

**STATE OF NEW MEXICO**  
**ENVIRONMENT DEPARTMENT**  
**ENVIRONMENTAL HEALTH DIVISION**

**LIQUID WASTE PROGRAM**

**TECHNICAL INFORMATION GUIDANCE 1:** Alternative Technologies to a Conventional Treatment System

**I. PURPOSE**

Many sites in New Mexico are not suitable for disposal of wastewater by a conventional on-site liquid waste system due to restrictive site conditions. The 2005 New Mexico Liquid Waste Treatment and Disposal Regulations (20.7.3 NMAC) recognized and identified site conditions that prevent the use of the standard conventional treatment system, i.e., the standard septic tank and gravity drainfield. The Regulations set performance treatment standards that need to be achieved to overcome some of these limiting site conditions. The Regulations include alternative designs and technologies that could be used to overcome these same site conditions without requiring the installation of an advanced treatment unit. In addition to these identified alternatives, other treatment or disposal alternatives also exist that may be used.

The purpose of this document is to describe selected alternative technologies and how they are used with respect to different site conditions. It should be noted there is **NO** one system that can cover every situation. Site conditions and other factors need to be taken into account to tailor fit an alternative system to a lot. This document is intended to raise consumer awareness and is not to be used as design guidance. It is important to realize not every installer is qualified to install every system discussed.

**II. APPLICABILITY**

This guidance document deals with treatment technologies and disposal options that can be used to overcome restrictive site conditions.

**III. GENERAL**

While there are numerous approved advanced treatment units that will treat liquid waste to a level acceptable to overcome restrictive site conditions, there are also industry-recognized, passive systems or simple pump systems that can be used in lieu of these more mechanical systems. It is important to understand alternative systems frequently require an increased depth of understanding. Mechanical complexity is replaced by a simpler system that may be more difficult to design and construct.

**IV. GUIDANCE STATEMENT**

The following technologies are classified into two groups, alternative treatment units and alternative disposal methods. The use of any of these technologies must meet the requirements of the Liquid Waste Regulations, including maintenance and monitoring requirements, if applicable. Design criteria are readily available and can be found published in various technical manuals and on the Internet. The applicant/installer is responsible for verifying the quality of the design guidance used in a specific project. This list is in no way exhaustive of the technologies available.

**A.** The following are some available alternative disposal options for dealing with restrictive site conditions.

### **1. Evapotranspiration Beds**

An evapotranspiration bed (ET bed) is a system that disposes of water by combining plant uptake, transpiration, and evaporation of water. An ET bed is normally underlain by a liner and creates a system that is completely contained and allows no discharge to the surrounding soils or water table. The bed is backfilled with sand and small gravel, the bed then crowned with appropriate soil to facilitate run-off, then planted with various grasses to blend back with the surrounding terrain or yard. A standard septic tank is used to collect solids prior to the water being distributed in the bed. The bed is odorless and requires no special maintenance other than occasional septic tank pumping and mowing the grass. These beds can be used on small substandard lot situations in lieu of a nitrogen-removing system, clearance to bedrock and water table situations, and may also be used in restrictive clay soils without a liner. These systems are also used when setback requirements to wells and watercourses cannot be met. Limitations for use include steep slopes, very small lots and very high elevations above 9000 ft. These systems must also be designed to protect the system from excessive runoff and flooding.

Section 605E of the Liquid Waste Regulations allows for the use of ET systems in lieu of advanced treatment and discharge to the soil. Construction and other requirements are found in Section 806 of the Liquid Waste Regulations. Additional design criteria are found in the EPA Design Manual (the 'purple manual') and the 1980's New Mexico Environment Department Technical Manual Series. This system can not be used with high strength waste if it is to remain odor free and not experience biomat plugging in the evaporative layer.

### **2. Tennessee Valley Authority Constructed Wetlands.**

This constructed wetlands treats wastewater through natural water quality improvement processes (physical, chemical, and biological) that occur in natural wetlands. The Tennessee Valley Authority developed and perfected these constructed wetlands for use on small discharges under 10,000 gpd down to single residences to be used in poor site conditions such as poor percolation, shallow soils, high groundwater table and Karst terrain. On a single residence, this system consists of a standard septic tank to remove solids, a single lined gravel cell with cattails to treat the water and a second overflow gravel/sand cell without a liner that absorbs into the

ground. The two cell design also lends itself to be useful on steep slopes where they can be terraced. This system is also easily expanded to three or more cells if needed to accommodate additional flow. These systems are aesthetically pleasing to look at and as mentioned before they can be installed in a variety of situations. They **may not**, however be used to overcome inadequate lot size. The Nitrogen removal from these has not been fully demonstrated. The only maintenance required is occasional septic tank pumping and cutting or burning the cattails after they die off in the winter months. The cattails are perennial and will grow back rapidly as warmer weather returns. As with any onsite liquid waste system, the wetlands cell must be protected from flooding. Design manuals are available from the New Mexico Environment Department.

### 3. Mound Systems

A mound system is a widely recognized alternative disposal system that is essentially composed of a raised drainfield with specified sand added under the drainfield and then covered and landscaped with grasses. Mound system designs require the use of a pump to provide lift to the mound and to provide equalized distribution of the water. A standard septic tank is used to collect solids before the water is distributed. Mound systems are used for site conditions that include shallow soils, inadequate percolation rates, shallow ground water table, and karst terrain. Mound systems are not practical when used on excessive slopes and **may not** be used for inadequate lot sizes. Mound systems are not considered to be nitrogen-removing systems. Maintenance for sand mound systems includes occasional pumping of the septic tank, pump replacement, and maintaining healthy vegetation (grasses) on the mound to prevent erosion.

Section 605F of the Liquid Waste Regulations allow for the use of a mound system to overcome clearance limitations or soil types. Construction and other requirements are found in Section 807 of the Liquid Waste Regulations. Mounds are required to be constructed in accordance with the most current design standards of the Wisconsin mound design. The Wisconsin Design Manual can be downloaded from the Internet at: [http://www.soils.wisc.edu/sswmp/SSWMP\\_15.24.pdf](http://www.soils.wisc.edu/sswmp/SSWMP_15.24.pdf), Publication 15.24. Workmanship is critical on a mound especially when used to overcome soil percolation rates. Any driving on the soil mound interface can do permanent damage to the interfaces ability to take water.

### 4. Elevated Drainfields and At-grade Systems

Elevated drainfields and at-grade systems are conventional drainfields built slightly below, at or above ground level. All of the same conventional drainfield materials are used in construction. Elevated drainfields are typically installed when insufficient soil depth for a standard drainfield occurs but enough suitable soil is present so a true mound would not be required. Sizing criteria is based on the conventional system square footage requirements. Proper preparation of the ground surface is critical for proper functioning. These drainfields are typically gravity fed, however, a pump may be necessary in some cases to lift water to the drainfield. Suitable soils must be used to cap over the top of the drainfield and vegetation maintained to prevent erosion.

The Liquid Waste Regulations address elevated drainfields or at-grade systems in Section 807, and in addition, standardized design criteria are found in design manuals and on-line.

## **5. Alternating Drainfields and Alternating beds**

Alternating drainfields and beds are among some of the earliest technology from the U.S. Public Health Codes. These systems are comprised of a standard septic tank and two or more disposal areas that the wastewater may be rotated to by means of a simple valve. This gives the opportunity for one area to rest and the biomat to biodegrade allowing for rejuvenation of the infiltrative surfaces and extension of the life of the disposal system. This also provides a back up system in case of leach field failure due to hydraulic overloading. These systems are used primarily to overcome soils with restrictive percolation rates, such as clay or caliche. In this application, the alternating between drainfields is done on a more frequent basis. The frequent alternating of drainfields allows the water to disperse out of the drainfield while the other drainfield is being loaded. These systems are generally used with primary treatment and are not intended to overcome lot size requirements. However, this type of disposal can be incorporated into almost any treatment technology.

The Liquid Waste Regulations do not specifically address alternating drainfield and alternating bed design. Each of the two drainfields must meet the design criteria for a single drainfield and each must be sized to meet the full design flow of the site they serve.

## **6. Split Flow System**

Split Flow systems are a combination discharging/non-discharging system that separates the toilet waste from the rest of the waste stream. The toilet waste, containing approximately 80% of the total nitrogen load, is directed to a holding vault that must be removed by a septage pumping service. The remaining waste is typically discharged to a conventional septic system. This portion of the waste stream is **NOT** considered graywater because it contains kitchen waste, which is defined as blackwater. While this system may be used to overcome lot size limitations, it cannot be used to overcome inadequate soil depth or clearance to groundwater. Also, it is not always a viable alternative because of the lack of septic tank pumping services and disposal sites in some rural areas. In addition, the ongoing cost associated with pumping the holding tank can become prohibitive.

Section 809 of the Liquid Waste Regulations details the holding tank requirements for this system. The discharging portion of the system is sized and constructed in accordance with Sections 701-703 of the Liquid Waste Regulations.

## **7. Low Pressure Dosed Disposal**

When soil conditions are not suited to deal with the volume of effluent from a conventional disposal system, a low pressure dosed disposal system (LPD) may be an alternative choice. The LPD system differs from a conventional disposal system by using a dosing chamber and a network of small diameter distribution pipes. The distribution pipes can be installed in a conventional configured trench or in shallow, narrow trenches. The septic tank effluent is pumped through the LPD system in controlled doses to insure uniform distribution throughout the entire absorption area. Uniform distribution minimizes problems from the clogging of the biomat. This is beneficial in both fast soils, like coarse sands where the biomat may not form adequately and slow soils, like clays where the biomat may become too restrictive. Also, the shallow placement and uniform distribution allows for the effective use of the upper soil horizons.

The LPD system consists of a standard treatment unit followed by a pump tank. The pump tank is equipped with a control panel with a high level water alarm. The pump tank should be adequately sized to hold all surge flows, thus allowing a uniform distribution of the effluent over a 24 hour period. Regular inspection of the dosing tank is recommended.

Section 808 of the Liquid Waste Regulations contain the low pressure dosed disposal system requirements.

## **8. Subsurface Drip Disposal**

Subsurface drip disposal can be considered a modification to the low pressure dosed system discussed above. Instead of a pressurized distribution pipe installed in a trench, the subsurface drip disposal is installed directly into the soil and with a dosing volume much reduced from the LPD system. The dosing can be considered micro-dose. This system doses the water into the soil at a shallow level, at a very slow rate, and equally with very small amounts of water at numerous dosing points. Because the disposal is accomplished through very small emitters, adequate pretreatment to the manufacturer's recommendation must be used. In most cases, secondary treatment is required.

Subsurface drip disposal is useful for slow soils such as clay and for installation on steep slopes where a conventional trench would be difficult to install.

Routine maintenance is necessary to ensure the proper functioning of these systems. The pumps and the control system must be in reliable working order and the treatment unit maintained to provide the necessary level of treatment.

**B.** The following are alternative treatment technologies used to overcome restrictive site conditions. Some of these systems have been installed in areas prior to the formulation of the performance measures now found in the Liquid Waste Regulations. However, upon enactment

of the current regulations, these treatment systems are regulated the same as any other treatment unit permitted to overcome a restrictive site condition. That is, a specific level of performance shall be achieved, this performance level shall be verified through effluent testing and an appropriate operation and maintenance agreement shall be in place. This is consistent with the requirements found in Sections 601, 901, and 902B of the Liquid Waste Regulations.

## **1. Intermittent Single Pass Sand Filters**

Intermittent single pass sand filters continue to be one of the most under utilized technologies available for wastewater disposal and yet this system is one of the easiest to install and maintain. Sand filters are one of the oldest treatment technologies and one of the most studied.

The typical sand filter is essentially a box with sand. It may be above ground, partially buried or totally below ground. Sand filters must have the septic tank effluent uniformly dosed to maintain optimum treatment conditions. Sand filters can be open bottomed or have a collection system to direct effluent to a drainfield or other form of disposal. However, with the open bottomed unit, it is difficult to assess performance and buried filters are difficult to maintain.

An intermittent single pass filter system is not nitrogen removing and therefore **may not** be used to overcome inadequate lot size. Recirculating sand filters with recycle to the head of the septic tank can be used for nitrogen control, but these are a form of advanced treatment that requires specific design. Maintenance for subsurface sand filters may vary from something as simple as occasional septic tank pumping to replacement of the top layers of sand in the bed or box design. The drain fields would be maintained like any other conventional drainfield. Design criteria are readily available and can be found in the EPA Design Manual (the 'purple manual') and many other sources.

Documentation of all design criteria and relevant parameters used must accompany permit applications. Monitoring before discharge to soil, to verify performance to secondary treatment standards in conformance with Section 602 of the Liquid Waste Regulations, is required for systems installed on sites with limitations requiring this level of treatment.

## **2. Aerobic Treatment Unit**

Aerobic treatment units (ATU) are self contained treatment units that provide an aerobic environment for the enhanced treatment of the wastewater. The two processes commonly utilized are (1) suspended growth, where the bacteria providing treatment are suspended in the wastewater, and (2) fixed growth, where the bacteria are attached to some sort of media. Each system has its own unique operational and design requirements, but all incorporate a means to provide added oxygen to the wastewater, intimate contact between the bacteria and the wastewater, and some means of solid separation from the treated effluent.

The typical system usually consists of: a trash tank or compartment; an aeration tank or compartment; an oxygen source, usually an air pump and diffuser system but could be a simple mechanical mixer; and a clarifying compartment or zone to separate the solids from the effluent.

ATU's are generally designed to meet secondary treatment standards of 20 mg/l of BOD and TSS. Some units are designed for nitrogen reduction, with recirculation of the effluent being the usual method for nitrogen reduction.

Documentation of all design criteria and relevant parameters used must accompany permit applications. All ATU's installed must be approved by the Department after a review by the Wastewater Technical Advisory Committee. Monitoring before discharge to soil, to verify the required performance level as required by the Liquid Waste Regulations, is required for systems installed on sites with limiting conditions.

### **3. Fixed-Film Process Unit/Trickling Filter/Packed Bed Filter**

This type of treatment unit is a modernized sand filter employing a different media other than sand. Media used are peat, plastic shapes of various configurations, foam cubes and hanging cloth sheets.

These units consists of a septic tank, a dosing pump, a tank for the media usually with spray heads to distribute the waste over the media, and a clarifier tank or compartment to separate any solids that slough off the media.

With controlled dosing of the media, aerobic conditions are maintained in the media bed and biomass forms through out the media. These units can meet secondary standards utilizing a single pass mode and can meet tertiary standards with recirculation of the effluent back through the system.

Documentation of all design criteria and relevant parameters used must accompany permit applications. All units installed must be approved by the Department after a review by the Wastewater Technical Advisory Committee. Monitoring before discharge to soil, to verify the required performance level as required by the Liquid Waste Regulations, is required for systems installed on sites with limiting conditions.