTEM VENTING:** Eljen mandates venting when the system has greater than 18" of cover material as measured from the top of the unit to finished grade. This will ensure proper aeration of the units.

**1.10 BACKFILL & FINISH GRADING:** Complete backfill with a minimum of five inches of clean porous fill measured from the top of one inch specified sand over the module. Backfill exceeding 18 inches measured from the top of the module requires venting at the far end of the trench or bed. Use well graded sandy fill that is clean, porous and devoid of large rocks. Do not use wheeled equipment over the system. A light track machine may be used. Divert surface runoff from the soil treatment area. Finish grade to prevent surface ponding. Seed and loam system area to protect from erosion.

**1.11 EFFLUENT FILTERS:** Effluent filters are recommended as a means of preventing solids from leaving the tank.

**1.12 DISTRIBUTION PIPE LAYOUT:** No additional distribution pipe is needed to connect units to one another. The support distribution pipe runs through the center of the units and provides distribution for all configurations. For bed systems, the distal ends of rows may be connected with non-perforated pipe.

**1.13 GARBAGE DISPOSALS:** The use of a garbage disposal is not recommended as they can cause septic system problems by generating an increased amount of suspended solids, grease and nutrients. Design drawings shall include a note "Garbage disposals shall not be used with this system".

State regulations require that the system is upsized by 25%

NOTE: Eljen recommends the use of septic tank outlet effluent filters on all systems, especially on those systems that a garbage disposal is installed, even if the tanks design capacity has been increased. Filters with higher filtration are recommended for systems with garbage disposals.

**1.14 ADDITIONAL FACTORS EFFECTING RESIDENTIAL SYSTEM SIZE:** Homes with expected higher than normal water usage should consider increasing the septic tank volume as well as increasing the size and number of units in the disposal area. For example: Homes with tubs holding more than 100 gallons or utilizing other high use fixtures and homes with higher than normal occupancy should consider septic tank and drain field modifications.

**1.15 WATER SOFTENERS OR CONDITIONERS:** Discharge of water softener or conditioner backwash to Eljen Products is not allowed. Discharge from these devices shall be into a separate disposal system meeting the requirements of State and Local Regulations.

**1.16 PLANS AND SPECIFICATIONS:** Typical treatment system drawings and specifications are shown at the end of this manual. When used in conjunction with a permit sketch, site specific specifications, and manufacturer installation criteria, these documents will normally be sufficient to assure a system can be properly installed. In some instances where a complex system is encountered, formal plans and specifications may be required. This determination is left to the discretion of the District Health Department.

# 1.0 General System Information

FIGURE 2: MANTIS M<sup>5</sup> CROSS SECTION

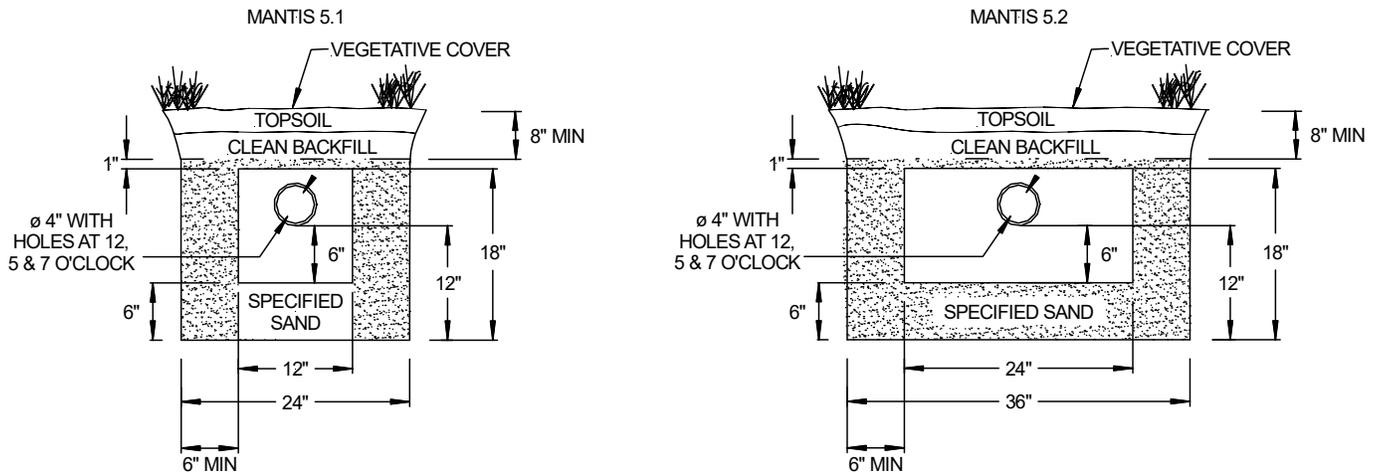
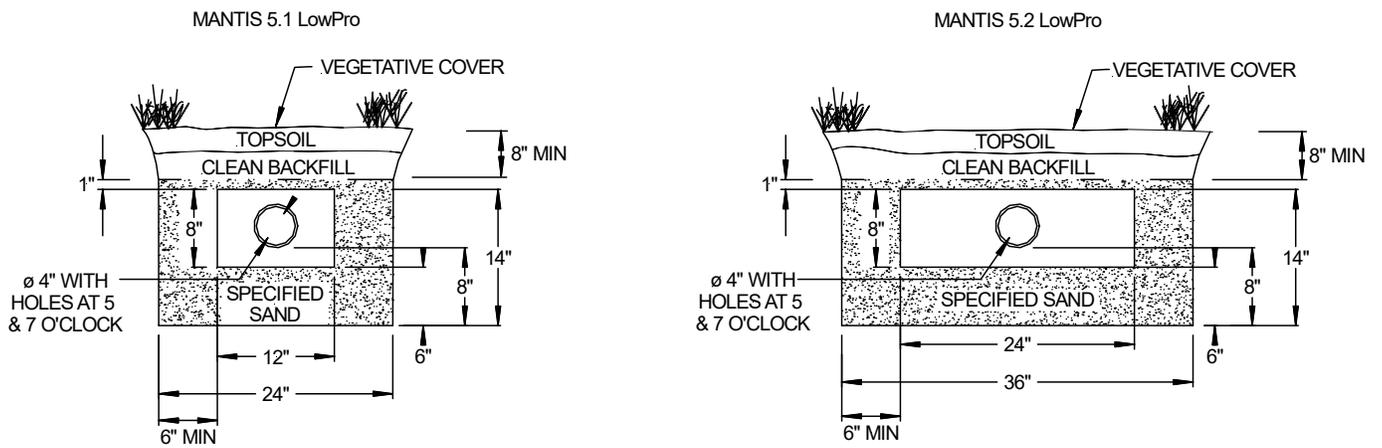


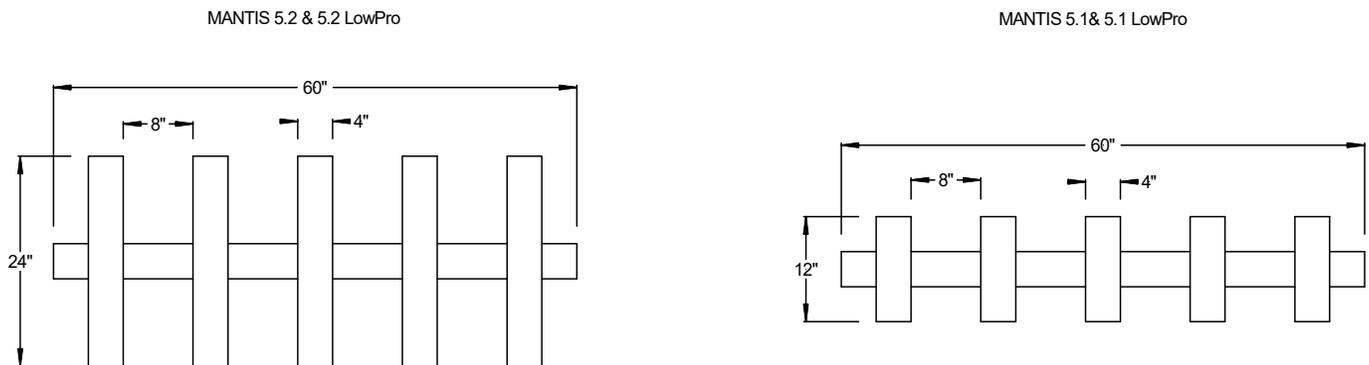
FIGURE 3: MANTIS M<sup>5</sup> LowPro CROSS SECTION



## 1.0 General System Information

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FIGURE 4: MANTIS M<sup>5</sup> & MANTIS M<sup>5</sup> *LowPro* PLAN VIEW



## 2.0 Design for Level Sites

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**2.1 BED/MOUND SYSTEMS ROW SPACING:** Design level in-ground or raised systems with a minimum of 12-inches of spacing between unit rows. The Mantis M<sup>5</sup> units and Specified Sand must be installed level at their design elevations.

**2.2 TRENCH ROW SPACING:** The minimum separation shall be 4' of naturally occurring, undisturbed soil between adjacent absorption trenches. The Mantis M<sup>5</sup> units and Specified Sand must be installed level at their design elevations.

## 3.0 Design for Sloped Sites

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**3.1 BED/MOUND SYSTEM ROW SPACING:** Design level in-ground or raised systems with a minimum of 12-inches of spacing between units. The Mantis M<sup>5</sup> units and Specified Sand must be installed level at their design elevations.

**3.2 TRENCH ROW SPACING:** The minimum separation shall be 4' of naturally occurring, undisturbed soil between adjacent absorption trenches. The Mantis M<sup>5</sup> units and Specified Sand must be installed level at their design elevations.

## 4.0 Trench Installation Guidance

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1. Carefully lay out all boundaries defining the location and elevation for all system components.
2. Prepare the site according to state and local regulations. Do not install a system on frozen or saturated soils. Take precautions not to compact or smear the area with heavy machinery.
3. Plan all drainage requirements above (up-slope) the system and set soil grades to insure storm water drainage and surface water is diverted away from the absorption area once the system is complete.
4. Excavate a minimum thirty-six inch (36") wide level trench for the Mantis 5.2 unit or a minimum twenty-four inch (24") wide level trench for the Mantis 5.1 unit. Remove all organic soil, roots, and rocks within the absorption trench area.
5. Scarify receiving layers including sidewalls to eliminate soil smearing. Once scarifying is completed, avoid walking over prepared absorption area until the Specified Sand has been placed on the bottom of the trench.
6. Place, compact, and rake a minimum 6" level layer of Specified Sand along the trench bottom. Specified Sand must meet the minimum requirements listed on Table 1 of this manual. Ask your material supplier for a sieve analysis report to verify that the sand you are going to install meets this specification. A hand tamper or a vibratory plate compactor is sufficient for stabilization of the Specified Sand layer.
7. Center the Mantis units in the trench with the fabric side up, adjust the Filter Support Modules to ensure they are spaced evenly and have not shifted during placement.
8. Connect the units by inserting the Support Distribution Pipe to one another. Direction changes are accomplished by using a variety of the shelf fittings.
9. Install a termination cap or vent piping if required at the distal (far) end of the distribution pipe.
10. Begin placing Specified Sand between the Filter Support Modules and to the sides of the units. Specified Sand must be placed lightly and may be accomplished with a backhoe or other suitable equipment. **DO NOT** dump full loads of Specified Sand directly on the units.
11. Steps for placement of Specified Sand.
  - a. Starting at the top center of the units, use a minimal amount of Specified Sand necessary to set in place the bottom section of the Filter Support Modules at their correct spacing.
  - b. Stabilize the sand that is in-between the Filter Support Modules with a tamping tool. Ensure that the void area under the Support Distribution Pipe is filled and compacted with Specified Sand.
  - c. Additional Specified Sand is lightly added between the Filter Support Modules and along the sides of the Mantis units to bring the sand fill 1-inch above the Filter Support Modules to account for sand settling.
  - d. Continue to moderately tamp and compact the sand that is in-between the Filter Support Modules. Spread additional Specified Sand as necessary.
12. Set distribution box to the proper elevation to achieve a 1/8" drop per foot to the first unit. Make the connection to the beginning of the first unit from the distribution box with SDR-35 pipe or equivalent.
13. Complete backfill over the Mantis M<sup>5</sup> units followed by topsoil to a depth of 6" – 18" as measured from the top of the units. 1" of the fill is Specified Sand, immediately on top of the unit. Systems with total cover that exceeds 18" as measured from the top of the units to finished grade shall be vented at the distal (far) end of the system. Backfill material shall be well graded sandy fill; clean, porous, and devoid of large rocks. Divert surface runoff with diversion ditches or berms. Finish grade to prevent surface ponding. Seed or sod excavated areas to protect against erosion. Do not drive or pave over the absorption area.

# 4.0 Trench Installation Drawings

FIGURE 5: MANTIS M<sup>5</sup> MULTIPLE TRENCH CROSS SECTION

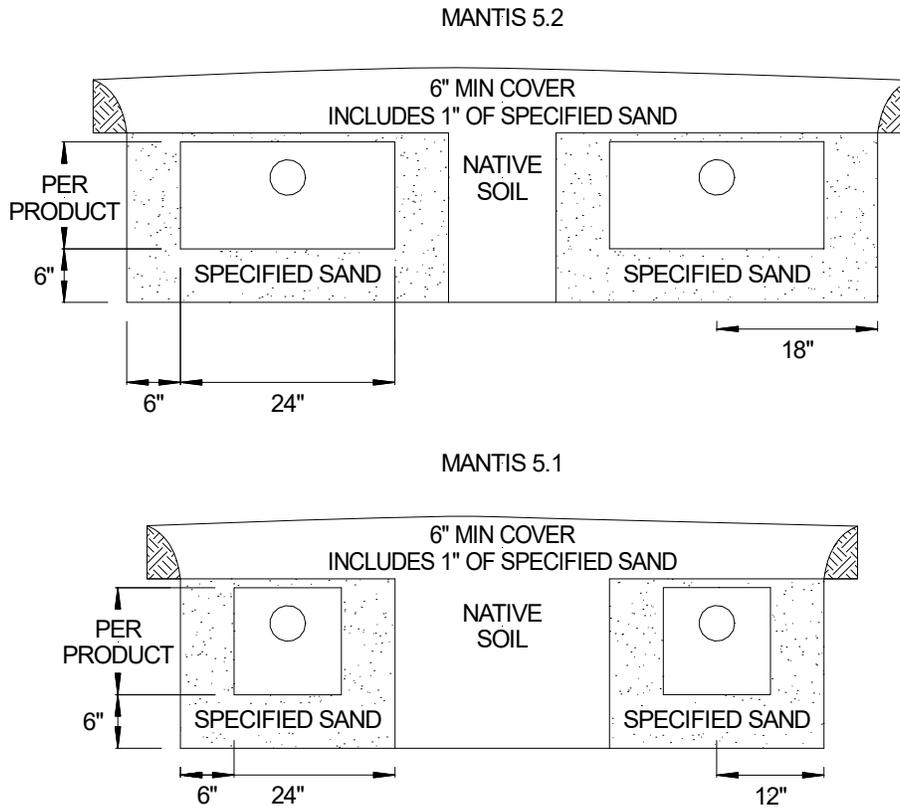
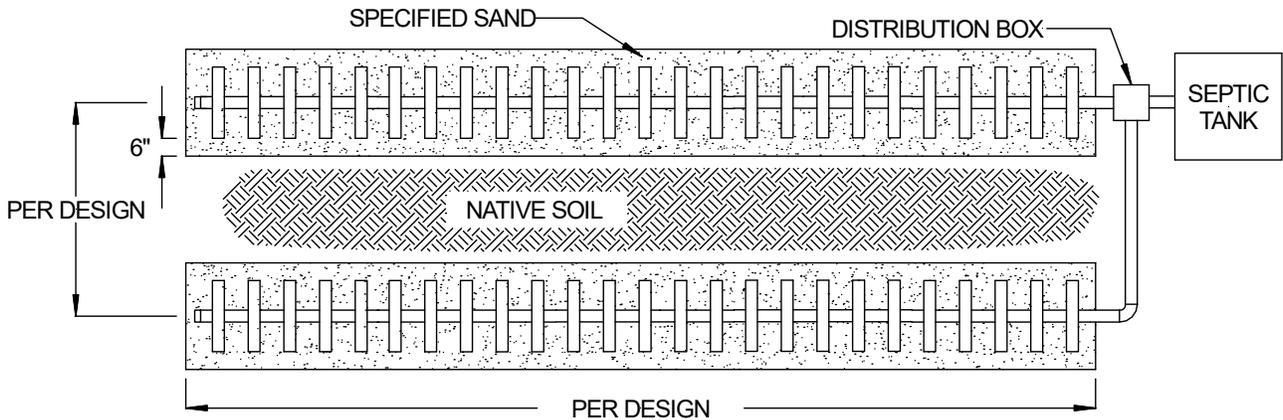


FIGURE 6: MANTIS M<sup>5</sup> MULTIPLE TRENCH PLAN VIEW



## 5.0 Bed Systems Installation Guidance

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1. Carefully lay out all boundaries defining the location and elevation for all system components.
2. Prepare the site according to state and local regulations. Do not install a system on frozen or saturated soils. Take precautions not to compact or smear the area with heavy machinery.
3. Plan all drainage requirements above (up-slope) the system and set soil grades to insure storm water drainage and surface water is diverted away from the absorption area once the system is complete.
4. Excavate the bed area. Remove all organic soil, roots, and rocks within the absorption area.
5. Scarify receiving layers including sidewalls to eliminate soil smearing. Once scarifying is completed, avoid walking over prepared absorption area until the Specified Sand has been placed on the bottom of the absorption area.
6. Place, compact, and rake a minimum 6" level layer of Specified Sand along the trench bottom. Specified Sand must meet the minimum requirements listed on Table 1 of this manual. Ask your material supplier for a sieve analysis report to verify that the sand you are going to install meets this specification. A hand tamper or a vibratory plate compactor is sufficient for stabilization of the Specified Sand layer.
7. Place the Mantis units in their rows with the fabric side up, adjust the Filter Support Modules to ensure they are spaced evenly and have not shifted during placement.
8. Connect the units by inserting the Support Distribution Pipe to one another. Direction changes are accomplished using a variety of off the shelf fittings.
9. Install a termination cap or vent piping if required at the distal (far) end of the distribution pipe.
10. Begin placing Specified Sand between the Filter Support Modules and to the sides of the units. Specified Sand must be placed lightly and may be accomplished with a backhoe or other suitable equipment. **DO NOT** dump full loads of Specified Sand directly on the units.
11. Steps for placement of Specified Sand.
  - a. Starting at the top center of the units, use a minimal amount of Specified Sand necessary to set in place the bottom section of the Filter Support Modules at their correct spacing.
  - b. Stabilize the sand that is in-between the Filter Support Modules with a tamping tool. Ensure that the void area under the Support Distribution Pipe is filled and compacted with Specified Sand.
  - c. Additional Specified Sand is lightly added between the Filter Support Modules and along the sides of the Mantis units to bring the sand fill 1-inch above the Filter Support Modules to account for sand settling.
  - d. Continue to moderately tamp and compact the sand that is in-between the Filter Support Modules. Spread additional Specified Sand as necessary.
12. Set distribution box to the proper elevation to achieve a 1/8" drop per foot to the first unit. Make the connection to the beginning of the first unit row from the distribution box with SDR-35 pipe or equivalent.
13. Complete backfill over the units followed by topsoil to a depth of 6" – 18" as measured from the top of the units. 1" of the fill is Specified Sand, immediately on top of the unit. Systems with total cover that exceeds 18" as measured from the top of the units to finished grade shall be vented at the distal (far) end of the system. Backfill material shall be well graded sandy fill; clean, porous, and devoid of large rocks. Divert surface runoff with diversion ditches or berms. Finish grade to prevent surface ponding. Seed or sod excavated areas to protect against erosion. Do not drive or pave over the absorption area.

## 5.0 Bed System Installations Drawings

FIGURE 7: MANTIS M<sup>5</sup> IN-GROUND BED SYSTEM CROSS SECTION

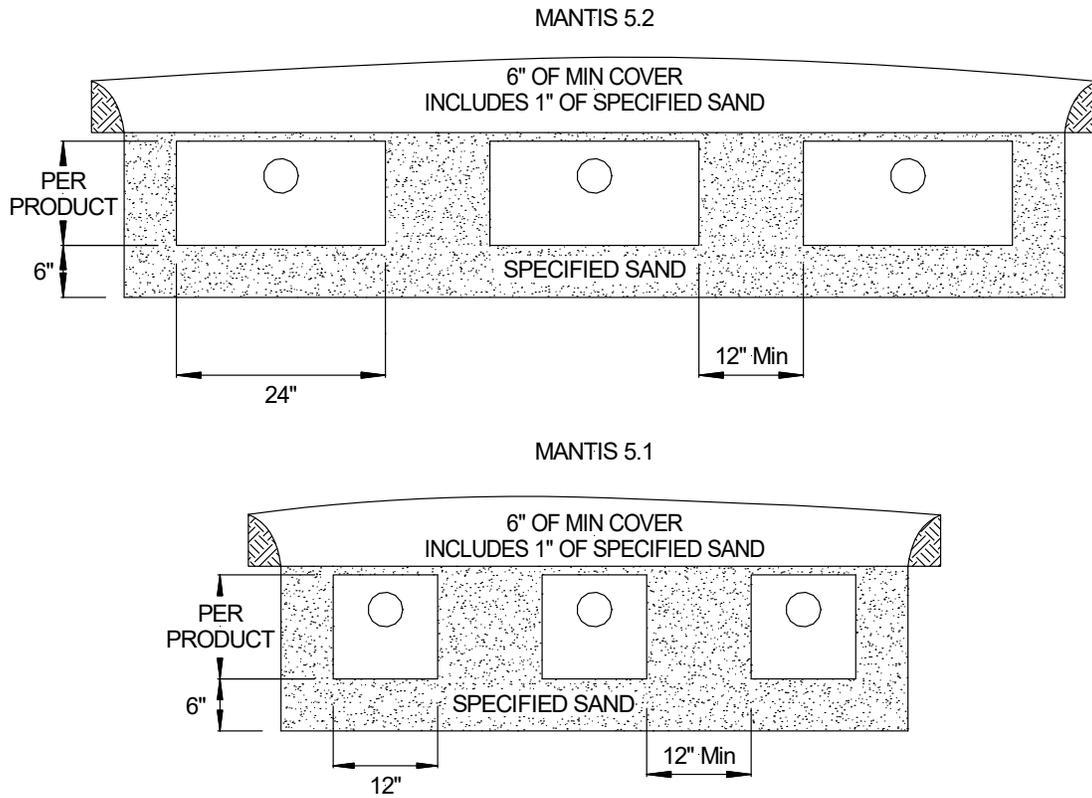
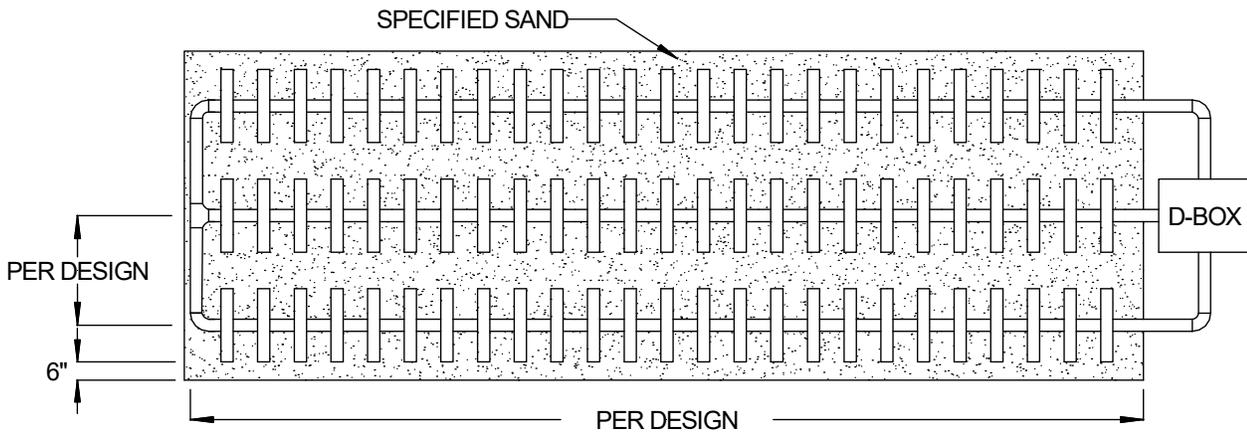


FIGURE 8: MANTIS M<sup>5</sup> BED SYSTEM PLAN VIEW



*Note: Units distal ends should not be tied together for sloped bed configurations.*

## 6.0 Mound System Installations Guidance

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1. Carefully lay out all boundaries defining the location and elevation for all system components.
  2. Prepare the site according to state and local regulations. Do not install a system on frozen or saturated soils. Take precautions not to compact or smear the area with heavy machinery.
  3. Plan all drainage requirements above (up-slope) the system and set soil grades to insure storm water drainage and surface water is diverted away from the absorption area once the system is complete.
  4. Above ground vegetation shall be closely cut and removed from the ground surface throughout the area to be used for the placement of the fill material. The area shall then be plowed to a depth of seven (7) to eight (8) inches, parallel to the land contour with the plow throwing the soil upslope to provide a proper interface between the fill and natural soils. Tree stumps shall be cut flush with the surface of the ground and roots shall not be pulled. Once plowing is completed, the area should be fenced to prevent vehicles and equipment from entering the plowed area, unless the fill material is going to be in place within 24 hours of the plowing. If the site cannot be plowed, a backhoe bucket fitted with chisel teeth may be used to “till” the site by creating furrows that are parallel to ground contour.
  5. Place, stabilize, and rake a minimum 6” level layer of Specified Sand along the mound basal area. Specified Sand must meet the minimum requirements listed on Table 1 of this manual. Ask your material supplier for a sieve analysis report to verify that the sand you are going to install meets this specification. A hand tamper or a vibratory plate compactor is sufficient for stabilization of the Specified Sand layer.
  6. Place the Mantis units in their rows with the fabric side up, adjust the Filter Support Modules to ensure they are spaced evenly and have not shifted during placement.
  7. Connect the units by inserting the Support Distribution Pipe to one another.
  8. Distribution methods permitted for use with the Mantis M<sup>5</sup> systems in shallow placement, elevated, or mound systems are:
    - Pump to d-box with timed dosing
    - Pipe-in-Pipe Pressure Distribution
- Pump to d-box distribution: The d-box shall be placed to center feed the laterals so that no lateral would exceed 50' (100' total).
- A maximum of 500 lf total is permitted for pump to d-box distribution. Pipe-in-pipe pressure distribution has no maximum length.
- Shallow placement, elevated or mound systems with a design flow of greater than 1000 gpd must utilize pipe-in-pipe pressure distribution.
9. Install a termination cap or vent piping if required at the distal (far) end of the distribution pipe.
  10. Begin placing Specified Sand between the Filter Support Modules and to the sides of the units. Specified Sand must be placed lightly and may be accomplished with a backhoe or other suitable equipment. **DO NOT** dump full loads of Specified Sand directly on the units.

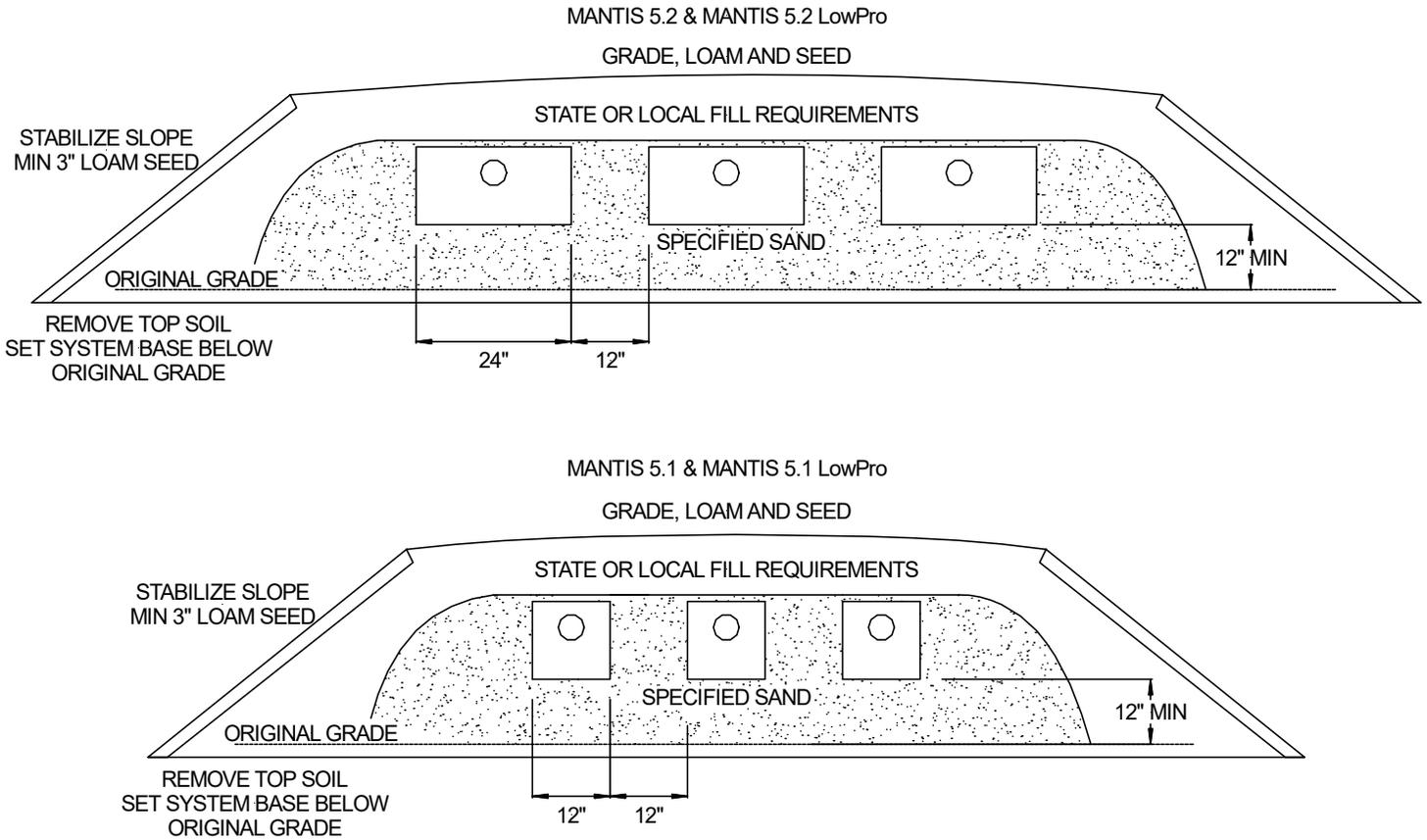
## 6.0 Mound System Installations Guidance

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11. Steps for placement of Specified Sand.
  - a. Starting at the top center of the units, use a minimal amount of Specified Sand necessary to set in place the bottom section of the Filter Support Modules at their correct spacing.
  - b. Compact the sand that is in-between the Filter Support Modules. Ensure that the void area under the Support Distribution Pipe is filled and compacted with Specified Sand.
  - c. Additional Specified Sand is lightly added between the Filter Support Modules and along the sides of the Mantis units to bring the sand fill 1-inch above the Filter Support Modules to account for sand settling.
  - d. Continue to moderately tamp and compact the sand that is in-between the Filter Support Modules. Spread additional Specified Sand as necessary.
12. Set distribution box to the proper elevation to achieve a 1/8" drop per foot to the first unit. Make the connection to the beginning of the first unit row from the distribution box with SDR-35 pipe or equivalent.
13. Complete backfill over the units followed by topsoil to a depth of 6" – 18" as measured from the top of the units. 1" of the fill is Specified Sand, immediately on top of the unit. Systems with total cover that exceeds 18" as measured from the top of the units to finished grade shall be vented at the distal (far) end of the system. Backfill material shall be well graded sandy fill; clean, porous, and devoid of large rocks. Divert surface runoff with diversion ditches or berms. Finish grade to prevent surface ponding. Seed or sod excavated areas to protect against erosion. Do not drive or pave over the absorption area.

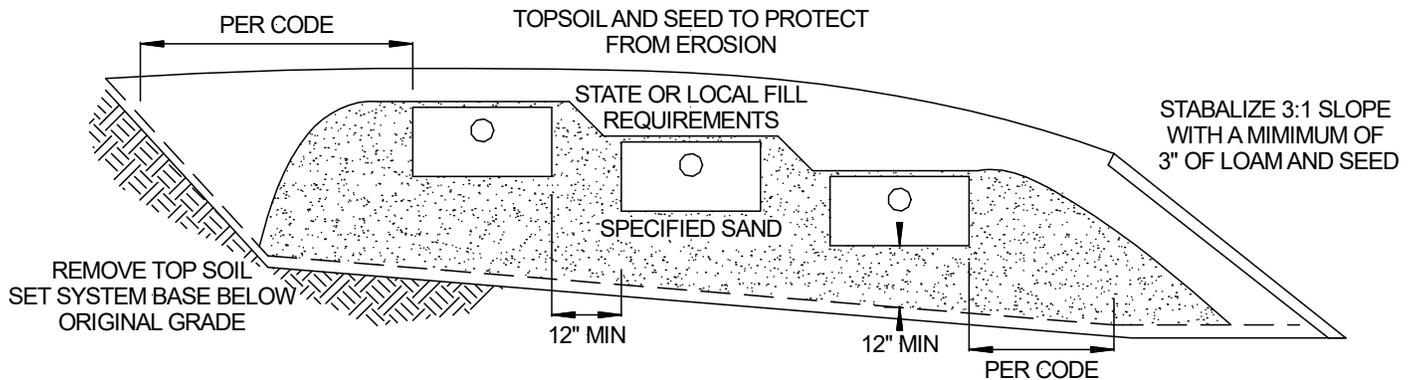
# 6.0 Mound System Installations Drawings

**FIGURE 9: MANTIS M<sup>5</sup> RAISED OR FILL BED SYSTEM CROSS SECTION**



**FIGURE 10: MANTIS M<sup>5</sup> SLOPED BED SYSTEM CROSS SECTION**

*Note: Units distal ends should not be tied together for this configuration.*



**NOTE:** Elevated mound systems require a minimum of 12 inches of Specified Sand below the units.

## 7.0 Pumped System Guidance

**7.1 PUMP DOSED DISTRIBUTION BOX:** Specify an oversized distribution box for pumped systems. Provide velocity reduction in the D-box with a tee or baffle.

**7.2 PRESSURE OR PUMPED DOSED DESIGN CRITERIA:** Dosing volume must be set to deliver a maximum of 6 gallons per Mantis 5.2 & Mantis 5.2 LowPro per dose cycle or 3 gallons per Mantis 5.1 & Mantis 5.1 LowPro per dose cycle.

Distribution methods permitted for use with these Mantis M<sup>5</sup> systems are:

- Pump to d-box with timed dosing
- Pipe-in-Pipe Pressure Distribution

Pump to d-box distribution: The d-box shall be placed to center feed the laterals so that no lateral would exceed 50' (100' total).

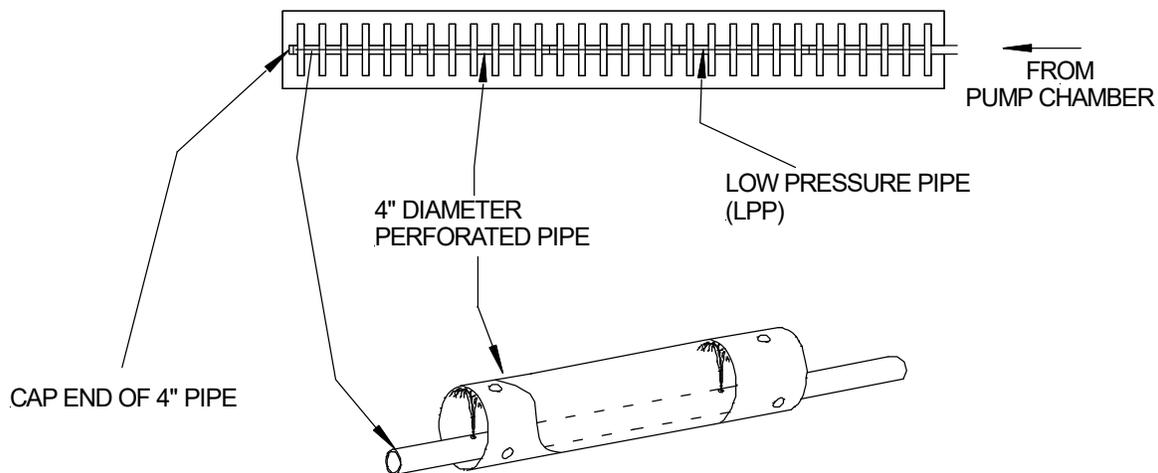
A maximum of 500 lf total is permitted for pump to d-box distribution. Pipe-in-pipe pressure distribution has no maximum length.

Shallow placement, elevated or mound systems with a design flow of greater than 1000 gpd must utilize pipe-in-pipe pressure distribution.

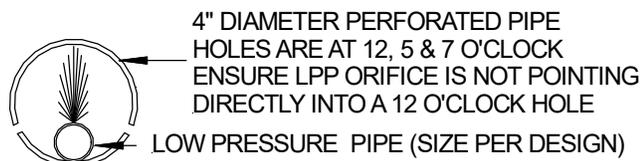
**7.3 LOW PRESSURE DISTRIBUTION:** Pressure lines should have a minimum 1 1/4 inch inside diameter. Orifices should be designed at 3/16 inch to 1/4 inch in diameter and at pre-determined intervals per design and code. Design requirements will vary depending on length of system and dose volume. At least one drain hole per line at the 6 o'clock position must be added to each line.

Flushing ports are required at the distal end of all pressure distribution networks. Flushing valves and vents can be consolidated in larger systems by using valves on the outlet manifold.

**FIGURE 11: MANTIS M<sup>5</sup> SERIES PRESSURE DISTRIBUTION – ORIFICE LAYOUT**



PRESSURE PIPE CROSS SECTION FOR ALL APPLICATIONS



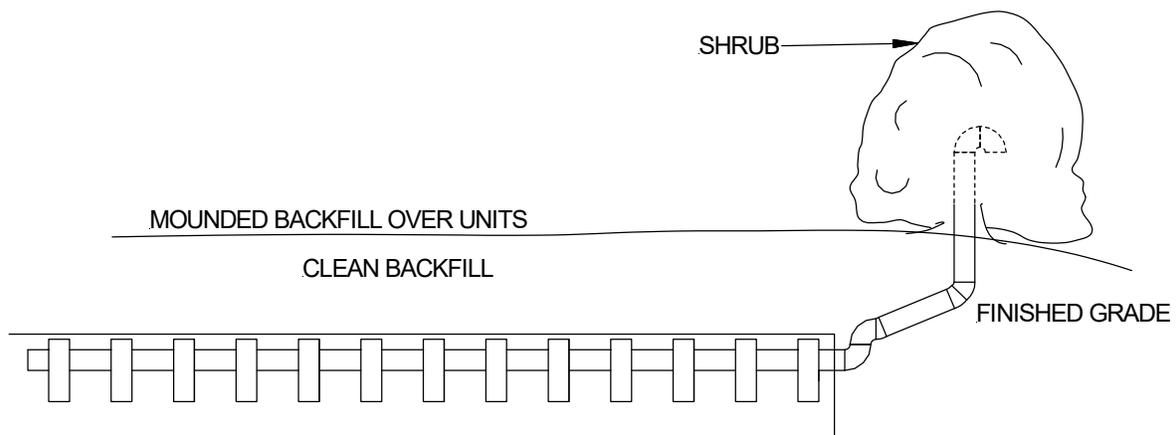
## 8.0 System Ventilation Guidance

**8.1 SYSTEM VENTILATION:** Air vents are required at the distal end of unit rows on all absorption systems with more than 18 inches of soil cover as measured from the top of the Mantis units or located under impervious surfaces. This will ensure proper aeration of the Mantis system. The extension of the distribution pipe at the distal end of each row to the vent provides adequate delivery of air into the Mantis system, as shown in Figure 10.

The vent is usually a 4-inch diameter pipe extended to a convenient location behind shrubs. Corrugated pipe can be used to vent the system. Make sure the pipe has a pitch towards the surface so it does not accumulate water or condensation that will close off the airflow to the system.

If a pump dosed system is specified with greater than 18 inches of cover, an additional 2-inch minimum airline must be extended from the D-box back to a knockout or riser on the septic tank or pump chamber. This maintains the continuity of airflow from the field.

**FIGURE 12: MANTIS M<sup>5</sup> SERIES VENTING DIAGRAM**



## 8.0 System Ventilation Example Drawing

FIGURE 13: MANTIS M<sup>5</sup> SERIES 2" BY-PASS LINE

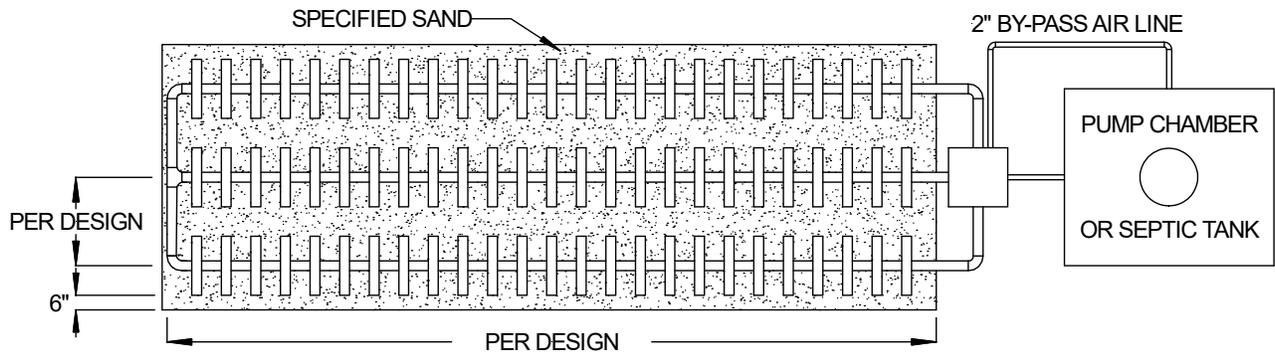
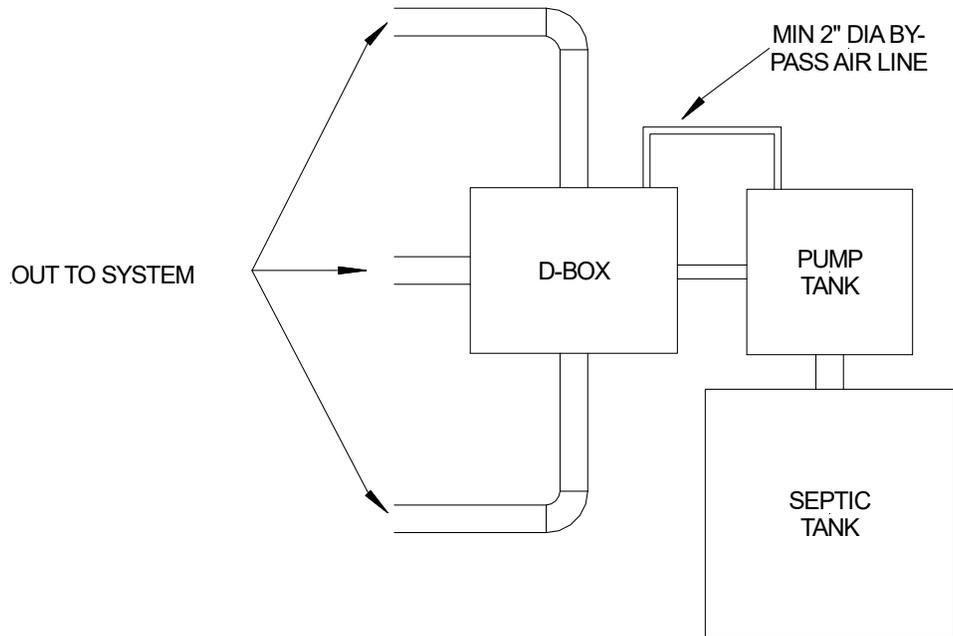


FIGURE 14: MANTIS M<sup>5</sup> SERIES 2" BY-PASS LINE, CLOSE UP



## 9.0 Recommended Notes on Design Plans

- This system is not designed for backwash from a water softener.
- This system (is/is not) designed for the use of a garbage disposal.
- The Mantis system is not for use under vehicular traffic or for under paving applications.
- Above ground vegetation shall be closely cut and removed from the ground surface throughout the area to be used for the placement of the fill material. The area shall then be plowed to a depth of seven (7) to eight (8) inches, parallel to the land contour with the plow throwing the soil upslope to provide a proper interface between the fill and natural soils. Tree stumps shall be cut flush with the surface of the ground and roots shall not be pulled. Once plowing is completed, the area should be fenced to prevent vehicles and equipment from entering the plowed area, unless the fill material is going to be in place within 24 hours of the plowing. If the site cannot be plowed, a backhoe bucket fitted with chisel teeth may be used to “till” the site by creating furrows that are parallel to ground contour.
- All Mantis M<sup>5</sup> Series installations utilize a Specified Sand envelope around the units. 6” minimum underneath, 6” minimum on the sides, 1” minimum on top, and 8” between the Filter Support Modules. The Specified Sand specification is listed below: The Specified Sand shall be washed concrete sand meeting the requirements of the table shown below or Vermont 1-913(c)2 with less than 10% passing a #100 sieve and less than 5% passing a #200 sieve.

### SPECIFIED SAND SIEVE REQUIREMENTS

Eljen Mantis M <sup>5</sup> Specified Sand Requirements		
Sieve Size	Sieve Square Opening Size	Specification Percent Passing (Wet Sieve)
0.375”	9.5 mm	100.0
#4	4.75 mm	95.0 – 100.0
#8	2.36 mm	80.0 – 100.0
#16	1.18 mm	50.0 – 85.0
#30	600 µm	25.0 – 60.0
#50	300 µm	5.0 – 30.0
#100	150 µm	< 10.0
#200	75 µm	< 5.0
Request a sieve analysis from your material supplier to ensure that the system sand meets the specification requirements listed above.		

- Eljen Corporation recommends the use of an appropriate sized septic tank effluent filter for all Mantis systems.
- Pumped systems shall have an oversized distribution box utilizing a velocity reduction tee or baffle.
- Eljen mandates venting when the system will have more than 18” of cover material as measured from the top of the unit to finished grade.
- After backfill, there should be a minimum of 6” of material as measured from the top of the Filter Support Modules to the finished grade. The first inch of that fill is specified sand.
- Backfill and Finish Grading: Carefully place backfill over the units, followed by a total minimum depth of 6 - 18 inches of well graded sandy fill; clean, porous, and devoid of rocks, as measured from the top of the Filter Support Modules. Finish grade must divert surface runoff from the soil treatment area and prevent surface ponding. Protect the system area from erosion by loaming and seeding or by using other approved methods of erosion control.
- Fill material shall meet the Eljen Mantis M<sup>5</sup> Series Design & Installation Manual requirements. All fill material shall be clean sand, free of topsoil, directly beneath the STA.
- For pumped systems, set pump floats or pump control panels to deliver a maximum of 6 gallons per Mantis 5.2 per dose cycle or 3 gallons per Mantis 5.1 per dose cycle.
- This design complies with and must be installed in accordance with the most current Eljen Mantis M<sup>5</sup> Design and Installation Manual.

## **COMPANY HISTORY**

Established in 1970, Eljen Corporation created the world's first prefabricated drainage system for foundation drainage and erosion control applications. In the mid-1980s, we introduced our Geotextile Sand Filter products for the passive advanced treatment of onsite wastewater in both residential and commercial applications. Today, Eljen is a global leader in providing innovative products and solutions for protecting our environment and public health.

## **COMPANY PHILOSOPHY**

Eljen Corporation is committed to advancing the onsite industry through continuous development of innovative new products, delivering high quality products and services to our customers at the best price, and building lasting partnerships with our employees, suppliers, and customers.



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