APPENDIX 3

LOW PRESSURE PIPE SYSTEMS

This Appendix shall be considered by the Department, as a comprehensive manual on the subject of Low Pressure Pipe (LPP) Systems. Additionally, this Appendix/Manual will specify how these systems are to be designed and installed in Williamson County.

<u>Important Note</u>*:* This manual was adapted from the UNC Sea Grant, College Publication UNC-SG-82-03, *Design and Installation of Low Pressure Pipe Waste Treatment Systems*, May 1982. The content was edited to conform to the specific geologic and physiographic characteristics of Williamson County, Tennessee. These standards promote reliability and longevity of waste treatment systems for environmental protection and public health.

TABLE OF CONTENTS ……………………………………………………………………………..……………PAGE

INTRODUCTION

Many sites under consideration for development in Williamson County, Tennessee are not suitable for conventional subsurface sewage disposal systems. Among these sites are some which have enough depth and area of usable soil to provide safe disposal via low-pressure pipe (LPP) systems. Though LPP systems are not a panacea for all the unsuitable soils of Williamson County, they are useful for various specific conditions where conventional systems have been known to fail.

The information in this Appendix/manual specifies the procedures and materials to be used for appropriate site and soils evaluation, design, installation/construction and maintenance of residential LPP systems. Accurate site evaluation, utilization of proper materials, and strict adherence to the installation procedures, as specified in this manual, are critical to the successful performance of a LPP system. As with any subsurface sewage disposal system, proper maintenance is a necessity to ensure the longevity and performance of the system.

This Appendix/manual only covers design and installation of small LPP systems suitable for homes and small businesses. Due to the fact that Williamson County possesses a wide and diverse range of soil, geologic, and topographic conditions, each site will be carefully considered on an individual basis. The final determination for the use of the LPP system shall be made by the Williamson County Department of Sewage Disposal Management. All such determinations shall be based on the specific site and soil characteristics which exist upon a parcel of land where the use of LPP systems is proposed.

All LPP systems shall be designed by an engineer licensed in the State of Tennessee. Said plans shall be in accordance with the design guidelines as outlined in this manual and in accordance with the design format as established in *Section 19* of these regulatons. Additionally, the design engineer shall provide construction supervision and inspection where requested by the Department.

CHAPTER 1

What is Low Pressure Pipe Distribution

A distribution/soil-absorption system must serve two purposes:

- disperse untreated effluent below the soil surface, and
- treat and purify the effluent before it reaches ground or surface water.

Maximum treatment potential of LPP systems is achieved when the distribution area is not saturated with water or effluent, allowing efficient aerobic bacteria to treat the wastes.

There are several conditions which frequently hinder the operation of soil-absorption systems. Clogging of the soil can occur from localized overloading during use or from the mechanical sealing of the soil-trench interface during construction. This clogging can cause effluent to break through to the ground surface, resulting in a system failure, thereby creating a public health hazard. Anaerobic conditions, caused by continuous saturation due to overloading or a high water table, retard treatment of the effluent, thereby increasing the potential for pollution. Shallow soils are not deep enough to purify the effluent.

LPP systems have three design features to help overcome these problems:

- uniform distribution of effluent
- dosing and resting cycles
- shallow placement of trenches

Problems from localized overloading are decreased when effluent is distributed over the entire absorption area. Dosing and resting cycles help maintain aerobic conditions in the soil, improving treatment. Shallow placement of the distribution trenches increases the vertical separation from the system to any restrictive horizon or seasonally high water table.

LPP systems shall not be used to dispose of wastewater wherein the average concentration of grease exceeds one hundred fifty (150) milligrams per liter (mg/L) because of the clogging potential of the distribution network.

A LPP system is a shallow, pressure-dosed soil absorption system. A conceptual view of a basic LPP system is shown in Figure A3-1. It consists of:

- two-compartment septic tank
- pump tank
- submersible sewage/effluent pump and level controls
- high water alarm
- supply line and manifold
- distribution laterals
- suitable area and depth of soil

When septic tank effluent rises to the level of the upper pump control, the pump turns on and effluent moves under pressure, through the supply line, manifold and distribution laterals. These laterals are Schedule 40 PVC pipes containing small holes (5/32 inch diameter) spaced five (5) feet apart. The pipes are placed in narrow trenches eighteen (18) inches deep, spaced a minimum of five (5) feet apart. Under low pressure (five [5] feet of head pressure [2.17 pounds per square inch (psi)]) supplied by the pump, septic tank effluent flows through the holes and into the trenches. It diffuses from the trenches into the soil where it is treated.

The pump turns off when the effluent level falls to the lower control. The level controls are set so that the effluent is pumped two (2) to four (4) times daily with resting periods in between to allow aerobic treatment of effluent. If the pump or level controls should fail, the effluent would rise to the level of the alarm control. The alarm would turn on, signaling the homeowner of a problem.

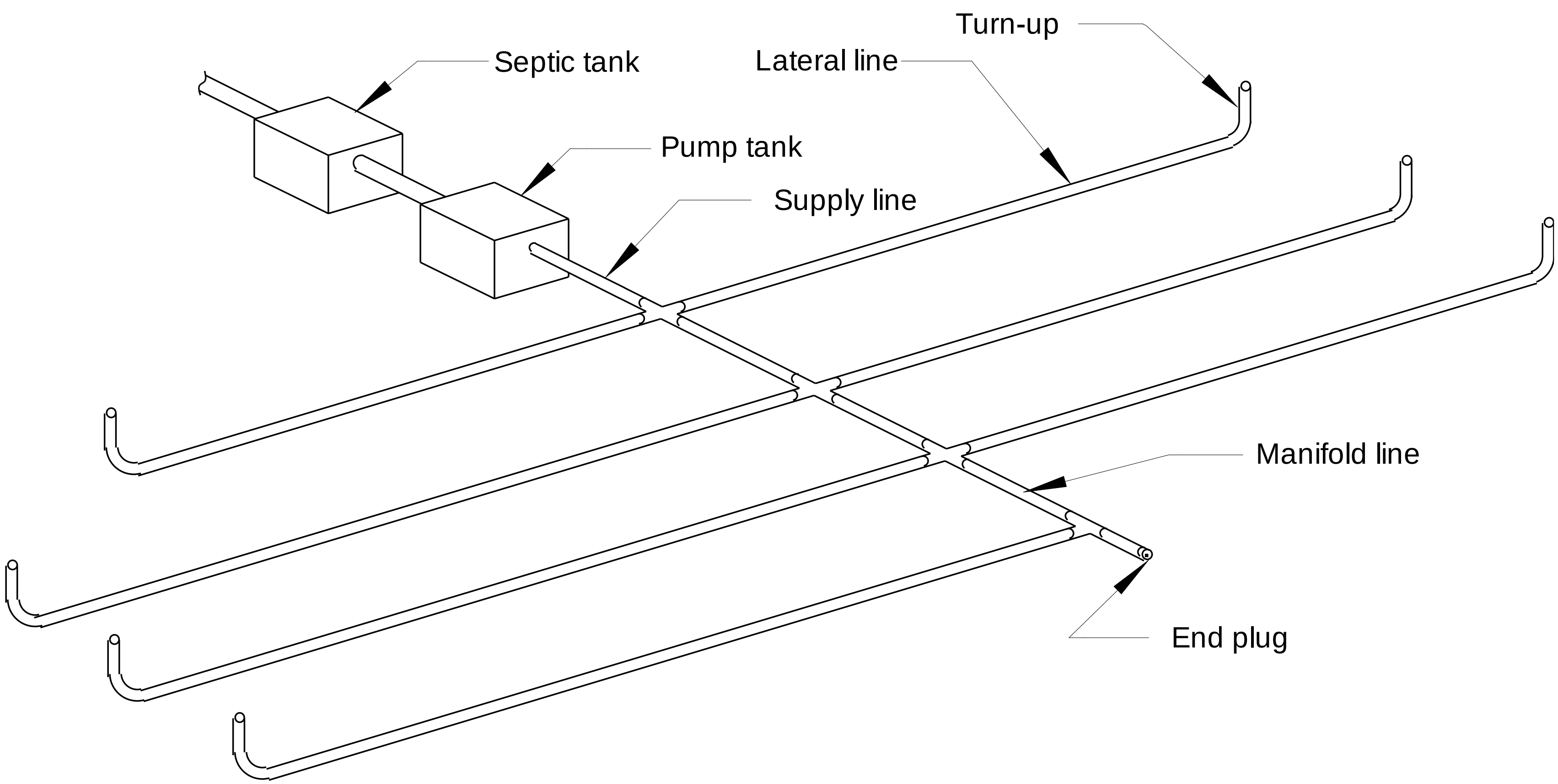

Figure A3-1. Basic conceptual diagram of a low pressure pipe system.

CHAPTER 2

Site and Soil Requirements for LPP Systems

The suitability of a LPP system for a given site is determined by the soil absorption rate, soil properties, slope, size and configuration of a suitable soil area (i.e. available space), and the anticipated daily waste flow (in gallons per day flow).

A. Acceptable Soil Area Requirements

The disposal field of most residential LPP systems (on newly constructed dwellings) occupies from 3,000 square feet to 8,500 square feet of area depending on the slope, soil properties, buffer requirements, and design waste load. Additionally, an area of equal treatment capability shall be set aside for future repair or replacement of the system. See Table A3-1 for LPP disposal field area requirements. Space between the existing lateral lines is not a suitable repair area.

All components of a LPP system shall meet all minimum setback restrictions as outlined in *Section 13*. *Although it is not feasible to integrate all of the site and soil setback criteria into a general lot size requirement, an undeveloped lot smaller than one acre will not be acceptable for a LPP system.*

Table A3-1. LPP Disposal Field Area Requirements

Number & Size (ft^2) of Absorption Fields					
Soil MPI Rates	Slopes	1-2 Bedrooms	3 Bedrooms	4 Bedrooms	5 Bedrooms
30-45 MPI	0-5%	2 @ 3,000	2 @ 3,000	2 @ 4,000	2 @ 5,000
	5-15%	2 @ 3,500	2 @ 3,750	2 @ 4,500	2 @ 5,500
	15-25%	2 @ 4,000	2 @ 5,000	2 @ 6,000	2 @ 8,000
60 MPI	0-5%	2 @ 3,250	2 @ 3,800	2 @ 4,500	2 @ 5,500
	5-15%	2 @ 3,750	2 @ 4,000	2 @ 5,000	2 @ 6,000
	15-25%	2 @ 4,000	2 @ 5,000	2 @ 7,000	2 @ 9,000
75 MPI	0-5%	2 @ 3,500	2 @ 5,000	2 @ 5,500	2 @ 7,500
	5-15%	2 @ 4,000	2 @ 6,000	2 @ 6,500	2 @ 8,000
	15-25%	2 @ 5,500	2 @ 6,500	2 @ 7,500	2 @ 8,500

Important Note*: The disposal field area requirements only represent the amount of square footage necessary to accommodate a single-family dwelling containing the number of bedrooms indicated in the column headings. No provisions regarding the additional square footage required in a disposal field area to accommodate any type of oversized bathing fixtures are included in Table A3-1.*

B. Soil Requirements

A LPP system shall be constructed in the designated or platted subsurface sewage disposal system soil areas on the lot. LPP systems shall be installed in natural, undisturbed soil. Areas of land that have been cut, filled or disturbed are considered unsuitable for LPP use. A minimum of twelve (12) inches of permeable soil, as ascertained by an approved Soil Scientist in accordance with the *Uniform Code of Soil Mapping Standards and Procedures for Williamson County, Tennessee* (*Appendix 1*), is required between the bottom of the lateral line trenches and any underlying restrictive horizons (or blocking layers). Restrictive horizons are described in detail in *Appendix 1*.

LPP lateral line trenches shall be placed at eighteen (18) inches deep, giving a minimum soil-depth requirement of thirty (30) inches. The soil shall have suitable textural, structural, absorption and drainage characteristics for such use as outlined in *Appendix 1*.

In cases where the depth to a blocking layer or restrictive horizon, within a soil profile, ranges from twenty-four (24) to thirty (30) inches, a *Modified* LPP (MLPP) may be installed using six (6) to eight (8) inches of compatible imported fill, as approved by the Department. MLPP lateral line trenches can be placed as shallow as twelve (12) inches deep, into the natural soil profile, giving a minimum natural soil-depth requirement of twenty-four (24) inches. Thus, the addition of the compatible soil fill material will result in a total soil profile depth of the required thirty (30) inches. The soil material covering a blocking layer or restrictive horizon shall have suitable textural, structural, absorption and drainage characteristics for such use as outlined in *Appendix 1*. It is essential that great care be used in installing these systems. Their design and construction are covered in *Chapter 7* of this Appendix/manual.

C. Topography and Landscape Positions

Low pressure disposal fields located on slopes require special design and installation procedures. The supply line delivering the effluent to the manifold, serving the lateral lines, shall always enter at the highest point of elevation in the distribution field. All LPP lateral line trenches shall be positioned and constructed parallel to the naturally existing contours of the ground surface in such a manner so as to ensure that the bottom of each lateral line trench remains level throughout its entire length.

Important Note: LPP systems may be installed on slopes ranging from zero to twenty-five percent (0-25%). LPP systems shall not be installed on sites where the slope exceeds twenty-five percent (25%). MLPP systems may be installed on slopes ranging from zero to fifteen percent (0-15%). MLPP systems may be considered for sites with slopes of sixteen to twenty-five percent (16-25%), however those sites shall be assessed in accordance with procedures outlined in *Appendix 1*, before any approval for such use is granted by the Department. MLPP systems shall not be placed on any slopes greater than twenty-five percent (>25%).

LPP and MLPP lateral line trenches may only be placed within the limits of a 100 year floodplain in accordance with *Appendix 1* of these regulations.

D. Drainage Requirements

All existing drainage features on a lot shall be avoided by the minimum setback requirements, as stated in *Section 13*, to prevent hydraulic overloading of the disposal field. All surface waters (including runoff from all impervious surfaces on the property) and all subsurface waters shall be intercepted and/or diverted away from the disposal field trench components (or all system components where determined to be necessary by the Department) of the LPP system via the use of the soil drainage improvement practice specified by the Department.

A curtain drain installed, as a soil improvement practice, around a LPP or MLPP disposal field shall be kept a minimum of ten (10) feet from any of the lateral line trenches. However, for MLPP systems, a site specific separation distance may be designated by a Department Soil Scientist depending upon the requirements for the limits of soil modification necessary for a particular site. See *Appendix 5*.

CHAPTER 3

Layout Design of a LPP System

The next three chapters outline a step-by-step procedure for designing a LPP system. Additional procedures used when designing LPP systems requiring the addition of modification of soil fill material (i.e., MLPP systems) are covered in Chapter 7 of this Appendix/manual.

Note: All LPP design plans shall conform to the design format as outlined in *Section 19* of these regulations.

A. Size of the Disposal Field Area

The total amount of absorption area depends on two factors: 1) the projected daily wastewater flow from the structure served by the LPP system and 2) the absorptive capacity of the soil within the designated LPP distribution area.

(1) Step 1 - Calculate projected daily waste flow.

For residential systems, the estimated daily wastewater flow shall be 150 gallons per day (gpd) for each bedroom (BDR) in the house. For those residences employing oversized bathing fixtures, additional flow calculations shall be incorporated into the overall gpd discharge figure. For calculations regarding dwellings containing more than one over sized bathing fixture and for facilities other than single-family dwellings, See *Appendix 7*, of these regulations, outlining the appropriate projected daily wastewater flows.

Example 1:

For a 3-BDR house:
Flow = 150 gpd/BDR x 3 BDR = 450 gal.

Example 2:

For a 3-BDR house with a 65-gal oversized tub:
Flow = (150 gpd/BDR x 3 BDR) + [(65gal – 30gal) x (3 BDR)]
Flow = 555 gal

(2) Step 2 - Determine the loading rate.

In conjunction with the estimated soil permeability rate (MPI) that is provided by the Department, determine the wastewater loading rate using Table A3-2 of this Appendix/manual.

Example:

For a 45MPI Stiversville soil:
Loading rate = 0.275 gpd/ft^2

Important Note: Where a designated or platted subsurface sewage disposal system area bridges two or more soils of dissimilar characteristics (i.e. permeability, drainage, or soil improvement practices such as modification, etc.), the Department shall require that the conditions associated with the most restrictive soil unit contained within that area prevail and dictate the LPP design specifications (i.e. permeability, drainage requirements and soil improvement requirements).

(3) Step 3 - Compute the Total Disposal Field Area Requirements

Compute the total area needed for the absorption system using the following equation:

Area = flow/loading rate.

Example:

Using flow and loading rates calculated above:
Area = 450 gpd/0.275 gpd/ft^2 = 1636 ft^2

(4) Step 4 - Determine total length of lateral distribution lines.

Spacing between lateral lines (center-to-center) shall be a minimum of five (5) feet to prevent overloading. Although the lateral spacing may exceed five (5) feet, the minimum required linear footage of lateral lines shall be determined by dividing the amount of required square footage of required soil area by five (5).

Example:

Length = 1636 ft^2/5 ft = 327 linear feet

Table A3-2. Wastewater Loading Rates

Maximum loading rates for LPP systems based on estimated soil absorption rates in Minutes Per Inch (MPI)	
Established Soil Absorption Rate in Minutes Per Inch (MPI)	Maximum Loading Rate* (gpd / ft^2)
10 - 45	0.275
60	0.200
75	0.150
90	0.100
105	0.075
120	0.050

*These loading rates shall be used only for calculating the size of LPP systems, not for other types of systems.

Note: When calculating area requirements for LPP systems to be installed in soils rated between 10MPI and 45MPI, a maximum load rating factor of 0.275 gpd/ft^2 shall be used.

Note: Soils rated above 120MPI are not approved for any type of LPP system use.

(5) Step 5 - Calculate gravel requirements.

To fiII a six (6) inch wide trench twelve (12) inches deep with gravel, 1.85 cubic yards is needed per 100 feet of trench.

Example:

For 327 ft of line:
Gravel needed = 327 ft x (1.85 yds^3 /100 ft)= 6 yds^3

B. Sizing the Septic tank and Pump tank

Septic tank volume is determined according to provisions outlined in *Section 14*. Pump tank volume is determined according to the provisions outlined in *Section 18*.

For single-family dwellings, the minimum effluent storage capacity shall be a minimum of twice the volume of the normal projected daily wastewater flow so as to provide for a minimum of one (1) day of emergency storage.

Example:

For a 450 gpd waste flow:
$V_{\text{pump tank}}$ = 450 gal. x 2 = 900 gallon tank, minimum

C. Location of the Lateral Lines

The lateral lines of the LPP system shall be located in the designated or platted subsurface sewage disposal system area and shall be designed so as to conform to all aspects of these regulations.

D. Configuration of the Lateral Lines Within the Disposal Field Area

The supply line delivering the effluent to the manifold, serving the lateral lines, shall always enter at the highest point of elevation in the distribution field. All LPP lateral line trenches shall be positioned parallel to the naturally existing contours of the ground surface in such a manner so as to ensure that the bottom of the lateral line trenches will remain level throughout the entire length of the trench. Refer to Figures A3-2, A3-3 and A3-4 for examples of typical layout configurations.

Important Note: Under no circumstances shall split manifold designs be utilized in Williamson County.

E. Drainage Requirements for the Disposal Field Site

Curtain/Interceptor drains shall be required on all sites utilizing LPP systems. Curtain/Interceptor drains shall conform to all specifications as set forth in *Appendix 5* of these regulations. Furthermore, additional drainage practices (e.g. drawdown drains, etc.) may be required by the Department on a site specific basis.

F. Lateral Line Trench Dimensions

Lateral line trenches for all LPP system shall be eighteen (18) inches deep, six (6) inches wide and spaced a minimum of five (5) feet apart (center-to-center). All lateral line lengths shall conform to Table A3-3.

Table A3-3. Maximum Lengths of Various Size Lateral Lines (based on $^{5}/_{32}$ in. diameter hole at 5ft spacing).

Nominal Pipe Size Diameter (inches)	Maximum Lateral Line Length (feet)
1	60
1¼	95
1½	120
2	170

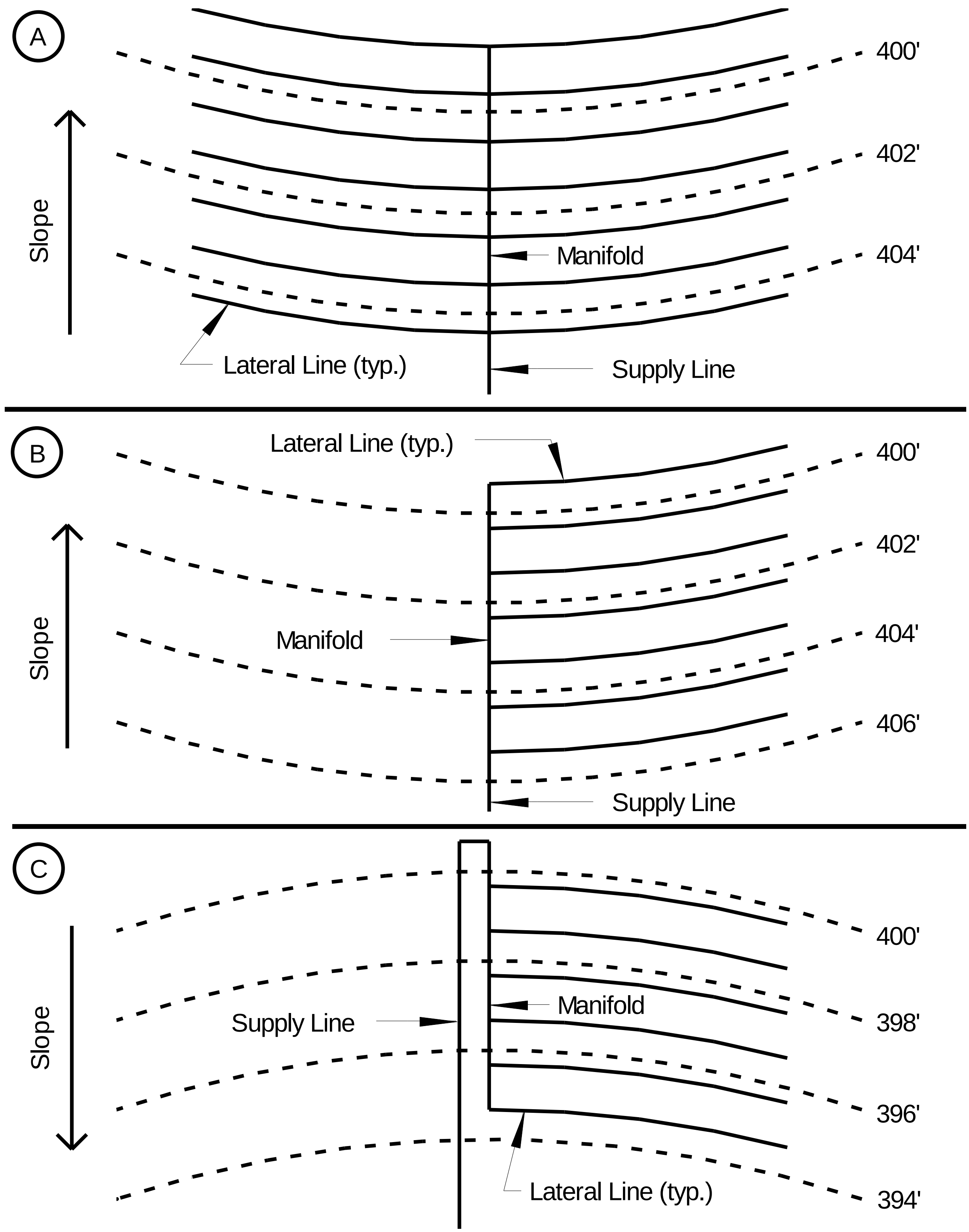

Figure A3-2. Three possible configurations of LPP distribution field; note that the supply line enters the manifold at the highest point in the field and that the lateral lines are laid parallel to the natural ground surface contours.

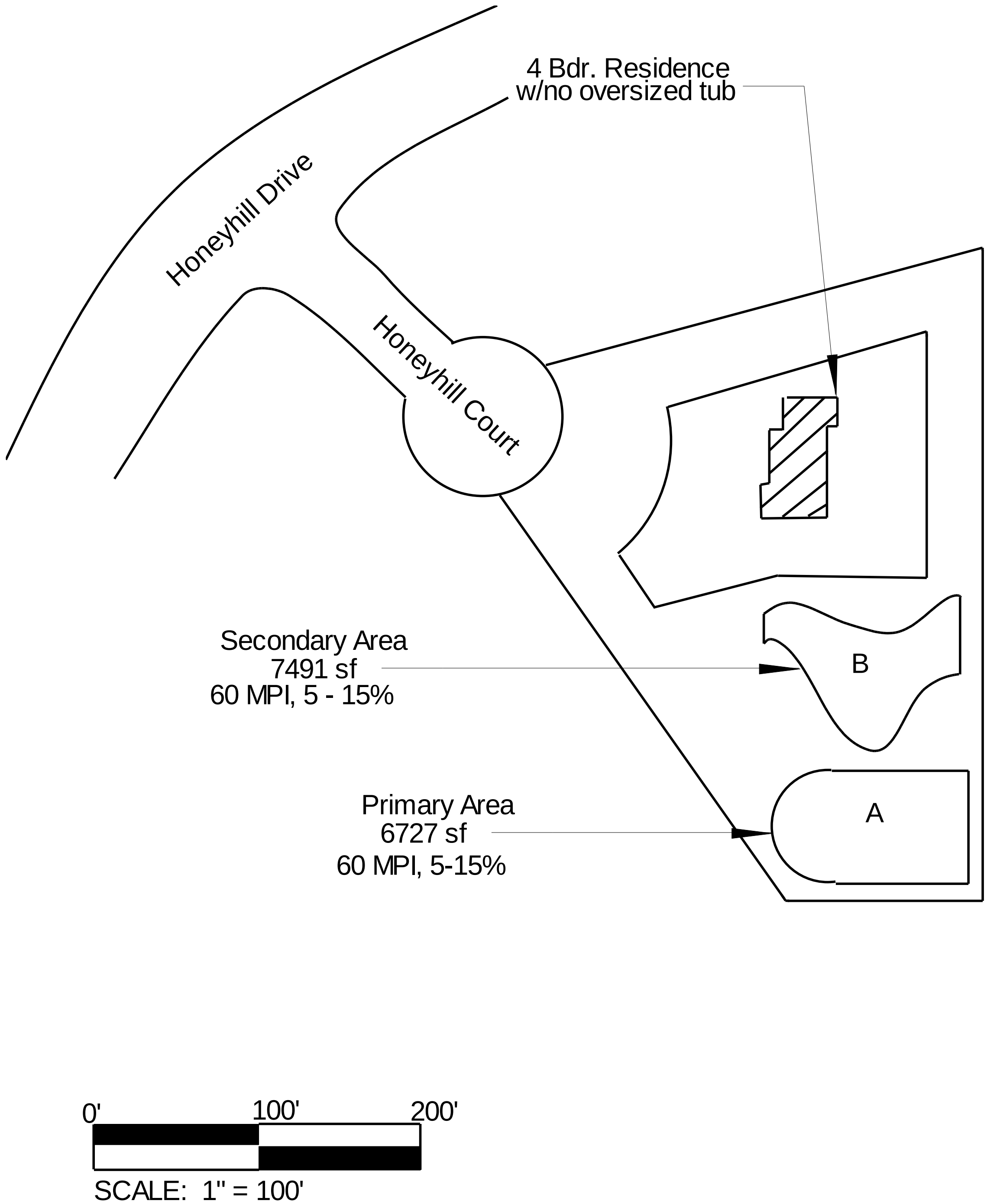

Figure A3-3. Example of a lot layout for a LPP system.

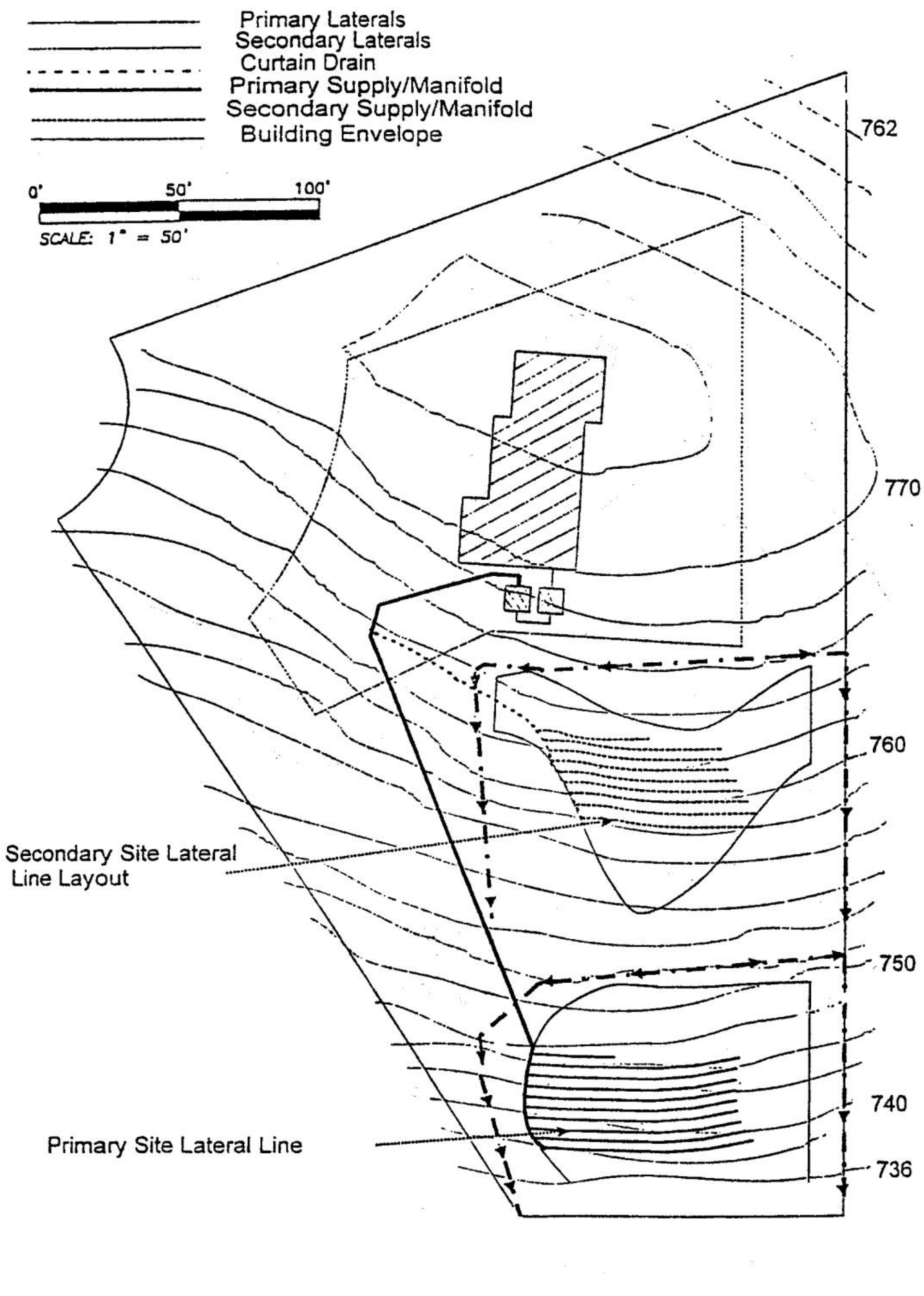

Figure A3-4. Example of a LPP system layout.

CHAPTER 4

Dosing and Distribution System Design

The purpose of low pressure dosing is to provide uniform distribution of sewage/effluent throughout the entire disposal field area. This is best achieved at a pressure head of five (5) feet [2.17 pounds per square inch (psi)]. Proper dosing involves balancing the size of the distribution system with the dosing volume, pumping capacity, desired pressure and flow rate.

A. Dosing Rate

The dosing rate per linear foot of disposal trench shall be uniform throughout the entire system. The gallons per minute (gpm) flow amount which the pump must provide shall be determined by adding the gallons per minute (gpm) flows per each and every hole over the entire system to be dosed by said pump. This dosing rate depends on the pressure head and the size and number of holes in the distribution lines. Pressure head shall be five (5) feet for adequate performance; holes shall be 5/32 inch in diameter, and hole spacing shall be five (5) feet (center-to-center).

(1) Step 1 - Calculate the number of holes.

Number of holes = length of line/hole spacing

Example:

For a system with 327 linear feet of lateral line at 5 foot hole spacing:

Total holes = 327 ft/ 5 ft = 65 holes

(2) Step 2 - Determine the flow rate per hole.

For 5 ft. pressure head and 5/32 in. holes, the flow rate equals 0.64 gallons per minute (gpm) per hole.

(3) Step 3 - Calculate total dosing rate.

Example:

Flow rate/hole = 0.64 gpm
Total flow rate = 0.64 x 65 holes = 41.6 gpm = 42 gpm

Important Note*: For systems where the absorption field is at a lower elevation than the pump, a ¼ inch siphon-breaker hole must be drilled in the supply line above the liquid level inside the pump tank. This hole will prevent inadvertent siphoning of the contents of the pump tank into the field. An extra two (2) gallons per minute must be added to the pumping rate to compensate for flow through the siphon-breaker hole.*

Example:

For a system with 42 gpm flow rate and a siphon-breaker hole.
Total flow rate = 42 gpm + 2 gpm = 44 gpm

Important Note: For systems where the absorption field is at a higher elevation than the pump, a check valve may be necessary. See the Check Valve Calculation information in Part D of this Chapter. When a check valve is utilized, a vent hole shall be drilled in the discharge pipe below the check valve, inside the pump tank, to purge the pump of trapped air. (This practice is recommended by the Sump & Sewage Pump Manufacturers Association (SSPMA)). The vent hole size shall be in accordance with the pump manufacturers installation instructions. An extra two (2) gallons per minute shall be added to the pumping rate to compensate for flow through the vent hole.

Example:

For a system with 42 gpm flow rate and a check valve vent hole.
Total flow rate = 42 gpm + 2 gpm = 44 gpm

Important Note*: With the total dosing rate (i.e. total flow rate) established, the design engineer shall verify that this rate conforms to the minimum required to ensure scour velocity. The acceptable flow rate that will ensure a minimum scour velocity of 2.5 feet per second shall be based upon the total dosing rate, in gallons per minute (gpm), and the supply line pipe size. See Table A13-1 in Appendix 13.*

B. Pump Selection

The pump must have enough power to pump effluent at the calculated flow rate against the total dynamic head (resistance) encountered in the distribution system. The total dynamic head is the amount of work the pump must do to overcome elevation (gravity) and friction in the system at the specified pressure and flow rate.

Thus, total dynamic head (TDH) = elevation head (EH) + pressure head (PH) + friction head (FH) + safety factor (SF).

or

TDH = EH + PH + FH + SF

Elevation head (EH) is the difference in elevation from the pump to the highest point of elevation of the manifold. Remember that the pump will be four (4) feet or five (5) feet below ground level in the pump tank.

Pressure head (PH) is the pressure required for even distribution throughout the entire lateral line network and shall be specified as five (5) feet.

Friction head (FH) is the loss of pressure due to friction as the effluent moves through the pipes. Pipe friction (PF) is estimated using Table A13-2 in *Appendix 13* of these regulations. When estimating pipe friction, use the total length of both the supply line and the manifold line but not the lateral lines. Add twenty percent (20%) to the pipe friction estimate to account for friction loss in joints and fittings. Note that friction loss varies with pumping rate as well as with pipe length and diameter.

A *Safety factor (SF)*, as described below, shall be added to the sum of EH plus FH plus PH. This factor of safety shall be based upon the potential elevation head (EH) and shall be dependent upon two factors:

- The accuracy and exactness of the location of the proposed house and its related tanks and pump; and
- The extreme potential elevation difference across the house site or building envelope.

The minimum safety factor (SF) shall be two (2) feet. If a LPP system design contains accurate and exact locations of the house, tanks and/or pump, or if the house site or building envelope is relatively flat or level (i.e., extreme elevation change across the house site or building envelope is less than or equal to two [2] feet based on the required topographical information submitted with the design packet), then the assigned SF shall be that of the minimum required (i.e., a safety factor equal to two [2] feet).

If however, the house, tank(s) and/or pump locations are only general in nature and not exact, then the SF shall be equivalent to the worst case scenario of where the pump/tank could be located, plus the minimum required safety factor.

Thus, for such a case, the total safety factor shall be equal to the greatest potential elevation change across the house site or building envelope (based on the required topographical information submitted with the design packet), plus an additional two (2) feet.

The total dynamic head must be calculated to select the proper size pump.

Important Note: The minimum assigned total dynamic head shall be ten (10) feet.

(1) Step 1 - Compute friction head (FH).

FH = 1.2(PF)

Example:

For 70 total linear feet of 2 inch diameter Schedule 40 PVC supply and manifold line and a 42 gpm pumping rate:

PF = (70 ft)(3.27 ft/100 ft) = 2.29 ft
FH = (1.2)(2.29 ft) = 2.75 = 2.8 ft

(2) Step 2 – Calculate total dynamic head (TDH).

Example #1:

For a system design in which the exact location of the house has been established from the site plan (and thus the exact location of the tanks and required pump is known), the topographic information reveals 10 feet of elevation head from pump to the point of connection between the supply line and the manifold (See Figure A3-5), with 5 feet of pressure head and with 2.8 feet of friction head:

Where:

PH = 5ft FH = 2.8ft
EH = 10ft SF = 2ft

Then:

TDH = EH + PH + FH + SF
TDH = 10ft + 5ft + 2.8ft + 2ft
TDH = 19.8ft

Thus, the system in this example will require a pump with a capacity of 42 gallons per minute against 20 feet of head.

Example #2:

For a system design in which the house site or building envelope is relatively flat (i.e., less than two foot of elevation change), the topographic information reveals a total elevation head from pump to the point of connection between the supply line and the manifold of 4.6 feet (See Figure A3-6), with 5 feet of pressure head and with 2.8 feet of friction head:

Where:

PH = 5ft FH = 2.8ft
EH = 4.6ft SF = 2ft

Then:

TDH = EH + PH + FH + SF
TDH = 4.6ft + 5ft + 2.8ft + 2ft
TDH = 14.4ft

Thus, the system in the example will require a pump with a capacity of 42 gallons per minute against 15 feet of head.

Example #3:

For the same system design as in the above example #1, except that the house, tank(s) and/or pump locations are only general in nature and not exact (See Figure A3-7):

Where:

PH = 5ft FH = 2.8ft
EH = 8ft SF = 8ft

Then:

TDH = EH + PH + FH + SF
TDH = 8ft + 5ft + 2.8ft + 8ft
TDH = 23.8ft

Thus, the system in the example will require a pump with a capacity of 42 gallons per minute against 24 feet of head.

It is always necessary to specify the total head when selecting a pump. The head and flow requirements are checked against the performance curve provided by the pump manufacturer. A example of a pump performance curve is shown in Figure A3-8.

Note: *Performance curves vary among pump brands. Thus, it is important to use the performance curve for the specific brand and size of pump to be used.*

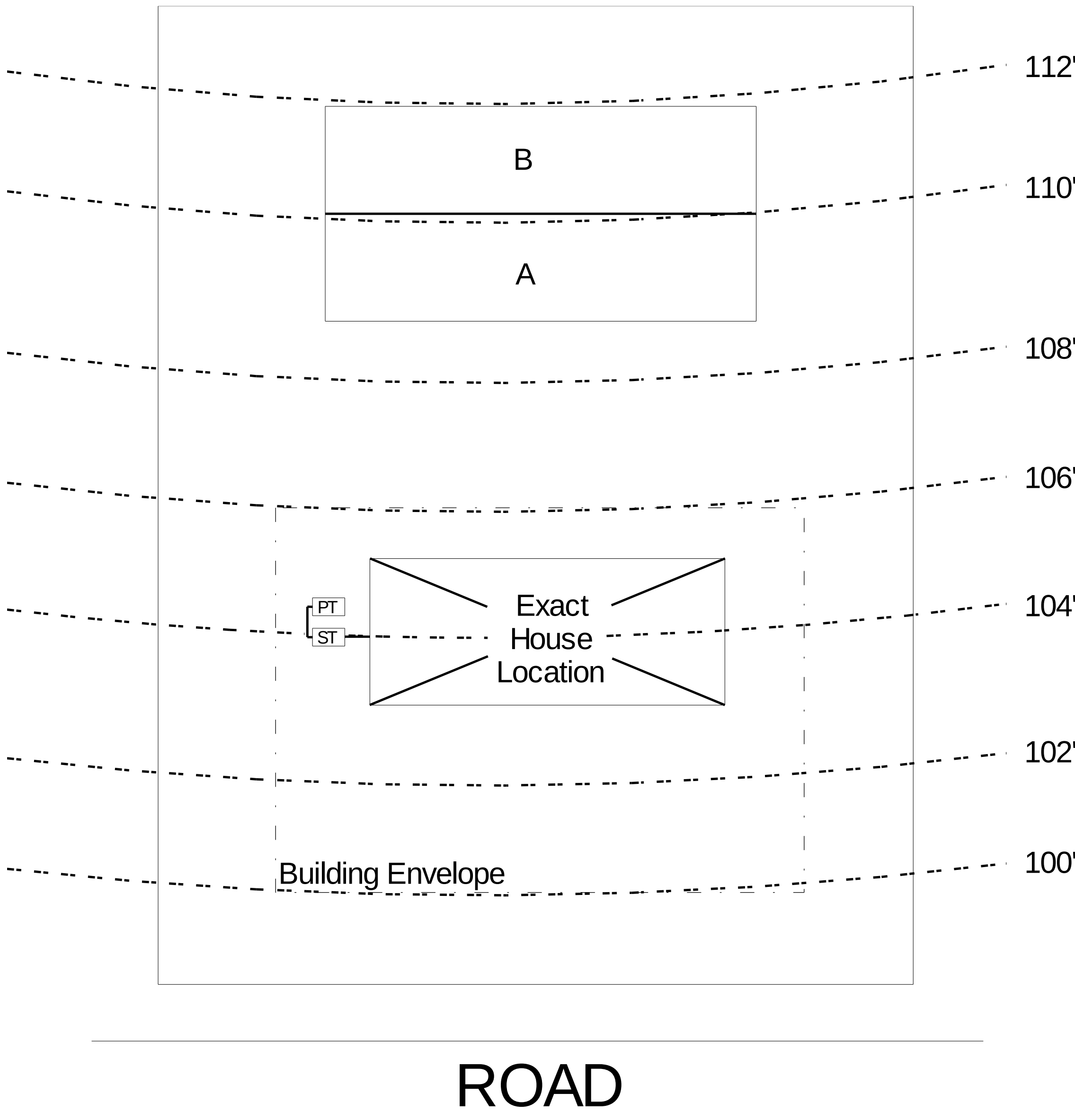

Figure A3-5. LPP system design showing <u>exact</u> house location. For example #1: EH=110ft – (104ft - 4ft) = 10ft; SF=2ft.

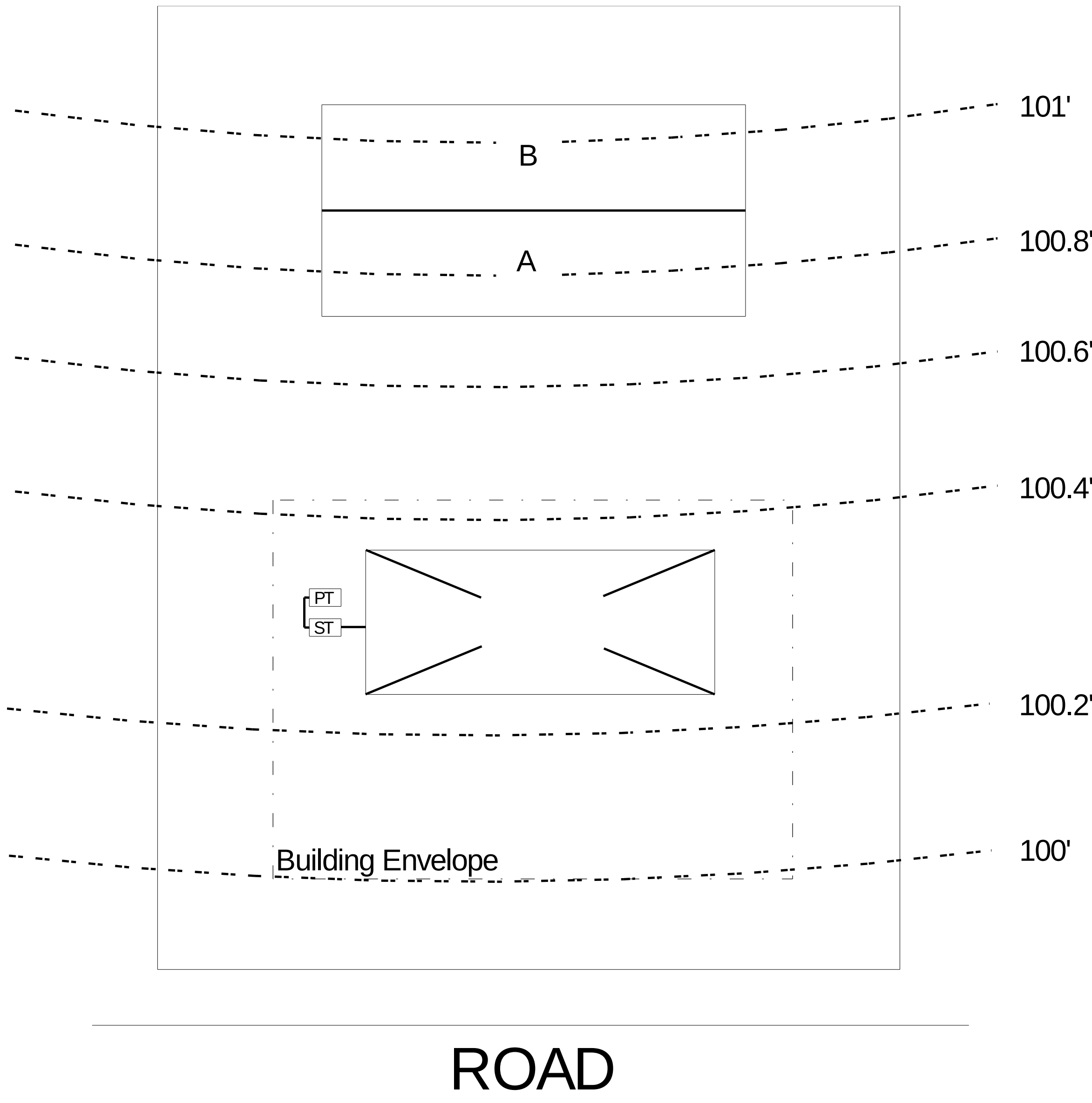

Figure A3-6. LPP system design on a relatively flat lot (i.e., ≤ 2ft elevation change). For example #2: EH = 100.9ft – (100.3ft – 4ft) = 4.6ft; SF = 2ft.

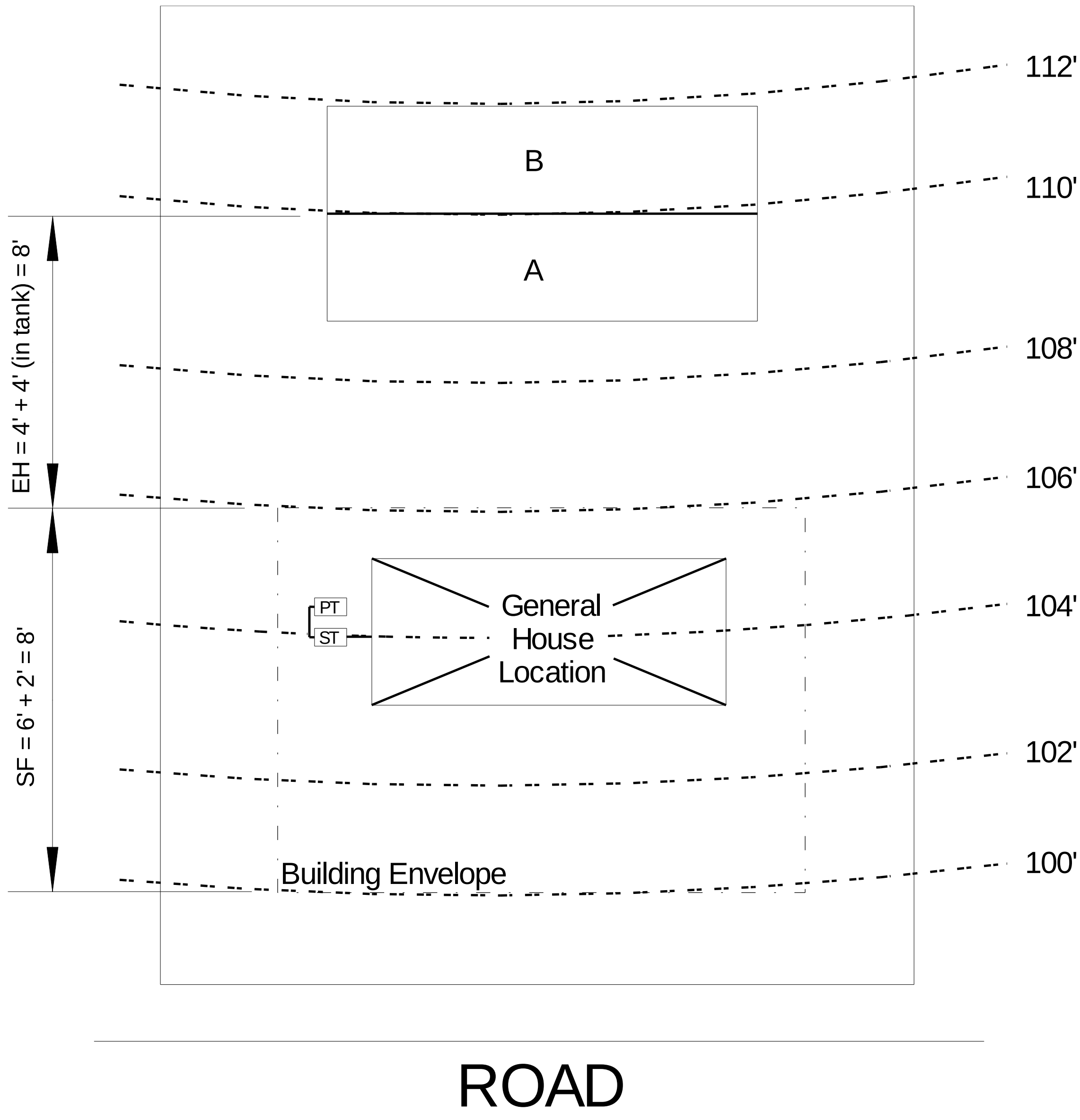

Figure A3-7. LPP system design for which the house location is only general in nature and not exact. For example #3: EH = 110ft – (106ft – 4ft) = 8ft; SF = (106ft – 100ft) + 2ft = 8ft. Note that this system layout is exactly the same as shown in Figure A3-5 for example #1 except the house location is general in nature and not exactly and accurately located.

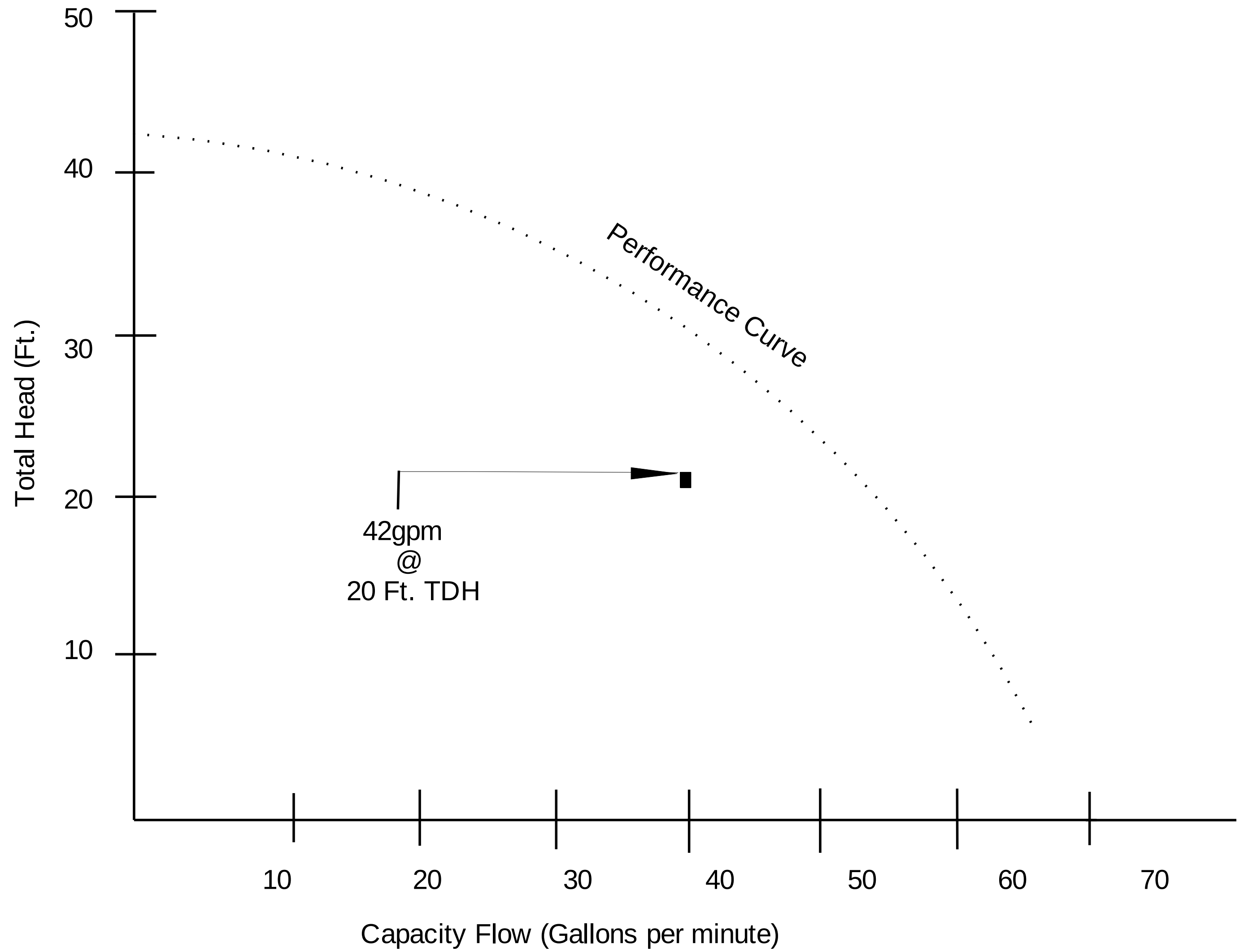

Figure A3-8. Example of a pump performance curve. The point shown falls below the curve; this particular pump is adequate for the situation described in example #1.

(3) Step 3 - Select a pump of proper capacity.

Consult the appropriate performance curve. The system requirements of flow and total head (in example #1, 42 gallons per minute at 20 feet) intersect at a point which must fall below the performance curve. If the point falls above the curve, then the pump is too small.

Example:

This point (as shown in Figure A3-8) falls below the curve; therefore, the pump is adequate.

When the chosen pump is too small, consider the following options:

- Select a larger pump.
- Reduce the friction-head loss by using larger diameter supply and manifold lines (two [2] inches is a minimum diameter for residential systems, with four [4] inch diameter being the maximum).

Important Note: The Department shall have the authority to specify pump sizing, where after a the review of a submitted LPP design plan, the Department determines that the proposed pump will not function properly on the proposed LPP installation site.

C. Dosing Volume

Dosing volume is the amount of effluent pumped to the absorption field each time the pump runs. The dosing volume must be large enough to provide adequate distribution in the field and adequate resting time between doses, yet small enough to avoid overloading. The minimum dose to provide adequate distribution depends on the size of the supply and lateral network.

(1) Step 1 - Calculate minimum dosing volume (V_{dose}).

$V_{dose\ min.} = V_{supply} + 5\ (V_{laterals})$

The minimum volume is the sum of the supply and manifold line volumes and five times the volume of the lateral lines. Storage capacities of various diameters of Schedule 40 PVC pipe can be found in Table A3-4.

Table A3-4.

Storage capacity per 100 feet of Schedule 40 PVC pipe	
Pipe Size (inches)	Storage Capacity ($^{gallons}/_{100\ ft}$)
1	4.50
1¼	7.76
1½	10.57
2	17.44
2½	24.91
3	38.39
4	66.12

Example:

1. For 70 total linear feet of 2 inch diameter Schedule 40 PVC supply and manifold line:

V_{supply} = (70 ft)(17.44 gal/100 ft)
= 12.21 gal

2. For 327 linear feet of 1¼ inch diameter Schedule 40 PVC lateral line:

$V_{lateral}$ = (327 ft)(7.76 gal/100 ft)
= 25.38 gal

3. $V_{dose\ min.}$ = 12.21 gal + 5 (25.38 gal)
= 139.11 gal

Thus, the minimum dosing volume for this example would be 140 gallons.

Dosing two (2)to four (4) times per day provides adequate resting time (as a general rule, use three [3] doses per day). Thus, the dosing volume shall be between one-fourth (¼) and one-half (½) the expected daily flow. In the example, for a 450 gallon-per-day design, this range would be between 112 to 225 gallons per dose (gal/dose).

Note*: In those situations where the minimum dose exceeds one-half (½) the expected daily flow, then the calculated minimum dose shall be the dosing volume.*

(2) Step 2. Select dosing volume.

Example:

Selecting 180 gal/dose would give between two and three doses per day. This volume is larger than the minimum in Step 1. If water use is less than 450 gpd, dosing will occur less frequently, providing longer resting periods between doses.

(3) Step 3 - Compute the depth of effluent pumped per dose.

In order to set the pump controls to deliver the proper dose, the depth of effluent to be pumped from the tank for each dose must be calculated. The following equation is used for this computation:

Dosing depth = (V_{dose} / V_{tank})(liquid depth of tank).

Example:

For a 900-gal pump tank, four (4) foot liquid depth (bottom of tank to invert of outlet); 180 gallon dose; (NOTE: If the liquid depth of the actual tank to be utilized is unknown, assume a minimum of a four (4) foot liquid depth [bottom of tank to invert of outlet]):

Dosing depth = (180 gal/900 gal)(4 ft) = 0.8 ft = 9.6 in.

The float control switch for the pump should be set for a nine and five-eighths (9 $^{5}/_{8}$) inch drawdown to provide automatic doses of approximately 180 gallons.

Important Note: This is a good approximation for the initial dosing volume and pump float switch setting. This dosing volume and float setting may require adjustment on site specific, case-by-case basis subject to the soil and topographic conditions present and to the individual resident's water use patterns.

D. Check Valve Calculation

Any effluent which remains in the supply line of a properly sited system has the potential to drain back to the pump tank when the pump shuts off. If this volume is too large, it can cause overuse of the pump and excessive consumption of electricity. A check valve is required to prevent this return flow to the pump tank, especially on a large system with a long pumping distance. A check valve shall be required if the total storage volume of the supply line pipe is greater than one fourth of the total daily waste flow.

(1) Step 1 - Calculate storage volume.

$V_{storage} = V_{supply}$

Example:

$V_{storage}$ = 12.21 gal

(2) Step 2 - Compare to ¼ daily waste flow.

<u>Example</u>:

(450 gpd)(¼) = 112 gal
12.21 gal < 112 gal
No check valve required.

<u>Note</u>: When a check valve is utilized, a vent hole shall be drilled in the discharge pipe below the check valve, inside the pump tank, to purge the pump of trapped air. (This practice is recommended by the Sump & Sewage Pump Manufacturers Association (SSPMA)). The vent hole size shall be in accordance with the pump manufacturers installation instructions. An extra two (2) gallons per minute shall be added to the pumping rate to compensate for flow through the vent hole.

CHAPTER 5

Parts and Components Specifications

All necessary equipment and tools shall be clearly listed by the LPP system designer in the complete design plan packet as outlined in *Section 19, Subsection C* of these regulations. In addition to ensuring that they meet the requirements as discussed below, *all* materials used in the construction of LPP systems shall conform to the specifications and provisions outlined in *Appendix 12* of these regulations.

A. Septic Tank and Pump Tank

All septic tanks and pump tanks utilized in LPP systems shall conform to the provisions outlined in *Section 10*, *Section 14*, *Section 17* and *Section 18*.

<u>Note</u>: Under septic system repair conditions, where a conventional septic system is being replaced by a LPP, the existing septic tank may be utilized only after inspection and approval by the Department.

B. Pipe and Fittings

All pipes and fittings in a LPP system shall be made of Schedule 40 pressure-rated PVC plastic with the exception of the gate, globe and/or ball valves used on the lateral lines and inside the pump tank. All of these valves shall be constructed of brass or bronze. The check valve inside the pump tank, however, may be either PVC, brass or bronze. There shall be no substitution of other plastic piping products (e.g. DWV [Drain, Waste and Vent] classified PVC pipe, ABS [Acrylonitrile-butadiene-styrene] pipe, CPVC [Chlorinated Poly Vinyl Chloride] pipe or plastic electrical conduit, etc.). In addition to meeting the material specifications as outlined in *Appendix 12* of these regulations, all PVC pipe shall also be utilized in accordance with all manufacturer recommended applications and installation procedures. All joints shall be properly solvent-welded.

<u>Important Note</u>: See Appendix 12 of these regulations for specifics regarding pipe materials.

The supply line from the pump tank to the LPP distribution field manifold shall be a minimum of ~~two (2)~~ <u>one and one-half (1½)</u> inch diameter Schedule 40 PVC pressure-rated pipe. A bushing or reducer may be needed to adapt the pump to the supply line. The pump outlet pipe shall be connected to the supply line with a threaded PVC union, or other similar connecting device, to allow easy pump removal or replacement. In lieu of a PVC threaded union, all other similar connecting devices require the approval of the Department prior to installation. A bronze globe, gate or ball valve shall be installed between the outlet of the PVC union and the inside tank wall to prevent effluent back-drainage during pump maintenance. Where a check valve is required (*Chapter 4*), it shall also be installed with threaded fittings inside the pump tank to provide easy access for maintenance.

Manifold lines shall be of the same pipe size diameter and specification as the supply line. All manifold lines shall have a threaded PVC plug at the terminus to provide access for clean-out or back-flushing. The lateral lines shall be connected to the manifold via solvent-welded Schedule 40 PVC pressure-rated pipe fittings (i.e., tees, crosses or elbows). *No screw-in or tapping arrangements (including saddle-taps) into the manifold shall be allowed.*

Lateral lines shall be a minimum of one inch diameter Schedule 40 pressure-rated PVC. Appropriate holes in the laterals shall be drilled on site (*Chapter 6*). A brass or bronze gate or ball valve for final pressure adjustment shall be installed at every lateral line to manifold junction. The end of each lateral line shall be equipped with a capped "turn-up" to provide above ground access for clean-out or back-flushing. Forty-five degree (45º) elbows shall be used, rather than 90-degree elbows, for the turn-ups. This will make clean-out easier to accomplish. The turn-up elbows shall be of the solvent-welded type Schedule 40 pressure-rated PVC pipe fittings. The turn-up caps shall be galvanized metal.

C. Pump, Float Controls and Alarm System

*<u>Important Note</u>**:** The pump and associated electrical controls for LPP systems shall meet all provisions outlined in Section 16 and Appendix 12 of these regulations.*

A good-quality, submersible sewage/effluent pump shall be used in all LPP systems. Grinder pumps shall not be used on LPP systems. The submersible pump shall be of sufficient quality to prevent corrosion by sewage and shall be located in the pump tank. Pumps with built-in switches shall not be used.

Pump selection shall conform to the information outlined in *Chapter 4* of this Appendix/Manual and be sized to meet or exceed the minimum flow and TDH requirements of the system. Pumping requirements for each system shall be checked against the performance curve of the pump to be used to ensure compatibility. The Department retains the authority to alter any pump specified in the alternative system design plans, where said pump is deemed insufficient by the Department for said use.

The controls for the pumping system shall include a switching control for turning the pump on and off and a high water alarm to signal pump malfunctions. The pump control system shall be adjustable to meet the recommended loading rates for different sizes and shapes of pump tanks. The controls shall be sealed against entry of corrosive effluent and/or corrosive/explosive gases from the effluent and should have NEMA (National Electrical Manufacturing Association) approval.

The pump controls shall be either sealed mercury float switches or sealed, self-contained mechanically-activated float switches. Mercury switches are activated by a sealed float which contains a tube of mercury in contact with power leads. The only approved mechanically-activated type switches shall be of the same design principle as that of the mercury-type switches. Instead of a tube of mercury, these mechanical switches employ a steel ball to activate the electrical contacts. Diaphragm switches or vertically rising mechanical-type float switches shall not accepted. All float switches shall be of a sufficient quality and material so as to perform under turbulent conditions and be resistant to the corrosive nature of the waste water.

The pump control system may employ either a single float switch or a dual float switch arrangement, operating in series, to control pump operation. In addition to the on and off control floats, there must be a separate float control for the high water alarm. This may be a sealed mercury-float switch or a sealed mechanically-activated float switch (as previously described) mounted several inches above the on/off float switch(es).

The high water alarm should consist of a clearly marked/labeled visual and audible alarm signal located in a conspicuous place. It should be on a separate electrical circuit from the pump power line, and be equipped with a test switch. The alarm should activate if the water level in the pump tank rises above the “pump-on" float control. The tank is sized to provide at least one day or more of excess storage capacity (depending on water use in the home) during which time the system must be repaired. See *Chapter 8* for repair and maintenance tips.

Important Note: Exact details regarding the electrical components and their set-up is outlined in Section 16 of these regulations.

D. Gravel

All LPP system installations shall require twelve (12) inches of gravel to be placed in the entire length of each and every lateral line distribution trench. The general gravel size shall be from one-half (½) to one (1) inch and shall be washed and free of fines. Gravel placement is discussed in *Chapter 6* of this manual.

Note: See *Appendix 12* of these regulations for the specific gravel requirements for LPP systems.

E. Home Water Conserving Devices

All homes served by a LPP system shall be equipped with low-flow shower-heads (2.5 gpm or less) and low-flush toilets (1.6 gallons or less per flush) in accordance with the *United States Code of Federal Regulations, Title 10, Part 430,* so as to minimize the hydraulic load on the system. These devices are a simple, low-cost way of reducing water consumption with no inconvenience to the homeowner. Installation of low-flow shower-heads and retro-fit dams for commode tanks shall be required in any existing home where a LPP system is installed.

CHAPTER 6

Installation Procedures

LPP systems shall only be installed by persons specifically licensed to install alternative subsurface sewage disposal systems in Williamson County. The licensed, approved installer shall have in their possession the *Permit to Install* packet prior beginning the installation of the LPP system. The packet will include the Permit to Install, a copy of the *Permit for Construction of a Subsurface Sewage Disposal System (i.e. Construction Permit)* issued for the lot, a copy of the approved LPP design plans, and any other pertinent supporting documentation. The installer shall be required to obtain this information prior to contacting the inspector for a Layout Inspection. Construction of the LPP system shall not begin until the Layout Inspection has been completed and approved by the Department. See *Section 20* of these regulations for specific guidelines and procedures in the installation and inspection process.

The LPP system installation shall conform to and shall not deviate from the permits, design plans and/or any other supporting documentation. During the course of the LPP system construction, should an installer encounter unforeseen problems, questionable soil conditions or other concerns not specified on either the permit or its related supporting documentation, the Department shall require that said installer cease construction immediately and contact the Department for consultation and an assessment of the problem. The Department shall schedule, as soon as possible, an *Assessment Investigation* of the problem (See *Subsection A, Part 13, of Section 20* of these regulations).

A. Machinery, Tools and Supplies

A backhoe is needed for the installation of the septic tank and pump tank. Additionally, a backhoe will be necessary to install the curtain drains, interceptor drains or drawdown drains. All other excavation is done with a trenching machine that will excavate a trench six (6) inches wide. An accurate surveying instrument is required for layout of manifold and all lateral lines.

Other common equipment and/or materials needed for installation may include:

- Shovels, rakes, hoes, and wheel barrows
- Electric drill to drill holes in lateral lines
- Drill bits
- Mechanical pipe cutter or Hack saw and blades
- PVC deburring tool, files, very course sandpaper, utility knife
- PVC primer and PVC solvent cement
- rags
- wire flags, wood stakes, spray paint
- Mortar to seal tank openings
- Measuring tape
- Electrical wiring tools, electrical tape
- silicone caulking
- plastic electrical wire ties
- miscellaneous hand tools (hammers, screwdrivers, pliers, etc.)

Note: The installer shall See the approved LPP design plans for the materials specification list.

B. Site Preparation and Imported Fill

One of the most important concerns for a LPP system is to protect the site from soil disturbance by heavy equipment. Cutting, compaction, or any disturbance of the soils in the designated LPP areas, especially during wet weather, will void the permit approval and may destroy the site's suitability for the use of a LPP system. As soon as the LPP areas have been platted or designated, they shall be *quarantined* from construction traffic in accordance with the requirements as outlined in *Appendix 10* of these regulations. No site preparation or LPP construction work shall occur if the soil is wet. A determination as to the proper soil moisture condition for LPP installation shall be solely determined by a Department Soil Scientist. Only after the preceding conditions are met, may the site be mowed of tall weeds/grass and cleared of brush and small trees. When trees larger than two (2) inches in diameter are to be removed, they shall be cut off at ground-level, rather than uprooted in order to avoid creating depressions and damaging the soil-pore network.

Provisions must be made for intercepting or diverting surface water and shallow groundwater away from the absorption area, septic tank, and pump tank in accordance with the approved LPP design plans and permit restrictions.

Note: All soil drainage improvement practices shall conform to all provisions of *Appendix 5* of these Regulations).

After the LPP area has been mowed and cleared, the location of the lateral lines and manifold shall be accurately staked out according to design specifications. Each lateral line must be laid out along a level contour using an accurate surveying instrument. One lateral may be higher or lower than the next one, but each individual lateral shall be level. Under no circumstances shall a lateral line be allowed to slope away (either up or down) from the manifold.

C. Septic Tank and Pump Tank Installation

The two-compartment septic tank for a LPP system is installed in the same manner as for a conventional system. Wastewater from the house flows directly into the large compartment of the septic tank. The septic tank shall be connected to the pump tank with an appropriate length of four (4) inch Schedule 40 PVC pipe, in such manner so as to ensure proper gravity flow from the septic tank outlet to the pump tank inlet.

The pipe connecting the two tanks shall be properly bedded and supported in such manner that will prevent it from sagging or being dislodged from the tanks. All pipe to tank connections shall be appropriately sealed in order to prevent infiltration and exfiltration.

All tank access lids shall be equipped with water-tight risers. The top of the risers shall be at least six (6) inches above final grade. Properly installed risers provide necessary access for repair and inspection and prevent surface water from entering the tanks. Under septic system repair conditions, where a conventional septic system is being replaced by a LPP, the existing septic tank may be utilized only after inspection and approval by the Department. Additional modifications to the existing septic tank may be required by the Department (e.g. installation of risers, baffle replacement, etc.)

<u>Note</u>*: All tank installations shall conform to the provisions outlined in Section 17*.

D. Supply Line, Manifold Line, and Manifold-to-Lateral Connection

The supply line conveys effluent from the pump to the manifold. The manifold line then distributes effluent to the individual lateral lines. The supply line and the manifold line shall be the same pipe size and specification. The supply line shall be designed and installed so as to ensure that it connects to the manifold line at the point of highest elevation in the designated/platted disposal field area (i.e., the supply line must enter the designated/platted disposal field area at the highest elevation). Further, the supply line shall be designed and installed so as to drain after each use unless the system design requires the use of a check valve.

The manifold line shall be installed perpendicular to the natural slope of the designated/platted disposal field area. The manifold line trench shall have a maximum depth of ten (10) inches and be uniform throughout its entirety. All manifold lines shall have a threaded plug at the terminus to provide access for clean-out or back-flushing. Further, the manifold line shall be designed and installed so as to drain after each use.

<u>Important Note</u>: Split manifold designs shall not be allowed under any circumstances. See Figure A3-9 for an example of a split manifold set-up.

The first lateral line shall be located in the highest portion of the designated/platted disposal field area. Thus, each subsequent lateral line will be placed below (lower in elevation) the previous. Each lateral line shall be connected to the manifold via solvent welded Schedule 40 pressure-rated PVC pipe fittings (e.g., crosses, tees or elbows). Additionally, bushings or reducers may be required due to differential pipe sizes (these fittings must also be of the solvent-welded type, Schedule 40 pressure-rated PVC).

No screw-in or tapping arrangements into the manifold shall be allowed. A brass or bronze gate or ball valve shall be installed between the manifold and each individual lateral line for pressure regulation. Further, the lateral lines shall be designed and installed so as to drain after each use. See Figure A3-10 for a visual depiction of typical manifold-to-lateral line connections.

After the manifold line has been placed in its trench and lateral lines connected, it shall be back-filled with tightly tamped soil *<u>only</u>* after passing the Open Ditch Inspection (as outlined in *Section 20* of these regulations). There shall be no gravel present in the manifold line trench (or the supply line trench).

E. Lateral Lines

The lateral line trenches shall be installed parallel to the naturally existing ground contours of the designated/platted disposal field area and spaced a minimum of five (5) feet apart (center to center). All lateral line trenches shall be six (6) inches wide and excavated to eighteen (18) inches in depth. The depth of a given lateral trench from the valve-assembly shall be uniform, and the trench bottom shall be level throughout its entire length. Under no circumstances shall a lateral line trench bottom contain rise or fall either towards or away from the valve-assembly. The lateral trench shall not extend more than one or two feet beyond the turn-up at the end of the lateral pipe.

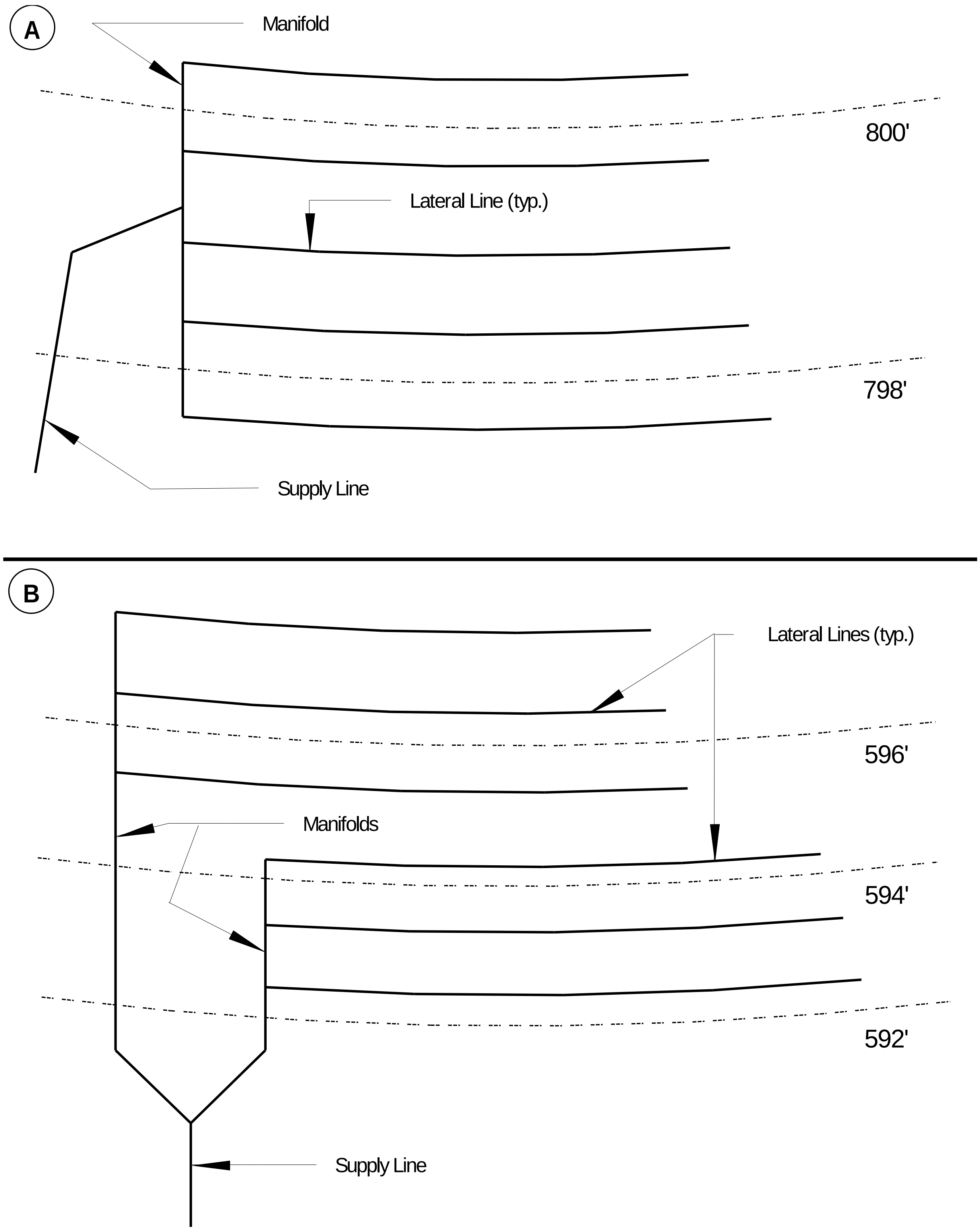

Figure A3-9. Examples of a split manifold design concept. This design concept is <u>not</u> allowed under the provisions of these regulations.

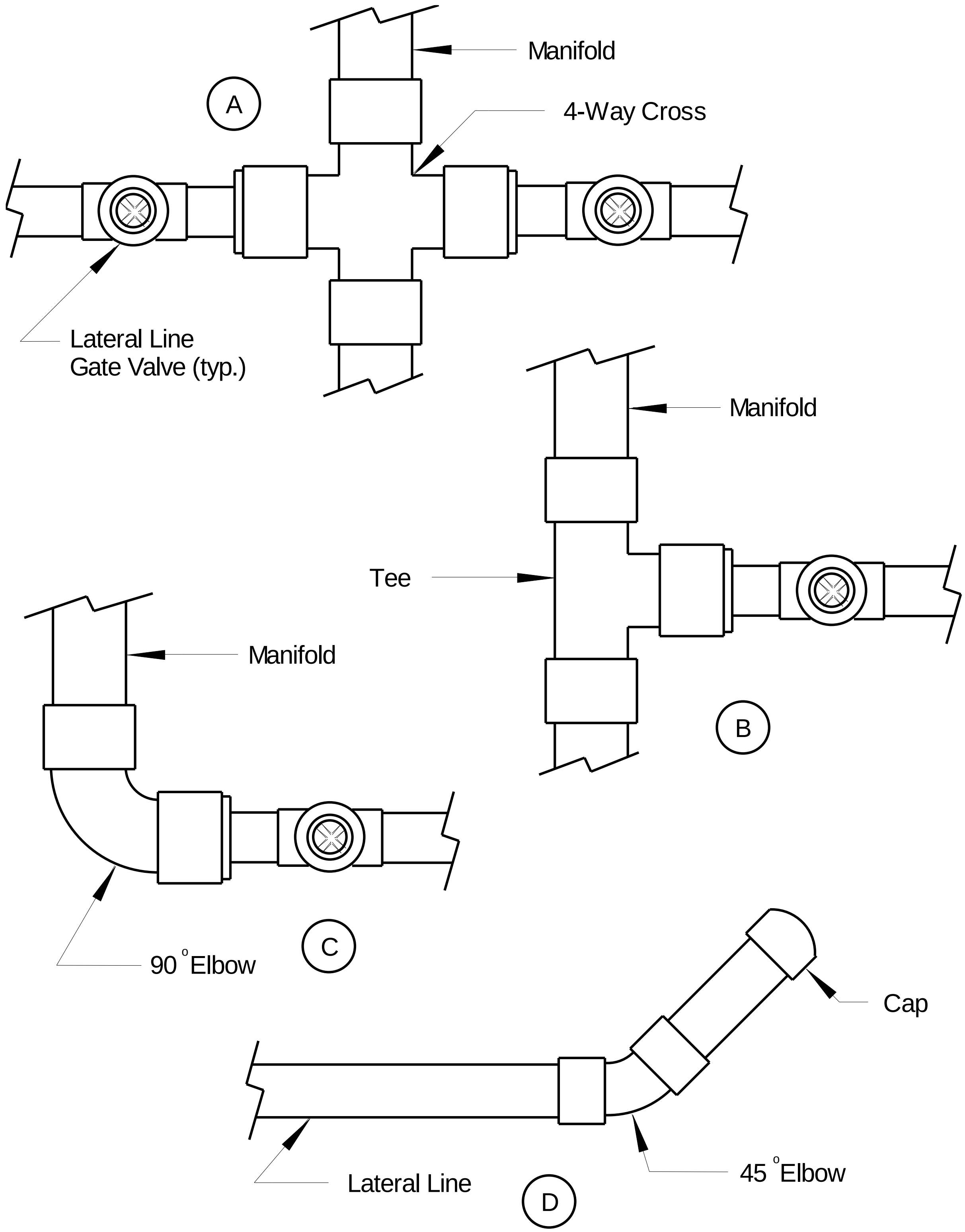

Figure A3-10. Examples of typical distribution pipe connections. Lateral line-to-manifold connections using (a) a 4-way cross, (b) a tee, and (c) an elbow. (d) Typical lateral line turn-up.

Earthen dams shall be placed at regular intervals throughout the length of the lateral line trench in order to maintain uniform distribution of effluent along each trench. Each earthen dam shall rise twelve (12) inches from the trench bottom and shall be a minimum of eighteen (18) inches long. The Department retains the authority to specify adjusted earthen dam dimensions as soil and site conditions so warrant. A four (4) inch deep notch shall be hand-cut with a sharp-shooter spade into the top of the dam in order to create a recess in which the PVC pipe will rest.

The initial dam shall begin at the outside edge of the manifold trench and extend into the lateral line trench. (The valve-assembly will actually be located within this initial dam. The placement of the valve-assembly in the initial dam shall be completed so as not to compromise its integrity. After placement, the valve-assembly shall be back-filled with tightly tamped soil <u>*only*</u> after passing the Open Ditch Inspection, as outlined in *Section 20* of these regulations). Each subsequent dam shall be placed at twenty (20) foot intervals thereafter. The dams shall be left as uncut from the soil during the trenching process by raising the trencher boom at the proper intervals when excavating the lateral line trench.

The Schedule 40 PVC pipes shall be laid out and cut to proper lengths for the lateral lines (*Note: Maximum lateral line lengths are established as per Table A3-3).* Holes are drilled (in a straight line) according to the design specifications after the laterals have been cut to their proper length. The first hole in each lateral shall be drilled at a point two and one-half feet from the valve; the last hole should be drilled two and one-half feet from the end of the lateral; the balance of the holes shall be spaced in accordance with the design specifications. Holes must not interfere with the earthen dams. Holes are only drilled through one side of the pipe. Should the drill bit go completely through the pipe, or if a hole is drilled in the wrong place, that section of lateral line pipe shall be discarded and replaced with a new length of pipe.

Lateral line pipes shall be suspended and/or supported at the proper depth within the trenches with the holes placed down toward the trench bottom. The end of each lateral line shall have a short turn-up with a metal end-cap. The capped end must be brought up above or flush with the final grade. At the time of trench back-filling, the turn-up shall be placed inside a short length of four (4) inch diameter corrugated black plastic (polyethylene) pipe with an appropriate end cap to protect it from damage, while still providing easy access. Positioning of the lateral line pipe shall be checked to ensure that it is level and centered at the proper depth within the trench. The lateral line pipe shall be centered between the trench sidewalls with the invert positioned eight (8) inches above the trench bottom. Thus, there shall be eight (8) inches of gravel media below the lateral line pipe invert. An additional four (4) inches of gravel shall be placed on top of that for a total of twelve (12) inches of gravel. Refer to Figures A3-11A and A3-11B for cross-sectional visual depictions of typical lateral line trenches.

<u>*Important Note*</u>: The gravel media shall not be placed in the lateral line trenches nor shall the lateral lines be covered with soil until they have received Open Ditch Inspection approval from the Department. See *Section 20* of these regulations regarding the inspection process and sequence.

Only after the lateral lines have been approved during the Open Ditch Inspection shall the gravel media be placed in the trenches. The gravel in the trenches shall be covered with untreated building paper or other comparable filter fabric determined to be equivalent by the Department. (Note: Straw shall not be allowed as covering for gravel media in LPP systems.) Corrugated polyethylene risers with snap-lock caps shall be placed over each and every lateral line valve and shall extend to the ground surface. Finally, the trenches are back-filled with the spoils from trench excavation. The lateral line trenches shall be back-filled as soon as possible after installation and Final Inspection approval, in order to protect the trenches from siltation.

F. Pump and Pump Controls

<u>***Important Note***</u>***:*** *The pump and associated electrical controls for LPP systems shall meet all provisions outlined in Section 16 and Appendix 12 of these regulations.*

Details of pump installation are shown in Figure A14-6 of *Appendix 14*. The pump shall be placed on two eight (8) inch concrete blocks, set tightly side-by-side, on the bottom of the tank. Elevating the pump (a minimum of eight inches) in this manner minimizes the potential of any solids from being drawn into the pump and discharged through the piping network. A length of nylon rope or other non-corrodible material shall be attached to the pump and to the outlet pipe for lifting the pump in and out of the pump tank.

Pump controls shall be securely fastened to the outlet pipe with a non-corrodible clamp or bracket. The pump control switches shall be positioned so as to pump the specified volume of effluent (as per design plans) while ensuring that the pump remains submerged at all times. The high water alarm control shall be positioned so as to ensure the minimum specified emergency storage capacity (as per design plans). Care shall be taken to ensure that the control floats do not become fouled by one another or by other components in the tank.

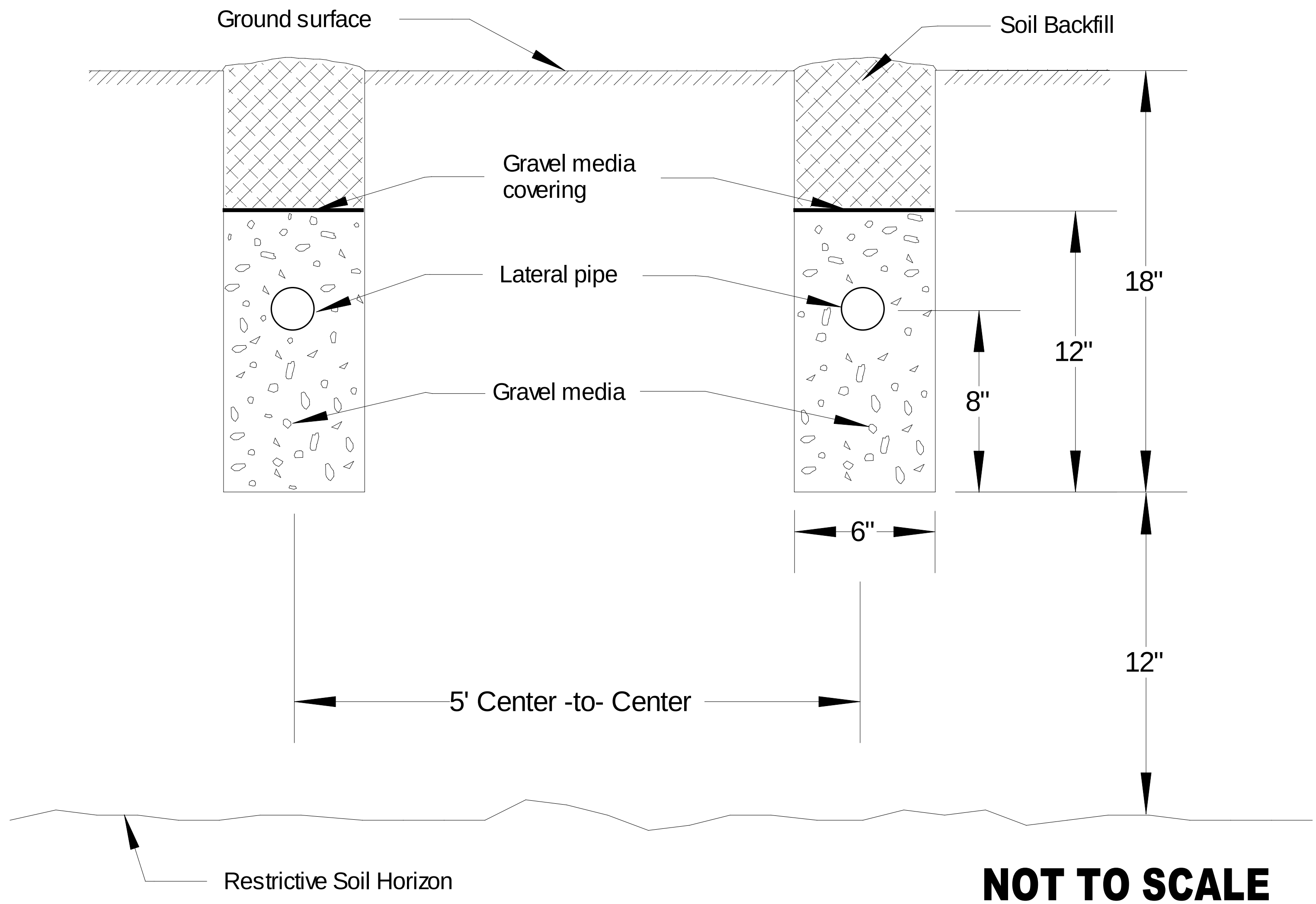

Figure A3-11A. Cross-sectional end view of typical LPP lateral line trenches.

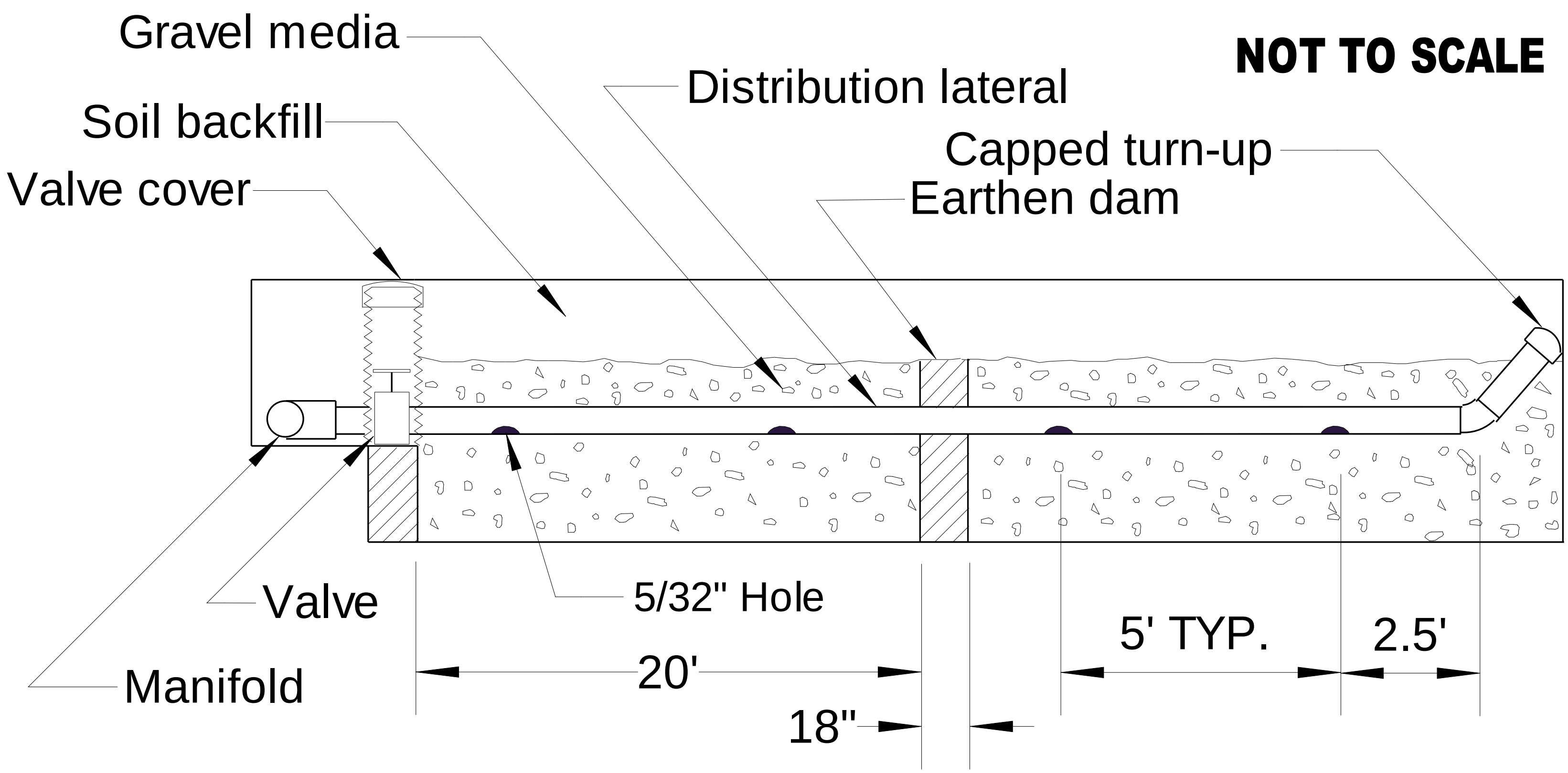

Figure A3-11B. Cross-sectional side view of typical LPP lateral line trenches.

A bushing or reducer may be needed to adapt the pump outlet to the pump outlet pipe. The pump outlet pipe shall be connected to the supply line with a threaded PVC union to allow for quick removal or replacement. A brass or bronze globe, gate or ball valve shall be installed in the supply line (within the pump tank) to prevent effluent back-drainage during pump maintenance. Where a check valve is required (*Chapter 4* of this Appendix/manual), it shall also be installed with threaded PVC fittings inside the pump tank to provide easy access for maintenance. For systems where the absorption field is at a lower elevation than the pump, a 1/4-inch siphon-breaker hole must be drilled in the supply line inside the pump tank. This breaks any vacuum in the system and prevents the inadvertent siphoning of effluent out of the tank. The placement of this hole is critical to the functioning of the system. Similarly, when a check valve is used, a vent hole (in accordance with the manufacturers recommendations) must be drilled in the supply line inside the pump tank. The placement of this hole will ensure the purging of any air trapped within the pump.

LPP systems are considered by the Department to be *Electrically Assisted Systems (EAS)* ---- i.e., any type of subsurface sewage disposal system requiring the use of a sewage/effluent pump. As such, all the electrical components (and their installation) associated with LPP systems shall meet all the requirements and provisions of these regulations relating to *EAS.*

Important Note: Details regarding the set up and placement of the electrical components is outlined in Section 16 of these regulations

G. Pump and Alarm Check

After all required installation tasks have been completed, the system shall be checked for proper operation. With electrical power turned off, fill the pump tank with water to a level sufficient to activate the high water alarm float.

Turn on the electrical power. The alarm should activate, and the pump should start operating. The alarm should deactivate when the liquid level falls below the high water alarm float. The pump should turn off when the liquid level reaches the lowest float control. At the lowest float control level, the pump shall remain completely submerged.

H. Pressure Head Adjustment

The valves on each individual lateral line must be adjusted so as to provide three (3) feet of pressure head at the end of each and every lateral line. The pressure head is measured as the height liquid will rise above the turn-up elbow when the pump is running. The pressure head check is performed simultaneously on all lateral lines to ensure proper effluent distribution.

To adjust the pressure head:

(1) Glue a five-foot length of PVC pipe to a threaded fitting that will screw onto the lateral line turn-up fitting. The pressure head standpipes and all necessary fittings shall be of the same size and specifications as the lateral line pipes.

(2) Replace each individual lateral line turn-up cap with a pressure head standpipe and appropriate connectors.

(3) Turn the pump on to allow the liquid level to rise in the standpipes.

(4) Adjust each lateral line valve until the liquid level reaches the desired height in each standpipe. Proper pressure head adjustment of each individual lateral line shall be achieved when the liquid barely overflows the top of each standpipe.

(5) Once the proper pressure head is achieved on each individual lateral, the pump may be turned off, the standpipes removed, and turn-up caps replaced.

(6) Upon the completion of this task, and with the approval of the Department inspector, the pressure of the system will have been properly regulated.

I. Final Landscaping

After the LPP system is installed, the following shall be checked to ensure that the system will not be hydraulically overloaded due to excessive surface and/or subsurface water:

- The trenches are back-filled with the spoils from trench excavation. The lateral line trenches shall be back-filled as soon as possible after installation in order to protect the trenches from siltation.

- The excess spoils, remaining after trench filling, shall be evenly spread over the entire distribution field area in order to shed rainwater and be free of low areas. These practices shall be implemented in such a manner so as to prevent compaction or rutting of the soils or any other damages to the system. Lightweight crawler-type bladed equipment is recommended for the completion of this task. Heavyweight dozers or any type of wheeled tractors/loaders shall not be used. Manual labor may also be used.

- The construction of any and all required soil drainage improvement practices upon any LPP installation site shall be in accordance with all provisions and requirements outlined in *Appendix 5* of these regulations. Additionally, the placement and/or location of said soil drainage improvement practices shall be in accordance with the any and all specifications required and/or approved by the Department.

- Gutter and downspout drains or any other runoff from impervious surfaces shall be directed away from the system.

Finally, the entire area shall be sown with grass in order to prevent erosion. The soil should be properly limed and fertilized before planting. After applying an appropriate amount of grass seed, the area shall be heavily mulched with straw or other suitable material. Additionally, the placement and/or use of any erosion control techniques (e.g. silt fences, sodding, geotechnical fabric, etc.), shall be in accordance with all Department specifications (i.e. either specified on the Construction Permit or its supporting documentation).

CHAPTER 7

Modified LPP (MLPP) Systems Using Compatible Soil Fill Material

Sites with a blocking layer, restrictive horizon or a seasonally high water table within twenty-four (24) inches of the surface are not suitable for a standard LPP system. Some of these sites can be used for waste treatment if the soil properties are such that the proposed subsurface sewage disposal system site can be supplemented with fill that has been carefully selected and added in accordance with the construction techniques outlined in this Chapter.

Where there is twenty-four (24) inches of usable soil on an acceptable site, as determined and noted through approved soil mapping standards and the use of such sites verified by the Department, a MLPP may be installed. Soil characteristics, site topography and landscape positions shall be assessed for such use under the criteria presented in *Appendix 1*. Prior to its application, all proposed imported soil fill material shall be evaluated and approved by a Department Soil Scientist as to its compatibility with the naturally occurring soil present on the designated MLPP site.

If the site requires imported fill to supplement the naturally existing soil profile, it shall be incorporated evenly into the underlying natural soil. It is critical that no sharp interface remain between the natural and imported soil layers. Before applying the imported fill to the absorption area, the ground surface shall be tilled with a small plow. Fill shall be applied with a minimum of wheeled traffic on the area, and the area tilled again to ensure even mixing. A very small tractor shall be used to spread the material around and to provide a convex shape to the area. There shall be no low spots or depressions, and the final shape should shed, rather than accumulate any surface waters.

Important Note: *The use of MLPP systems with Extra Modification (MLPP/EM) are experimental subsurface sewage disposal systems and as such shall be restricted to use on properties for repair purposes only. Such repairs shall be limited to properties where existing structures, buildings or homes, have non-functioning or non-existent subsurface sewage disposal systems, and where the proper soils conditions will not allow for the installation of a subsurface sewage disposal system to be in accordance with the provisions of these regulations. A Department soil scientist shall investigate a site's suitability for the use of this type of system. Should a site meet the provisions outlined in Chapter 6 of Appendix 1 for a MLPP/EM system installation, the design criteria shall be specified by the Department on an individual case-by-case, site specific basis.*

A. Modified LPP (MLPP) Design

The only difference between designing a MLPP and standard LPP is the calculation of the imported compatible fill requirements. The volume of the fill needed is the area to be filled multiplied by the depth of fill. The area to be modified is the absorption field plus an appropriate amount of incorporated soil buffer around the outside perimeter of the designated or platted subsurface sewage disposal system area. The required amount of incorporated soil buffer area is determined on a site-specific basis, depending upon the soil and site characteristics.

The buffer distance may range from five (5) to twenty-five (25) feet and shall be determined and specified by a Department Soil Scientist. The distance of the modification buffer requirement will increase on the downslope side of a MLPP site as the slope increases. However, depending upon the site and soil characteristics of the MLPP installation area, a Department Soil Scientist has the authority to specify the amount of modification buffer on any MLPP installation site. The final depth of fill (i.e. after natural soil settling) shall be a minimum of six (6) inches over the entire modification area. However, in order to achieve this minimum depth, the Department shall require that a minimum of eight (8) inches of imported soil material be incorporated to allow for natural soil settling.

Note: See Section 8, Part D of these regulations regarding the placement requirements of the soil fill material.

(1) Step 1 - Calculate area to be filled.

Example:

For a platted MLPP subsurface sewage disposal system area measuring 60 ft x 30 ft and requiring a 10 foot buffer around the perimeter:

Total area = 80 ft x 50 ft = 4000 ft^2

(2) Step 2 - Calculate the volume (V_{fill}) of fill needed.

Example:

V_{fill} = total area x depth of fill
V_{fill} = (4000 ft^2)(8 in)(1 ft/12 in) = 2667 ft^3

(3) Step 3 - Convert to cubic yards.

Example:

$$V_{fill} = 2667\ ft^3/(27\ ft^3\ per\ yd^3) = 98.8\ yd^3$$

(4) For the remaining design steps, follow the procedures outlined in Chapters 3 and 4 of this Appendix/manual.

B. Installation

In order to ensure the successful functioning of a MLPP system, careful attention must used in selecting and incorporating the fill material. The soil fill material to be utilized on a MLPP site shall have been specifically approved for use by the Department prior to its placement on a construction site. The approved soil fill material shall not be excavated, hauled or incorporated wet.

One of the most important concerns for a MLPP system is to protect the site from soil disturbance by heavy equipment. Cutting, compaction or any disturbance of the soils in the designated MLPP areas, especially during wet weather, may result in revocation of Construction Permit approval and may destroy the site's suitability for the use of a MLPP system. As soon as the MLPP areas have been platted or designated, they shall be *quarantined* from construction traffic in accordance with the requirements as outlined in *Appendix 10* of the regulations.

The soil conditions of a MLPP installation site shall be dry prior to beginning the process of incorporating the modification soil onto said site. Incorporating or tilling damp or wet soil can cause compaction and sealing, leading to failure of the system. No site preparation or MLPP construction work shall occur if the soil is wet. A determination as to the proper soil moisture condition for MLPP installation shall be determined by a Department Soil Scientist. Prior to the incorporation of the soil fill material, and only after the preceding conditions are met, may the site be mowed of tall weeds/grass and cleared of brush and small trees. When trees larger than two (2) inches in diameter are to be removed, they shall be cut off at ground-level, rather than uprooted in order to avoid creating depressions and damaging the soil-pore network. After the brush and small trees have been removed, the soil surface shall be tilled to a minimum depth of six (6) inches using a plow.

Fill is moved to the system installation site using a front-end type loader. Care must be utilized to avoid driving on the plowed area. The first load of fill is pushed into place using a very small crawler tractor with a blade or a roto-tiller with a blade. The fill is then tilled into the first few inches of natural soil to create a gradual boundary between the two. Failure to do so could ruin the system by forming a barrier to water movement at the soil-fill interface. Subsequent loads of fill are placed on the system and tilled until the desired height is reached. The site should be shaped to shed water and be free of low spots before proceeding.

After the MLPP area has been mowed, cleared and the imported fill properly incorporated, the location of the lateral lines and manifold shall be accurately field-staked according to design specifications. Each lateral line shall be installed in the same manner as described in *Chapter 6, Part E* of this Appendix/manual.

Provisions shall be made for intercepting or diverting surface water and shallow groundwater away from the absorption area, septic tank and pump tank in accordance with the approved MLPP design plans and permit restrictions. The construction of any and all required soil drainage improvement practices upon any LPP installation site shall be in accordance with all provisions and requirements outlined in *Appendix 5* of these regulations. Additionally, the placement and/or location of said soil drainage improvement practices shall be in accordance with the any and all specifications required and/or approved by the Department.

The same installation procedures discussed in *Chapter 6* of this manual shall also apply to MLPP systems.

<u>Important Note:</u> The imported soil fill material <u>shall</u> be incorporated onto the site under the direct supervision of the Department.

CHAPTER 8

Inspection and Maintenance

A. Installation, Inspection and Approval

All inspection practices, procedures and final approval of the system installation process shall be in accordance with the information outlined in *Section 20*.

B. Operation Inspections

A properly designed and installed LPP system requires very little maintenance. Several routine items should be checked periodically and an extra pump should be readily available. LPP systems should be observed by the property owner one (1), three (3), six (6) and nine (9) months after initial installation, and every six (6) months thereafter. Should any problems be noted, the property owner shall contact the Williamson County Department of Sewage Disposal Management immediately. The Department retains the right to conduct an on-site investigation of the system and may further require participation from the design engineer and system installer.

C. Maintenance

All septic tanks, whether for conventional or alternative systems, require occasional pumping. Sludge and scum accumulation should be checked annually. Virtually all solids will be retained in the first compartment of the two-compartment septic tank. Little or no accumulation should occur in either the second compartment of the septic tank or in the pump tank. The rate of sludge accumulation will vary with individual living habits. It is recommended that septic tanks be pumped once every three (3) to five (5) years, regardless of the amount of solids accumulation.

Some LPP systems may gradually accumulate solids within the lateral lines. These should be removed at least once a year by unscrewing the caps on each of the turn-ups, and back-flushing the laterals.

Pressure head in all the laterals should also be checked and adjusted one month after initial installation and annually thereafter (*Chapter 6* of this manual) Proper pump and float-control operation should be checked during all routine inspections. The alarm panel operation should be checked regularly. Pump maintenance should follow the manufacturer's recommendations.

D. Minor Troubleshooting

The alarm should activate whenever the effluent level in the pump tank rises above the high water float setting. This can occur for several reasons:

- *Power failure*: If there has been a power failure, effluent will continue to accumulate in the tank until power is restored. At this time the alarm may come on for a brief period, but will go off as soon as the pump draws down the effluent.

- *Pump or switch failure*: If the pump or float switch controls malfunction, they can be quickly replaced with new components by unscrewing the PVC union and lifting the entire assembly out of the pump tank.

  Important Note*: It is imperative to ensure that the electrical power supply to the pump tank and its associated electrical control panel/box is shut off before beginning any work related to the pump or any of its associated components*.

- *Clogged valve or discharge holes*: If the distribution system becomes clogged, the tank will not be emptied. Back-flush the laterals, manifold and/or supply line if necessary.

Before replacing any components, make sure that the level controls have not simply become tangled. The problem can usually be isolated by checking the pump operation independently from the controls. Repair or replace the appropriate components.

Should the initial investigation reveal that more extensive repairs are required, the property owner shall contact the Department for proper advisement. Any and all repairs, other than those previously mentioned in this Chapter, shall follow all specifications set forth in these regulations.