APPENDIX 5

SOIL DRAINAGE IMPROVEMENT PRACTICES

The Department shall have the authority to require soil drainage improvement practices on any lot served by subsurface sewage disposal systems.

A. Designation of Soil Drainage Improvement Practices

Soil drainage improvement practices shall be required on sites as prescribed by a soil map of said site or by an evaluation of said site by a Department Soil Scientist *(See Appendix 1)*. Further, all sites served by an alternative subsurface sewage disposal system shall require the use of a drain (i.e., curtain drain, interceptor drain, and/or draw-down drain or a combination of the aforementioned drainage improvements) as specified by the Department, unless it is determined by a licensed soil scientist (either Department staff soil scientist or private licensed soil scientist) that said alternative system will not be adversely impacted by surface or subsurface waters due to the specific soil and site (i.e., landscape position, topography, etc.) conditions present on the property. Said determination shall be justified in writing on an individual case-by-case basis. Ground surface berms or swales shall not be considered, in lieu of drains, for the aforementioned sites.

Important Note: All soil drainage improvement practices shall be considered as part of the subsurface sewage disposal system and shall be subject to inspection by the department in accordance with the provisions outlined in *Section 20*.

B. Soil Drainage Improvement Practices Approved for Use

The concept of soil drainage improvement practices deals with modification of the drainage characteristics of a site. Drainage modification, as utilized in Williamson County, is concerned with all factors related to the hydraulic nature (both surface and subsurface) of a platted or designated subsurface sewage disposal system site. Site drainage modification may involve the diversion of surface water, and/or the removal and diversion of subsurface water. The following soil drainage improvement practices, approved for use in Williamson County, include but shall not be limited to:

1. Surface Water Diversion

This aspect of drainage is concerned with one goal: the redirection of water moving along the ground surface. Thus, any approach used for this purpose would involve the creation of a channel to collect and reroute the course of water flow over the ground surface away from the platted or designated subsurface sewage disposal system disposal field area. The most commonly used methods of directing runoff away from said areas is by the use of the following:

(a) Berm

Berms are typically specified for use on sites with gentle slopes where small volumes of surface water, at lower flows, are anticipated. Constructed from imported soil material placed directly on top of the natural ground surface, a berm is designed to divert water around and away from the disposal field area. The junction of the up-slope side of the berm with the natural ground surface creates a small channel to collect and direct the water. Where required, the Department shall specify the berm location and dimensions.

Depending upon site conditions, the use of berms may be required in conjunction with the use of one or more of the other soil drainage improvement practice(s). Under no circumstances shall ground surface berms be considered in lieu of any type of required subsurface drainage improvement practice.

(b) V-Ditch

V-Ditches are excavated channels typically used on sites with medium slopes where medium runoff volumes and flows are anticipated. These channels are designed and constructed to collect and divert water around and away from the disposal field area. Where required, the Department shall specify the V-ditch location and dimensions.

Depending upon site conditions, the use of V-ditches may be required in conjunction with the use of one or more of the other soil drainage improvement practice(s). Under no circumstances shall ground surface V-ditches be considered in lieu of any type of required subsurface drainage improvement practice.

(c) Terrace

Broadbase or channel-type terraces may be thought of as a combination of a V-ditch with a berm on the downslope side of the channel. The combination of these two drainage techniques results in a more effective surface water diversion method, capable of handling a wider range of runoff volumes and flows. Where required, the Department shall specify the terrace location and dimensions.

Depending upon site conditions, the use of terraces may be required in conjunction with the use of one or more of the other soil drainage improvement practice(s). Under no circumstances shall ground surface terraces be considered in lieu of any type of required subsurface drainage improvement practice.

2. Subsurface Water Drainage and Diversion

Subsurface water drainage and diversion involves two different approaches to two different groundwater movement scenarios. Either the subsurface water is moving laterally, downgradient along a subsurface restrictive layer or vertically, upwards into the upper thirty-six (36) inches of the soil profile of the platted or designated areas for subsurface sewage disposal system utilization.

In order to drain and divert the lateral or vertical movement of groundwater, a path shall be provided to intercept or collect the water and carry it away from the disposal field area. The path created for the subsurface water to follow is a trench filled with gravel excavated to a depth where it intersects with a blocking layer in the lower soil profile. The trench thus becomes the conduit for the water to move to the outlet provided.

There are three (3) methods, approved by the Department, to drain and divert subsurface water from a site. They are interceptor drains, curtain drains and drawdown drains. Interceptor and curtain drains are used to collect and divert laterally moving groundwater, while drawdown drains are used to collect and divert vertically moving groundwater.

(a) Interceptor Drain

Interceptor drains are designed to intercept and divert laterally moving groundwater flow around the area to be protected. The interceptor drain contains an impermeable barrier placed on the downslope wall of the trench and along the trench bottom. This impermeable barrier acts to intercept the laterally moving subsurface water, preventing it from proceeding on its downslope course and diverting it away from the subsurface sewage disposal system disposal field area. This impervious barrier is the only main element that differentiates it (and a curtain drain) from a drawdown drain. See Figures A1-10, A1-11 in *Appendix 1* and Figure A14-8 in *Appendix 14* for examples of typical cross sectional views of interceptor drains.

The configuration of this drain is the main difference between an interceptor and a curtain drain. An interceptor drain is only located at the highest elevation of the disposal field area, above the initial or first field line, and parallel to the disposal field trenches. It does not wrap around (or horseshoe) the sides of the disposal field or extend downslope, perpendicular to the disposal field trenches. See Figure A14-9 in *Appendix 14* for an example of a typical plan view of an interceptor drain. However, the interceptor drain shall still be configured in such a manner so as to protect all of the primary disposal field area and the platted or designated backup or duplicate sewage disposal field areas.

The interceptor drain shall be installed deep enough so as to intercept all interfering (or potentially interfering) groundwater, divert said groundwater and discharge it to a positive outlet away from the disposal field area or areas. The required minimum depth will be determined either by the depth of the restrictive layer, the depth of the disposal field lines or the depth needed to lower the high water table. Additionally, the drain shall conduct the intercepted water via gravity flow to a positive outlet or discharge point.

Depending upon site conditions, the use of interceptor drains may be required in conjunction with the use of one or more of the other soil drainage improvement practice(s).

(b) Curtain Drain

Curtain drains derive their name from their layout configuration. A curtain drain is an expanded version of an interceptor drain. The curtain drain is designed so as to wrap around (or curtain) the disposal field area on more than one side (i.e., it horseshoes the area), thus providing an additional degree of protection and drainage to a disposal field area.

Curtain drains are identical to interceptor drains except for their layout configuration, which includes an extension of those portions of the drain (i.e. the trench bottom of the drain) that is excavated to minimum required depth before it is allowed to proceed to its required positive outlet. Whereas an interceptor drain only protects the designated area(s) on the upslope side, a curtain drain wraps around the side(s) of the disposal field and extends downslope, perpendicular to the field line trenches. See Figures A1-10 and A1-11 in *Appendix 1* for an examples of typical plan views of curtain drains.

Other than the above-mentioned difference, curtain drains must conform to all provisions outlined in *Subpart (a) of Part 2*.

Depending upon site conditions, the use of curtain drains may be required in conjunction with the use of one or more of the other soil drainage improvement practice(s).

(c) Drawdown Drain

Drawdown drains are designed to lower a localized water table found in an area platted or designated for SSDS use. Drawdown drains are typically specified for use on sites with little or no slope and are configured so as to either completely encircle or to horseshoe the disposal field. The configuration and depth of the drain is designed to create a meniscus effect on the horizontal profile of the top of the water table; thus, lowering the uppermost vertical level of the water table to allow the disposal field to function properly without being inundated. See Figure A1-12A in *Appendix 1* for an example of a typical plan view of a drawdown drain.

Drawdown drains differ from interceptor drains and curtain drains in that their trenches do not contain an impermeable barrier placed on the downslope wall of the trench and along the trench bottom to block the lateral movement of subsurface water. It has an open interface between the gravel and the trench walls (side walls and bottom) to allow free movement of groundwater into the gravel from all sides of the trench. See Figure A1-12B in *Appendix 1* for an example of a typical cross sectional view of a drawdown drain.

The required minimum depth shall be determined either by the depth of the restrictive layer, the depth of the disposal field lines or the depth needed to lower the high water table. Additionally, the drain shall conduct the collected water via gravity flow to a positive outlet or discharge point.

Depending upon site conditions, the use of drawdown drains may be required in conjunction with the use of one or more of the other soil drainage improvement practice(s). For example, in situations where the Department would require the use of a combination interceptor drain and drawdown drain to achieve the required drainage improvement results for a disposal field area site, the placement of the interceptor drain above a disposal field area would be specified so as to intercept water moving downgradient onto the site, while the placement of a drawdown drain would be specified so as to collect and drain water from the base of the slope.

C. Design of Soil Drainage Improvement Practices

1. Berms

Berms shall be designed such that the junction of the up-slope side of the berm with the natural ground surface creates a small channel to collect and direct the water. Placed ten (10) to fifteen (15) feet up-slope of the highest (first) disposal field trench, the berm shall be a minimum of eight (8) to ten (10) inches high with a base of three (3) to six (6) feet wide. See Figure A1-9 in *Appendix 1* for a general conceptual view of a berm. Further, the berm shall be continuous and extend to a length, specified by the Department, so as to ensure adequate protection of the entire disposal field area. Where required, the Department shall specify the berm location and dimensions.

2. V-Ditch

V-Ditches shall be designed so as to create a channel a minimum of fifteen (15) feet up-slope of the highest (first) disposal field trench. The channel shall be a minimum of eight (8) to twelve (12) inches deep at its center and ten (10) to twenty (20) feet wide. See Figure A1-9 in *Appendix 1* for a general conceptual view of a V-ditch. Further, the V-ditch shall be continuous and extend to a length, specified by the Department, so as to ensure adequate protection of the entire disposal field area. The grade on the V-ditch shall be six (6) to twelve (12) inches of fall per one hundred (100) linear feet, so as to minimized silt accumulation. Where required, the Department shall specify the V-ditch location and dimensions.

3. Terrace

For design purposes, the cross section of a broad-base terrace can be considered as a triangular channel (similar to a V-ditch). After smoothing during the construction phase, the terrace will resemble that of Figure A1-9 in *Appendix 1*. The primary purpose of this type of terrace is to intercept and conduct the runoff away from the sewage disposal area to a safe outlet at a non-erosive velocity.

Placed a minimum of fifteen (15) feet up-slope of the highest (first) disposal field trench, the terrace channel shall be a minimum of four (4) to eight (8) inches deep and a minimum of three (3) to six (6) feet wide. The grade on the terrace channel shall be the same as that of a V-ditch. The associated berm, constructed from the excavated channel spoils, shall be a minimum of four (4) to eight (8) inches high with a base of three (3) to six (6) feet wide. See Figure A1-9 in *Appendix 1* for a general conceptual view of a terrace.

Further, the terrace shall be continuous and extend to a length, specified by the Department, so as to ensure adequate protection of the entire disposal field area. Where required, the Department shall specify the terrace location and dimensions.

4. Interceptor Drain

Interceptor drains shall be designed and constructed so as to intercept and divert laterally moving groundwater flow around the disposal field area. Placed a minimum of ten (10) feet from the disposal field trenches *(See Section 13)*, the interceptor drain trench shall be designed at a minimum of eighteen (18) inches wide and excavated to the minimum depth as dictated by the soils map or by a Department Soil Scientist. The design shall configure the interceptor drain in accordance with the provisions as outlined in *Subsection B, Part 2 (a)* of this Appendix.

The design shall be such that the excavated trench bottom maintains the required minimum depth (plus fall at six [6] inches per one hundred [100] linear feet) a minimum distance of ten (10) feet past the disposal field area. This portion of the drain shall contain the impermeable barrier and required gravel. Once this requirement has been met, the drain shall then be extended to the designated and/or approved positive outlet.

On a site where the distance from the end(s) of the drain proper (i.e. that portion of the drain, specified by the Department as requiring the placement of the impermeable barrier and gravel media) to the point of the required positive outlet, exceeds twenty-five (25) feet, that remaining portion of the drain may be designed and constructed, with approval from the Department, as a tight-line (i.e. trench contains no plastic and no gravel). Where the distance between the drain proper and the point of the required positive outlet is less than twenty-five (25) feet, this portion of said drain shall continue with the placement of the impermeable barrier (i.e. plastic) and gravel media. The tight-line trench shall be in accordance with all aforementioned slope and gradient specifications. Said tight-line shall consist of a solid pipe, of a type and diameter as specified in *Appendix 12*, shall extend to the positive outlet of the drain and shall have an outlet end pipe installed in accordance with the provisions of this Appendix.

The drain shall be designed so as to provide gravity flow of the collected water to a positive outlet or discharge point. Thus, the collection line (and any tight-line) must be designed with a downgrade. Where the natural ground contours, on a particular site, do not allow for an appropriate amount of fall to achieve positive drainage, six (6) inches of fall per one hundred (100) linear feet of trench bottom shall be considered necessary to ensure positive flow of the collected water to the point of discharge.

A detailed site assessment, which shall include the information outlined in *Section 26, Part A, Subpart 3 (g)*, is required to prove that a positive outlet can be achieved in accordance with the proposed drainage configuration. The Department shall review and approve said site assessment information prior to drain installation. In accordance with the provisions outlined in *Section 26,* it shall be the responsibility of the registered land surveyor who prepared the plat to provide this site assessment information for all platted lots requiring a soil drainage improvement practice. In accordance with *Subsection C of Section 19*, it shall be the responsibility of the design plan engineer to provide this site assessmet information for all alternative subsurface sewage disposal systems proposed on either vested plats and lots (see *Section 2, Subsection J*) or unplatted parcels of land requiring a soil drainage improvement practice. For conventional subsurface sewage disposal systems proposed on either vested plats and lots (see *Section 2, Subsection J*) or unplatted parcels of land requiring a soil drainage improvement practice, the Department shall be responsible for this site assessment information.

If the drain discharges into a naturally existing drainageway, the drain outlet pipe shall be designed so as to enter the drainageway above its normal flood stage and shall be oriented in the same direction as the natural flow of the drainageway. Placement of the outlet pipe in a drainageway in this manner helps prevent flood waters from blocking the interceptor drain flow or from backing up into the interceptor drain. Further, the drain shall not outlet into a naturally existing closed depression (i.e. sink hole, etc.).

<u>Note:</u> If it is determined that a positive drainage outlet is not available or cannot be achieved on the lot in question, an off-site easement may be required by the Department.

The trench design shall contain an impermeable barrier placed on the downslope wall of the trench and along the trench bottom. This impermeable barrier shall be in the form of six (6) to eight (8) mil plastic, or other impermeable material as specified or approved by the Department. The material utilized for the impermeable barrier shall be strong enough to withstand installation conditions and be able to provide a long service life. Where site and soil characteristics so warrant (i.e. sites comprised of soils containing large chert fragments, cobbles, etc.), the Department shall have the authority to specify and require the use of plastic, for the impermeable barrier, having a higher thickness rating.

Additionally, the interceptor drain design shall specify that a pipe be placed in the bottom of the trench to collect the water and conduct it to the outlet. This collection pipe shall be a slotted plastic agricultural-type drain pipe, a minimum of four (4) inches in diameter, strong enough to withstand crushing. On sites where the anticipated amount of water to be collected is great, the Department shall have the authority to specify and require the use and placement of either multiple pipes or a pipe of larger diameter.

The interceptor drain design shall specify the gravel media to be placed in the trench. Media for the interceptor drain trench shall consist of crushed rock, gravel or other suitable material as approved by the Department and in accordance with the provisions as outlined in *Appendix 12*. The trench shall be completely filled with gravel and leveled at the ground surface along the entire length of the drain. No soil shall be placed over the top of the gravel.

The interceptor drain shall be designed so that the excavated spoils be placed and Mounded on the downgrade side of the trench to be used as a surface berm. The berm shall be a minimum of eight (8) to ten (10) inches high with a base of three (3) to six (6) feet wide. The berm shall be shaped and smoothed so as to be one continuous section extending the entire length of the drain. Further, the berm shall be shaped in such a manner that it gradually slopes downgrade away from the drain towards the disposal field area. The berm must be such that it is not only technically functional but also visibly aesthetic.

Note: Where required, the Department shall specify the interceptor drain location and dimensions.

5. Curtain Drain

Curtain drains shall be designed in a manner identical to interceptor drains except for their layout configuration. Whereas an interceptor drain is designed to protect the platted or designated disposal field area(s) only on the upslope side, a curtain drain shall be designed so as to protect the sides of the platted or designated disposal field area(s) as well. Thus, its layout design shall wrap around the side(s) of the disposal field and extend downgrade, perpendicular to the field line trenches. The design configuration shall be such that the curtain drain extends a minimum distance of ten (10) feet past the last (lowest) disposal field trench (maintaining its required minimum depth) before an outlet is to be sought or a tight-line to the positive outlet is to be initiated.

Other than the above-mentioned difference, curtain drains shall conform to all provisions outlined in *Part 4 of this Subsection*.

Note: Where required, the Department shall specify the curtain drain location and dimensions.

6. Drawdown Drain

Drawdown drains shall be designed in a manner similar to interceptor and curtain drains except for the omission of the impermeable barrier. Whereas interceptor and curtain drains are designed to protect the platted or designated area(s) from lateral groundwater movement, a drawdown drain shall be designed so as to protect said area(s) from vertically moving subsurface water as well. Thus, their design shall not specify an impermeable barrier placed on the downslope wall of the trench or along the trench bottom. It shall be designed such that an open interface between the gravel and the trench walls (side-walls and bottom) exists to allow free movement of groundwater into the gravel from all sides of the trench.

The design of these types of drains shall be configured to either completely encircle the disposal field or to horseshoe it similar to a curtain drain configuration. Drawdown drains also differ from the other drain types in that their trenches shall be designed at a minimum distance of twenty-five (25) feet from the disposal field. See *Section 13*.

Other than the above-mentioned differences, drawdown drains must conform to all provisions outlined in *Parts 4 and 5 of this Subsection*.

Note: Where required, the Department shall specify the drawdown drain location and dimensions.

D. Installation of Soil Drainage Improvement Practices

IMPORTANT NOTE: No underground utility lines (i.e. electric lines, water lines, etc.) shall be installed in or routed through any trenches excavated for the purposes of installing a Soil Drainage Improvement Practice. Further, any trenches excavated for said underground utilities shall be a minimum of five (5) feet away from the trenches excavated for a Soil Drainage Improvement Practice.

Prior to installing any soil drainage improvement practice, the installer of said drain shall conform to all preparatory provisions as outlined in *Section 20*. The installation of any soil drainage improvement practice shall strictly conform to all supporting documentation (i.e., permit, soil map, plat, approved alternative system design plans, etc.) associated with said land parcel (i.e. whether a platted or unplatted parcel of land), there being no exceptions.

1. Trench Excavation

   NOTE: Only after the Department inspector has approved the layout of the proposed drainage improvement practice may the trench excavation process begin.

   Soil excavation may be accomplished in a variety of ways depending upon the width, depth and length of the drainage practice to be installed. Typical excavation equipment utilized for these applications include: backhoes, trenchers, bobcats and various manual tools. The sides of the trench shall be cleared of any roots, sharp rocks or other protrusions that might cause hazards or damage the barrier. In the case of placement of an associated berm, the excavated spoils shall be mounded and smoothed on the downgrade side of the trench so as to form the surface berm.

2. Impermeable Barrier Installation (where applicable)

   The impermeable barrier, installed after the trench has been excavated to the specified and required dimensions, shall lie on the trench bottom and continue up the downhill side of the trench wall and over the upper edge of the downgrade trench lip. The plastic barrier shall extend the entire length of the drain. Where more than one piece of plastic is needed in order to extend the entire length of the trench, the abutting ends of the barrier must overlap a minimum of ten (10) feet.

   Additionally, where any subsurface sewage disposal system component breaches the integrity of the plastic barrier (e.g. a tight line or supply line pipe crossing the curtain drain going from tanks to the disposal field), the crossing and proper sealing of the plastic barrier around the intrusion so as to minimizes preferential groundwater flow at this junction shall be as follows:

   (a) At the junction point between the two trenches (i.e. tight line/supply line trench and drain trench) a small slit shall be placed in the plastic barrier for the insertion of the tight line/supply line pipe.

   (b) At this intersection, PVC tape shall be utilized to seal the plastic barrier to the pipe. Said tape shall be in accordance with the specifications outlined in *Appendix 12*. The use of any other type of tape (i.e. duct tape, masking tape, etc.) shall not be utilized.

3. Pipe

   The specified drain pipe(s) shall be placed along the trench bottom on top of the plastic barrier prior to placement of the gravel. All individual sections of pipe, utilized in the construction of a drain, shall be properly joined by the use of the manufactured fittings and couplings, specifically made for the type of pipe being used, in accordance with the manufacturer specifications. The pipe shall be laid in the entire length of the drain.

   Where the Department has authorized the use of a tight-line pipe to extend from the drainage pipe to the point of discharge, the pipes shall be properly joined by the use of manufactured fittings and couplings, specifically made for the type of pipe being connected, in accordance with the manufacturer specifications. Where the use of PVC piping is specified, by the Department, for use in the aforementioned tight-line, the joining of the PVC pipe to the drain pipe shall be in accordance with the specifications outlined in *Appendix 12*.

4. House Gutters

   Where applicable, the gutters from the structure may be tied into the drainage system to further lessen the water load on the subsurface sewage disposal system area. Where this practice is utilized, all excavations, placement of piping and associated fittings and couplings shall be in place prior to requesting the Open Ditch inspection from the Department.

   Where the Department has determined that the site conditions relating to a subsurface sewage disposal system installation (i.e. proximity of the house, structure or any other impermeable surfaces juxtaposed to the platted or designated subsurface sewage disposal system disposal field areas) have the potential to adversely affect the system installation, the Department shall have the authority to mandate this practice.

5. Outlet End Pipe

   In each outlet end of a drain, a five (5) foot section of Schedule 40 PVC pipe shall be inserted a minimum of three (3) feet into the drain pipe so as to prevent crushing of the outlet. A metal band-type clamp shall be placed around the outside of the drain pipe, six (6) to eight (8) inches from its end. Once the PVC has been inserted into the drain pipe the required distance, the clamp shall be tightened so as to firmly secure the placement of outlet end pipe. Additionally, the end of the outlet pipe shall be cut at an angle conforming to that of the natural ground surface.

   On sites where the drop at the outlet is minor, a grassed area will be sufficient protection from soil erosion. However, where the outlet fall exceeds twelve (12) inches, the placement of extra protection, such as rock/gravel rip-rap, concrete, or a drop outlet, shall be required to prevent soil erosion. Where a drain outlet discharges into a naturally existing drainageway, the drain outlet pipe shall be designed so as to enter the drainageway above its normal flood stage and shall be oriented in the same direction as the natural flow of the drainageway. Further, the drain shall not discharge into a naturally existing closed depression (e.g. sinkhole, etc.). Where an outlet discharges onto a land surface which is either maintained as a lawn or subject to periodic mowing, the terminus of the outlet end pipe shall be cut at an angle parallel to the ground slope at said outlet in order to minimize potential destruction from mowing activities.

6. Inspection – Open Ditch (No Gravel)

   After the completion of the first four (4) Parts of this Subsection, the drain shall be subject to an inspection by the Department. The requirements of this inspection are outlined in *Section 20.*

7. Gravel

   After the trench, impermeable barrier, pipe and outlet end pipe have been approved during the aforementioned inspection, the trench shall be leveled to the ground surface, along the entire length of the drain, with the appropriately specified gravel media. No soil shall be placed over the top of the gravel.

   On subsurface sewage disposal system installation sites where the Department has specified that surface water diversion is not necessary, a thin veneer of soil may be placed over the top of the gravel. However, the Department shall require that a permeable barrier (i.e., straw, builders paper, filter fabric, etc.) be placed between the gravel surface and the soil backfill. The depth of backfill shall be minimal to allow for the establishment of grass. The depth of the backfill over the gravel shall not exceed six (6) inches.

8. Surface Berm and V-Ditch

   The soil used for berms and channels shall be smoothed, shaped and graded to allow for easy mowing and maintenance. Additionally, the berm must be such that it is not only technically functional but also visibly aesthetic.

9. Inspection – Final

   After the completion of Part 7 of this Subsection, the drain shall be subject to a final inspection by the Department. The requirements of this inspection are outlined in *Section 20.*

E. Erosion and Sediment Control

The determination for the use of erosion and sediment controls shall be made by the Department on a case-by-case, site-specific basis. Where the Department has determined that a site shall require the use of erosion and sediment controls, the Department shall specify the type of controls to be utilized in accordance with the provisions outlined in *Section 23.*

F. Maintenance of Soil Drainage Improvement Practices

For V-ditches, berms, terraces or other surface water diversion structures, maintaining their integrity and preventing silt accumulation is vital to their proper function. For drains to function at their maximum potential, it is crucial that their associated berm on the lower side be left in place, and that the gravel media remain open at the ground surface and not be covered with dirt. Additionally, the outlet pipe must remain open so that water may exit freely as it enters the trench.