DESIGN, CONSTRUCTION, AND INSTALLATION OF ALTERNATIVE SEWAGE TREATMENT SYSTEMS

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Section 1 ALTERNATIVE SEWAGE TREATMENT SYSTEM DEFININTION

Alternative sewage treatment systems (ASTS's) are defined as any sewage treatment and dispersal system other than a conventional sewage disposal system. ASTS's are used to overcome one or more adverse site or soil condition such as high groundwater, slowly permeable soils, or other limiting condition or where increased wastewater treatment is needed. Unlike conventional sewage disposal systems, ASTS's vary in design and concept depending on the site and soil conditions. The design goals of all sewage treatment and dispersal systems, including ASTS's, are the prevention of disease, treatment and dispersal of sewage effluent below the surface of the ground, and the prevention of contamination of groundwater and other beneficial waters by discharges from sewage disposal systems.

Section 2 ADMINISTRATIVE REQUIREMENTS FOR ALTERNATIVE SEWAGE TREATMENT SYSTEMS

(A) REQUIRMENTS SUBJECT TO CHANGE:

The technology of ASTS's is constantly evolving and changing. Technical data is gathered about ASTS's through the Napa County Department of Environmental Management (the "Department") Alternative Sewage Treatment System Monitoring Program as well as through research studies by other agencies and organizations. Because of the evolving technology and information gathered through the monitoring program, the regulations for ASTS's may change.

(B) CURRENT REGULATIONS AND CONSTRUCTION PERMITS:

Property owners, designers, and contractors are cautioned that regulations for ASTS's may change by legislative action, action of the Regional Water Quality Control Boards, or the Department. Therefore, despite previously performed and accepted work by the Department; any proposal for an ASTS must meet the regulations that are in effect at the time that the Department approves the septic system permit. Any plans approved without an installation permit issued, or where an installation permit has expired, are subject to Department review and shall comply with the ASTS regulations in place at the time the sewage permit is issued regardless of prior approval.

(C) SPECIAL REQUIREMENTS FOR THE USE OF SAND WITH WINERY WASTE:

Any ASTS which utilizes ASTM C-33 sand such as a mound system or sand filter system are prohibited for winery wastewater unless the wastewater is pretreated to sanitary septic tank effluent quality or better as described in Table 1.

(D) ALTERNATIVE SEWAGE TREATMENT SYSTEM MONITORING PROGRAM:

All newly constructed ASTS's, pretreatment systems, or any ASTS that is modified are required to enter into the ASTS monitoring program. See: Section 13 Alternative Sewage Treatment System Monitoring Program regulations.

Section 3 GENERAL REQUIREMENTS FOR ALTERNATIVE SEWAGE TREATMENT SYSTEMS

(A) SOIL AND SITE CONDITIONS:

(1) A site evaluation or percolation test must be performed prior to design of the system.

(2) All ASTS's must have a minimum of three (3) feet of acceptable soil above a limiting condition. Up to one (1) foot of the required three (3) feet of soil may be satisfied by including sand within the system (such as a Mound system) or other approved pretreatment device. In all cases, a minimum of two (2) feet of suitable permeable soil shall be available.

(3) Suitable permeable soil has a percolation rate between 1 and 120 minutes per inch (mpi) (except for ETI systems where percolation rates between 30 and 480 mpi are acceptable), shows no signs of present or previous high groundwater levels, has less than fifty (50) percent rock content by volume, and is not fractured rock, bedrock, hardpan, or claypan.

(B) PERFORMANCE STANDARDS FOR ALTERNATIVE SEWAGE TREATMENT SYSTEMS:

(1) Monitoring wells shall be provided to verify performance of ASTS's. Monitoring wells shall be protected and encased within plastic, concrete, or other approved type box to provide easy access. Monitoring wells shall be constructed to a depth that will allow verification that the system is functioning properly and not contaminating groundwater. Please refer to Fig. 1 for specific monitoring well design criteria.

(2) Monitoring wells may be sampled for coliform bacteria, fecal bacteria, nitrate, or other chemical or physical constituent that acts as an indicator of sewage contamination.

(a) An alternative system with sample results exceeding 240,000/100 ml most probable number (MPN) total coliform bacteria and/or greater than 2.2 MPN fecal coliform bacteria from purged wells located twenty-five (25) feet or further down gradient shall be deemed to be in a state of failure. Exception: if the up gradient monitoring well(s) have similar contamination levels as down gradient wells, then the contamination shall be deemed to be background in the area and shall not cause a determination of a state of failure on this criteria alone.

(b) An alternative system with sample results exceeding 3,000/100 ml MPN but less than 240,000/100 ml MPN total coliform bacteria and/or 2.2 MPN fecal coliform bacteria from purged wells located twenty-five (25) feet or further down gradient shall be deemed in a state of marginal operation. Exception: if the up gradient monitoring well(s) have similar contamination levels as down gradient wells, then the contamination shall be deemed background in the area.

(3) Any ASTS or component that causes sewage to surface or discharge at ground level is deemed to have an adverse effect on the surface water and is considered a public health hazard. It is defined as a failing onsite sewage treatment system. Such a system shall be immediately corrected or abated.

(4) See Section 13 for additional information regarding the ASTS monitoring program.

(C) DESIGN AND INSTALLATION REQUIREMENTS:

(1) A California Registered Civil Engineer or a California Registered Environmental Health Specialist must prepare designs for ASTS's. Designers must file proof of current registration with the Department. The designer must be knowledgeable in onsite wastewater treatment systems; in particular the rules and regulations specified

herein, possess adequate drafting skills and adequate verifiable experience in the design and construction of ASTS's.

(2) Designs for ASTS's shall include such technical data as necessary to support and demonstrate that the system will function as designed, will not adversely effect surface and/or groundwater quality, and will not create a public health hazard.

(3) Installers of ASTS's must have an active California Type A, C-42 or C-36 contractor's license and must have current verification of Workmen's Compensation Insurance on file with the Department if any employee will work on the system construction. Property owners may apply for sewage disposal system installation permits but may not install ASTS's unless they have an appropriate and current contractor's license as stated above. Installation permits will not be issued until a qualified licensed contractor is designated on the application.

(4) Prior to issuance of the sewage disposal system installation permit, the owner of the property shall submit the Supplemental Application to Construct and Operate an ASTS to the Department.

(5) All meetings and inspections shall be scheduled with the Department at least forty-eight (48) hours in advance and shall occur during normal business hours.

(6) The ASTS designer and the Department must inspect the construction of the ASTS during the stages of its installation for its conformance with the approved plans. Upon completion of the system, and prior to final, the designer shall (1) submit a written certification verifying that the system has been constructed in conformance with the approved plans, including an "As-Built" drawing (only required if the installation varied from the approved plan) and certify that it is functioning properly and (2) provide the Department with a copy of the Operations and Maintenance manual for the ASTS in an unbound hard copy format or an electronic format if available.

(D) SOIL HYDRAULIC LOADING RATES:

See Tables 2 & 3.

Section 4 PLAN SUBMITTAL REQUIREMENTS FOR ALTERNATIVE SEWAGE TREATMENT SYSTEMS

(A) PLANS AND SPECIFICATIONS:

(1) Three copies of design plans and design calculations are required.

(2) Plans must be drawn to an appropriate scale to show sufficient detail. The preferred scale is one (1) inch = twenty (20) feet when possible.

(3) The design plan shall include:

(a) Lot dimensions with North point.

(b) Vicinity map, owner's name with site address and assessor's parcel number.

(c) Accurate topographic contours shall be shown in the area of the sewage treatment system, primary dispersal field and reserve area. At a minimum, two (2) foot contour intervals shall be provided on slopes exceeding fifteen (15) percent. One (1) foot contour intervals shall be provided on slopes less than fifteen (15) percent.

(d) Location of existing, proposed or abandoned wells, springs, lakes, ponds, marsh areas, streams, and drainage ditches or channels within two hundred (200) feet of any portion of the sewage treatment and dispersal field and reserve area.

(e) Location of existing and/or proposed structures, driveways, swimming pools, patios, retaining walls, paved areas, large trees, and cut banks.

(f) Location of existing sewage disposal systems and existing and/or proposed easements, water lines, and underground utilities.
(g) Location of all site evaluation profile holes, percolation test holes (including the holes that have failed) and soil sample locations.
(h) Designated reserve area with potential system design identified. Design criteria and drawings may be required. The reserve area shall be sized according to these standards based on the site and soil conditions in the reserve area location. Reserve area(s) shall remain fully protected and unencumbered to prevent damage to soils and any adverse impact on the immediate surroundings that may effect the installation of the replacement system or its function.
(i) Cross-section of distribution trench and/or Wisconsin Mound, At-grade, ETI bed, sand filter, sump detail, septic tank detail, monitoring wells, manifold, balancing valve and purge valve assembly, interceptor drain, surface water diversion, etc. Sump detail shall include the dose counter, alarm system, dose volume, and float settings. See Figures in Appendix 2.
(j) Designer's inspection schedule shall be clearly specified on the plans.

Section 5 PRESSURE DISTRIBUTION (PD) SYSTEMS

(A) GENERAL FUNCTION AND SUITABILITY:

(1) Pressure distribution systems apply effluent uniformly over the entire absorption area such that each square foot of bottom area receives approximately the same amount of effluent per dose at a rate less than the saturated hydraulic conductivity of the soil. This process promotes soil treatment performance by maintaining vertical unsaturated flow at all times and also reduces the degree of clogging in finer textured soils. Pressure distribution system components include a septic tank, dosing tank, pump with associated controls, and small diameter low pressure piping with small diameter perforations laid in gravel or inside chambers placed in trenches. The system distributes septic tank effluent uniformly throughout the dispersal field under pressure through intermittent small volume doses. A timer may also be used to discharge the effluent to the dispersal field evenly over time as opposed to demand dosing. Pressure distribution systems can be utilized alone or after a pretreatment device if site conditions warrant.

(2) These below ground systems allow wastewater disposal on sites with shallow soil, slowly permeable soil over impermeable soil, fractured rock or bedrock, rapidly draining soils, sites with high groundwater, and sites with slopes up to thirty (30) percent. Required minimum separation for pressure distribution systems to a limiting condition is thirty-six (36) inches below the trench bottom, unless an approved pretreatment device is provided, then it may be reduced to twenty-four (24) inches.

(B) PRESSURE DISTRIBUTION SITE REQUIREMENTS:

(1) Pressure distribution systems can be installed in acceptable soil types as listed in Table 2. Where a percolation test has been performed, pressure distribution systems may be placed in all soil types with percolation rates ranging from 1 to 120 mpi. Soil application rates based on percolation rates are listed in Table 3. Pretreatment may be required in some soil types.

(2) No part of the pressure distribution dispersal field may be located where the site slope exceeds thirty (30) percent.

(3) The minimum soil depth under the bottom of the trench shall be thirty-six (36) inches unless an approved pretreatment device is utilized, in which case the minimum soil depth under the bottom of the trench shall be twenty-four (24) inches.

(4) To maximize evapotranspiration, pressure distribution systems shall not be installed below non-permeable type soils such as high shrink-swell clays, highly compacted soils, highly cemented soils, and/or massive or platy soil structures.

(C) PRESSURE DISTRIBUTION DESIGN REQUIREMENTS:

(1) Design Calculations:

(a) Single and multiple family dwelling sewage flows shall be calculated based on one hundred and fifty (150) gallons per bedroom per day.

(b) Commercial and other non-residential building sewage flows shall be calculated in accordance with the quantities listed in Table 4.

(c) Reduction in residential design flow may be granted when certain water saving devices are incorporated permanently into the dwellings being served. The reduction shall not exceed twenty (20) percent of the design flow.

(d) Effective infiltrative surface area shall be calculated as the total sidewall from the top of the distribution lateral to the trench bottom. The trench bottom area shall not be used calculating the effective infiltrative surface area.

(e) The maximum sidewall area allowed is three (3) ft^2/linear foot.

(f) The soils application rate is based on the soil classification and/or percolation test. See Table 2 for soil infiltration rates based on soil classification or Table 3 for infiltration rates based on percolation rates.

(g) Lineal footage calculation:

(i) Total PD system length = $\frac{\text{Maximum daily sewage flow}}{\text{(Effective Surface Area)(Soil Application Rate)}}$

(h) Designers shall calculate the total dynamic head loss as feet of elevation in the entire distribution system. The calculations shall include:

(i) Vertical differences.

(ii) Length of entire piping.

(iii) Head loss of all valves, tees, elbows, and appurtenances.

(iv) Hydraulic orifice discharge.

(v) Other hydraulic head loss in the system.

(vi) Dose volume shall be designed to provide smaller more frequent doses. The maximum dose volume should not be less than five (5) times the lateral pipe volume and should not exceed twenty (20) percent of the daily design flow. Designer must consider both factors when determining the appropriate dose volume.

(2) Dispersal Trench Requirements: See Figure 4.

(a) The trench depth shall not exceed forty (40) inches.

(b) Trench spacing shall comply with the required trench spacing for conventional sewage disposal systems. See Table 5.

(c) Minimum trench backfill shall be twelve (12) inches. Maximum trench backfill shall be eighteen (18) inches.

(d) Distribution trenches shall follow the natural contour of the ground. The bottom of the trench shall remain level within a tolerance of one (1) inch per one hundred (100) feet. Trenches may be curved or angled to stay on contour.

(e) Trench widths shall be a minimum of eighteen (18) inches and a maximum of thirty-six (36) inches.

(3) Aggregate Specification:

The aggregate media placed within a pressure distribution trench shall consist of three-eighth (3/8) to two (2) inch diameter river rock, crushed drain rock, lava rock, pea gravel, or other hard rock as approved by the administrative authority. All absorption bed filter media must have less than one (1) percent fines, dust, sand, and/or silts (passing the # 200 sieve).

(4) Distribution Piping:

(a) Pressurized perforated distribution pipe shall be Schedule 40 PVC or greater of at least three quarters (3/4) of an inch diameter laid within rock or inside chamber components. The maximum distance between perforations is forty-eight (48) inches. The first and last orifice must start one-half (1/2) the distance used between orifices from the beginning and end of the perforated distribution line.

(b) The minimum orifice diameter shall be one-eighth (1/8) of an inch and provide a minimum of sixty (60) inches of hydraulic lift at all orifices. Three sixteenths (3/16) of an inch diameter orifices and larger must produce a minimum of twenty-four (24) inches of hydraulic lift at all orifices. Orifices shall face upward and shall be protected with an orifice shield, except in chamber systems where orifice shields are not required. If a chamber component is utilized, the pressure distribution lateral shall be suspended within the chamber from the top with the orifices facing upward or other method of distribution pipe installation as approved by the administrative authority.

(c) The maximum length of run for pressurized perforated distribution piping shall be one hundred (100) feet.

(d) There shall be a minimum of two (2) feet of separation from the transmission line to the beginning of the dispersal trench. Transmission line(s) shall be laid on native soil. The cross section of the transmission line and the beginning of the distribution line shall be stepped so as to prevent seepage of effluent from trench to trench.

(5) Balancing Valves and Purge Valves:

(a) The beginning of the perforated distribution lateral shall have a balancing valve. See Fig. 2.

(b) The end of the perforated distribution lateral shall have a purge valve. See Fig. 3.

(c) All balancing and purge valves shall be encased in plastic or concrete boxes that extend to grade, have a secure cover and are marked “sewer”. The boxes shall be a minimum of ten (10) inches across, round or square, and be of adequate size to allow for maintenance.

(d) Balancing valves shall be gate or ball valves Schedule 80 PVC or greater.

(e) Purge valves shall be gate or ball valves Schedule 80 PVC or greater.

(f) Balancing valves shall be located at least twenty-four (24) inches from the dispersal trench. Purge valves and related boxes shall be located within the dispersal trench. All valve boxes shall be placed on screen blocks or equivalent.

(g) Valve boxes shall be designed, installed, and maintained so as to prevent soil and rodent intrusion into the box over the life of the system.

(6) Soil Cover Specification:

(a) Soil cover shall be of the same structure and texture as the topsoil already existing at the site, except if clay or silty clay, then the soil cover shall be sandy

loam or loam. A minimum depth of cover of twelve (12) inches or maximum of eighteen (18) inches is required over the gravel or chamber component.

(b) When fill is used, the soil cover shall extend over the entire dispersal area. Soil cover shall extend uphill and laterally a minimum of five (5) feet beyond the trenches. Downhill soil cover shall conform to Table 9.

(7) Monitoring Wells:

(a) Monitoring well construction shall be in conformance with Fig. 1A & 1B.

(b) On sloping sites, greater than two (2) percent, two (2) monitoring wells shall be installed twenty-five (25) feet down slope of the lowest trench line. One (1) or more monitoring well shall be installed ten (10) feet up slope of the highest trench. Monitoring wells installed within the subfield shall be installed in the leach line trench. A minimum of one (1) monitoring well shall be installed for every two (2) leach line trenches or portion thereof, per subfield.

(c) On flat sites, zero to two (0-2) percent slope, at least one (1) monitoring well shall be installed twenty-five (25) feet on all sides of the dispersal field. Monitoring wells installed within the subfield shall be installed in the leach line trench. A minimum of one (1) monitoring well shall be installed for every two (2) leach line trenches or portion thereof, per subfield.

(d) Additional monitoring wells or alternate locations of monitoring wells may be required.

(D) PRESSURE DISTRIBUTION CONSTRUCTION REQUIREMENTS:

(1) Construction shall only occur when soil moisture conditions will allow installation of the system without compaction or smearing of the soils, and weather conditions during the construction process will not cause unsuitable soil moisture conditions.

(2) Placement of the transmission line from the dosing tank to the first manifold shall be a minimum of twenty-four (24) inches below ground.

(3) Trenches shall be constructed with strict attention to the proper depth and contour.

(4) Sidewall and bottom of the trenches shall be scarified to remove all smearing.

(5) Distribution to and through all laterals shall be balanced so all laterals and orifices receive an equal volume. The difference in head between any two lines, and the beginning and end orifice of the same line shall not exceed ten (10) percent.

(6) For shallow systems requiring the placement of fill above the natural ground surface, a track vehicle may be required.

(E) PRESSURE DISTRIBUTION CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the system, the following inspections are required:

(a) Pre construction inspection where the following items shall be verified:

(i) Imminent weather conditions are such that they will not create unsuitable soil conditions during construction.

(ii) Soil moisture in the area of the proposed system is not so high as to cause smearing or compaction as a result of construction activities.

(iii) Construction staking or marking of all components of the system shall occur prior to commencement of construction so that configuration, location, and system details may be verified.

(iv) Review and approval of the source of the materials to be used including gravel and soil cover. Samples may be required prior to placement.

(b) Interim inspection(s):

(i) Function and setting of all control devices.

(ii) Hydraulic test (squirt test) of system.
(iii) Depth and location of gravel or chamber component in trenches.
(iv) Water tightness test of septic tank and dosing tank.

(c) Final Inspection:
(i) Depth and texture of final soil cover over the pressure distribution system is verified.
(ii) All construction elements are in general conformance with the approved plans and specifications.
(iii) All monitoring wells are installed and erosion control has been completed.
(iv) System controls are hardwired to permanent power and all floats, pumps and alarms tested.
(v) A letter from the designer that the pressure distribution system has been installed and is operating in conformance with the design specifications must be returned to the Department.
(vi) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department.

Section 6 WISCONSIN MOUND SYSTEMS

(A) GENERAL FUNCTION AND SUITABILITY:

(1) The Wisconsin mound wastewater treatment system (mound system) was developed to treat and disperse wastewater via subsurface in an environmentally acceptable manner. The mound system is a combination of a single pass sand filter and a dispersal unit characterized by a pretreatment device (usually a septic tank, conventionally sized) and the pressure distribution components (pump chamber, pump and controls, and low-pressure distribution laterals).

(2) These above ground systems allow wastewater disposal on sites with shallow or slowly permeable soil over impermeable soil, fractured rock or bedrock, high groundwater, or other limiting condition within twenty-four (24) inches of the ground surface and on slopes up to twenty five (25) percent.

(3) Wastewater from non-residential sources or high-strength wastewater from residential sources must receive pretreatment sufficient to lower the waste-strength to the level of that septic tank effluent as listed on Table 1 before discharge to a mound.

(B) WISCONSIN MOUND SITE REQUIREMENTS:

(1) Mound systems should be located in open areas for exposure to sun and wind where evaporation and transpiration will be maximized. Good design practice must consider drainage constraints for both up gradient and down gradient area drainage. Mound systems shall not be installed in concave landscape formations, areas of seasonal saturation such as flood plains, vernal pools, drainage areas, areas that have been filled to artificially raise the separation to ground water or other limiting condition, cut or fill sites, or hummocky terrain. Wastewater from residential sources must receive pretreatment at least equal to that provided in a conventional two-compartment septic tank, before discharge to a mound.

(2) Placement of mound systems into areas that require the removal of large trees, boulders, or rock outcroppings is not permitted.

(3) The minimum effective soil depth below the mound system shall be twenty-four (24) inches.

(4) No part of the mound dispersal system may be located where the site slope exceeds twenty five (25) percent.

(5) Mound systems can be installed in acceptable soil types as listed in Table 2. Where a percolation test has been performed, mound systems may be placed in all soil types with percolation rates ranging from 1 to 120 mpi. Soil application rates based on percolation rates are listed in Table 3.

(6) In addition to the other setbacks required by these standards, mound systems shall also comply with the following setbacks measured between the perimeter of the basal area of the filter media and the respective features:

(a) Buildings and Structures:	
(i) Up gradient and laterally	10 feet
(ii) Down gradient	25 feet
(b) Property Lines or Underground Utility Easements:	
(i) Up gradient and laterally	10 feet
(ii) Down gradient	25 feet
(c) Areas of Geologic Instability	100 feet

(C) WISCONSIN MOUND DESIGN REQUIREMENTS: See Figure 5A & 5B

(1) Design Calculations:

(a) Single and multiple family dwelling sewage flows shall be calculated based on one hundred and fifty (150) gallons per bedroom per day.

(b) Reduction in residential design flow may be granted when certain water saving devices are incorporated permanently into the dwellings being served. The reduction shall not exceed twenty (20) percent of the design flow.

(c) Commercial and other non-residential building sewage flows shall be calculated in accordance with the quantities listed in Table 4.

(d) The soils application rate is based on the soil classification and/or percolation test. See Table 2 for soil infiltration rates based on soil classification or Table 3 for infiltration rates based on percolation rates.

(e) Sand fill media shall conform to the ASTM C-33 sand with less than 5% fines less than 0.053mm specifications (See Table 6).

(f) For residential systems, the design loading rate for the sand fill must not exceed 1.0 gallons/day/ft^2.

(g) For commercial systems, the design loading rate for the sand fill must not exceed 0.8 gallons/day/ft^2.

(h) Designers shall calculate the total dynamic head loss as feet of elevation in the entire distribution system. The calculations shall include:

(i) Vertical differences.

(ii) Length of entire piping.

(iii) Head loss of all valves, tees, elbows, and appurtenances.

(iv) Hydraulic orifice discharge.

(v) Other hydraulic head loss in the system.

(vi) Dose volume shall be designed to provide smaller more frequent doses. The maximum dose volume should not be less than five (5) times the lateral pipe volume and should not exceed twenty (20) percent of the daily design flow. Designer must consider both factors when determining the appropriate dose volume.

(2) Infiltration Area (dispersal bed)— The size of the infiltration area (the bottom infiltrative surface area of the bed) is determined by applying the following formula:

(a) Infiltrative Surface Area (ft^2) = $\frac{\text{Daily Design Flow (gal/day)}}{\text{Sand Fill Loading Rate*}}$

*(See Section 6, (C), (1), (e) & (f))

(3) Dispersal Bed Width—The dispersal bed width is determined by the linear loading rate of certain soil type and depth. Linear Loading Rates are shown in Table 7. Maximum bed width shall be ten (10) feet.

(a) Bed width (A) = $\frac{\text{Linear Loading Rate}}{\text{Sand Fill Loading Rate*}}$

*(See Section 6, (C), (1), (e) & (f))

(4) Dispersal Bed Length— The length of the infiltration area (the infiltrative surface area of the dispersal bed) is determined by applying the following formula:

(a) Dispersal Bed length (B) = $\frac{\text{Required Infiltrative Surface Area}}{\text{Dispersal Bed Width (A)}}$

(5) Dispersal Bed Depth—A minimum of six (6) inches of aggregate is placed beneath the distribution pipe and two (2) inches of aggregate is placed above the pipe.

Field Code Ch

(a) Dispersal Bed depth (F) = nine (9) inches (twelve (12) inches for commercial systems)

(6) Dispersal Bed Grade—The bottom of the dispersal bed must be level.

(7) Filter Media Depth—The depth of filter media shall be at least twelve (12) inches under all parts of the dispersal bed.
(a) The depth of filter media below the dispersal bed varies with ground slope according to the following formulas:
(b) Filter media depth below upslope edge of dispersal bed (D) = one (1) foot.
(c) Filter media depth below downslope edge of dispersal bed (E) = one (1) foot+[% natural slope as a decimal x width of dispersal bed (A)]

(8) Filter Media Length and Width—The length and width of the filter media are dependent upon the length and width of the dispersal bed, filter media depth and side slopes of the filter media.
(a) Side slopes must be no steeper than three-to-1 (3:1) (i.e. three (3) feet of run to every one (1) foot of rise)
(b) The filter media length consists of the end slopes (K) and the dispersal bed length (B).
(c) The filter media width consists of the upslope width (J), the dispersal bed width (A), and the downslope width (I). On sloping sites, the downslope width (I) will be greater than on a level site if a three-to-one (3:1) side slope is maintained. Table 8 gives the slope correction factor (multiplier) for slopes from zero (0) up to twenty (25) percent with a three-to-one (3:1) side slope.
(d) The sand fill shall be level and extend a minimum of twenty-four (24) inches horizontally beyond the dispersal bed on all sides, and then uniformly slope as determined by the mound dimensions. On slopes greater than two (2) percent, the twenty-four (24) inch dimension may be reduced to twelve (12) inches on the uphill side of the distribution bed.

(9) Slope Width and Length of the Mound System:

(a) For sloping sites the downslope width (I) and upslope width (J) are a function of the depth of the sand fill below the respective downhill or uphill side of the dispersal bed, the desired side slope, three-to-one (3:1), and the slope correction factor. See Table 8.

(b) For level sites and endslope length (K), no slope correction factor is used.

(c) Upslope width (J) = (D+ F+1)(3) (slope correction factor)

(d) Downslope width (I) = (E+ F+1)(3) (slope correction factor)

(e) Endslope length (K) = $\{(\frac{D+E}{2})+F+H\}(3)$

(10) Basal Area Calculation—The amount of sand basal area required is dependent upon the permeability of the original soil.

(a) For level sites the total basal area [length of filter media (L) x width of filter media (W)] beneath the filter media is available for effluent absorption into the soil.

(b) For sloping sites, the only available basal area is the area beneath the dispersal bed (A x B) and the area immediately downslope from the dispersal bed [bed length (B) x downslope width (I)]. It includes the area enclosed by [B x (A + I)]. The upslope and end slopes will transmit very little of the effluent on sloping sites, and are therefore disregarded.

(c) The available basal area must equal or exceed the required basal area:

(i) Basal area required = $\frac{\text{Daily flow}}{\text{Soil Infiltration rate}}$

(ii) Basal area available = B x (A + I) on sloping site **OR**
L x W on level site.

(11) Dispersal Bed—The dispersal bed shall consist of a gravel bed placed upon a portion of a sand bed (filter media).

(a) The dispersal bed shall follow the natural contour of the ground. The dispersal bed must be installed within a tolerance of one (1) inch vertically per one hundred (100) feet horizontally.

(b) Only single dispersal beds are allowed.

(c) Dispersal bed filter media shall consist of three-quarter (¾) to one and one-half (1½) inch diameter river rock, crushed drain rock, lava rock or other hard rock as approved by the administrative authority. All dispersal bed filter media must have less than one (1) percent fines, dust, sand, and/or silts (passing the # 200 sieve). The dispersal bed shall be covered with an approved geo-textile filter fabric.

(12) Distribution Piping:

(a) Pressure manifolds shall enter only from the uphill side or end of the mound system.

(b) The distribution piping shall be Schedule 40 PVC or greater of at least three-quarter (¾) inch diameter.

(c) The maximum distance between orifices shall be thirty-six (36) inches.

(d) Distribution laterals shall be located at least eighteen (18) inches from the ends and sides of the dispersal bed.

(e) Where two or more laterals are laid in the dispersal bed, the laterals shall be spaced at least twenty-four (24) inches apart.

(f) Orifices shall face upward and shall be protected with orifice shields.

(g) The minimum orifice diameter shall be one-eighth (1/8) of an inch and provide a minimum of sixty (60) inches of hydraulic lift at all orifices. Three sixteenths (3/16) of an inch diameter orifices and larger must produce a minimum of twenty-four (24) inches of hydraulic lift at all orifices.
(h) The maximum length of run for pressurized perforated distribution piping shall be one hundred (100) feet.

(13) Balancing Valves and Purge Valves:
(a) The beginning of the perforated distribution lateral shall have a balancing valve. See Fig. 2.
(b) The end of the perforated distribution lateral shall have a purge valve. See Fig. 3.
(c) All balancing and purge valves shall be encased in plastic or concrete boxes that extend to grade, have a secure cover and are marked "sewer". The boxes shall be a minimum of ten (10) inches across, round or square, and be of adequate size to allow for maintenance.
(d) Balancing valves shall be gate or ball valves Schedule 80 PVC or greater.
(e) Purge valves shall be gate or ball valves Schedule 80 PVC or greater.
(f) All valve boxes shall be placed on screen blocks or equivalent.
(g) Valve boxes shall be designed, installed, and maintained so as to prevent soil and rodent intrusion into the box over the life of the system.

(14) Cap and Topsoil Specifications:
(a) The soil placed over the entire mound system must be selected and placed to promote aeration of the mound, rainwater movement off and away from the mound, and establishment and maintenance of a vegetative cover.
(b) The soil cover shall be of equal or better texture and structure than the soil existing on the site. Sandy loam, loamy sands and silt loams are recommended.
(c) The final settled depth of the topsoil cap (H) should be no less than twelve (12) inches above the center and six (6) inches above the outer edge of the dispersal bed (G). Additional depth of topsoil must be placed during final construction activities to assure that the minimum depths are achieved following natural settling of the soil.
(d) Soil cover shall extend beyond the mound system a minimum of four (4) feet uphill and on both ends. The downhill soil cover distances shall comply with Table 9.
(e) The mound system must not be left without a vegetative cover or to go to weed. Vegetation shall be shallow-rooted, drought tolerant plants, shrubs, or grasses.

(15) Monitoring Wells:
(a) Monitoring well construction shall be in conformance with Fig. 1A.
(b) On sloping sites, greater than two (2) percent, a minimum of seven (7) monitoring wells shall be installed. Two (2) monitoring wells shall be installed at the center of the dispersal bed during construction. Two (2) monitoring wells shall be placed at the down slope toe of the sand, two (2) monitoring wells shall be placed twenty-five (25) feet down gradient from the down slope sand toe, and one (1) monitoring wells shall be placed ten (10) feet up gradient from the up slope sand toe.
(c) On flat sites, zero to two (0-2) percent slope, a minimum of ten (10) monitoring wells shall be installed. Two (2) monitoring wells shall be installed at the center of the dispersal bed during construction. One (1)

monitoring well shall be placed at each sand toe. One (1) monitoring well shall be placed twenty-five (25) feet from each sand toe. For dispersal beds greater than seventy-five (75) feet in length, two (2) monitoring wells shall be placed at the long side of each sand toe and two (2) monitoring wells shall be placed twenty-five (25) feet from the long side of the sand toe.

(d) Additional monitoring wells or alternate locations of monitoring wells may be required.

(D) WISCONSIN MOUND CONSTRUCTION REQUIREMENTS:

(1) The use of wheeled vehicles is prohibited for the ripping or chisel plowing, driving on areas that have been ripped or chisel plowed, driving on the sand fill, placing or moving the soil cover, or anytime the soil conditions are wet, moist or saturated.

(2) Surface vegetation shall be mowed to native ground and the clippings removed.

(3) Construction stakes or marking shall be provided for all components of the system prior to construction. The Department shall conduct a pre-construction inspection of the staking or marking to confirm the system will be constructed as designed.

(4) The soil surface shall be ripped or chisel plowed to a depth of eight (8) inches to ten (10) inches, with rippers set eight (8) inches to ten (10) inches apart. Initial ripping shall be performed in a path parallel to the contour of the land and only within the limits of the sand base. The interface of the native soil and the mound soil shall be ripped after the sand has been placed and just prior to mound soil cover placement. On steeper sloping sites, soil cover may be keyed into the native soil in lieu of ripping the soil, at the designers' discretion.

(5) The sand fill shall be uniformly placed and compressed by track rolling to a neat line and to a grade of three-to-one (3:1), or as specified on the plans with a horizontal tolerance not exceeding one quarter (1/4) foot horizontally.

(6) No traffic is permitted on any ripped surface until after the soil cover has been placed.

(7) Temporary form boards are required for placement of materials and shall be removed prior to placement of soil cover.

(8) Distribution to and through all laterals shall be balanced so all laterals and orifices receive an equal volume. The difference in head between any two lines, and the beginning and end orifice of the same line shall not exceed ten (10) percent.

(9) Finished grade of the mound system shall be established by track rolling and grooming by hand. Soil cover shall be conditioned with sufficient moisture to allow track rolling to a firm and cohesive surface. The placement of topsoil used must not adversely inhibit the free transfer of oxygen to the bed and filter media of the mound.

(10) All drainage work and erosion control shall be completed prior to final construction inspection. Upslope runoff must be diverted around the mound.

(11) The soil cover shall be landscaped or seeded.

(E) WISCONSIN MOUND CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the system, the following inspections are required:

(a) Pre-construction inspection where the following items shall be verified:

(i) Imminent weather conditions are such that they will not create unsuitable soil conditions during construction.

(ii) Soil moisture in the area of the proposed mound system is not so high as to cause smearing or compaction as a result of construction activities.

(iii) Layout and staking or marking of all components of the mound system.

(iv) Review and approval of the source of the materials to be used including sand, gravel and soil cover. Samples may be required prior to placement.

(b) Ripping of the soil, sand quality, placement and depth.

(c) Interim inspections(s):

(i) Sand bed prior to placement of gravel.

(ii) Gravel placement and depth.

(iii) Function and setting of all control devices.

(iv) Hydraulic test (squirt test) of system.

(v) Water tightness test of septic tank and dosing tank.

(d) Final Inspection:

(i) Depth and texture of final soil cover over the mound is verified.

(ii) All construction elements are in general conformance with the approved plans and specifications.

(iii) All monitoring wells are installed and erosion control has been completed.

(iv) System controls are hardwired to permanent power and all floats, pumps and alarms tested.

(v) A letter from the designer that the system has been installed and is operating in conformance with the design specifications must be returned to the Department.

(vi) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department.

Section 7 WISCONSIN AT-GRADE SYSTEMS

(A) GENERAL FUNCTION AND SUITABILITY:

(1) The Wisconsin At-Grade (At-Grade) soil absorption system functions as an absorption trench system and mound dispersal unit. These above ground systems allow wastewater disposal on sites with shallow or slowly permeable soil over impermeable soil, fractured rock or bedrock, high groundwater, or other limiting condition within thirty-six (36) inches of the ground surface and on slopes up to twenty-five (25) percent. If pretreatment is used, a minimum of twenty-four (24) inches of native soil is required.

(2) At-Grade dispersal systems shall only receive septic tank effluent as per Table 1.

(B) WISCONSIN AT-GRADE SITE REQUIREMENTS:

(1) The At-Grade system shall be located in open areas for exposure to sun and wind where evaporation and transpiration will be maximized.

(2) At-Grade systems shall not be installed in concave landscape formations, areas of seasonal saturation such as flood plains, vernal pools, drainage areas, areas that have been filled to artificially raise the separation to ground water or other limiting condition, cut or fill sites, or hummocky terrain. Upslope runoff must be diverted around the At-Grade system.

(3) Placement of the At-Grade system in areas that require the removal of large trees, boulders, or rock outcroppings is not permitted.

(4) The minimum effective soil depth below the At-Grade system is thirty-six (36) inches. If an approved pretreatment device is provided it may be reduced to twenty-four (24) inches.

(5) No part of the At-Grade dispersal system may be located where the site slope exceeds twenty (25) percent.

(6) Commercial operations, which generate high strength wastewater, are required to utilize a pretreatment device that can meet the discharge standards of septic tank effluent as specified in Table 1 prior to dispersing into an At-Grade system.

(7) In addition to the other setbacks required by these standards, At-grade systems shall also comply with the following setbacks measured between the perimeter of the basal area of the filter media and the respective features:

(a) Buildings and Structures:	
(i) Up gradient and laterally	10 feet
(ii) Down gradient	25 feet
(b) Property Lines or Underground Utility Easements:	
(i) Up gradient and laterally	10 feet
(ii) Down gradient	25 feet
(c) Areas of Geologic Instability	100 feet

(C) WISCONSIN AT-GRADE DESIGN REQUIREMENTS: See Figures 6A & 6B

(1) Design Calculations:

(a) Single and multiple family dwelling sewage flows shall be calculated based on one hundred and fifty (150) gallons per bedroom per day.

(b) Reduction in residential design flow may be granted when certain water saving devices are incorporated permanently into the dwellings being served. The reduction shall not exceed twenty (20) percent of the design flow.

(c) Commercial and other non-residential building sewage flows shall be calculated in accordance with the quantities listed in Table 4.

(d) The soils application rate is based on the soil classification and/or percolation test. See Table 2 for soil infiltration rates based on soil classification or Table 3 for infiltration rates based on percolation rates.

(e) Designers shall calculate the total dynamic head loss as feet of elevation in the entire distribution system. The calculations shall include:

(i) Vertical differences.

(ii) Length of entire piping.

(iii) Head loss of all valves, tees, elbows, and appurtenances.

(iv) Hydraulic orifice discharge.

(v) Other hydraulic head loss in the system.

(vi) Dose volume shall be designed to provide smaller more frequent doses. The maximum dose volume should not be less than five (5) times the lateral pipe volume and should not exceed twenty (20) percent of the daily design flow. Designer must consider both factors when determining appropriate dose volume.

(2) Effective Absorption Area—The effective absorption area is that which is available to accept effluent. The size of the effective absorption area (aggregate and soil interface) is determined by applying the following formula:

(a) Effective Absorption Area = $\frac{\text{Maximum Daily Flow}}{\text{Soil Infiltration Rate}}$

(3) Effective Absorption Width—The effective absorption width on a level site is the width of the aggregate. On a sloping site it is the distance from the uppermost distribution pipe to the toe of the aggregate.

(a) Effective Absorption Width (A) = $\frac{\text{Linear Loading Rate*}}{\text{Soil Infiltration Rate}}$

*(See Table 7)

(i) The aggregate width shall not exceed ten (10) feet.
(ii) Emphasis shall be placed on making the gravel bed long and narrow.

(4) Effective Absorption Length—The effective absorption length is the length of the aggregate along the contour.

(a) Effective Absorption Length (B) = $\frac{\text{Maximum Daily Flow}}{\text{Linear Loading Rate}}$

(b) The absorption bed shall extend a minimum of twenty-four (24) inches from the edge of the distribution pipes on all sides.

(5) Absorption Bed Depth—The minimum depth of aggregate for residential systems shall be nine (9) inches and for commercial systems shall be twelve (12) inches.
(a) Absorption Bed Depth (residential)
(i) Six (6) inches of aggregate below the distribution pipe, two (2) inches of aggregate above the distribution pipe.
(b) Absorption Bed Depth (commercial)
(i) Nine (9) inches of aggregate below the distribution pipe, three (3) inches of aggregate above the distribution pipe.

(6) Absorption Bed Installation— The absorption bed shall follow the natural contour of the ground.
(a) The absorption bed must be installed within a tolerance of one (1) inch vertically per one hundred (100) feet horizontally.
(b) Only single gravel beds are acceptable.
(c) The entire area of the aggregate shall be covered with an approved geo-textile filter fabric.

(7) Aggregate Specification:
(a) Absorption bed filter media shall consist of three-eighth (3/8) to two (2) inch diameter river rock, crushed drain rock, lava rock, pea gravel, or other hard rock as approved by the administrative authority. All absorption bed filter media must have less than one (1) percent fines, dust, sand, and/or silts (passing the # 200 sieve).

(8) Distribution Piping:
(a) Pressure manifolds shall enter only from the uphill side or end of the At-Grade system.
(b) The distribution piping shall be Schedule 40 PVC or greater of at least three-quarter (¾) inch diameter.
(c) The maximum distance between orifices shall be thirty-six (36) inches.
(d) Distribution laterals shall be located at least eighteen (18) inches from the end and sides of the dispersal bed.

(e) Where two or more laterals are laid in the dispersal bed, the laterals shall be spaced at least twenty-four (24) inches apart.
(f) Orifices shall face upward and shall be protected with orifice shields.
(g) The minimum orifice diameter shall be one-eighth (1/8) of an inch and provide a minimum of sixty (60) inches of hydraulic lift at all orifices. Three sixteenths (3/16) of an inch diameter orifices and larger must produce a minimum of twenty-four (24) inches of hydraulic lift at all orifices.
(h) The maximum length of run for pressurized perforated distribution piping shall be one hundred (100) feet.

(9) Balancing Valves and Purge Valves:
(a) The beginning of the perforated distribution lateral shall have a balancing valve. See Fig. 2.
(b) The end of the perforated distribution lateral shall have a purge valve. See Fig. 3.
(c) All balancing and purge valves shall be encased in plastic or concrete boxes that extend to grade, have a secure cover and are marked "sewer". The boxes shall be a minimum of ten (10) inches across, round or square, and be of adequate size to allow for maintenance.
(d) Balancing valves shall be gate or ball valves Schedule 80 PVC or greater.
(e) Purge valves shall be gate or ball valves Schedule 80 PVC or greater.
(f) All valve boxes shall be placed on screen blocks or equivalent.
(g) Valve boxes shall be designed, installed, and maintained so as to prevent soil and rodent intrusion into the box over the life of the system.

(10) Soil Cover Specification:
(a) The soil placed over the entire At-Grade must be selected and placed to promote aeration of the At-Grade, rainwater movement off and away from the At-Grade, and establishment and maintenance of a vegetative cover.
(b) The soil cover shall be of equal or better texture and structure than the soil existing on the site. Sandy loam, loamy sands and silt loams are recommended.
(c) The final settled depth of the soil cover should be no less than twelve (12) inches above the center and six (6) inches above the outer edge of the aggregate. Additional depth of topsoil must be placed during final construction activities to assure that the minimum depths are achieved following natural settling of the soil.
(d) Soil cover shall extend a minimum of five (5) feet uphill and on both sides of the system. Downhill soil cover shall conform to Table 9.
(e) The At-Grade must not be left without a vegetative cover or to go to weed. Vegetation shall be shallow-rooted, drought tolerant plants, shrubs, or grasses.

(11) Monitoring Wells:
(a) Monitoring well construction shall be in conformance with Fig. 1A.
(b) On sloping sites, greater than two (2) percent, a minimum of six (6) monitoring wells shall be installed. Three (3) monitoring wells shall be installed at the downhill toe of the aggregate bed. Two (2) monitoring wells shall be placed twenty-five (25) feet down gradient from the aggregate, and one (1) monitoring wells shall be placed ten (10) feet up gradient from the aggregate.
(c) On flat sites, zero to two (0-2) percent slope, a minimum of eight (8) monitoring wells shall be installed. One (1) monitoring wells shall be placed twenty-five (25) feet from each edge of each aggregate toe. Four (4) monitoring wells shall

be installed at each aggregate toe. For aggregate beds greater than seventy-five (75) feet in length, two (2) monitoring wells shall be placed at the long side of each aggregate toe and two (2) monitoring wells shall be placed twenty-five (25) feet from the long side of each aggregate toe.

(d) Additional monitoring wells or alternate locations of monitoring wells may be required.

(D) WISCONSIN AT-GRADE CONSTRUCTION REQUIREMENTS:

(1) The use of wheeled vehicles is prohibited for the purpose of ripping or chisel plowing, driving on areas that have been ripped or chisel plowed, moving the soil cover, or anytime the soil conditions are wet, moist, or saturated.

(2) Surface vegetation shall be mowed to native ground and the clippings removed.

(3) Construction stakes or marking shall be provided for all components of the system prior to construction. The Department shall conduct a pre-construction inspection of the staking or marking to confirm the system will be constructed as designed.

(4) The soil surface shall be ripped or chisel plowed to a depth of eight (8) inches to ten (10) inches, with rippers set eight (8) inches to ten (10) inches apart. Initial ripping shall be performed in a path parallel to the contour of the land and only within the limits of the gravel bed. The interface of the native soil and the At-Grade soil shall be ripped after the gravel has been placed and just prior to At-Grade soil cover placement. On steeper sloping sites, soil cover may be keyed into the native soil in lieu of ripping the soil, at the designers' discretion.

(5) No traffic is permitted on any ripped surface until after the gravel or soil cover has been placed.

(6) Temporary form boards required for the placement of material shall be removed prior to placement of the soil cover.

(7) Distribution to and through all laterals shall be balanced so all laterals and orifices receive an equal volume. The difference in head between any two lines, and the beginning and end orifice of the same line shall not exceed ten (10) percent.

(8) Finished grade of the At-Grade system shall be established by track rolling and grooming by hand. Soil cover shall be conditioned with sufficient moisture to allow track rolling to a firm and cohesive surface.

(9) All drainage work and erosion control shall be completed prior to final construction inspection. Upslope runoff must be diverted around the system.

(10) The soil cover shall be landscaped or seeded.

(E) WISCONSIN AT-GRADE CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the system, the following inspections are required:

(a) Pre-construction inspection where the following items shall be verified:

(i) Imminent weather conditions are such that they will not create unsuitable soil conditions during construction.

(ii) Soil moisture in the area of the proposed At-Grade system is not so high as to cause smearing or compaction as a result of construction activities.

(iii) Layout and staking or marking of all components of the At-Grade system.

(iv) Review and approval of the source of the materials to be used including the gravel and soil cover. Samples may be required prior to placement.

(b) Ripping of the soil, gravel quality, placement and depth.

(c) Interim inspections:

(i) Distribution piping, balancing valves, purge valves.

(ii) Function and setting of all control devices.

(iii) Hydraulic test (squirt test) of system.
(iv) Water tightness test of septic tank and dosing tank.

(d) Final Inspection:
(i) Depth and texture of final soil cover over the At-Grade is verified.
(ii) All construction elements are in general conformance with the approved plans and specifications.
(iii) All monitoring wells are installed and erosion control has been completed.
(iv) System controls are hardwired to permanent power and all floats, pumps and alarms tested.
(v) A letter from the designer that the At-Grade system has been installed and is operating in conformance with the design specifications must be returned to the Department.
(vi) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department.

Section 8 EVAPOTRANSPIRATION-INFILTRATION SYSTEMS (ETI)

(A) GENERAL FUNCTION AND SUITABILITY:

(1) These above ground systems are used for treatment and disposal of wastewater on sites with shallow or slowly permeable soil over impermeable soils with at least fifty (50) percent silt and clay within thirty-six (36) inches of the ground surface. If pretreatment is used, a minimum of twenty-four (24) inches of native soil is required. These systems differ from other wastewater treatment systems in that the primary effluent dispersal method is by evapotranspiration, rather than infiltration.

(B) EVAPOTRANSPIRATION-INFILTRATION SYSTEM SITE REQUIREMENTS:

(1) The ETI system shall be located in open areas for exposure to sun and wind where evaporation and transpiration will be maximized.
(2) ETI systems shall not be installed in concave landscape formations, areas of seasonal saturation such as flood plains, vernal pools, drainage areas, areas that have been filled to artificially raise the separation to ground water or other limiting condition, cut or fill sites, or hummocky terrain. Upslope runoff must be diverted around the ETI system.
(3) Placement of the ETI system in areas that require the removal of large trees, boulders, or rock outcroppings is not permitted.
(4) The minimum effective soil depth below the ETI system is thirty-six (36) inches. If an approved pretreatment device is provided, it may be reduced to a minimum of twenty-four (24) inches.
(5) No part of the ETI dispersal system may be located where the site slope exceeds five (5) percent.
(6) ETI systems shall be installed only in fine textured soils and not in coarse soils. Soils shall contain at least fifty (50) percent silt and clay.
(7) The design shall assume that all rain that falls on the ETI system enters the ETI system.

(C) EVAPOTRANSPIRATION-INFILTRATION DESIGN REQUIREMENTS: See Figure 7A & 7B

(1) Design Calculations:

(a) A = 1.3 [Q/(ET-Pr + P)]

(i) Where A= total bed surface in square feet.

(ii) 1.3 = thirty (30) percent safety factor.

(iii) Q = Annual flow in cubic feet per year.

(iv) ET = Annual potential evapotranspiration rate in feet per year from local climatological data.

(v) Pr = annual precipitation rate (10 year annual average) in feet per year from local climatological data.

(vi) P = annual percolation rate of the soil in feet per year.

(b) ETI systems are prohibited for soils with percolation rates slower than 480 mpi or faster than 30 mpi. Soils with percolation rates between 120 mpi and 480 mpi shall receive no percolation rate credit. .

(2) Berm Specifications:

ETI Bed berms or walls shall be constructed of clay compacted to a minimum ninety (90) percent or greater relative density or shall have an impermeable thirty (30) mil PVC liner placed within an approved support structure.

(3) Bed Bottom Specifications:

(a) The bed bottom of the ETI Bed shall be level to within a tolerance of one (1) inch vertically per one hundred (100) feet horizontally.

(b) Construction on filled material is prohibited.

(c) Grading of the bed bottom shall be permitted provided no fill is placed and any cut areas do not exceed twelve (12) inches and the vertical separation to groundwater or an impervious layer is maintained.

(4) Dispersal Bed Design:

(a) A gravel base layer between eight (8) and twelve (12) inches shall be uniformly placed over the bed bottom after the bed surface has been ripped.

(b) Distribution piping shall be placed level on top of the gravel base layer.

(c) Additional gravel shall be placed level two (2) inches above the piping.

(d) The gravel shall be covered with an approved geo-textile filter fabric.

(e) The sand fill shall be placed to a depth of not less than twenty (20) inches or more than thirty (30) inches over the fabric.

(f) A minimum depth of soil cover of six (6) inches and a maximum of twelve (12) inches shall be placed over the sand bed.

(g) The bed surface shall be crowned with a two (2) to three (3) percent slope away from the bed center.

(5) Dispersal Bed Media Specifications:

(a) Gravel used shall be double washed with less than one (1) percent fines by weight and range in size from three-eighths (3/8) to two (2) inches in diameter.

(b) Sand used shall be clean and uniform, with at least fifty (50) percent passing through a #100 sieve and ninety to one hundred (90-100) percent passing through a #30 sieve.

(6) Distribution Piping:

(a) For pressure distribution:

(i) The distribution network and all related components shall comply with Sections 5, 8 and 9 when applicable.

(ii) The pressure distribution pipes shall be spaced no more than twelve (12) feet apart and shall be at least three (3) feet from the wall of the bed.

(b) For gravity distribution:

(i) A distribution box shall be installed within the gravel bed to provide equal distribution to the distribution network.

(ii) Distribution boxes shall comply with Fig. 8.

(iii) Distribution piping shall be approved leach line pipe.

(iv) Gravity distribution pipes shall be spaced no more than twelve (12) feet apart and shall be at least three (3) feet from the wall of the bed.

(7) Monitoring Wells:

(a) Monitoring well construction shall be in conformance with Fig. 1A.

(b) Two (2) monitoring wells shall be placed in the dispersal bed to the gravel/soil interface.

(c) One (1) monitoring well shall be placed ten (10) feet outside the toe of the berm on each side of the ETI system.

(d) Additional monitoring wells or alternate locations of monitoring wells may be required.

(D) EVAPOTRANSPIRATION-INFILTRATION BED CONSTRUCTION REQUIREMENTS:

(a) Surface vegetation shall be mowed to native ground and the clippings removed.

(b) The berms or walls of the bed shall be constructed prior to ripping of the bed bottom. A means of exiting the bed after ripping shall be provided.

(c) Berms or walls shall be properly keyed into the native soil. Liners shall be bedded in at least three inches of sand between the liner and the wall structure. For clay berms, the interior and exterior wall of the berm shall be installed to a two-to-one (2:1) slope and compacted to a minimum of ninety (90) percent relative density. Berms shall be a minimum of two (2) feet wide at the narrowest part.

(d) The bed bottom surface shall be ripped or chisel plowed to a depth of eight (8) to ten (10) inches, with rippers set eight (8) to ten (10) inches apart. Ripping shall be performed in a path parallel to the contour of the land and only within the limits of the ETI system bed bottom.

(e) The use of wheeled vehicles is prohibited for the purpose of ripping or chisel plowing, driving on areas that have been ripped or chisel plowed, moving the soil cover, or anytime the soil conditions are wet, moist, or saturated.

(f) No traffic of any kind is permitted on any ripped surface until after the gravel cover has been placed.

(g) The soil cover over the bed surface shall be a sandy loam or loam soil.

(h) Soil cover shall be conditioned with sufficient moisture to allow track rolling to a firm and cohesive surface.

(i) Finished grade of the ETI system shall be established by track rolling and grooming by hand.

(j) All drainage work and erosion control shall be completed prior to the final construction inspection. The soil cover shall be landscaped or seeded.

(k) Surface plants or grasses with shallow roots that are able to withstand a wide range of soil moisture levels shall be planted over the ETI system. The vegetative cover should be chosen to provide maximum transpiration. Salt tolerant plants are recommended as salt accumulation may occur in the bed and destroy plant tissue.

(E) EVAPOTRANSPIRATION-INFILTRATION BED CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the system, the following inspections are required:

(a) Pre-construction inspection where the following items shall be verified:

(i.) Imminent weather conditions are such that they will not create unsuitable soil conditions during construction.

(ii) Soil moisture in the area of the proposed system is not so high as to cause smearing or compaction as a result of construction activities.

(iii) Layout and staking or marking of all components of the system.

(iv) Review and approval of the source of the materials to be used including sand, gravel and soil cover. Samples may be required prior to placement.

(v) Ripping of the soil.

(b) Interim inspections(s):

(i) Level bed bottom prior to placement of gravel.

(ii) Gravel placement and depth.

(iii) Function and setting of all control devices.

(iv) Hydraulic (squirt test) test of system for pressure distribution networks, flow test for gravity fed networks to ensure equal distribution.

(v) Water tightness test of septic tank and dosing tank (if used).

(c) Final Inspection:

(i) Depth and texture of final soil cover over the bed is verified.

(ii) All construction elements are in general conformance with the approved plans and specifications.

(iii) All monitoring wells are installed and erosion control has been completed.

(iv) If used, system controls are hardwired to permanent power and all floats, pumps and alarms tested.

(v) A letter from the designer that the system has been installed and is operating in conformance with the design specifications must be returned to the Department.

(vi) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department if a pump system is used.

Section 9 SUBSURFACE DRIP DISPERSAL SYSTEMS

(A) GENERAL FUNCTION AND SUITABILITY:

(1) A subsurface drip dispersal system is an efficient pressurized wastewater distribution system that can deliver small, precise doses of effluent to shallow subsurface disposal/reuse fields. Subsurface drip dispersal system distribution piping is small diameter, flexible polyethylene tubing (*dripline*) with small in-line *emitters* (orifices that can discharge effluent at slow, controlled rates, usually specified in gallons per hour).

(2) A typical subsurface drip dispersal system installation includes a dosing chamber, pump(s), control panel, timed dosing and flow monitoring, particulate filter, filter backwashing and drip line flushing, driplines, and monitoring wells.
(3) These below ground systems allow wastewater disposal on sites with shallow or slowly permeable soil over impermeable soil, fractured rock or bedrock, rapidly draining soils or sites with high groundwater on slopes up to and exceeding thirty (30) percent. An approved pretreatment device is required for a subsurface drip dispersal system. Effluent dispersed from these systems must be located at least twenty-four (24) inches above groundwater or other limiting condition.
(4) Subsurface drip dispersal systems designed and installed in accordance with the manufacturer's recommendations and consistent with these standards are suitable for treatment and disposal of residential sewage. Where waste strength is characterized as higher than residential sewage, the designer must propose an approved pretreatment system and demonstrate to the satisfaction of the administrative authority that pretreatment will reduce effluent strength to the required quality standards.
(5) The level of pretreatment must comply with the effluent quality parameters described in this code for pretreated effluent, as shown in Table 1, or as specified by the manufacturer, whichever effluent quality is cleaner. Different subsurface drip dispersal products may require different levels of pretreatment.

(B) SUBSURFACE DRIP DISPERSAL SYSTEM SITE REQUIREMENTS:
(1) Subsurface drip dispersal systems can be installed in acceptable soil types as listed in Table 10.
(2) No part of the subsurface drip dispersal field may be located where the site slope exceeds thirty (30) percent when fill will be used and the soil cover will be placed above existing grade.
(3) The minimum acceptable soil depth under the bottom of the dripline shall be twenty-four (24) inches.
(4) To maximize evapotranspiration, subsurface drip dispersal systems shall not be installed below non-permeable type soils such as high shrink swell clays, highly compacted soils, highly cemented soils, and/or massive or platy soil structures.

(C) SUBSURFACE DRIP DISPERSAL SYSTEM DESIGN REQUIREMENTS:
(1) Design Calculations:
(a) Soil application rates shall be based on Table 10 or the manufacturer's requirements whichever is more restrictive.
(b) All subsurface drip dispersal system designs shall demonstrate that sufficient suitable area exists to construct two hundred (200) percent reserve area. The two hundred (200) percent reserve area shall also apply when a subsurface drip dispersal system is proposed only as a reserve area.

(2) Distribution Piping:
(a) All subsurface drip dispersal system materials must be warranted by the manufacturer for use with wastewater and resistant to plugging from solids and bacterial slime.
(b) All materials shall meet applicable ASTM standards and be resistant to common household chemicals. The drip tubing must be color coded, by the manufacturer, to be easily identified as tubing designed for wastewater disposal.

(c) All subsurface drip dispersal systems must include a USDA-approved "root growth inhibitor" incorporated into the material during the manufacturing process to prevent root intrusion into emitters.
(d) All transport piping; supply and return manifolds and fittings must be Schedule 40 PVC or greater.
(e) Fittings used to join dripline to the distribution and flush manifolds must be in accordance with manufacturer's recommendations. Both compression and barb fittings may be specified, depending on the manufacturer recommendations and system operating pressure.
(f) The length of each distribution line shall not exceed manufacturer's specifications to insure equal distribution to each emitter.
(g) Vacuum breakers/air release valves shall be installed as per manufacturer's specification. A minimum of one (1) vacuum breaker/air release valve shall be provided for each drip field zone. One (1) air/vacuum relief valve shall be installed on the supply manifold and one (1) on the return line. All valves must be installed in a valve box with access to grade.
(h) A subsurface drip disposal system shall contain, if necessary, pressure compensating devices or regulators to ensure equal distribution from all emitters at +/- ten (10) percent of the designed discharge rate.

(3) Dosing Chambers:
(a) All dosing chambers must be IAPMO approved.
(b) The dosing chamber shall have a grade level access large enough to allow servicing and/or removal of the largest component in the chamber. Access ports shall be protected against unauthorized entrance or removal and be gas and watertight.
(c) The dosing chamber shall have a minimum capacity of one and one half (1½) times the estimated daily flow.
(d) The dosing chamber shall be equipped with an audible high water alarm.
(e) The high water alarm must be set so as to allow a reserve capacity equal to one (1) day's estimated flow.

(4) Pump Specifications:
(a) All subsurface drip disposal systems shall be time dosed. On-demand dosing will not be considered.
(b) Means must be provided to track and verify dosing such as can be accomplished with a digital control panel, elapsed time meter (ETM) or event counter, etc.
(c) The pumping system shall be capable of dosing the drip field a minimum of six (6) equally spaced doses per twenty-four (24) hour period. Each dose volume shall not exceed the estimated maximum daily flow divided by the number of dosing cycles.
(d) The pumping system shall be designed to discharge the required volume of wastewater within the pressure range specified by the tubing manufacturer.
(e) The pump shall be equipped with a low water shutoff to prevent damage to the pump during low water conditions in the dosing chamber.
(f) The pump shall be constructed of corrosion resistant materials suitable for effluent.
(g) The pump shall be sized per manufacturers' specifications to meet or exceed the hydraulic requirement of the system.
(h) The pump shall be installed in compliance with manufacturers' specifications so as not to violate pump warranty.

(i) The suction and pressure lines shall be Schedule 40 PVC or greater and be sized to meet or exceed the hydraulic requirements of the system.
(j) Flow meters must be installed in a readily accessible location for reading and servicing. The manufacturer must warrant flow meters for use with wastewater and be accurate within the expected flow range of the installed system.

(5) Filter Specifications:
(a) The filter shall filter the effluent to the specifications of the drip disposal-tubing manufacturer to prevent clogging of the emitters.
(b) The filter shall achieve the required filtration at a rate equal to or greater than the peak discharge rate. This includes filter and/or system backwash from either the treatment facility or pump whichever is applicable.
(c) The filter shall be made of material resistant to the corrosive effects of wastewater and common household chemicals.
(d) The filters shall be readily accessible for inspection and/or service.
(e) The filter flush volume and velocity shall be per manufacturer's specifications.
(f) The filter residue shall be returned to the septic tank.

(6) Flushing System Specifications:
(a) A system must be provided for the flushing of distribution lines to prevent the build-up of solids in the distribution system, with its discharge returning to the septic tank.
(b) The system shall be capable of achieving a flushing velocity of a minimum of two (2) feet per second. The return line must be permanently installed as a component of the system.
(c) Automated filter backwash and dripline flushing is required for all drip systems.
(d) Hose bibs are not allowed for use as a flushing component (to prevent cross contamination).

(7) Monitoring Wells:
(a) Monitoring well construction shall be in conformance with Fig. 1A.
(b) A minimum of six (6) monitoring wells shall be installed.
(c) On flat sites, zero to two (0-2) percent slope, two (2) monitoring wells shall be installed within the subsurface drip dispersal field and one (1) monitoring well shall be installed twenty five (25) feet away from all sides of the drip dispersal field. For multiple zones, two (2) monitoring wells are required for each zone.
(d) On sloping sites, greater than two (2) percent slope, two (2) monitoring wells shall be placed twenty-five (25) feet down gradient from the drip dispersal field, two (2) monitoring wells shall be installed within the drip dispersal field and two (2) monitoring wells shall be installed ten (10) feet up gradient of the drip dispersal field. For multiple zones, two (2) monitoring wells are required for each zone.

(D) SUBSURFACE DRIP DISPERSAL SYSTEM CONSTRUCTION REQUIREMENTS:
(1) Installers are responsible for obtaining proper training before attempting to install a subsurface drip dispersal system.
(2) Drip lines should be installed in the "A" horizon (as defined by the National Resources Conservation Services) with six (6) to eight (8) inches of cover soil above the drip line. The maximum cover soil may not exceed eighteen (18) inches above the drip line. In all cases there shall be a minimum of twenty-four (24) inches separation between the drip line and water table and/or restrictive horizon.

(3) If fill will be used for soil cover, drip dispersal lines may be installed at original grade provided that the minimum of six (6) inches of acceptable fill soil is placed prior to installation of the lines. Existing ground surface shall be stripped of vegetation and scarified prior to the placement of fill soil.

(4) The drip lines may be installed using any of the following methods:

(a) Installed in a trench excavated by a trenching machine or by hand.

(b) Installed using an approved plowing method. The insertion tool must be of the type that does not pull or stretch the drip line during insertion. The use of "cable plows" or any type insertion method that employs pulling the drip line through the plowed trench is prohibited.

(5) Lines shall be on contour and shall not be installed perpendicular to the slope; elevation difference in a line or the entire grid shall not exceed the manufacturer's specifications.

(6) Separation between emitter line laterals shall be a minimum of two (2) feet.

(7) Minimum emitter spacing is twelve (12) inches for all soil types.

(8) Lateral spacing of three (3) feet or more should be used for slopes of twenty (20) percent or greater.

(9) Drip tubing shall either be placed four (4) inches lower than the supply manifolds or water breaks shall be used to prevent effluent from flowing from drip trenches to the supply manifold trenches.

(10) Equipment susceptible to freezing must be adequately protected to prevent freezing.

(E) SUBSURFACE DRIP DISPERSAL SYSTEM CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the system, the following inspections are required:

(a) Pre-construction inspection where the following items shall be verified:

(i) Imminent weather conditions are such that they will not create unsuitable soil conditions during installation.

(ii) Layout and staking or marking of all components of the system.

(iii) Review and approval of the source of the materials to be used.

(b) Interim inspections(s):

(i) Installation of all pretreatment components.

(ii) Drip field installation and functioning of all drip components.

(iii) Function and setting of all control devices.

(iv) Connections of all piping and related components.

(v) Water tightness test of all connections, septic tank and dosing tank.

(c) Final Inspection:

(i) All construction elements are in general conformance with the approved plans and specifications.

(ii) Final soil cover over the subsurface drip dispersal field is verified.

(iii) System controls are hardwired to permanent power and all floats, pumps and alarms tested.

(iv) Letter from the designer that the system has been installed and is operating in conformance with the design specifications shall be provided.

(v) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department.

Section 10 SAND FILTRATION SYSTEMS

(A) GENERAL FUNCTION AND SUITABILITY:

(1) These systems are used as a treatment technology to reduce wastewater strength prior to dispersal. Sand filter effluent discharged to a pressure distribution system or At-Grade system shall be located at least twenty-four (24) inches above groundwater or other limiting condition.

(2) There are two (2) approved types of sand filter systems:

(a) Intermittent Sand Filter (ISF) system: Wastewater passes through the filter once to achieve the desired treatment, including total and fecal coliform reductions.

(b) Recirculating Sand Filter (RSF) System: Wastewater is recirculated through the filter media multiple times to achieve the desired treatment. In addition to coliform reduction, RSF's can be designed to reduce the nitrate concentration of the wastewater. Wastewater is typically recirculated up to four (4) times through the RSF. Each time the wastewater is circulated through the RSF, seventy five (75) to eighty (80) percent is recirculated back to the septic tank and twenty-five (25) to twenty (20) percent is released to the dispersal field.

(3) The components of a sand filter are a containment pit or structure with a waterproof liner, distribution piping, gravel, sand, collection drain system, and a pump. A sand filter is an approved pretreatment device if built according to these standards.

(4) The use of an approved sand filter or other approved pretreatment device may allow a reduction of up to one (1) foot of the three (3) foot minimum vertical separation distance above a limiting groundwater or soil condition otherwise required for a dispersal system. Increasing the sand depth of a sand filter beyond the two (2) feet does not allow a further decrease in the required depth of the minimum effective soil above a limiting condition.

(B) SAND FILTER SITE REQUIREMENTS:

(1) The minimum setback requirements for sand filters are the same as required for septic tanks.

(C) SAND FILTER DESIGN REQUIREMENTS:

(1) Design Calculations:

(a) The surface area of the sand filter bed must be determined by dividing the design flow estimate by the loading rate.

(i) The loading rate to an ISF must not exceed 1.2 gallons/day/ft^2.

(ii) The loading rate to a RSF must not exceed four (4) gallons/day/ft^2.

(b) Designers shall calculate the total dynamic head loss as feet of elevation in the entire distribution system. The calculations shall include:

(i.) Vertical differences.

(ii.) Length of entire piping.

(iii.) Head loss of all valves, tees, elbows, and appurtenances.

(iv.) Hydraulic orifice discharge.

(v.) Other hydraulic head loss in the system.

(vi.) Dose volume shall be designed to provide smaller more frequent doses. The maximum dose volume should not be less than five (5) times the lateral pipe volume and should not exceed twenty (20) percent of the daily design flow. Designer must consider both factors when determining appropriate dose volume.

(2) Influent Characteristics:
   (a) Intermittent and Recirculating sand filters are designed for treating residential strength wastewater.
   (b) High-strength wastewater and wastewater from non-domestic sources (such as restaurants, hotels, bed and breakfast establishments, industrial and commercial wastewater sources) must be individually evaluated to determine the degree of pretreatment required, if any, prior to an intermittent or recirculating sand filter for final treatment and disposal.

(3) Filter Media Specifications:
   (a) Filter media must meet the particle size criteria detailed in Table 11. Media used in constructing a sand filter must be accompanied with a written certification from the supplier.
   (b) The filter media depth must be a minimum of twenty (24) inches and be thoroughly washed and as free of fines as possible.

(4) Distribution Piping:
   (a) The pressure manifold and under drain shall pass through factory heat or solvent welded boots in the PVC liner and be sealed watertight. Appropriate stainless steel clamps (two (2) clamps are recommended) shall seal the PVC boot around the pressure manifold and under drain pipes.
   (b) The distribution piping shall be Schedule 40 PVC pipe of at least three quarter (¾) inch diameter.
   (c) The maximum distance between orifices shall be thirty-six (36) inches.
   (d) Distribution laterals shall be located at least twelve (12) inches from the end and sides of the filter bed.
   (e) Where two (2) or more laterals are laid in the sand filter, the laterals shall be spaced at least twelve (12) inches apart.
   (f) Orifices shall face upward and shall be protected with orifice shields.
   (g) The minimum orifice diameter shall be one-eighth (1/8) of an inch and provide a minimum of sixty (60) inches of hydraulic lift at all orifices. Three sixteenths (3/16) of an inch diameter orifices and larger must produce a minimum of twenty-four (24) inches of hydraulic lift at all orifices.
   (h) The maximum length of run for pressurized perforated distribution piping shall be one hundred (100) feet.

(5) Balancing Valves and Purge Valves:
   (a) The beginning of the perforated distribution lateral shall have a balancing valve. See Fig. 2.
   (b) The end of the perforated distribution lateral shall have a purge valve. See Fig. 3.
   (c) All balancing and purge valves shall be encased in plastic or concrete boxes that extend to grade, have a secure cover and are marked “sewer”. The boxes shall be a minimum of ten (10) inches across, round or square, and be of adequate size to allow for maintenance.
   (d) Balancing valves shall be gate or ball valves Schedule 80 PVC or greater.
   (e) Purge valves shall be gate or ball valves Schedule 80 PVC or greater.
   (f) All valve boxes shall be placed on screen blocks or equivalent.
   (g) Valve boxes shall be designed, installed, and maintained so as to prevent soil and rodent intrusion into the box over the life of the system.

(6) Monitoring Wells:
   (a) Monitoring well construction shall be in conformance with Fig. 1A.
   (b) One (1) monitoring well shall be installed to the bottom of the drain rock/top of the media interface.
   (c) A second monitoring well shall be installed to the bottom of the under drain.
   (d) Additional monitoring wells or alternate locations of monitoring wells may be required.

(D) SAND FILTER CONSTRUCTION REQUIREMENTS:

(1) A pit shall be excavated into the ground for installation of the sand filter.

(2) Inside the pit, walls shall be constructed of at least one-half (½) inch plywood, pressure treated or redwood heart grade material. All fasteners shall be flush, counter sunk, or recessed.

(3) The walls shall be constructed so that the top is at least six (6) inches above natural grade.

(4) The bottom of the pit shall be covered with sand to "bed" liner, adequate in depth (minimum of three (3) inches) to protect liner from puncture.

(5) The bottom of the pit (bedding layer of sand) shall be graded to provide a sloping liner surface, from the outer edge of the filter toward the point of under drain collection.

(6) A geo-textile fabric in a thickness appropriate to protect the liner shall be placed over all wood surfaces.

(7) At least a thirty (30) mil PVC liner shall be installed. All seams of the liner must be factory heat or solvent welded.

(8) A four (4) inch diameter Schedule 40 PVC or greater slotted under drain collection pipe shall be placed directly on the bottom of the enclosure. Under drain slots should be one quarter (¼) of an inch wide, two and one half (2½) inches deep and spaced four (4) inches apart. To avoid the slots being pushed down into the liner and covered by liner material, the slots shall be faced upwards (vertical). The distal end of the pipe shall be brought to grade and covered with a removable cap. This shall serve as a vent and cleanout. In a sand filter with a pump basin located in the center where two (2) under drain pipes converge, only one (1) of the under drain pipes needs to be brought to the surfaced and capped. The under drain pipe can lay level or have no more than a one half (1/2) percent grade towards the outlet. In larger sand filters, under drain pipes shall be spaced apart a maximum of ten (10) feet on center.

(9) A minimum of four (4) inches of double washed gravel with less than one (1) percent fines by weight and range in size from three quarter (3/4) to two (2) inches in diameter shall be placed over and immediately around the under drain pipe. Avoid angular and sharp gravel that could damage the PVC liner.

(10) Eight (8) inches of three eighth (3/8) inch clean washed pea gravel shall be placed at the inside bottom of the enclosure. This should be mounded over the washed gravel covering the under drain. Care should be taken to make certain that the above- mentioned layers are installed properly. This layering sequence is meant to prevent sand filter media from washing into the under drain pipe of the filter.

(11) It is recommended that the sand media be placed in level eight (8) inch lifts in the filter and wetted slightly during installation to promote even settling. It is important not to wet the sand too much because particle stratification may occur.

(12) As the liner is filled with sand, the edges of the filter media should be "walked down" by the installer to make sure the sand is tight along filter perimeter and no voids exist. The installer should watch that the liner is not stretched during the filling process.

(13) After the required amount of filter sand has been added to the filter, place three (3) inches of three eighth (3/8) inch washed pea gravel over the filter sand. After the distribution laterals have been installed atop the pea gravel and a squirt test performed, install orifice shields over each orifice of the distribution laterals, add two (2) more inches of pea gravel to cover the distribution laterals. No filter fabric of any kind should be placed between the sand and overlying pea gravel layers.

(14) A geo-textile filter fabric must be placed over the pea gravel prior to placement of the soil cover. Soil cover shall be sandy loam or loam soil and shall be a minimum of six (6) inches but not greater than twelve (12) inches in depth over the sand filter.

(15) The cover soil must be capable of maintaining vegetative growth while not impeding the passage of air and be sloped to promote drainage off of and away from the sand filter.

(E) SAND FILTER CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the sand filter, the following inspections are required:

(a) Pre-construction inspection where the following items shall be verified:

(i) Imminent weather conditions are such that they will not create unsuitable soil conditions during construction.

(ii) Layout and staking or marking of all components of the sand filter system.

(iii) Review and approval of the source of the materials to be used including sand, gravel and soil cover. Samples may be required prior to placement.

(b) Interim Inspections(s):

(i) Inspection of rock, sand and soil to be used.

(ii) Excavation of sand filter pit and wall construction.

(iii) Placement of gravel, pea gravel, under drain and sand fill.

(iv) Assembly and layout of sand filter distribution network.

(c) Final Inspection:

(i) Depth and texture of final soil cover over the sand filter is verified.

(ii) All construction elements are in general conformance with the approved plans and specifications.

(iii) All monitoring wells are installed and erosion control has been completed.

(iv) System controls are hardwired to permanent power and all floats, pumps and alarms tested.

(v) A letter from the designer that the system has been installed and is operating in conformance with the design specifications must be returned to the Department.

(vi) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department.

Section 11 AEROBIC TREATMENT UNITS (ATU) AND ALTERNATIVE FILTER MEDIA UNITS (AFMU)

(A) GENERAL FUNCTION AND SUITABILITY

(1) These are proprietary devices used in lieu of sand filters to treat sewage effluent prior to dispersal. Pressure distribution trenches, At-Grade systems and ETI systems receiving effluent from these treatment units must be located a minimum of twenty-four (24) inches above groundwater or other limiting conditions.

(2) ATU's or AFMU'S may only be approved provided all of the following conditions are met:

(a) An appropriately sized intermittent sand filter meeting all setback requirements on the parcel could be installed if necessary.

(b) Documentation acceptable to the Department is provided to demonstrate that the unit will provide effluent quality equal to or better than that defined in Table 1 for pretreated effluent quality.

(c) The Department may require installation of an intermittent sand filter should performance monitoring of the unit, after installation, indicates it is not providing the required effluent quality.

(d) The owner may be required to maintain a maintenance agreement with the proprietor, the proprietor's distributor, or other contractor knowledgeable in the repair and maintenance of the unit.

(B) AEROBIC TREATMENT UNIT (ATU) AND ALTERNATIVE FILTER MEDIA (AFMU) UNIT SITE REQUIREMENTS:

(1) The minimum setback requirements for Aerobic Treatment Units and Alternative Filter Media Units are the same as required for septic tanks.

(C) AEROBIC TREATMENT UNIT (ATU) AND ALTERNATIVE FILTER MEDIA (AFMU) UNIT DESIGN REQUIREMENTS:

(1) The ATU or AFMU shall be listed by NSF as meeting the NSF Standard 40, Class 1 performance evaluation, or have a certification by a third party agency as complying with NSF Standard 40. The ATU or AFMU shall be manufactured and installed in accordance with the design specifications used to determine compliance to NSF Standard 40. Alternative pre-treatment technologies for high-strength wastes may be considered for review and approval by the Department, and possibly the RWQCB. The manufacturer shall endorse the use, in writing, of the proposed ATU or AFMU for the anticipated wastewater quality and quantity. Such alternative pre-treatment technologies are subject to additional or alternative monitoring requirements to verify system function according to design expectations.

(2) All tanks housing an ATU or AFMU shall be structurally sound, water tight and capable of withstanding anticipated loads.

(3) The designer and installer shall follow the manufacturer's design, installation, construction, and operations procedures.

(4) The ATU or AFMU shall be preceded by a septic tank unless it can be demonstrated that such a requirement will adversely affect the performance of the ATU or AFMU.

(D) AEROBIC TREATMENT UNIT (ATU) AND ALTERNATIVE FILTER MEDIA (AFMU) UNIT CONSTRUCTION REQUIREMENTS:

(1) See manufacturer's instructions and specifications.

(E) AEROBIC TREATMENT UNIT (ATU) AND ALTERNATIVE FILTER MEDIA (AFMU) UNIT CONSTRUCTION INSPECTIONS:

(1) Prior to beginning construction and/or covering any elements of the system, the following inspections are required:

(a) Pre-construction inspection where the following items shall be verified:

(i.) Imminent weather conditions are such that they will not create unsuitable soil conditions during installation.

(ii.) Layout and staking or marking of all components of the system.

(iii) Review and approval of the source of the materials to be used.

(b) Interim inspections(s):

(i) Function and setting of all control devices.

(ii) Connections of all piping and related components.

(iii) Water tightness test of all connections, septic tank and dosing tank (if used).

(c) Final Inspection:

(i) All construction elements are in general conformance with the approved plans and specifications.

(ii) System controls are hardwired to permanent power and all floats, pumps and alarms tested.

(iii) The Septic System Sump Pump Electrical System Installation Conformance Certification must be completed, signed by the installing contractor and returned to the Department if a pump system is used.

(iv) Letter from the designer that the ATU or AFMU system has been installed and is operating in conformance with the design specifications shall be provided.

Section 12 EXPERIMENTAL SYSTEMS:

A) EXPERIMENTAL SYSTEM DEFINED:

(1) Any system proposed that varies from these standards or is not addressed in these standards is considered experimental and shall be subject to joint Regional Water Quality Control Board and Department review.

(B) EXPERIMENTAL SYSTEM APPROVAL REQUIREMENTS:

(1.) Experimental systems shall only be allowed for repairs of existing sewage disposal systems on existing lots.

(2.) The designer of an experimental system shall include proposed monitoring requirements in the design submittal. The Department and/or RWQCB may require modification and/or additional monitoring requirements of the system.

(3.) Experimental systems are subject to Environmental Review by the Napa County Conservation, Development and Planning Department.

(4.) If the proposed experimental system is approved by both agencies, the RWQCB may require a wastewater discharge permit. If required, the wastewater discharge permit shall establish performance standards that the experimental system must comply with.

(5.) A maximum of three (3) experimental systems shall be approved in any given calendar year.

(6.) The designer of the system shall provide the Department with a copy of the Operation and Maintenance manual for the system prior to final. The system must be monitored by an Approved Service Provider. The owner shall provide the Department with a copy of the contract between the owner and the Service Provider prior to issuance of the operation permit.

Section 13 NAPA COUNTY ALTERNATIVE SEWAGE TREATMENT SYSTEM MONITORING PROGRAM:

(A) CODE SECTION AND APPLICABILITY

(1) The Napa County Code, Division II, Chapter 13.56, Section 13.56.010 has established the legal authority for the ASTS monitoring program. The Director of the Department has determined that all ASTS's approved by the Department after January 1, 2000 shall be included in this ASTS Monitoring Program.

(2) All ASTS's permitted* on or after July 1, 2006 are subject to inspection and monitoring by an approved Service Provider. An approved Service Provider means a Registered Civil Engineer, Registered Environmental Health Specialist, or any person who is licensed as a "certified on-site wastewater system inspector" or other equivalent license by passing a state or nationally accredited test.

(3) All ASTS's permitted prior to July 1, 2006 will have the option of being permitted with an approved Service Provider, or remain as they are currently permitted.

(4) The Director shall maintain the right to require any and all systems installed after September 25, 1969 to enter into this or any other monitoring program as allowed by Napa County Code.

***** Permitted in this sentence refers to the date the construction permit was issued for the ASTS.

(B) PROGRAM OVERVIEW

(1) ASTS's employ enhanced treatment technologies to overcome restrictive site conditions where conventional sewage treatment systems are not feasible. ASTS allow for the development of otherwise "unbuildable" parcels or repairs of existing sewage disposal systems on sites that have greater environmental sensitivity. Due to the complex technologies and engineering principles utilized with these systems, monitoring and maintenance becomes an essential part of the performance of the system. The Department has established this ASTS monitoring program to formalize the requirements for monitoring and maintenance of these systems.

(2) ASTS's are required to have an operational permit issued by the Department. The operational permit prescribes the maintenance and inspection requirements as conditions of the permit. Routine self-monitoring of the system as well as periodic inspections by Department staff or an approved Service Provider is required to assure the system is functioning properly and allows for the collection and analysis of data from the ASTS technologies utilized. Renewable operational permits provide a mechanism for continuous oversight of system performance and negotiating corrective action or levying penalties if compliance with the permit is not maintained. The ASTS monitoring program will serve to determine the overall success of the various types of ASTS's, to assist homeowners with the necessary maintenance requirements of their ASTS, and to provide necessary data on such systems that contribute to the continued research that ensures the protection of water quality, the environment, and public health and safety.

(C) OPERATION & MAINTENANCE REQUIREMENTS

(1) All ASTS's in the monitoring program are required to have an operational permit.

(2) Operational permits are not transferable. A new operating permit shall be obtained at the time of sale, or in the case of commercial properties, upon change of occupants (if the landlord is not the permit holder).

(3) ASTS shall be operated and maintained in conformance with the conditions prescribed in the operational permit.

(4) If in the opinion of the administrative authority, the ASTS is causing an adverse effect upon the ground or surface waters, public health, or a significant effect on the environment, enforcement action may be initiated. This may include but not be limited to ordering the permit holder on mandatory pump status or issuance of a Notice to Abate a Public Nuisance through the District Attorney's office.

(5) The County may recover costs associated with the abatement of operational permit violations.

(6) The current owner of the property has the responsibility for informing succeeding property owners of the renewable operating permit and self-monitoring requirements.

(7) Prior to issuance of the sewage disposal system installation permit, the owner of the property shall submit the Supplemental Application to Construct and Operate an ASTS to the Department.

(D) OWNER RESPONSIBILITIES

(1) Operational permits are not transferable. With the sale of a property, a new operating permit shall be obtained by the new owner/operator. Change of ownership for residential properties shall mean when a property served by an ASTS is purchased and title to the property has changed. For commercial properties, change of ownership shall mean the effective date of any lease or other agreement to operate the business for which the ASTS serves.

(2) Within thirty (30) days of gaining control of the property or business (close of escrow, lease/agreement effective date), a new operating permit must be applied for and obtained from the Department by the new owner/operator. In the case where the business owner is not the property owner, the operating permit may be issued to the property owner or the owner of the business.

(3) Although property owners are responsible for assuring the alternative system does not create a threat to public health or the environment, the business served by the ASTS is responsible for wastewater discharged to the system. Therefore, the business owner will be required to obtain the operating permit unless the property owner submits a written request that he/she be the operating permit holder.

(4) All required operating, maintenance, and monitoring of the ASTS is the responsibility of the permit holder. All required fees must be paid at the time of application.

(5) Prior to final on the project and prior to issuance of the first operating permit, the owner shall provide a copy of a signed contract with the approved Service Provider.

(6) For those systems permitted prior to July 1, 2006, prior to final on the project and prior to issuance of the first operating permit, the owner shall either provide a copy of a signed contract with the approved Service Provider or shall submit a complete self-monitoring report that was completed in conjunction with design engineer.

(7) Subsequent self-monitoring reports shall be submitted as described in the Service Provider Monitoring Requirements detailed in this section and as prescribed on the operational permit conditions.

(8) A copy of a signed contract with the approved Service Provider, if applicable, and a completed monitoring inspection report shall be submitted to the Department with any application for a change of ownership.

(E) HOMEOWNER MAINTENANCE OF ALTERNATIVE SEWAGE TREATMENT SYSTEMS

(1) ASTS's will function better and last longer if properly maintained. Following are some simple and practical maintenance procedures (Basic Maintenance below) that shall be performed to improve the operation of the system and comply with the requirements of the ASTS monitoring program. In addition to the maintenance requirements specified herein, the designer of the ASTS system must provide the homeowner with an operation and maintenance manual specific to the type of system installed.

(F) BASIC MAINTENANCE

(1) Inspect the septic tanks and sumps for signs of leakage and groundwater intrusion on top of the tank, at the inlet and outlet, and especially around the risers.
(2) Septic tanks are to be pumped when the combined sludge and scum layer is greater than thirty five (35) percent of the liquid capacity of the tank. A licensed septic tank pumper shall pump the septic tanks. See manufacturer's specifications and/or ASTS construction drawings for tank capacities and dimensions.
(3) Maintain all surface and subsurface drainage and improvements in accordance with the operation and maintenance manual.
(4) Assure wastewater quality discharged to the system is consistent with the design parameters. The addition of any atypical wastewater component into the system is prohibited. Contact the Department prior to disposing of any wastewater constituent incongruous with the designed wastewater parameters.
(5) ASTS shall be operated and maintained in conformance with the conditions prescribed in the operational permit.
(6) Report any malfunction of the ASTS to the Department.
(7) Do not allow any disturbance of the soil cover by animals, vehicles, structures, etc.
(8) Do not hydraulically overload (exceed the designed daily wastewater flow) the ASTS.
(9) Do not dispose of any hazardous material into a septic tank or system including toxic substances, pesticides, chlorine bleach, cleaners (other than minute concentrations contained in mild cleansers and chemicals used in normal household cleaning), or flammable products.
(10) Do not plant vegetation incompatible with the proper function of a sewage treatment system in an area that may affect the disposal field or reserve area.
(11) Do not disc, plow, rip, or allow any other disturbance of the soil in a manner that could adversely impact the function of the sewage treatment system and/or reserve area.

(G) SERVICE PROVIDER MONITORING REQUIREMENTS

(1) Service Provider Monitoring requirements will vary depending on the specific type of ASTS, but in general, may include the following:
(i) Recording of wastewater flows based on water meter readings, pump event counters, elapsed time meters or other approved methods.
(ii) Inspection and recording of water levels in the monitoring wells in the disposal field.

(iii) Water quality testing of selected water samples taken from points in the treatment process, including but not limited to; monitoring wells, surface streams or drainage ways, and pre-treatment devices. Water quality parameters to be analyzed may include total and fecal coliform, nitrate, biochemical oxygen demand (BOD), and total suspended solids.

(iv) Inspection and observation of pump operation and other mechanical equipment.

(v) General inspection of treatment and disposal areas for evidence of seepage, surfacing effluent, erosion or other indicators of malfunction.

(2) Monitoring inspections shall be performed at a frequency of once during every six (6) month period. Each six (6) month period is denoted as "winter season" and "summer season". Winter season shall mean between the months of November 1st and April 30th. Summer season shall mean between the months of May 1st and October 31st. The two (2) self-monitoring inspections shall be performed a minimum of ninety (90) days apart.

(3) Monitoring reports shall be submitted to the Department within 30 days of completion. All monitoring reports for the previous summer and winter seasons shall be submitted no later than December 1st of each year. All monitoring data shall be reported in the format established by the Department.

(4) In some cases, additional monitoring requirements and/or an increase in monitoring frequency may be required at the discretion of the Director of Environmental Management.

(5) For systems permitted prior to July 1, 2006 the above noted monitoring can be performed by the owner/operator (operating permit holder), or an approved Service Provider.

(H) COUNTY RESPONSIBILITIES:

(1) Data in the ASTS yearly status report will be used to evaluate the effectiveness of the monitoring program, assess the treatment technologies utilized, and to make regulatory and/or policy improvements, as needed, to protect water quality, public health, and the environment.

(2) All septic systems in the ASTS Monitoring Program are required to have a valid Operational Permit issued by the Department. Operational permits are valid for a period of one (1) year. If operated under the same ownership, the operating permit may be extended to a two (2) year permit after five (5) years of operation provided past inspections indicate performance, operation, monitoring, and maintenance of the ASTS has been satisfactory.

(3) The Department shall inspect all ASTS's included in the monitoring program that are not permitted with a an approved Service Provider at a frequency of once per calendar year, or in the case of two (2) year permits, once every two (2) calendar years. The Department may inspect the ASTS's in the monitoring program that are permitted with an approved Service Provider. Any inspection by the Department shall consist of an on-site evaluation of the system and written findings provided to the owner/operator.

(4) All inspections by the Department shall be pre-arranged with the property owner or Service Provider for gaining access to the property.

(5) A copy of the inspection reports shall be retained at the Department of Environmental Management for a period of not less than ten (10) years.

(6) The Department shall maintain a record keeping and tracking system to verify compliance with maintenance, operation, and monitoring requirements. The record keeping and tracking system shall including:
(i) System location including assessor's parcel number or some other distinctive identification number.
(ii) Type of System.
(iii) Date of final on the installation permit.
(iv) Owner of record.
(v) Written maintenance, operation, and monitoring requirements.
(vi) Results of maintenance and monitoring reports.

(7) Results from the ASTS Monitoring Program shall be recorded in the Alternative Sewage Treatment System yearly status report. This report shall include all relevant data for the prior year for all ASTS within the monitoring program and shall be available for public and RWQCB review by the first day of February.

(8) The monitoring status report shall include the number of operating permits issued, number of yearly inspections performed by the Department, number of inspections performed by a Service Provider, number of functioning, marginally functioning and not functioning ASTS's needing repair.

(9) Any ASTS documented to be failing or in need of repair shall be noted by system type only.

(10) Further inquiries pertaining to these systems shall be made according to established record review policy.

(I) NAPA COUNTY EVALUATION SYSTEM

The performance of the ASTS's as determined from annual inspections and self-monitoring reports shall be used as the basis for determining the operational level of each ASTS for reporting purposes. Each system shall be classified according to one of the following operational levels:

FUNCTIONING: Minor, insignificant, or no operational or maintenance problems
FUNCTIONING MARGINALLY: Operational problems or equipment malfunction
NOT FUNCTIONING: Significant operational problems or overt malfunction.

To be classified as FUNCTIONING the ASTS must be in good working order with components functioning as required. The dose counter or flow meter is working, design flows are not being exceeded, monitoring wells are in good condition, no groundwater is present in the monitoring wells within twenty-four (24) inches of the system installation depth, and the field evaluation reveals system to be in good physical condition. A system with minor problems in these areas may still be classified as functioning, however those minor problems must be repaired as needed and may require a follow up inspection.

To be classified as FUNCTIONING MARGINALLY the ASTS is in working order but shows signs of stress including excessive green growth, damp soil cover, groundwater at less than twenty four (24) inch separation (but greater than twelve (12) inches) to system installation depth, bacteriological analysis of a purged monitoring well twenty five (25) feet down gradient of the system reveals marginal treatment (e.g., >3000 MPN but <240,000 MPN total coliform with 2.2 MPN fecal bacteria), flow rates greater than design capacity, field visit that reveal general neglect of system with extensive restoration necessary to return installation to original condition, routine monitoring of system reveals chronic operational difficulties. A system classified as

"functioning marginally" will require specific repair and maintenance to be completed which will be verified at a follow up inspection.

To be classified as NOT FUNCTIONING the ASTS is failing to work properly such that the system is hydraulically overloaded almost to the point of sewage breakout or surfacing sewage is documented in the area of the septic and/or sump tank or in the area of the final effluent dispersal system. Not functioning includes high groundwater (within twelve (12) inches of system installation depth) in any well and/or bacteriological analysis of a purged monitoring well twenty five (25) feet down gradient of the system indicates a subsurface malfunction (>240,000 MPN total coliform and/or greater than 2.2 MPN fecal bacteria), field visit that reveals severe neglect of the system with failure imminent and/or overt malfunction likely to occur soon, bacteriological analysis performed revealing gross contamination (>240,000 MPN total coliform and/or the presence of fecal bacteria) in samples obtained from the ground surface. When the disposal system of an ASTS is identified as non-functioning and there is an immediate or imminent public health concern, the operator of the system will be placed on immediate pumping status such that no sewage effluent is allowed to the disposal field. The operator will be directed to contact a qualified professional (Engineer or REHS) to assist with a repair proposal. Failure to repair the system will result in further enforcement action, which may include legal action.

TABLE 1

SEPTIC TANK EFFLUENT (STE)

CONSTITUENT	CONCENTRATION (MG/L)
5-day Biochemical Oxygen Demand (BOD_5)	300
Total suspended solids (TSS)	350
Fats Oil and Grease (FOG)	125
Total Nitrogen (TN)	100

PRE-TREATED EFFLUENT (PTE)

CONSTITUENT	CONCENTRATION (MG/L)
5-day Biochemical Oxygen Demand (BOD_5)	30
Total suspended solids (TSS)	30
Total Nitrogen (TN)	As specified on a case by case basis by administrative authority

TABLE 2

SEWAGE DISPERSAL SYSTEM HYDRAULIC LOADING RATES (GAL/FT^2/DAY) BASED ON SOIL PROFILE

TEXTURE	STRUCTURE		Hydraulic loading (Gal/ft^2/day)	
	Shape	Grade	STE[1]	PTE[1,2]
Coarse sand, sand, loamy coarse sand	**Single grain**	**Structureless**	**1.0**	**1.2**
Fine Sand, loamy fine sand	**Single grain**	**Structureless**	**0.6**	**1.0**
Sandy Loam, Loamy Sand	**Massive**	**Structureless**	**0.35**	**0.5**
	Platy	**Weak**	**0.35**	**0.5**
	Prismatic, blocky, granular	**Weak**	**0.5**	**0.75**
		Moderate, strong	**0.8**	**1.0**
Loam, Silt Loam, Sandy Clay Loam, Fine Sandy Loam	**Massive**	**Structureless**		
	Platy	**Weak, mod, strong**		
	Prismatic, blocky, granular	**Weak, Moderate**	**0.5**	**0.75**
		Strong	**0.8**	**1.0**
Sandy clay, silty clay loam, Clay Loam	**Massive**	**Structureless**		
	Platy	**Weak, moderate, strong**		
	Prismatic, blocky, granular	**Weak, Moderate**	**0.35**	**0.5**
		Strong	**0.6**	**0.75**
Clay, silty clay	**Massive**	**Structureless**		
	Platy	**Weak, mod, strong**		
	Prismatic, blocky, granular	**Weak**		
		Moderate, strong	**0.2**	**0.25**

1: See Table 1
2: Higher hydraulic loading rates for pretreated effluent may only be used when pretreatment is **not** used for one foot of vertical separation credit

TABLE 3
SOIL HYDRAULIC LOADING RATES BASED ON PERCOLATION RATES

1-3 MPI = 1.2 GAL/FT^2/DAY	47 MPI = 0.437 GAL/FT^2/DAY
4 MPI = 1.143 GAL/FT^2/DAY	48 MPI = 0.430 GAL/FT^2/DAY
5 MPI = 1.086 GAL/FT^2/DAY	49 MPI = 0.423 GAL/FT^2/DAY
6 MPI = 1.029 GAL/FT^2/DAY	50 MPI = 0.417 GAL/FT^2/DAY
7 MPI = 0.971 GAL/FT^2/DAY	51 MPI = 0.410 GAL/FT^2/DAY
8 MPI = 0.914 GAL/FT^2/DAY	52 MPI = 0.403 GAL/FT^2/DAY
9 MPI = 0.857 GAL/FT^2/DAY	53 MPI = 0.397 GAL/FT^2/DAY
10 MPI = 0.800 GAL/FT^2/DAY	54 MPI = 0.390 GAL/FT^2/DAY
11 MPI = 0.786 GAL/FT^2/DAY	55 MPI = 0.383 GAL/FT^2/DAY
12 MPI = 0.771 GAL/FT^2/DAY	56 MPI = 0.377 GAL/FT^2/DAY
13 MPI = 0.757 GAL/FT^2/DAY	57 MPI = 0.370 GAL/FT^2/DAY
14 MPI = 0.743 GAL/FT^2/DAY	58 MPI = 0.363 GAL/FT^2/DAY
15 MPI = 0.729 GAL/FT^2/DAY	59 MPI = 0.357 GAL/FT^2/DAY
16 MPI = 0.714 GAL/FT^2/DAY	60 MPI = 0.350 GAL/FT^2/DAY
17 MPI = 0.700 GAL/FT^2/DAY	61 MPI = 0.345 GAL/FT^2/DAY
18 MPI = 0.686 GAL/FT^2/DAY	62 MPI = 0.340 GAL/FT^2/DAY
19 MPI = 0.671 GAL/FT^2/DAY	63 MPI = 0.335 GAL/FT^2/DAY
20 MPI = 0.657 GAL/FT^2/DAY	64 MPI = 0.330 GAL/FT^2/DAY
21 MPI = 0.643 GAL/FT^2/DAY	65 MPI = 0.325 GAL/FT^2/DAY
22 MPI = 0.629 GAL/FT^2/DAY	66 MPI = 0.320 GAL/FT^2/DAY
23 MPI = 0.614 GAL/FT^2/DAY	67 MPI = 0.315 GAL/FT^2/DAY
24 MPI = 0.600 GAL/FT^2/DAY	68 MPI = 0.310 GAL/FT^2/DAY
25 MPI = 0.593 GAL/FT^2/DAY	69 MPI = 0.305 GAL/FT^2/DAY
26 MPI = 0.587 GAL/FT^2/DAY	70 MPI = 0.300 GAL/FT^2/DAY
27 MPI = 0.580 GAL/FT^2/DAY	71 MPI = 0.295 GAL/FT^2/DAY
28 MPI = 0.573 GAL/FT^2/DAY	72 MPI = 0.290 GAL/FT^2/DAY
29 MPI = 0.567 GAL/FT^2/DAY	73 MPI = 0.285 GAL/FT^2/DAY
30 MPI = 0.560 GAL/FT^2/DAY	74 MPI = 0.280 GAL/FT^2/DAY
31 MPI = 0.553 GAL/FT^2/DAY	75 MPI = 0.275 GAL/FT^2/DAY
32 MPI = 0.545 GAL/FT^2/DAY	76 MPI = 0.270 GAL/FT^2/DAY
33 MPI = 0.538 GAL/FT^2/DAY	77 MPI = 0.265 GAL/FT^2/DAY
34 MPI = 0.531 GAL/FT^2/DAY	78 MPI = 0.260 GAL/FT^2/DAY
35 MPI = 0.523 GAL/FT^2/DAY	79 MPI = 0.255 GAL/FT^2/DAY
36 MPI = 0.516 GAL/FT^2/DAY	80 MPI = 0.250 GAL/FT^2/DAY
37 MPI = 0.509 GAL/FT^2/DAY	81 MPI = 0.245 GAL/FT^2/DAY
38 MPI = 0.501 GAL/FT^2/DAY	82 MPI = 0.240 GAL/FT^2/DAY
39 MPI = 0.494 GAL/FT^2/DAY	83 MPI = 0.235 GAL/FT^2/DAY
40 MPI = 0.487 GAL/FT^2/DAY	84 MPI = 0.230 GAL/FT^2/DAY
41 MPI = 0.479 GAL/FT^2/DAY	85 MPI = 0.225 GAL/FT^2/DAY
42 MPI = 0.472 GAL/FT^2/DAY	86 MPI = 0.220 GAL/FT^2/DAY
43 MPI = 0.465 GAL/FT^2/DAY	87 MPI = 0.215 GAL/FT^2/DAY
44 MPI = 0.457 GAL/FT^2/DAY	88 MPI = 0.210 GAL/FT^2/DAY
45 MPI = 0.450 GAL/FT^2/DAY	89 MPI = 0.205 GAL/FT^2/DAY
46 MPI = 0.443 GAL/FT^2/DAY	90+ MPI = 0.200 GAL/FT^2/DAY

TABLE 4

TYPE OF OCCUPANCY	GALLONS PER DAY
Airports	**5 per passenger**
Campgrounds: **Campground with central comfort station** **Campground with flush toilet, no showers** **Day Camps (no meals)** **Luxury Camp, private bath** **Summer and seasonal**	 **35 per person** **25 per person** **15 per person** **100 per person** **50 per person**
Churches (sanctuary) **With kitchen wastes**	**5 per seat** **7 per seat**
Country Club	**125 per person**
Factories	**35 per person per shift**
Hospitals **Kitchen waste only** **Laundry waste only**	**250 per bed space** **25 per bed** **40 per bed**
Hotels/Motels with private bathroom (no kitchen waste) **Hotels/Motels without private bathroom (no kitchen waste)** **Hotel/Motel with private bath and kitchen**	**60 per two person room** **50 per two person room** **75 gallons per person**
Institutions other than hospitals	**125 per bed space**
Movie Theaters	**5 per seat**
Offices	**20 per employee**
Picnic parks with toilets and showers **Picnic parks with toilet waste only**	**10 per person** **5 per person**
Resort camps with limited plumbing	**50 gallons per person**
Restaurants: **Kitchen waste (multi-use utensils)** **Kitchen waste (disposable utensils)** **And add the following for type of facility present:** **Conventional sit down** **Short Order** **Bar and Cocktail**	 **5 per meal served** **3 per meal served** **10 per person** **8 per person** **3 per person**
School (non-boarding **With gym and showers add** **With cafeteria using disposable utensils**	**20 per student** **5 per student** **3 per meal served**
Self service laundries	**50 gallons per wash**
Service station	**10 gallons per vehicle served**
Retail stores **For public restrooms add**	**20 per employee** **1 per 10 square feet**
Swimming pools and bathhouses	**10 per person**
Tourist camps or mobile home parks with individual bath units **Tourist camps or trailer parks with central bathhouse**	**100 per person** **75 per person**
Work or construction camps (semi-permanent)	**50 per person**
Wine tasting facility (no meals served)	**3 per person**
Employee	**15 per employee**

TABLE 5

SLOPE	TRENCH SPACING (MINIMUM)
0-5%	5 feet
6-10%	8 feet
11-20%	12 feet
21-30%	16 feet

TABLE 6

SAND FILL MEDIA SPECIFICATIONS FOR MOUNDS	
Sieve Size	Percent passing
#3/8	100%
#4	95-100%
#8	80-100%
#16	50-85%
#30	25-60%
#50	10-30%
#100	2-10%
#200	0-5%

TABLE 7

Linear Loading Rates Based on Limiting Conditions			
Nature of Limiting Condition	**Linear Loading Rate Range (gpd/linear ft)**		
	Conservative Value		**Space-Limited Value**
Solid bedrock	3	to	4
Impermeable soil layer	3	to	4
Seasonal high water table	3	to	4
Semi-permeable soil layer	5	to	6
Fractured compacted till	5	to	6
Creviced or fractured bedrock	8	to	10
Sand and/or gravel layer	8	to	10

TABLE 8

DOWN SLOPE AND UP SLOPE CORRECTION FACTORS		
Slope (%)	Down Slope Correction Factor	Up Slope Correction Factor
0	1.0	1.00
1	1.03	0.97
2	1.06	0.94
3	1.10	0.92
4	1.14	0.89
5	1.18	0.88
6	1.22	0.85
7	1.27	0.83
8	1.32	0.80
9	1.38	0.79
10	1.44	0.77
11	1.51	0.75
12	1.57	0.73
13	1.64	0.72
14	1.72	0.71
15	1.82	0.69
16	1.92	0.68
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.50	0.62
21	2.70	0.61
22	2.94	0.60
23	3.23	0.59
24	3.57	0.58
25	4.00	0.57

TABLE 9

DOWNHILL SOIL COVER REQUIREMENTS (TOE WIDTH)	
Slope	Cover (lineal feet beyond sand/gravel)
0-2%	4
2-4%	6
4-6%	8
6-8%	10
8-12%	12
12-16%	16
>16%	20

TABLE 10

MINIMUM SURFACE AREA GUIDELINES TO DISPOSE OF 100 GPD OF SECONDARY TREATED EFFLUENT FOR SUBSURFACE DRIP DISPERSAL SYSTEMS

		Soil Absorption Rates		Design Hydraulic Loading Rate gal. /sq. ft. per day	Total Area Required Sq. ft. /100 gallons per day
Soil Class	Soil Type	Est. Soil Perc. Rate minutes/in.	Hydraulic Conductivity inches/hr.		
I	Coarse sand	1-5	>2	1.400	71.5
I	Fine sand	5 - 10	1.5 - 2	1.200	83.3
II	Sandy loam	10 - 20	1.0 - 1.5	1.000	100.0
II	loam	20 - 30	0.75 - 1.0	0.700	143.0
III	Clay loam	30 – 45	0.5 - 0.75	0.600	167.0
III	Silt - clay loam	45 - 60	0.3 - 0.5	0.400	250.0
IV	Clay non-swell	60 - 90	0.2 - 0.3	0.200	500.0
IV	Clay - swell	90 - 120	0.1 - 0.2	0.100	1000.0

1. *For design purpose, the "Soil Type" category to be used in the above table shall be based on the most restrictive soil type encountered within two feet below the bottom of the dripline*
2. *Dispersal field area calculation:*
   Total square feet area of dispersal field = Design flow divided by loading rate

TABLE 11

	Sand Specifications for Intermittent Sand Filters	**Sand Specifications for Recirculating Sand Filters**
Sieve Size	**Percent Passing**	
#3/8	100	100
#4	95-100	70-100
#8	80-100	5-78
#16	45-85	0-4
#30	15-60	0-2
#50	3-10	0-1
#100	0-2	0-1
#200	0-1	0-1

Intermittent Sand Filters:
Effective size and uniformity:
$D_{10} > 0.3\text{-}0.5$ mm
Cu = 1-4

Recirculating Sand Filters:
Effective size and uniformity
$D_{10} > 1.5\text{-}2.5$ mm
Cu = 1-3

APPENDIX 2

FIGURES