PROJECT : Bill Skeen
COUNTY : Iredll
REFERENCE NO. : 01
DATE : 10-12-2006

SUMMARY OF DESIGN
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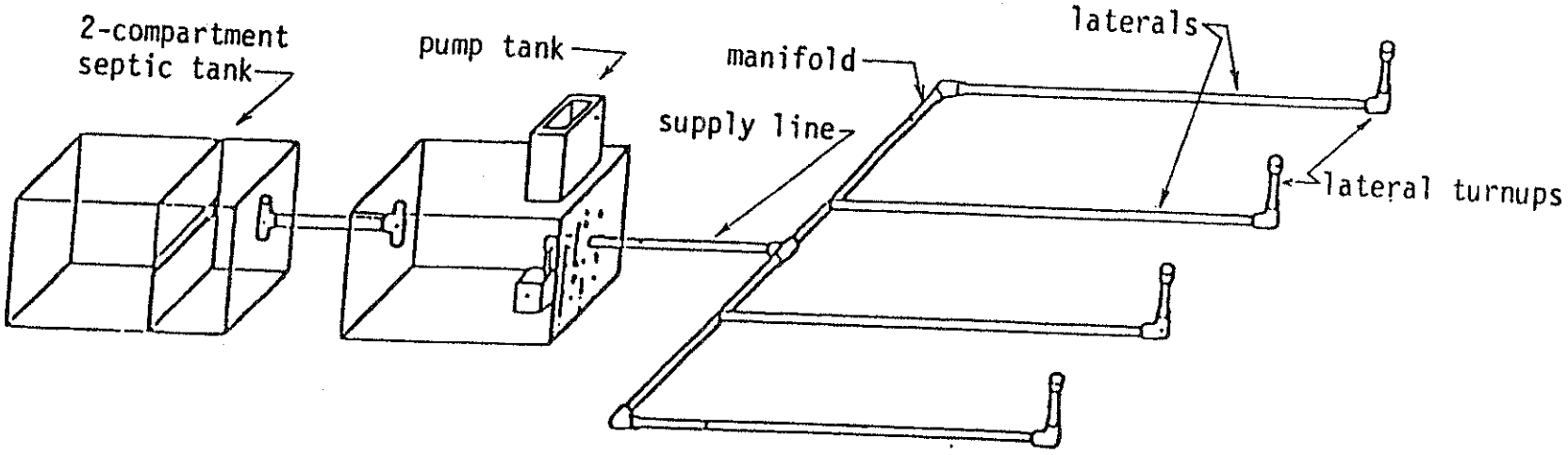
DESIGN FLOW	:	360	GPD
APPLICATION RATE	:	0.17	GPD/SQFT
TOTAL AREA REQUIRED	:	2057	SQFT
TOTAL LATERAL LENGTH REQUIRED	:	411	LFT
TOTAL LATERAL LENGTH SPECIFIED	:	414	LFT
NUMBER OF FIELDS	:	1	
LATERAL LENGTH	:	69	FT
NUMBER OF LATERALS	:	6	
NUMBER OF LATERALS PER FIELD	:	6	
SLOPE	:	8	PERCENT

FIELD NO. 1

LAT. NO.	LENGTH	ELEV-ATION	PRESS. HEAD	HOLE SIZE	HOLE SPAC.	NO.OF HOLES	FLOW PER HOLE	FLOW PER LATERAL
Top 1	69	100.00	2.00	0.156	4.06	17	0.41	6.90
2	69	99.58	2.42	0.156	4.60	15	0.45	6.69
3	69	99.17	2.83	0.156	5.31	13	0.48	6.27
4	69	98.75	3.25	0.156	5.75	12	0.52	6.20
5	69	98.34	3.66	0.156	6.27	11	0.55	6.04
6	69	97.92	4.08	0.156	6.90	10	0.58	5.79
Bottom TOTAL	414 FEET					FLOW TO FIELD		37.89 GPM
						FLOW VARIATION		16.0 %

LATERAL PIPE SIZE	:	1 1/4	INCHES (SDR 26)
MANIFOLD PIPE SIZE	:	3	INCHES (SDR 26)
SUPPLY LINE PIPE SIZE	:	2	INCHES (SCHEDULE 40)
SUPPLY LINE LENGTH	:	30	FEET
TOTAL DYNAMIC HEAD	:	-11.08	FEET
DOSING VOLUME	:	240	GALLONS
PUMP TANK INSIDE LENGTH	:	8.00	FEET
PUMP TANK INSIDE WIDTH	:	4.00	FEET
PUMP TANK DRAWDOWN	:	1.00	FEET

MINIMUM DOSING VOLUME:	198.7 GALS	(PUMP RUN TIME : 5.2 MIN.)
MAXIMUM DOSING VOLUME:	397.4 GALS	(PUMP RUN TIME :10.5 MIN.)
SELECTED DOSING VOLUME:	240.0 GALS	(PUMP RUN TIME : 6.3 MIN.)



From: Cogger, C., B. L. Carlile, D. Osborne, and E. Holland. 1982.

Figure 1. Typical low-pressure pipe distribution system.

RECOMMENDED DESIGN CONSIDERATIONS FOR

PREVENTING COMMON LPP PROBLEMS

(OSWS/DEH/NCDEHNR - 2/95, rev. 3/96; addendum to "Design of Large Low-Pressure Pipe Distribution Systems in North Carolina", Marinshaw, 1988)

DESIGN COMPONENT	REQUIRED	RECOMMENDED
Lateral Line Diameter	1-inch, minimum.	1- 1/4-inch. - 1 -1/2-inch, maximum.
Trench Width	8 inches, minimum. 12" trench width	12 inches, minimum. 18 inches, recommended when site conditions allow. Protect trench with geotextile fabric (see below).
Washed Gravel Classification	#3, 4, 5, 57 or 6 of ASTM D-448	#5 of ASTM D-448
Orifice Size	5/32-inch for 2/3 of holes, minimum. ~~1/8-inch, absolute min. for 1/3 of holes.~~	5/32 -inch, minimum. 3/16-inch, minimum, for food services ✓Protect orifices by sleeving or shielding (see below)

OTHER RECOMMENDATIONS

1. *Sleeve laterals in 3- or 4-inch conventional nitrification line perforated tubing.* Reduces the effects of rock shadowing and root intrusion and enables easy removal or replacement of the LPP laterals, if necessary. (See Figures 1 and 3)

2. *Following item 1, drill all orifices facing upwards, except for a hole 1/3 of the way from the beginning and end of each line which should face down.* Having the orifices face up: helps bleed air out of the system better during pressurization; ensures no shadowing of these orifices by rock, roots, or perforated pipe corrugations; helps breaks the air block better after pump shut off, reducing siphonage from laterals to the supply manifold, which, in turn, may reduce the overloading of the lower laterals; and allows less opportunity for hole clogging by solids and bioslime. Having the two holes on each line face down allows effluent to drain after pumps shut off which: prevents anaerobic conditions inside the laterals; prevents standing water inside the laterals which could

possibly attract plant, grass, and tree roots; and prevents freezing of the laterals (though typically not a problem in southeastern climates). (See Figure 3)

3. *Use one 90-degree bend for lateral turn-ups, not one or two 45-degree bends.* This will facilitate accurate measurement of operating pressure head in the laterals. Using one or two 45-degree bends for constructing the manifold cleanouts, however, would be warranted. (See Figure 3)

4. *Use geotextile fabric over the trench, at the gravel - backfill interface.* Prevents the infiltration of small soil particles into the trench voids. (See Figures 1 and 3)

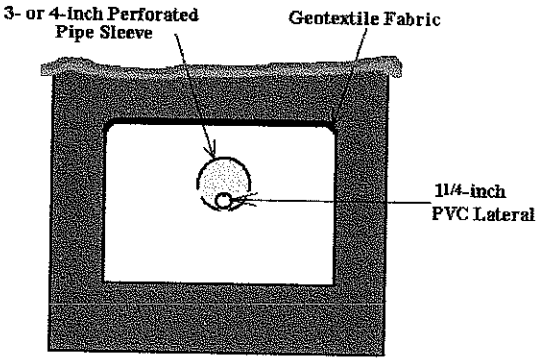


FIGURE 1: Cross-Sectional, Profile Detail of Recommended LPP Trench

5. *For LPP laterals, tee off of the manifold directly using, for example, a 3" x 3" x 1-*

1/4" tee, rather than "bushing-down", (ie. using a 3" x 3" x 3" tee with reducing fittings to 1-1/4"). This results in a hydraulically smoother transition and allows less opportunity for irreversible solids accumulation. (See Figure 2)

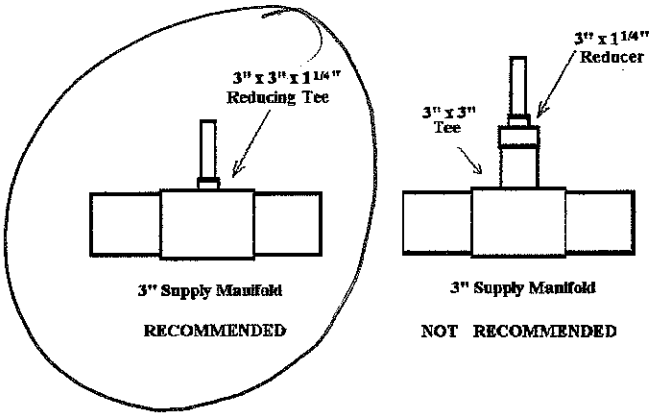


FIGURE 2: Side, Profile Detail of Recommended Supply Manifold-to-Lateral Connection.

6. *Elbow the manifold-to-lateral connection over the earthen dam, particularly on sloping sites.* This reduces effluent drain-back through the manifold or along the manifold trench. (See Figure 3)

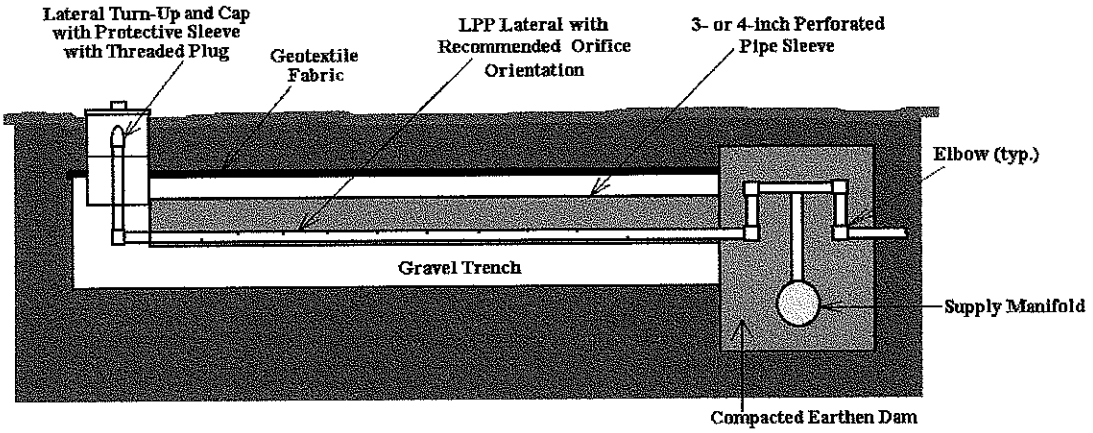


FIGURE 3: Side, Profile Detail of Recommended LPP Trench, including Cross-Section of Recommended Manifold-to-Lateral Connection.

7. *Provide two cleanouts on each supply manifold for LPP systems on sloping sites; one at the beginning (typically, the bottom) and one at the end (typically, the top) of the line.* Facilitates cleaning out the manifold after blowing out the LPP laterals, without reintroducing solids into the LPP laterals.

8. *Use the smallest pressure-adjustment gate valves which do not cause the total dynamic head of the system to exceed that which can be adequately handled by a reasonably-sized pump. This is typically achieved using gate valves which are one nominal size smaller than the effluent supply line or manifold (whichever is smaller).* The use of smaller valves allows for more precise pressure head adjustment. There will typically also be a net cost savings associated with the use of a smaller valve.

In fields served by multiple manifolds, place all pressure-adjustment gate valves in a common area for easy adjustment by one individual.

9. *Design/configure system to prevent or offset the hydraulic overloading of the lower laterals.* Overloading of lower LPP laterals is anticipated because: the lowest laterals fill up with effluent first and drain last, and they will receive effluent stored in the manifold and, perhaps, upper LPP laterals after dosing. Additionally, lateral, subsurface movement of water through the drainfield may

occur, potentially contributing to the overloading of the lower laterals. There are several ways to alleviate these problems, including item number 6, listed above, as well as the following:

A. *Design the system to "overload" the upper laterals during dosing. This can be accomplished by varying the orifice spacing and/or orifice size among the LPP laterals.*

B. *Incorporate a drainback mechanism to return effluent to the pump tank between doses.*

C. *Configure fields to make maximum use of slope width (along contour), thereby reducing the number of lines installed at different elevations.*

D. *Use check valves to keep effluent dosed to the upper subfields from draining to the lower subfield laterals.*

E. *Split flow to the subfields or laterals using a pressure manifold above the highest lateral, to prevent redistribution of effluent to the lower subfields or laterals.*

10. *Use effluent filter(s) for the outlet of the septic tank.* The use of effluent filters prevents the carry-over of solids to the LPP fields, which may result in orifice clogging and premature failure of the LPP system. Other forms of pretreatment should also improve LPP performance.

11. *Provide an elapsed time meter and cycle counter for each pump in the control panel.* Knowing the pump run time, number of pump cycles and pump tank drawdown or dose volume allows the operator and/or inspector to monitor delivery rates to an LPP network for comparison with design delivery rates. As orifices in the LPP network become clogged, delivery rates will decrease thereby alerting personnel that further inspection and maintenance, or perhaps, repair of the system is in order.

12. *Utilize lower long term application rates (LTARs) for LPP system design.* More conservative sizing of LPP systems should decrease the potential for hydraulic overload of the trench infiltrative surface. Recommended LTARs are as follows:

Soil Group	Recommended LTAR
I	0.50-0.35
II	0.35-0.20
III	0.20-0.10
IV	0.10-0.04

0.175

RECOMMENDED DESIGN CRITERIA FOR SEPTIC TANK EFFLUENT PUMPS (STEP) SEWAGE SYSTEMS

A. Septic Tank

1. Use two-compartment tank, sized and constructed in accordance with the state sewage rules (15A NCAC 18A .1900, et. seq.).

2. Provide risers above access manhole above sanitary tee to ground surface and divert surface runoff away from the manhole cover and/or make it watertight.

B. Pump Tank

Tanks must be generally constructed as per sewage rules (15A NCAC 18A .1900, et. seq.) with following modifications:

1. Tank must be large enough to provide:

   - 18 inches for pump submergence, minimum;
   - 3 minute minimum pump run time (15 gallon per minute minimum pump flow rate);
   - full day of emergency storage capacity above high-water alarm level. This may include septic tank freeboard capacity, if effluent will remain below ground and below building drain outlet invert.

2. Tank must be sealed watertight tank (fiber glass or one-piece, precast pump tank or special provisions for assuring watertight tank indicated).

3. Anti-buoyancy provisions must be adequate.

4. All pipe and wire conduits into tank must be through hubs or fittings made during the construction of the tank and installed in a watertight and gastight fashion.

5. Tank access riser must extend at least six inches above finished grade.

C. Pump

1. Must be an effluent pump capable of delivering at least 15 gallons per minute at the expected total dynamic head at each station.

2. All pump in a single STEP system must be the same model and size.

3. Pumps must be activated by mercury level control switch(es).

4. Pump discharge pipe must be of Schedule 40 PVC, or stronger material, and include a check valve, disconnect union, and gate valve within the pump tank. Pump must be readily removable from the ground surface.

5. When any pump is located at a higher elevation than the elevation at the terminal end then a siphon-break valve must be provided for that pump. As a rule if a siphon-break valve is provided for more than one pump in the system then such valves should be considered to be provided for all pumps.

6. Provisions for ventilation should be provided for all pump tanks with the vent opening located above the 100-year flood elevation. A vent with screen must be provided for all pump tanks.

D. Wires must be conveyed to a watertight (NEMA 4X), outside, vandal-resistant junction box through waterproof and gasproof conduits, with no splices made inside the lift station. Junction box may be mounted on the outside of the lift station riser above the ground surface.

E. Control panel must be mounted on the side of the house nearest the pump tank and readily accessible.

1. Panel must be in a NEMA 4X, vandal-resistant enclosure and located above 100-year flood.

2. Panel must be U.L. listed and include a pump run light and hand-off-automatic (H-O-A) switch. The panel should also include an elapsed time clock and cycle counter.

3. An audible and visible high-water alarm must be provided. The visible alarm must be visible from the road. The audible alarm must be audible inside the house and may be located in the house.

4. Two separate circuits must be supplied from the main house electrical panel--one circuit for the pumps and pump controls and one circuit for the high-water alarm.

F. Service laterals must be of Schedule 40 PVC, or stronger material, and must include a check valve and gate valve within a valve box adjacent to the property line, prior to connecting in the force main.

G. Force mains must include cleanouts at the end of each line, and at all main junctins and at least every 1000 feet. Air release valves must be provided at any high spots along the line.

H. Surge storage tank must be provided in front of the final common dosing tank with liquid capacity of at least 10 percent the total required septic tank capacity for the project as a whole to give further solids retention in case of upset at one or more of the individual lift station.

I. Legal Arrangements/Operation and Maintenance Requirements

1. Developer or owners association must be responsible for installing the individual lift stations and for continuous station maintenance. They must retain easements permitting access and maintenance to each lift station and to the electrical controls.

2. Developer or owners association must retain a certified subsurface wastewater system operator (Operator in Responsible Charge) to be responsible for operation and maintenance of the entire system, including the individual lift stations and individual septic tanks.

3. An inventory of at least 10 percent of the active pumps, level control floats, and complete control panels must be maintained by the developer or owners association and readily available to the system operator.

4. The tri-party agreement among the developer, owners association , and health department must clearly indicate ownership, operation and maintenance requirements for the individual lift stations.