4.25 Sand Mound

Revision: December 10, 2014

4.25.1 Description

A sand mound is a soil absorption facility consisting of a septic tank, dosing chamber, mound constructed of medium sand, a pressurized small-diameter pipe distribution system, and topsoil cap. Figure 4-34 provides a diagram of a sand mound.

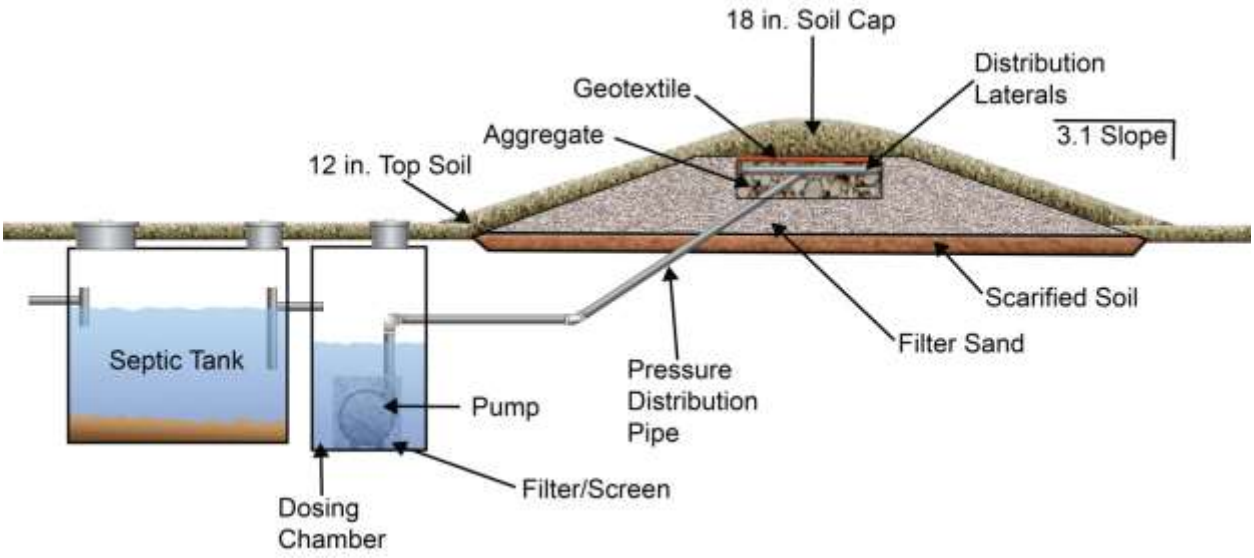

Figure 4-34. Cross-sectional view of sand mound.

4.25.2 Approval Conditions

1. Effective soil depth to limiting layers may vary depending upon thickness of filter sand beneath the absorption bed:
   a. If 12 inches of filter sand is placed beneath the absorption bed, then Table 4-19 lists the minimum depth of natural soil to the limiting layer.
   b. If 24 inches of filter sand is placed beneath the absorption bed, then Table 4-17 in Section 4.23 "Intermittent Sand Filter," identifies the effective soil depth to limiting layers.
2. The soil application rate used in the sand mound design is based on the most restrictive soil layer within the soil profile's effective soil depth as determined by approval condition 1 except that the effective sizing depth shall not be less than 18 inches.
3. Table 4-20 shows the maximum slope of natural ground, listed by soil design group.
4. Sand mound must not be installed in flood ways, areas with large trees and boulders, in concave slopes, at slope bases, or in depressions.
5. Minimum pretreatment of sewage before disposal to the mound must be a septic tank sized according to IDAPA 58.01.03.007.07.
6. The maximum daily wastewater flow to any mound or absorption bed cell must be equal to or less than 1,500 GPD.

7. Multiple mounds, or absorption bed cells, may be used to satisfy design requirements for systems larger than 1,500 GPD.
   a. Appropriate valving should be used in the design to ensure that flows are evenly divided between all of the mounds or absorption bed cells.
   b. Valving should be accessible from grade and insulated from freezing.
8. Design flow must be 1.5 times the wastewater flow.
9. Pressure distribution system and associated component design shall conform to section 4.20 of this manual.

Table 4-19. Minimum depth of natural soil to limiting layer.

Soil Design Group	Extremely Impermeable Layer (feet)	Extremely Permeable Layer (feet)	Normal High Ground Water (feet)
A, B	3	3	3
C	3	2	2

Table 4-20. Maximum slope of natural ground.

Design Group	A	B	C-1	C-2
Slope (%)	20	20	12	6

4.25.3 Design

The sand mound has three different sections with different design criteria: absorption bed cell, medium sand fill, and soil cap. The minimum design criteria for each section are provided in the following subsections.

4.25.3.1 Absorption Bed Cell Design

1. Only absorption beds may be used. The maximum absorption bed disposal area should be 2,250 ft^2 (A x B). Beds should be a maximum of 10 feet wide (B $\leq$ 10 feet). Beds should be as long and narrow as practical, particularly on sloped ground, to minimize basal loading. It is recommended that beds are less than 10 feet wide if site conditions will allow.
2. If multiple absorption bed cells are used in a sand mound design, a separation distance of 10 feet should be maintained between each cell (Figure 4-35).
3. Absorption bed cells should only be placed end to end in a single mound design.

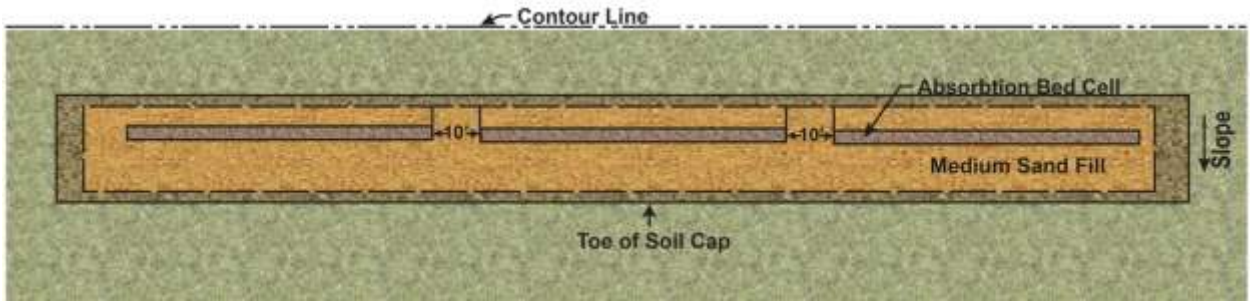

Figure 4-35. Multiple absorption bed cells installed in one sand mound.

4. Application rate of effluent in the sand bed should be calculated at 1.0 gallon/ft^2 (sand HAR = 1.0 gallon/ft^2).
5. Absorption bed must be filled with 9 inches of clean drainrock; 6 inches of which must be below the pressurized distribution pipes.
6. The absorption bed drainrock must be covered with a geotextile after installation and testing of the pressure distribution system.
7. Two observation ports should be installed extending from the drainrock/medium sand interface through the soil cap at approximately the one-quarter and three-quarter points along the absorption bed. The observation ports should contain perforations in the side of the pipe extending up 4 inches from the bottom of the port. Observation ports must be capped.
8. Absorption bed disposal area or dimensions may not be reduced through the use of extra drainrock, pretreatment, or gravelless drainfield products.
9. Pressurized laterals within the absorption bed should not be further than 24 inches from the absorption bed sidewall and should not be spaced farther than 48 inches between each lateral within the absorption bed.
10. Orifice placement should be staggered between neighboring laterals.

4.25.3.2 Medium Sand Fill Design

1. Mound sand fill must conform to the medium sand definition provided in section 3.2.8.1.2 of this manual.
2. Minimum depth of medium sand below the absorption bed shall be 1 foot.
3. Medium sand fill shall extend out a minimum of 24 inches level from the top edge of the absorption bed on all sides (medium sand fill absorption perimeter), and then uniformly slope as determined by the mound dimensions and the slope limitations described in item 6 below. This is dimension H in Figure 4-36 and Figure 4-37.
4. Flat sites: The effective area will be A x (C+B+D+2(H)).
5. Sloped sites: The effective area will be A x (B+D+H).

Equation 4-15 shows the calculation for the absorption bed area.

$$\frac{\text{Design Flow (GPD)}}{\text{Soil Application Rate } (\text{GPD}/\text{ft}^2)}$$

Equation 4-15. Effluent application area.

6. Slope of all sides must be 3 horizontal to 1 vertical (3:1) or flatter.
7. Sand fill area must be as long and narrow as practical, with plan view dimension G exceeding dimension F (Figure 4-36).
8. Slope correction factors as provided in Table 4-21 should be used to determine the downslope width of the medium sand fill for sloped sites.
9. Slope correction factors as provided in Table 4-22 should be used to determine the upslope width of the medium sand fill for sloped sites.

Table 4-21. Downslope correction factors for sloped sites.

Slope (%)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Correction Factor	1.03	1.06	1.10	1.14	1.18	1.22	1.27	1.32	1.38	1.44	1.51	1.57	1.64	1.72	1.82	1.92	2.04	2.17	2.33	2.5

Table 4-22. Upslope correction factors for sloped sites.

Slope (%)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Correction Factor	0.97	0.94	0.91	0.89	0.87	0.85	0.83	0.81	0.79	0.77	0.75	0.73	0.72	0.7	0.69	0.67	0.66	0.65	0.64	0.62

Figure 4-36 and Figure 4-37 can be used with Table 4-23 and Table 4-24 (sand mound design checklist) for flat and sloped sites.

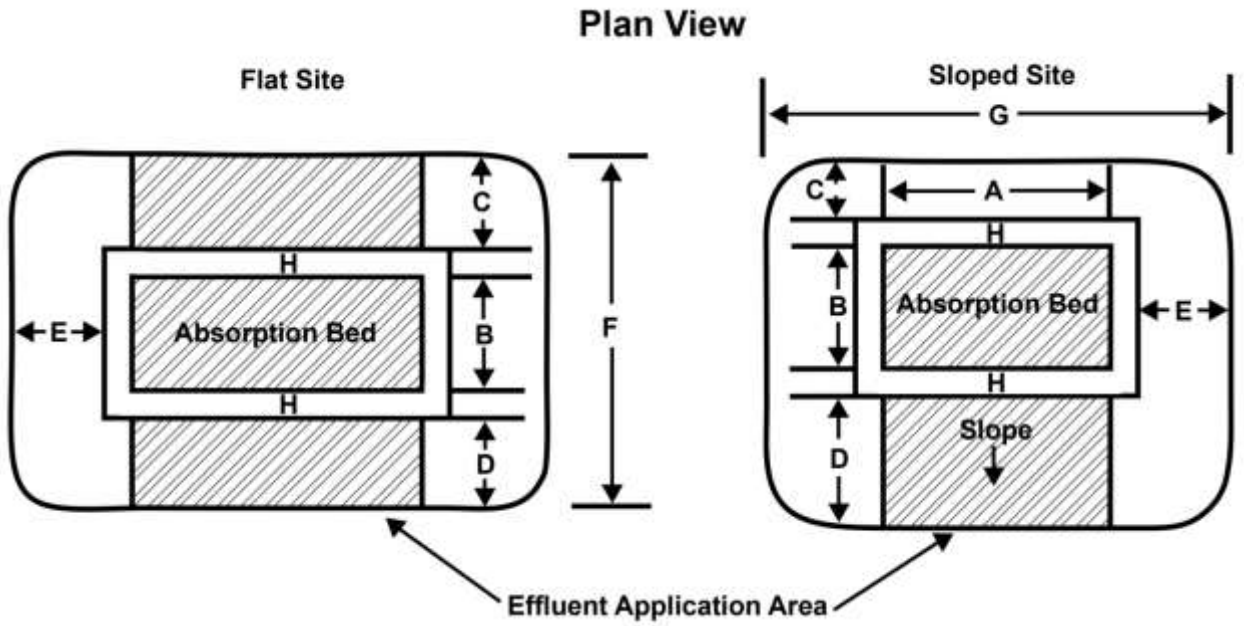

Figure 4-36. Design illustrations for sand mound installation on flat and sloped sites (use with sand mound design checklist).

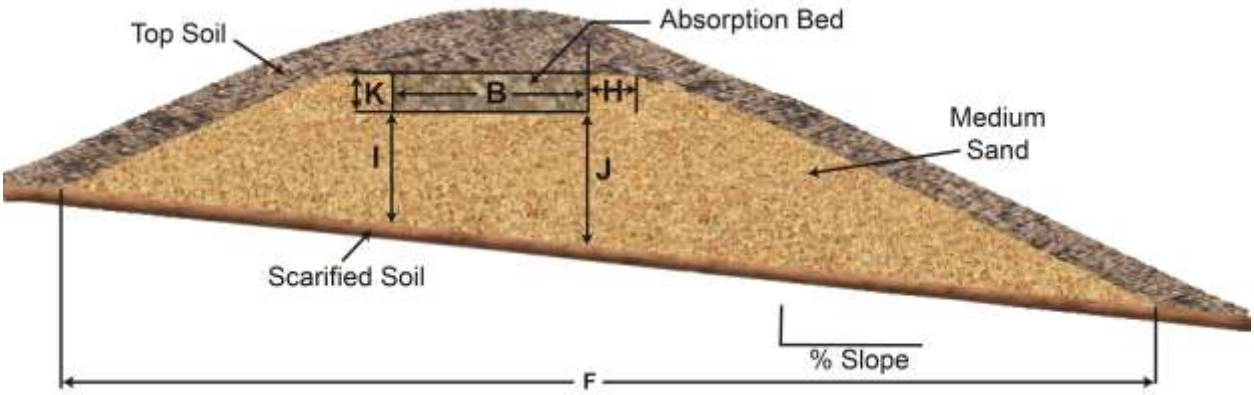

Figure 4-37. Design dimensions for use with the sand mound design checklist.

4.25.3.3 Soil Cap Design

1. Sand mound must be covered with a minimum topsoil depth of 12 inches. The soil cap at the center of the mound must be crowned to 18 inches to promote runoff.
2. Topsoil and soil cap must be a sandy loam, loam, or silt loam. Soils meeting the soil design group classification of A and C shall not be used for the topsoil and soil cap cover.
3. Mound should be protected to prevent damage caused by vehicular, livestock, or excessive pedestrian traffic. The toe of the mound must be protected from compaction.
4. Mounds on slopes should have design considerations taking surface runoff diversion into account.

Table 4-23. Example sand mound design checklist (use with Table 4-21, Table 4-22, Figure 4-36, and Figure 4-37).

	Sand Mound Design Checklist (Example for a three-bedroom house on soil design subgroup B-2 soils, flat site, 12-inch medium sand fill depth below the absorption bed cell)	
1	Determine soil application rate (AR) (Example: B-2 soil)	AR = GPD/ft^2 (Example: 0.45 GPD/ft^2)
2	Determine daily flow rate (DFR) (Example: 250 GPD x 1.5 safety factor)	DFR = GPD x 1.5 (Example: 375 GPD)
	Absorption Bed Cell Design	
3	$Area = \frac{Daily\_Flow\_Rate\_GPD(\#2)}{Sand\_Application\_Rate\_{}^{GPD}/_{ft^2}\left(1.0\_{}^{GPD}/_{ft^2}\right)}$	Area = ft^2 (Example: 375 ft²)
4	Width (B): $Width\_(B) = \sqrt{\frac{Area\_(\#3) \times Soil\_AR\_(\#1)}{Sand\_Application\_Rate\_\left(1.0\,{}^{GPD}/_{ft^2}\right)}}$ Maximum bed width: 10 ft *Beds may be designed narrower than determined by this equation if desired. Beds are recommended to be as long and narrow as site conditions allow.* Example: $Width\_(B) = \sqrt{\frac{(\#3 \times \#1)}{1.0\,{}^{GPD}/_{ft^2}}} \approx 13\,ft$	Width (B) = feet (Example: 13 ft or 10 ft max.) (Example: use 10 ft)
5	Length (A): $Length\_(A) = Area\_(\#3)/Width\_(\#4)$ (Example: 375 ft²/10 ft)	(A) feet (Example: 37.5 ft)
	Sand Mound Design	
6	Total area (TA): $TA = DFR\_(\#2)/soil\_AR\_(\#1)$ (Example: 375 gallon/0.45 gallon/ft^2)	TA = ft^2 (Example: 833 ft²)
7	Medium sand fill absorption bed perimeter (SFAP) area: Flat site: SFAP = 2 x [2 ft x length (#5)] Sloped site: SFAP = 2 ft x length (#5) (Example: 2 x [2 ft x 37.5 ft])	SFAP = ft^2 (Example: 150 ft^2)
8	Effluent application area (EAA) = Total area–(bed area + SFAP): EAA = TA (#6) – [Area (#3) + SFAP (#7)] = (Flat site example: 833 ft^2 – [375 ft^2 + 150 ft^2] = 308 ft^2); (Sloped site example: 833 ft^2 – [375 ft^2 + 75 ft^2] = 383 ft^2)	EAA = ft^2 (Flat site example: 308 ft²; sloped site example: 383 ft^2)

9	Flat site perimeter (C,D): 0.5 x [EAA (#8)/length (#5)] *Perimeter must maintain a maximum slope of 3:1.* *Perimeter width must result in a disposal area that meets or exceeds the minimum total area (#6). This will be verified in step 16.* (Example: 0.5 x [308 ft^2/37.5 ft] = 4.1 ft)	(C) = (D) = feet (5.25 ft minimum for 3:1 slope in 12 in. mound, 8.25 ft minimum for 3:1 slope in 24 in. mound) (Example: 4.1 ft, use default of 5.25 ft to meet minimum slope)
10	Sloped site: Downslope length (D) = EAA (#8)/length (#5) x DCF *Downslope length must result in a maximum slope of 3:1.* *Downslope length must result in a disposal area that meets or exceeds the minimum total area (#6). This will be verified in step 17.* Example based on 5% slope: (Example: D = [383 ft^2/37.5 ft] x 1.18 = 12.1 ft)	(D) = feet (Example: 12.1 ft)
11	Sloped site: Upslope (C) = [(K + I) x 3] x UCF *Upslope length must result in a maximum slope of 3:1.* Example based on 5% slope: (Example: C = [(0.75 ft + 1.0 ft) x 3] x 0.87 = 4.6 ft)	(C) = feet (Example: 4.6 ft)
12	Flat site: End slope (E) = (K + I) x 3 *End slope length must result in a maximum slope of 3:1.* (Example: [0.75 ft + 1.0 ft] x [3] = 5.25 ft)	(E) = feet (Example: 5.25 ft)
13	Sloped site: End slope (E) = (J + K) x 3 *End slope length must result in a maximum slope of 3:1.* Example based on 5% slope: (Example: [1.5 ft + 0.75 ft] x [3] = 6.75 ft	(E) = feet (Example: 6.75 ft)
14	Total width (F) = B + C + D + 2(H) (Flat site example: 10 ft + 5.25 ft + 5.25 ft + 4 ft = 24.5 ft) (Sloped site example (5%): 10 ft + 4.6 ft + 12.1 ft + 4 ft = 30.7 ft)	(F) = feet (Example: 24.5 ft) (Example: 30.7 ft)
15	Total length (G) = A + (2 x E) + 2(H) (G > F) (Flat site example: [G] = 37.5 ft + [2 x 5.25 ft] + 4 ft = 52 ft) (Sloped site example (5%): [G] = 37.5 ft + [2 x 6.75 ft] + 4 ft = 55 ft	(G) = feet (Example: 52 ft) (Example: 55 ft)

	Total Area Verification	
16	Flat site: Design area (DA) = A x F [DA ≥ TA(#6)] (Example: [37.5 ft x 24.5 ft] = 918.75 ft^2; (918.75 ft^2 ≥ 833 ft^2)	DA = ft^2 Example: 919 ft^2
17	Sloped site: Design area (DA) = A x (B + D + H) [DA ≥ TA(#6)] (Example (5%): 37.5 ft x [10 ft + 12.1 ft + 2 ft] = 903.75 ft^2); (903.75 ft^2 ≥ 833 ft^2)	DA = ft^2 Example: 903.75 ft^2
	Finished Mound Dimensions (Sand Mound + Soil Cap)	
18	Sand mound length + 6 ft min. (G + 6) (Flat site example: 52 ft + 6 ft = 58 ft) (Sloped site example: 55 ft + 6 ft = 61 ft)	(G+6) = feet (Example: 58 ft) (Example: 61 ft)
19	Sand mound width + 6 ft min. (F + 6) (Flat site example: 24.5 ft + 6 ft = 30.5 ft) (Sloped site example: 30.7 ft + 6 ft = 36.7 ft)	(F+6) = feet (Example: 30.5 ft) (Example: 36.7 ft)

Notes: gallons per day per square foot (GPD/ft2), feet (ft), inches (in.), downslope correction factor (DCF), upslope correction factor (UCF), total area (TA), design area (DA), effluent application area (EAA), sand fill absorption perimeter (SFAP), daily flow rate (DFR), soil application rate (AR)

4.25.4 Construction

1. Pressure transport line from the dosing chamber should be installed first.
   a. The pressure transport line should slope down to the pump so that the pressure line will drain between discharges.
   b. If a downward slope from the mound to the pump chamber is not practical due to the length of run, then the pressure transport line should be laid level below the anticipated frost line for that region.
   c. On a sloped site, the pressure transport line should enter the absorption bed from the end of the bed or upslope side of the mound; do not enter the absorption bed from the downslope side.
2. Grass and shrubs must be cut close to ground surface and removed from the mound site.
   a. If extremely heavy vegetation or organic mat exists, these materials should be removed before scarification and replaced with filter sand (typically 3 or 4 inches of filter sand is added).
   b. Larger than 2-inch caliper trees and shrubs and large boulders are not to be removed. Trees should be cut as close to ground level as possible and the stumps left in place. If stumps or boulders occupy a significant area in the mound placement area, additional area should be calculated into the total basal area of the mound to compensate for the lost infiltrative area.
3. When the soil is dry and site vegetation has been cut or removed, the ground in the basal placement area of the sand mound should be scarified using a chisel plow or backhoe teeth to a depth of 6–8 inches.

4. Sand fill will then be placed and shaped before it freezes or rains. No vehicles with pneumatic tires should be permitted on the sand or scarified area to prevent the soils from being compacted. For sloped sites, all work should be done from the upslope side or ends of the mound placement area if possible.
5. Absorption bed will be shaped and filled with clean drainrock. The bottom of the absorption bed should be constructed level on all sites regardless of slope.
6. After leveling the drainrock, the low-pressure distribution system manifold and laterals will be installed. The system should be tested for uniformity of distribution.
7. Geotextile fabric must be placed over the absorption bed and backfilled with 12 inches of soil on the sides and shoulders, and 18 inches of soil on the top center. Soil types must be sandy loam, loam, or silt loam.
8. Typical lawn grasses or other appropriate low-profile vegetation should be established on the mound cap as soon as possible, preferably before the system is put into operation. Do not plant trees or shrubs on the mound, or within the mature rooting radius of the tree or shrub from the mound. Trees with roots that aggressively seek water should be planted at least 50 feet from the mound (e.g., poplar, willow, cottonwood, maple, and elm).
9. Mounds placed upslope and downslope from each other should maintain a mound-toe to mound-toe separation distance of 35 feet (Figure 4-38).
    a. The first 15 feet below the upslope mound should remain free of vehicular traffic and other activities resulting in soil compaction.
    b. The 20 feet above the downslope mound should be maintained for construction of the downslope mound.
10. A separation distance of 15 feet should be maintained from the toe of each mound when multiple mounds are constructed on the same elevation contour.

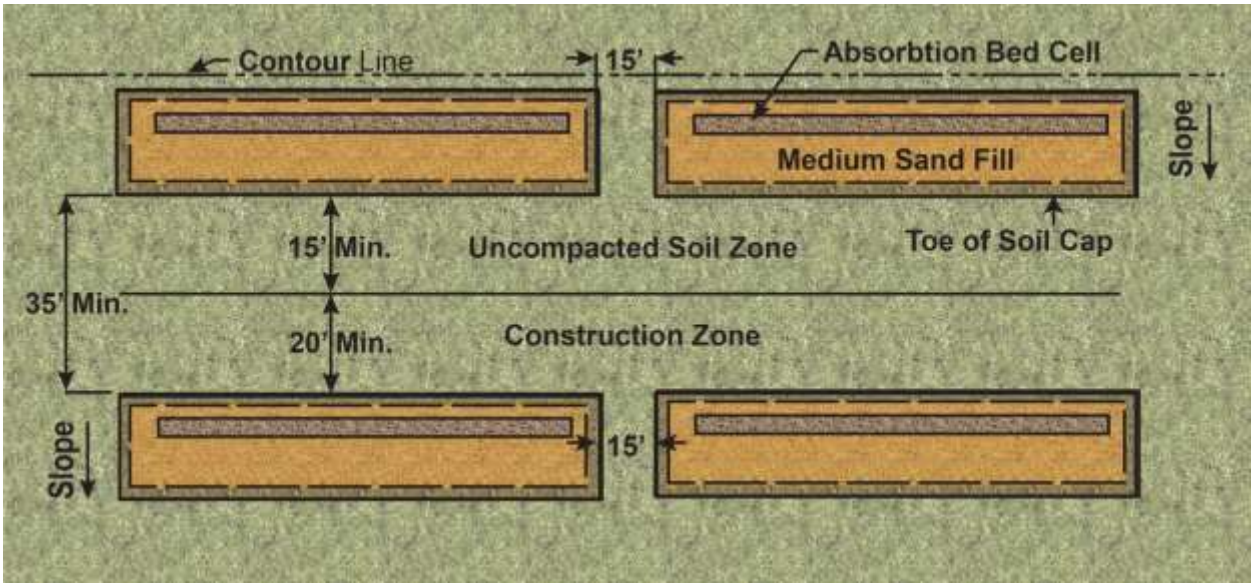

Figure 4-38. Mounds placed upslope and downslope of one another.

4.25.5 Inspections

1. Site inspections shall be conducted by the health district at the following minimum intervals (IDAPA 58.01.03.011.01):
   a. Preconstruction conference that should be conducted with the health district, responsible charge engineer, complex installer, and property owner (if available) present.
   b. During construction as needed, including scarification, pressure line installation, medium sand mound construction, absorption bed construction, and pressure distribution piping construction.
   c. Final construction inspection including a pump drawdown/alarm check, pressure test of the distribution network, and soil cap material and placement.
2. The responsible charge engineer shall provide the health district with a written statement that the system was constructed and functions in compliance with the approved plans and specifications. Additionally, the responsible charge engineer shall provide as-built plans to the health district if any construction deviations occur from the permitted construction plans. (IDAPA 58.01.03.005.15).

4.25.6 Operation and Maintenance

An O&M manual shall be developed by the system's design engineer that contains the following minimum requirements and shall be submitted as part of the permit application (IDAPA 58.01.03.005.14):

1. Operation and maintenance is the responsibility of the system owner.
2. Sludge depth in the septic tank should be checked annually and the tank should be pumped when the sludge exceeds 40% of the liquid depth.
3. All pump and pump chamber alarm floats and controls should be inspected on a regular schedule to ensure proper function.
4. Pump screens and effluent filters should be inspected regularly and cleaned. All material created by cleaning the screen should be discharged to the septic tank.
5. Sand mound observation port caps should be removed and the monitoring ports observed for ponding. Corrective action should be taken, if excessive ponding is present, as specified by the system design engineer.
6. Observation ports for testing of residual head should be inspected regularly to ensure the residual head meets the system design minimum residual head.
7. Lateral flushing should occur annually to ensure any biomat buildup is removed from the distribution lateral. Lateral flushing procedures should be described.
8. On a regular schedule, any valving for sand mounds containing multiple absorption bed cells should be inspected and verified to be functioning properly.
9. Any other operation and maintenance as recommended by system component manufacturers and the system design engineer.

Table 4-23 is a sample sand mound design checklist, and Table 4-24 is a blank checklist for sand mound design.

Table 4-24. Sand mound design checklist (use with Table 4-21, Table 4-22, Figure 4-36, and Figure 4-37).

	Sand Mound Design Checklist	
1	Determine soil application rate (AR)	AR = _____GPD/ft^2
2	Determine daily flow rate (DFR) *DFR = GPD x 1.5*	DFR = _____GPD
	Absorption Bed Cell Design	
3	$Area = \frac{Daily\_Flow\_Rate\_GPD(\#2)}{Sand\_Application\_Rate\_\frac{GPD}{ft^2}\left(1.0\_\frac{GPD}{ft^2}\right)}$	Area = _____ft^2
4	Width (B): $Width\_(B) = \sqrt{\frac{Area\_(\#3)\times Soil\_AR\_(\#1)}{Sand\_Application\_Rate\_\left(1.0\frac{GPD}{ft^2}\right)}}$ Maximum bed width: 10 ft	Width (B) = _____ft
5	Length (A): $Length\_(A) = Area\_(\#3)/Width\_(\#4)$	(A) _____ft
	Sand Mound Design	
6	Total area (TA): $EAA = DFR\_(\#2)/soil\_AR\_(\#1)$	TA = _____ft^2
7	Medium sand fill perimeter area (SFAP) Flat site: SFAP = 2 x [2 ft x length (#5)] Sloped site: SFAP = 2 ft x length (#5)	SFAP = _____ft^2
8	Effluent application area (EAA) = Total area – (Bed area + SFAP): EAA = TA (#6) – [Area (#3) + SFAP (#7)]	EAA = _____ft^2
9	Flat site perimeter (C,D): 0.5 x [EAA (#8)/length (#5)] (5.25 ft minimum for 12 in. mound, 8.25 ft minimum for 24 in. mound)	(C) = (D) = _____ft
10	Sloped site: Downslope length (D) = [EAA (#8)/length (#5)] x DCF	(D) = _____ft
11	Sloped site: Upslope (C) = [(K + I) x 3] x UCF	(C) = _____ft
12	Flat site: End slope (E) = (K + I) x 3	(E) = _____ft
13	Sloped site: End slope (E) = (J + K) x 3	(E) = _____ft
14	Total width (F) = B + C + D + 2(H)	(F) = _____ft
15	Total length (G) = A+(2 x E) + 2(H) (G > F)	(G) = _____ft
	Total Area Verification	
16	Flat site: Design area (DA) = A x F [DA ≥ TA(#6)]	DA = _____ft^2 ≥ #6
17	Sloped site: Design area (DA) = A x (B + D + H) [DA ≥ TA(#6)]	DA = _____ft^2 ≥ #6
	Finished Mound Dimensions (Sand Mound + Soil Cap)	
18	Sand mound length + 6 ft min. (G + 6)	(G+6) = _____ft
19	Sand mound width + 6 ft min. (F + 6)	(F+6) = _____ft

Notes: gallons per day per square foot (GPD/ft2), feet (ft), downslope correction factor (DCF), upslope correction factor (UCF), total area (TA), design area (DA), effluent application area (EAA), sand fill absorption perimeter (SFAP), daily flow rate (DFR), soil application rate (AR)