ON-SITE
WATER SUPPLY AND WASTEWATER DISPOSAL
for
PUBLIC AND COMMERCIAL ESTABLISHMENTS

BULLETIN S.E. 13
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INDIANA STATE BOARD OF HEALTH
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Section 100. GENERAL CONDITIONS AND SCOPE

The purpose of this bulletin is to guide architects and engineers in the basic requirements for layout and design of on-site water supply and wastewater disposal systems for commercial establishments including office buildings, apartments, condominiums, motels, mobile home parks, churches, campgrounds, schools, hospitals, nursing homes, subdivisions, restaurants, etc., at locations where such facilities may be approvable.

A connection to an approved public or area water supply and an approved public or area wastewater system is a primary requirement where such is possible and economically feasible.

Wherever water supply or wastewater treatment may be contemplated for use, adequate preliminary engineering investigation shall be made to determine if water or wastewater disposal facilities may be approvable for the use intended and at the location contemplated.

Some locations and uses may not be approved due to such reasons as: (1) inadequate area for facilities, (2) inadequate or nonpotable ground water supplies, (3) tight or wet soils, (4) areas subject to flooding, (5) watershed sanitation considerations, (6) availability of municipal or approved utility facilities, or (7) other health and sanitation considerations.

It is not intended to provide detailed construction drawings in this bulletin and the information herein should be considered only as a planning guide. Each proposed facility will be considered separately.

The installation of septic tank-absorption sytems will be considered only where circumstances warrant such an installation and only for wastewater flows of human excrement, bathing, handwashing, and food service waste.

New water supply and wastewater treatment facilities should be located so that future expansion or additions to a building can be done without jeopardizing the use of such systems or making it necessary to replace them.

No condition shall be created or maintained which may result in or cause a potential health or safety hazard.

Section 101. PREPARATION, SUBMITTAL AND APPROVAL OF PLANS

In addition to the requirements of filing plans for building projects and developments with the appropriate local and State agencies, complete, detailed working plans and specifications for water supply and wastewater disposal facilities, or changes to existing facilities, shall be submitted where required to the State Board of Health for review and approval action, including facilities for building projects such as those listed in Section 100.

Plans and specifications submitted to the State Board of Health shall be certified by an architect or engineer currently registered to practice in Indiana. As provided in IC 25-31-1-2(h) a registered land surveyor may certify plans only for gravity sanitary sewers, storm sewers and tile drains. Only one set of plans and specifications and revisions thereto is necessary. Final plans and specifications will be microfilmed upon approval of the project; therefore, the documents must be of sufficient clarity to be reproduced to create legible microfilm.

Plans and specifications submitted to the State Board of Health shall have been approved in writing prior to requesting bids or beginning construction.

Local permits for zoning, building construction, and installation of water supply and wastewater disposal facilities are required by many cities, towns and counties, and such permits must also be obtained prior to construction.

Section 102. SOME ITEMS TO BE INCLUDED ON PLANS

The following items are representative of some of the location and construction information to be supplied on plans and specifications:

1. A location map of the project with the exact site indicated.

2. Topography with contours established at intervals of two feet or less.

3. Property lines, streets, drives, roads, buildings, easements and any adjoining lakes, streams or ditches.

4. Location of all existing or proposed water supply sources or structures, water lines, sewers, sewage treatment facilities, etc., for at least 300 feet outside the project property boundary lines.

5. Details of well construction including casing diameter (minimum 4-inch), casing material type (ASTM F-480 if PVC), water line and pitless adapter depth, protection from flooding (casing must extend 24 inches or more above grade) and pump capacity.

6. Details of grouting the well casing.

7. Details of the pumping equipment including controls and type of pump.

8. Details of the water storage tank or the combination water pressure-storage tank and the well housing if any.

9. Details of the water piping including materials, sizes, location and installation.

10. Location, details and capacities of any type of proposed water treatment device.

11. A summary of lengths of water lines, sanitary sewers and force mains for each diameter of pipe utilized.

12. Specifications for disinfection of the water supply system and bacteriological analysis of the water prior to use of the supply.

13. Location and details of existing and proposed sewers and manholes including materials, bedding, slopes and invert elevations.

14. Location and details of lift stations, including control settings, pump capacities and type.

15. If a septic tank-absorption field is proposed, submit a report of the on-site soil survey which has been conducted. Said report must indicate soil structures and textures at each soil horizon, and the depth to seasonal high groundwater or bedrock. See Figure 8.

16. An estimate of the wastewater flow on the peak day.

17. Details of the plumbing systems showing compliance with the Indiana Plumbing Code (675 IAC 5).

WATER SUPPLY

Section 200. GENERAL REQUIREMENT

Connection to an approved public water supply is required where feasible. However, wells may be proposed for a water supply source where public water is not available.

Section 201. LOCATION OF WELLS

Water wells shall be located a safe distance from all existing and potential sources of contamination. See Table 1 for minimum allowable separation distances between wells and possible sources of contamination.

If the aquifer is not effectively protected by an extensive, continuous strata of clay, hardpan, rock, etc., greater separation distances than those specified in Table 1, and other precautions may be necessary to protect the well from contamination. This is especially true in Karst areas and where soil is loamy coarse sand or medium sand, which are classified by the U.S. Soil Conservation Service as "Severe due to poor filter" for septic system absorption fields.

Wells shall be located outside the foundation walls of buildings and at a minimum of 100 feet from sewers.

Wells should be located so that the natural topography will provide surface drainage away from the wells. Wells should be located at elevations high enough to prevent any drainage toward them from sewers or wastewater treatment facilities or other sources of contamination. Also, wells should not be located where flooding occurs, but if they must be located in a flood-plain, the wells must be protected from flooding.

It should be noted particularly that water supply wells should be located so that future expansion or additions to the project can be accomplished without jeopardizing use of the existing wells or making it necessary to abandon them.

Section 202. CAPACITY OF WELLS

The capacity of the well as indicated by test pumping shall be adequate to supply the daily and peak load requirements. Where this is not possible, the water supply system design shall be adequate for daily and peak load requirements. This may involve storage or other considerations.

Test pumping should be conducted on the well for at least 24 hours (preferably 36 hours). If drawdown has not yet stabilized, test pumping should continue until it does.

See Table 6 for estimating daily water requirements (not instantaneous peak requirements) for drinking and sanitary purposes.

Section 203. PEAK WATER DEMAND

It is essential that the water supply system be designed to meet peak water demands for drinking and other sanitary purposes. The water supply system shall also be designed so that a minimum water pressure of 20 pounds per square inch is maintained under all conditions of use. The facilities should be designed in accordance with the flows listed in Table 6; however, it should be noted that a design in accordance with Table 6 will not be sufficient to provide for fire protection.

Table 1

SOME MINIMUM SEPARATION DISTANCES FOR WATER SUPPLY AND WASTEWATER DISPOSAL FACILITIES

Type of Facility	Separation in Feet					
	Water Well	Building Foundations	Property Lines	Stream	Lake	Water Supply Reservoir
Sewers, Force Mains and Drains (1)(2)(5)	100*	10	10	—	—	—
Septic Tank (2)	100*	10	25	25	25	—
Absorption Field (2)(3)(4)(5)	100*	50	25	25	50	200
Water Well (4)(5)(6)	—	Outside foundation walls and 100 feet from sewers	100	25	25	—

*Increase to 200 feet for soils classified by the U.S. Soil Conservation Service as "Severe due to poor filter" for septic system absorption fields, such as loamy coarse sand and medium sand.

1. If it is necessary to locate sewers, force mains or drains closer than 100 feet to a well or pump suction line, waterworks grade ductile iron pipe with mechanical joints, or SDR26 PVC pressure sewer pipe with compression fittings must be used. Said piping shall not be constructed closer than 30 feet to water sources, however.
2. No wastewater treatment facility, sewer, force main or drain shall be closer than 200 feet to a public or municipal water supply well. In fissured or otherwise unprotected water-bearing formations, greater separation distances and other precautions may be necessary to minimize possibilities of water contamination.
3. Wastewater treatment facilities shall not be located under buildings, parking areas, drives, walks, playgrounds, cultivated land, picnic, assembly or other heavily used areas where damage to the system may occur.
4. Wastewater treatment facilities and water wells should not be located where flooding may occur. Wells should be located at elevations high enough to prevent any drainage toward them from sewers or wastewater treatment facilities or other sources of contamination.
5. If it is necessary to locate sewers or drains closer than 200 feet to a well or pump suction line in a mobile home park with 25 or more lots, waterworks grade ductile iron pipe with mechanical joints, or SDR 26 PVC pressure sewer pipe with compression fittings shall be used. Said piping shall not be constructed closer than 70 feet to water sources, however.
6. The 100 foot clearance between a water well and the property line may include the right-of-way width of a road or street adjacent to the property if the required clearance is not otherwise available. Additional separation distance may also be obtained by easement from the adjacent property owner.

Section 204. CONSTRUCTION OF WELLS

The construction of wells must comply with the requirements of Section 3 of Indiana State Board of Health Bulletin P.W.S. 2, particularly with respect to depth, casing size and material, protection from flooding, design and installation of the pitless adapter, grouting of the casing and design of screens.

In addition, if plastic pipe is utilized for the casing it must:

1. Be of sufficient thickness to allow threading (solvent-weld or push-type couplings are not acceptable), and

2. Be adequately located and otherwise protected against breakage through accident or vandalism.

Section 205. SELECTION OF THE PUMP

Selection of the pump must be correlated with the design conditions for the water supply and distribution system.

For example, where a well has sufficient capacity and other conditions are favorable so that only a pressure tank need be used, the pump should then have sufficient capacity to deliver the daily water requirements as well as peak demands.

Where water storage is provided, such as elevated storage or by a combination of storage and pressure tanks and repumping, then the pump(s) should be selected and sized accordingly.

In any event, the water supply and distribution system should be designed to meet maximum daily water requirements and peak demands while still providing a minimum pressure of 20 psi at each point of water use.

Section 206. PUMP INSTALLATION

The pump shall be located and housed at the well. A detail of one type of pump house is shown in Figure 1. The pump installation shall comply with the requirements as stated in Section 6 of the Indiana State Board of Health Bulletin P.W.S. 2. See Figure 2.

Section 207. STORAGE AND PRESSURE TANKS AND CONTROLS

Pumps shall discharge into an adequately sized elevated tank or pressure tank.

If elevated storage is to be used, it shall be of sufficient capacity to supply the highest volume use period (or combination of periods) when peak demand use exceeds the pump capacity. Proper controls are necessary to prevent overflowing the elevated tank.

If the pump capacity is adequate to meet peak demands, the pressure tank need only be designed to meet instantaneous peak demands and to avoid excessive on-off cycling of the pump. The nameplate capacity of a pressure tank is its total volume. However, portions of both hydropneumatic (air assisted) and bladder type pressure tanks are not available as usable capacity. The usable capacity of a pressure tank is that volume of water available from its pump starting pressure to its pump shut-off pressure. For hydropneumatic tanks see Table 2. The usable capacity of the pressure tank must be a minimum of three times the installed pump capacity. As an example, a 20 gpm pump would require a tank of at least 60 gallons usable capacity.

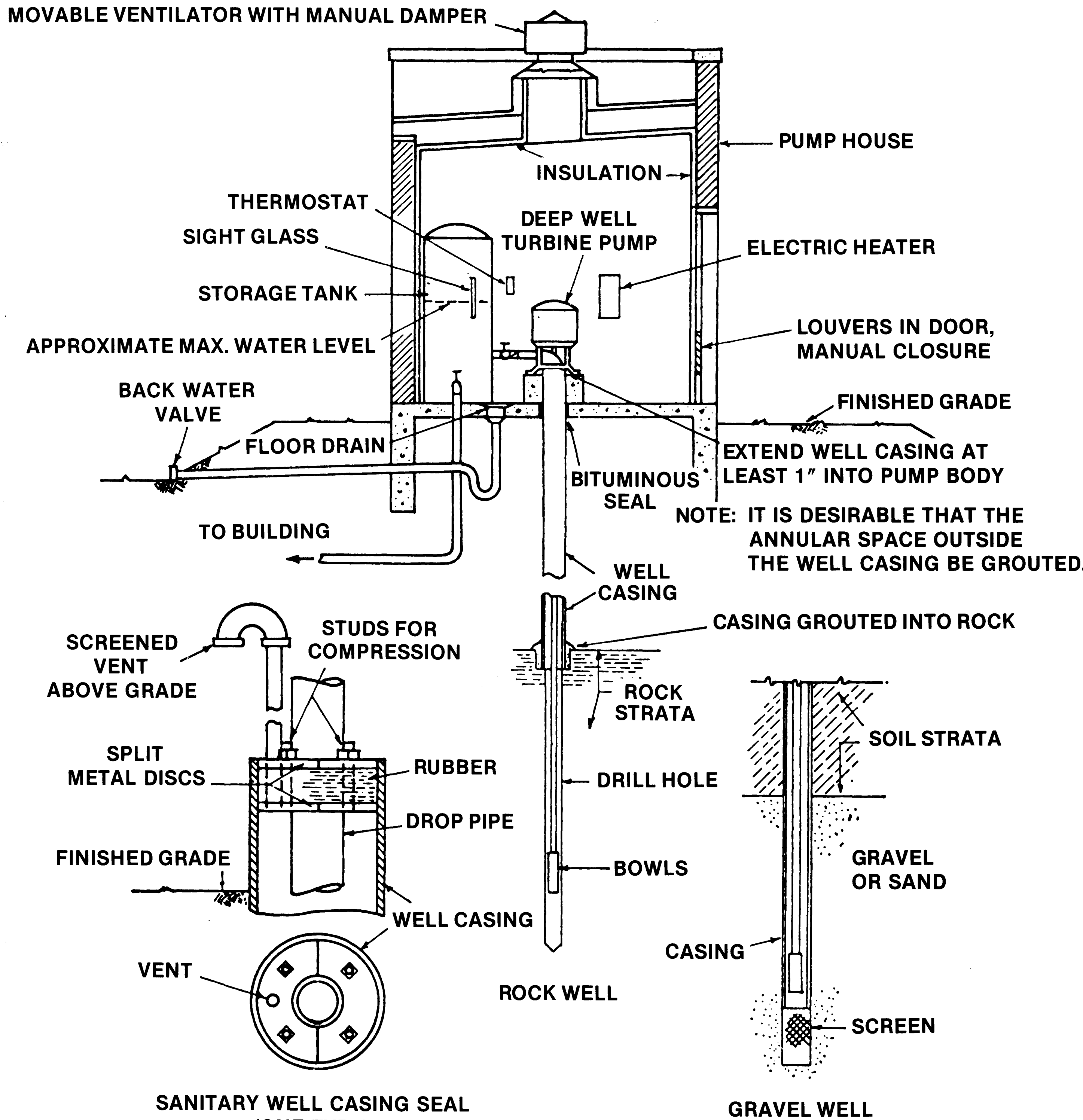


Figure 1. Pump house and wells, schematic—no scale.

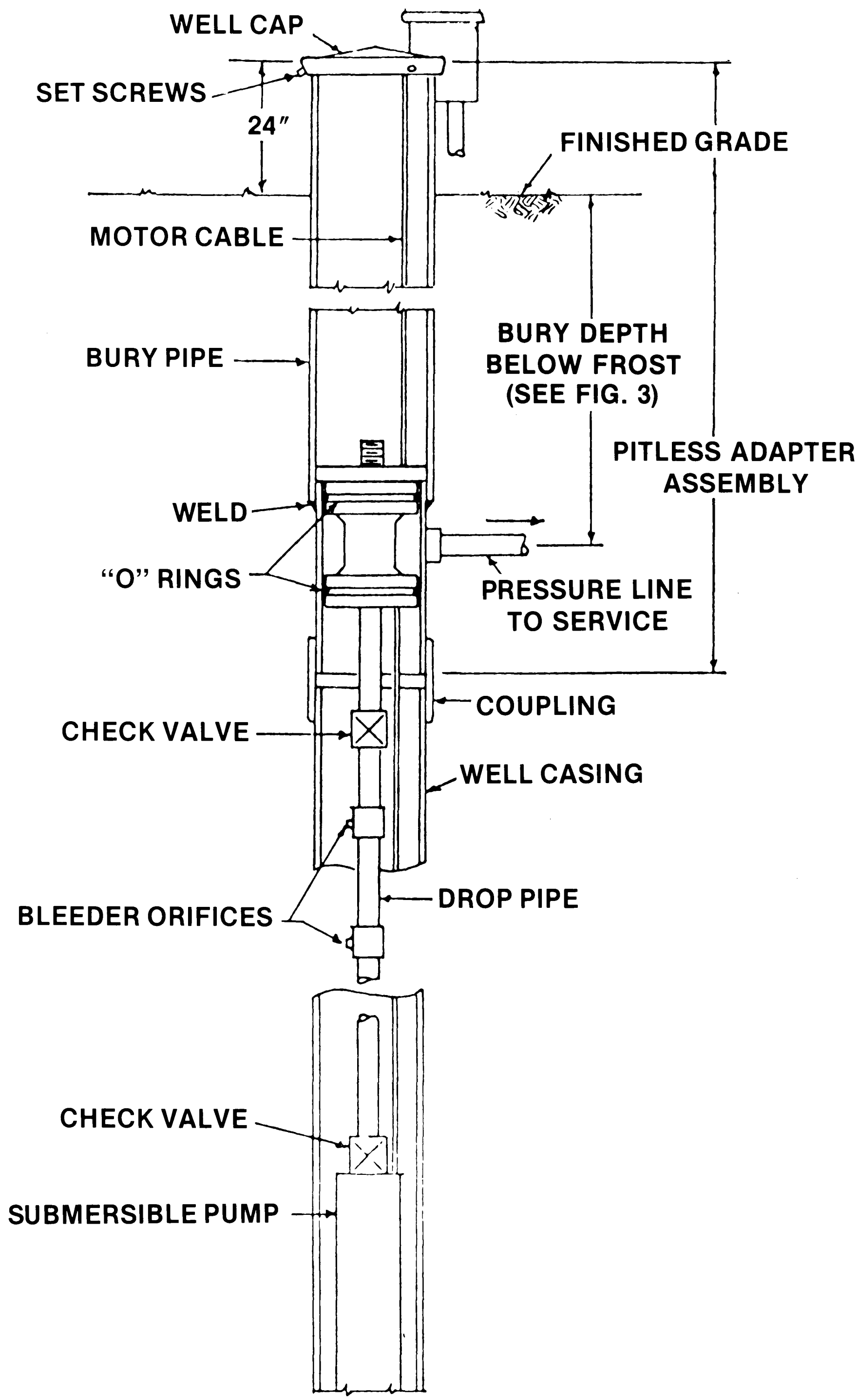


Figure 2. Pitless well adapter, schematic—no scale

Table 2

APPROXIMATE GALLONAGE USABLE AT SOME PRESSURE RANGES
FOR AN UPRIGHT HYDROPNEUMATIC TANK

PRESSURE IN PSI		GALS. USABLE BY TANK SIZE		
Pump				
Starting*	Shut-off	30	50	100
20	50	13	22	44
20	40	11	20	40
25	50	9	15	29
25	45	8	13	26

*Must be sufficient to maintain at least 20 psi pressure at all points of water use.

To determine the total tank size required when using bladder tanks, the required usable capacity must be divided by a factor determined from the pump cut-in and cut-out pressures as shown in Table 3, Bladder Tank Capacity Factor. The smallest tank size available which meets this capacity requirement is recommended.

Table 3
BLADDER TANK CAPACITY FACTOR

PUMP CUT-OUT PRESSURE (PSIG)	PUMP CUT-IN PRESSURE (PSIG)														
	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90
30	.22														
35	.30	.20													
40	.37	.27	.18												
45	.42	.34	.25	.17											
50	.46	.39	.31	.23	.15										
55	.50	.43	.36	.29	.22	.14									
60	.54	.47	.40	.33	.27	.20	.13								
65		.50	.44	.38	.31	.25	.19	.13							
70		.53	.47	.41	.35	.30	.24	.18	.12						
75			.50	.45	.39	.33	.28	.22	.17	.11					
80			.53	.48	.42	.37	.32	.26	.21	.16	.11				
85				.50	.45	.40	.35	.30	.25	.20	.15	.10			
90				.53	.48	.43	.38	.33	.29	.24	.19	.14	.10		
95					.50	.46	.41	.36	.32	.27	.23	.18	.14	.09	
100					.52	.48	.44	.39	.35	.31	.26	.22	.17	.13	.09

If well pump capacity is not adequate to meet peak demands, the pressure tank may be oversized to serve as a storage tank. It shall have sufficient usable capacity to supply the highest volume use period (or combination of periods) when peak demand exceeds the pump capacity.

The pumping system shall be automatically controlled to assure adequate working pressures at all times.

The system shall be designed to meet maximum daily water requirements and peak demands with adequate pressure and volume at each point of water use.

Pressure tanks in a water supply system that may be subjected to excessive pressure shall have an approved-type pressure relief valve installed.

In any installation where water supply system pressure may exceed 100 pounds per square inch, a pressure reducing valve should be installed.

Section 208. DISINFECTION OF THE WATER SUPPLY SYSTEM AND BACTERIOLOGICAL TESTING

Before the water supply system is approved for use, it shall be properly disinfected using a chlorine solution of at least 50 parts per million (milligrams per liter) strength. Sufficient chlorine solution should be poured down the well casing and column pipe such that a detectable chlorine odor can be obtained at each water supply outlet in the facilities served. The piping system should remain thusly chlorinated for at least 24 hours (contact time) after which the chlorine solution can be flushed out. Higher chlorine concentrations should be used if reduced contact times are desired. For example, a 100 parts per million solution would be acceptable for a 12 hour contact time; 200 parts for six hours, etc. Samples should then be collected for bacteriological analysis, and those analyses should confirm satisfactory bacteriological quality. Sterile bottles for water samples and bacteriological tests may be obtained from private laboratories or the Indiana State Board of Health, 1330 West Michigan Street, Indianapolis, Indiana 46206. A charge will be made for each test made by the State Board of Health laboratories.

Section 209. CHLORINATION AND OTHER WATER TREATMENT

In some instances softening, chlorination, iron removal or other treatment of the water supply may be desirable. In such instances, adequate details of the treatment equipment shall be submitted as a part of the water supply system plans and specifications. This requirement does not apply to boiler feedwater or cooling water treatment.

Section 210. WATER PIPING

The water supply and distribution system piping, materials and jointing shall conform to the requirements of the Indiana Plumbing Rules (675 IAC 5) and, where applicable, to "Recommended Standards for Water Works" published by the Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers. Plastic water piping, if utilized, must be selected from the List of Acceptable Plastic Pipe, Table 4.

In buildings where an unsafe, non-potable water distribution system is installed or used, all such unsafe, non-potable water piping shall be completely separate from any other water piping and all such unsafe, non-potable water piping shall be durably color-coded with a distinctive yellow paint and plainly labeled at not more than ten feet intervals with permanent-type labels, "NON-POTABLE WATER."

All potable water supply systems shall be designed, installed and maintained to prevent contamination and introduction of toxic materials. There shall be no cross-connections, either existing or potential. The use of stop and waste valves is not permitted.

Table 4
LIST OF ACCEPTABLE PLASTIC PIPE

Gravity Sewer

PVC ASTM-D 2665 for 4-inch and 6-inch pipe only
ASTM-D 3033 SDR 35 for 4-inch pipe; SDR 41 for 6-inch through 15-inch pipe
ASTM-D 3034 SDR 35 for 4-inch through 15-inch pipe
Pressure sewer, SDR 26, with compression fittings for special crossing conditions with potable water lines

ABS ASTM-D 2661 4-inch and 6-inch pipe only
ASTM-D 2680 8-inch through 15-inch pipe
ASTM-D 2751 SDR 23.5 or SDR 35 for 6-inch pipe

Force Main

Any PVC or ABS pipe listed below for potable water or else PVC ASTM-D 1785 Schedule 40, 80 or 120
Compression fittings must be used in crossing situations with potable water lines.

Absorption Field Laterals

1. Sewer pipe listed above or potable water pipe (at least 4-inches in diameter) listed below, as well as pipe meeting ASTM-D 2729 or ASTM F810-83, are acceptable for absorption field gravity laterals.

2. The pipe must have perforations with the equivalent total opening as a comparable tile laid with ¼-inch open joints per foot of tile, with the following provisions:
   a. Three rows of holes
   b. ½-inch to ¾-inch diameter holes, with:
      ½-inch holes at 2 ¼ inch, or closer spacing
      ⅝-inch holes at 3 ½-inch, or closer spacing
      ¾-inch holes at 5-inch, or closer spacing.

   c. Equal separation of rows around the circumference.

3. The pipe must be delivered in straight (uncoiled) lengths.

Potable Water

The pipe must have the NSF (National Sanitation Foundation) seal for potable water and be rated to withstand the applied pressure.
Solvent-weld fittings are not acceptable.

POLYETHYLENE	160 p.s.i. SDR 7 in ¾-inch, 1-inch and 1 ¼-inch diameters only.	
PVC	ASTM-D 2241	SDR 13.5, 17, 21 or 26.
ABS	ASTM-D 1527	Schedule 40, 80
	ASTM-D 2282	SDR 13.5, 17, 21 or 26

Section 211. TRENCHING

Water piping shall be adequately protected from freezing, and buried water lines shall be laid below the deepest known frost penetration. See Figure 3 for frost penetration information.

Water lines, storm and sanitary sewers shall not be laid in the same trench. A horizontal separation of 10 feet shall be maintained.

Crossings of buried sewers and water lines should be avoided as much as possible. However, where crossings are necessary, a minimum of 18 inches vertical clearance must be maintained (measured from the bottom of the upper pipe to the top of the lower pipe), preferably with the water main above the sewer.

When it is impossible to maintain proper horizontal and vertical separation, the sewer shall be constructed of waterworks grade ductile iron pipe with mechanical joints or SDR 26 PVC pressure sewer pipe with compression fittings, and shall be pressure tested to assure water tightness prior to back-filling.

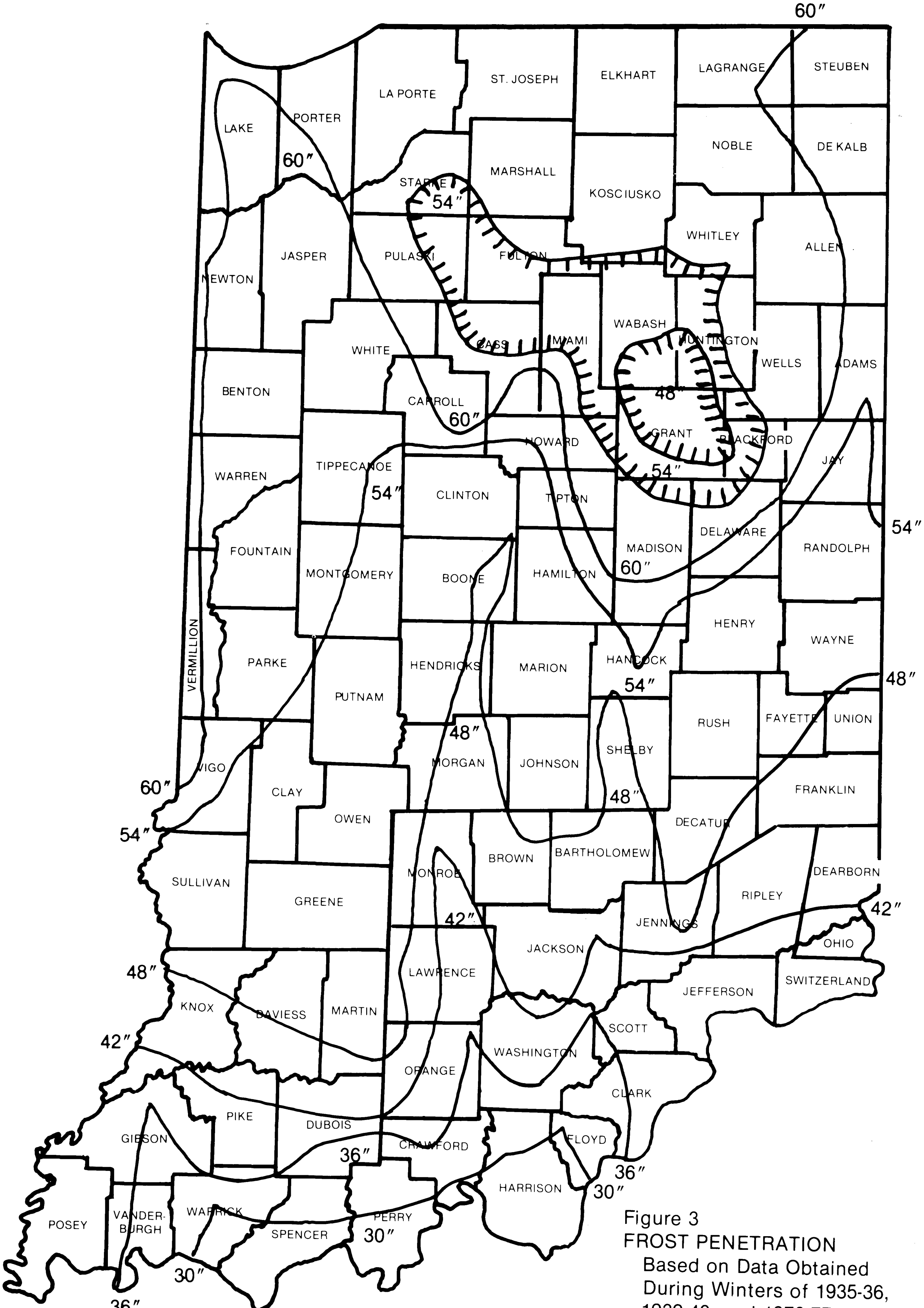


Figure 3
FROST PENETRATION
Based on Data Obtained
During Winters of 1935-36,
1939-40, and 1976-77

SEWERS

Section 300. LOCATION OF SEWERS

The location of all sewers shall conform to the minimum separation distances in Table 1. Wells in mobile home parks with 25 or more lots are defined as community public water supplies, and must therefore, meet municipal water supply construction standards. Sewers for such mobile home parks which are less than 200 feet from a water supply well shall be constructed of waterworks grade ductile iron pipe with mechanical joints or SDR 26 PVC pressure sewer pipe with compression fittings, and no sewer or drain shall be constructed less than 70 feet from a well or pump suction line.

Section 301. CONSTRUCTION OF SEWERS

Sewers and water lines shall not be laid in the same trench. A horizontal separation of not less than 10 feet shall be maintained. See Section 211.

Except as otherwise required in Sections 300 and 301 herein, sewers beginning three feet outside the foundation walls of buildings may be constructed of vitrified clay, concrete, or other proven sewer pipe materials with approved tight joints, such as PVC and ABS. See Table 4 for information on acceptable PVC and ABS plastic sewer pipe.

Sewers serving individual units may connect to the main sewer by wye fittings. Sewers serving more than one unit must connect to the main sewer at a manhole.

Sewers shall be laid to a uniform grade and at a slope equal to or greater than the minimum slopes shown in Table 5. Sewers may not be increased in size for the sole purpose of reducing the required slope.

Adequate sewer bedding shall be provided. All sewers shall be buried with at least two feet of cover to protect them from freezing. Force mains must be buried deep enough to prevent freezing unless the lift station and force main can be designed such that the force main will drain completely. See Figure 3.

Sewers proposed under driveways, parking slabs, or other heavily loaded areas, shall be adequately constructed to prevent damage or breaking.

Manholes must be installed at the end of each line, at all changes in grade, size or alignment, at all intersections, and at intervals not greater than 400 feet for sewers 15 inches diameter or less; intervals not greater than 500 feet are allowed for sewers 18 inches or greater in diameter.

A drop manhole should be installed where a sewer enters the manhole 24 inches or more above the manhole invert. The outside drop connection constructed with a drop manhole should be encased in concrete.

The minimum acceptable diameter for manholes is 48 inches. The access opening into the manhole must be at least 22 inches in diameter.

Cleanouts may be substituted for manholes on short sewer runs. Cleanouts must be the same diameter as the sewer they are to serve, and must extend to grade. A cleanout may be installed at the terminus of a sewer provided that a manhole is within 300 feet of the terminus.

Section 302. SIZE OF SEWERS

No outside building sewer shall be less than four inches in diameter. Minimum sewer diameters will vary upward from four inches according to use. Because of slope, cleaning and maintenance problems, installation of four-inch sewers is unacceptable except where they can adequately serve a building or facility having very low anticipated sewage flows. Sewers shall be adequately sized to carry average and intermittent peak flows. Soil, waste, vent and drain piping inside the building shall comply with the Indiana Plumbing Rules (675 IAC 5).

TABLE 5
MINIMUM SLOPES OF SEWERS

Sewer Size		*Minimum Slope in Feet per 100 Feet
4-inch diameter	(Building sewer only)	1.33
6-inch diameter		0.61
8-inch diameter		0.40
10-inch diameter		0.28
12-inch diameter		0.22
15-inch diameter		0.15
16-inch diameter		0.14
18-inch diameter		0.12
21-inch diameter		0.10
24-inch diameter		0.08

*Based on Hazen-Williams formula using C = 140.

Section 303. SEPARATE STORM AND SANITARY SEWERS REQUIRED

Storm water run-off, footing drains, roof drains, downspouts, cooling water, swimming pool drains and filter backwash, potable water treatment system wastes, etc., shall not be discharged to an on-site wastewater treatment system. Separate storm water drains and sanitary sewers shall be provided. Filter backwash must be treated by sedimentation or other means to separate solids before discharging clear water to a storm sewer.

Section 304. SEWAGE LIFT STATIONS AND FORCE MAINS

Sewage lift stations must be protected from damage by a 100-year flood and shall remain fully operational and accessible by maintenance vehicles during the 25-year flood, and all weather conditions.

Submersible pumps and motors must be designed specifically for raw sewage use. Pumps must be readily removable for maintenance, repair or replacement by installation with guide rail systems, break-away flanges and lifting chains.

Except where grinder or cutter pumps are used, raw sewage pumps shall be capable of passing spheres of at least three inches in diameter. Effluent pumps may be used in lift stations following septic tanks.

At least two pumps shall be provided in each lift station. Pumps shall be of the same capacity. Each shall be capable of handling at least the expected maximum flow to the lift station.

Controls other than float switches shall be installed outside the lift station and shall comply with the Indiana Electric Code (675 IAC 17). Controls shall include automatic pump alternators. Encapsulated mercury float type switches are preferred over other types. Motor controls shall be protected by a conduit seal or other appropriate measures to exclude moisture from the wet well. Power cords shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Ground fault interruption protection shall be used to de-energize the circuit in event of any failure of the cable.

An audio-visual alarm system shall be provided to indicate power failure, pump failure, excessive water level or any cause of pump station malfunction. The alarm should be located in an area where it can be observed 24 hours a day. The alarm should be powered by a circuit separate from the pump circuit.

Overflows from lift stations are not permitted.

Pump discharge lines shall include suitable shutoff and check valves. Check valves shall be located between the pump and the shutoff valve and only in the horizontal portion of the line. Check valves should be omitted in discharge lines connected individually to pumps where the lines must drain back into the pump station wet well between pumpings.

Force mains should be sized to provide a scouring velocity of at least two feet per second at the design capacity of the pump.

Automatic air relief valves shall be installed at high points in the force main to prevent air locking.

Separation distances between sanitary force mains and water lines shall be the same as required for gravity sewers. A ten-foot horizontal separation is required between parallel water lines and force mains and an 18-inch vertical separation is required where force mains cross water lines.

Force mains crossing other properties will have to be kept accessible through construction and maintenance easements.

WASTEWATER DISPOSAL SYSTEM SELECTION AND LOCATION

Section 400. GENERAL REQUIREMENT

Connection to and use of an approved public sewer system is required where feasible. In the absence of public sewers at a reasonable distance, on-site wastewater disposal systems may be proposed where such facilities may be approvable. Discharging wastewater treatment plants may be constructed only after plans for such plants have been approved by the Indiana Department of Environmental Management.

Section 401. WASTEWATER DISPOSAL SYSTEMS

It is not practical to give specific standards to be used in selecting the most suitable treatment units, or combination of units, for a particular installation. This can be done only by careful consideration of each proposed project. For example, if an on-site disposal system is contemplated for an area with high seasonal groundwater and perimeter drains must be utilized to artificially lower the groundwater, there must be a suitable outlet to freely drain the water from the site.

Furthermore, if the project is anticipated to generate toxic wastes or other than domestic type wastes, the wastewater shall not be discharged to septic tank-absorption systems. Car and truck washes, laundromats, contaminated industrial area floor drains and oil-water separators are sources of unacceptable wastes.

Listed below are some generalized selection and design factors:

1. Quantity and rate of wastewater flow
2. Soil characteristics
3. Area available for location of treatment systems
4. Watershed characteristics
5. Topography in relation to access and gravity flow
6. Ground water levels and flood or high water levels
7. Surrounding land development and use
8. Wastewater composition
9. Projected future expansion needs
10. Location of water wells

Section 402. MAINTENANCE AND OPERATION

Any building, structure, device, process, equipment or machine must have adequate inspection and maintenance if it is to provide the function or service intended. Wastewater facilities are no exception.

Septic tanks need periodic scum and sludge removal. Grease traps must be periodically cleaned and the grease and oils incinerated or otherwise disposed of by sanitary methods. Wastewater pumps, controls, etc., must have attention.

Listed below are a few suggestions that the designing engineer or architect, the vendor and the contractor should consider in this regard.

1. At the completion of the job, explain to the owner and the maintenance supervisor the limitations of the system and outline check points and needs for routine maintenance and inspection.

2. Provide the owner and the maintenance supervisor with adequate written operating and maintenance instructions and a schematic diagram of the system showing all controls, valves, pumps, units, devices, etc.

3. Provide adequate warning or alarm systems, etc., for vital points of possible failure or inoperation in the system. Such alarm or warning systems should be carefully designed and installed tamper-proof so that they cannot be disconnected or by-passed.

4. Adequate space for access, operation and maintenance should be provided. For example, if valves are located so that access is not easy, or if equipment that needs periodic servicing, maintenance or inspection is placed in enclosed spaces too small to permit access, servicing to assure proper operation and maintenance will not be performed.

Section 403. INDUSTRIAL WASTE TREATMENT

It is necessary that the Indiana Department of Environmental Management be consulted for recommendations and requirements prior to design or installation of any industrial waste treatment facilities.

Section 404. LOCATION REQUIREMENTS

It is essential that safe distances be maintained between water supplies and wastewater treatment facilities. See Table 1. In addition to Table 1, Section 401 outlines other concerns which will affect location of the wastewater treatment facility.

It should be noted particularly that wastewater treatment facilities should be located so that future expansion or additions to a building can be done without jeopardizing the use of the existing facilities or making it necessary to relocate them.

Also, an existing wastewater disposal system shall be suitably expanded or revised to provide for any building addition. Separate, scattered facilities for each expansion of a building or development will be considered only on an individual basis.

Septic tanks and absorption fields should not be located under buildings, parking areas, drives, walks, playgrounds, cultivated land, picnic, assembly or other heavily used areas where damage to the septic system may occur.

WASTEWATER DISPOSAL SYSTEMS

Section 500. REQUIREMENTS

A construction permit is required from the State Board of Health under Rule 410 IAC 6-10 for construction, installation or modification of a public or commercial on-site sewage disposal system. A construction permit may be obtained by submitting an application using a form provided by the State, along with plans and specifications for the project, for review and approval. The submittal shall be made at least 90 days prior to the date construction is to commence.

Plans and specifications must be certified by an engineer or architect with a current registration in the State of Indiana. As provided in IC 25-31-1-2(h) a registered land surveyor is limited to certifying plans for only gravity sanitary sewers, storm sewers, and tile drains; thus, he may not certify plans for sewage disposal systems.

An on-site soil survey must be performed at the site of a proposed subsurface wastewater disposal field by a soil scientist to determine soil loading rates and other design criteria. The survey may be performed by the Soil Conservation Service or by a certified private soil scientist.

In addition to soil characteristics, the system design depends upon the peak daily wastewater flow. See Table 6 for estimating daily flows from various types of establishments.

TABLE 6
GUIDE FOR ESTIMATING WASTEWATER FLOWS

TYPE OF ESTABLISHMENT	ESTIMATED FLOW (gallons per day)
Agricultural Labor Camp	50 per occupant
Airport	3 per passenger plus 20 per employee
Apartment	200 per one-bedroom 300 per two-bedroom 350 per three-bedroom
Assembly Hall	3 per seat
Bar (without food service)	10 per seat
Beauty Salon	35 per customer
Bowling Alley	
a. with bar and/or food	125 per lane
b. without food service	75 per lane
Bus Station	3 per passenger
Campground	
Organizational	
a. with flush toilets	40 per camper
b. without flush toilets	20 per camper
Recreational	
a. with individual sewer connection (independent)	100 per campsite
b. without individual sewer connection (dependent)	50 per campsite

Church	
a. with kitchen	5 per sanctuary seat
b. without kitchen	3 per sanctuary seat
Condominiums	200 per one-bedroom 300 per two-bedroom 350 per three-bedroom
Correctional Facilities	120 per inmate
Day Care Center	20 per person
Dentist	750 per chair plus 75 per employee
Factory	
a. with showers	35 per employee
b. without showers	20 per employee
Food Service Operations	
Cocktail Lounge	35 per seat
Restaurant (not 24-hour)	35 per seat
Restaurant, 24-hour	50 per seat
Restaurant, 24-hour, along Interstate	70 per seat
Tavern	35 per seat
Curb Service (drive-in)	50 per car space
Hospital, medical facilities	200 per bed
Hotel	100 per room
Kennels	20 per animal enclosure
Mental Health Facility	100 per patient
Mobile Home Park	200 per lot
Motel	100 per room
Nursing Home	100 per bed
Office Building	20 per employee
Outpatient Surgical Center	50 per patient
Picnic Area	5 per visitor
School	
Elementary	15 per pupil
Secondary	25 per pupil
Service Station (Gas Station)	400 per restroom
Shopping Center	0.1 per square foot of floor space, plus 20 per employee
Swimming Pool Bathhouse	10 per swimmer
Theater	
a. Drive-in	5 per car space
b. Inside building	5 per seat

For establishments not mentioned in Table 6, contact the State Board of Health's Division of Sanitary Engineering to discuss how to proceed before commencing with detailed design.

Designs for flows less than estimated in Table 6 will be considered based on substantial evidence (such as water meter readings) that smaller flows will occur. Flow data for similar installations of equal capacity and similar surroundings may be considered on an individual basis.

Section 501. GREASE TRAPS

All waste discharge sewers from commercial kitchens and food services that will contain high amounts of grease, fats or oils should be connected to a grease trap before discharging to the septic tank. Wastes from sinks, dishwashers and kitchen floor drains should be combined and routed through the grease trap to the septic tank. Sanitary wastes should be connected directly to the septic tank.

An approved septic tank may be used as a grease trap if the outlet baffle is extended to within six inches of the tank bottom. See Figure 4.

The recommended grease trap size may be calculated as follows:

Tank Size (in gallons)	=	Meals Served During Peak Hour	X	Waste Flow Rate Factor	X	Retention Time Factor	X	Storage Factor

Waste Flow Rate Factor

a.	Commercial kitchen with dishwashing machine	6
b.	Commercial kitchen without dishwashing machine	5
c.	Single service kitchen	2
d.	Food waste disposal only	1

Retention Time

a.	Commercial kitchen waste	2.4
b.	Single service kitchen	1.5

Storage Factor

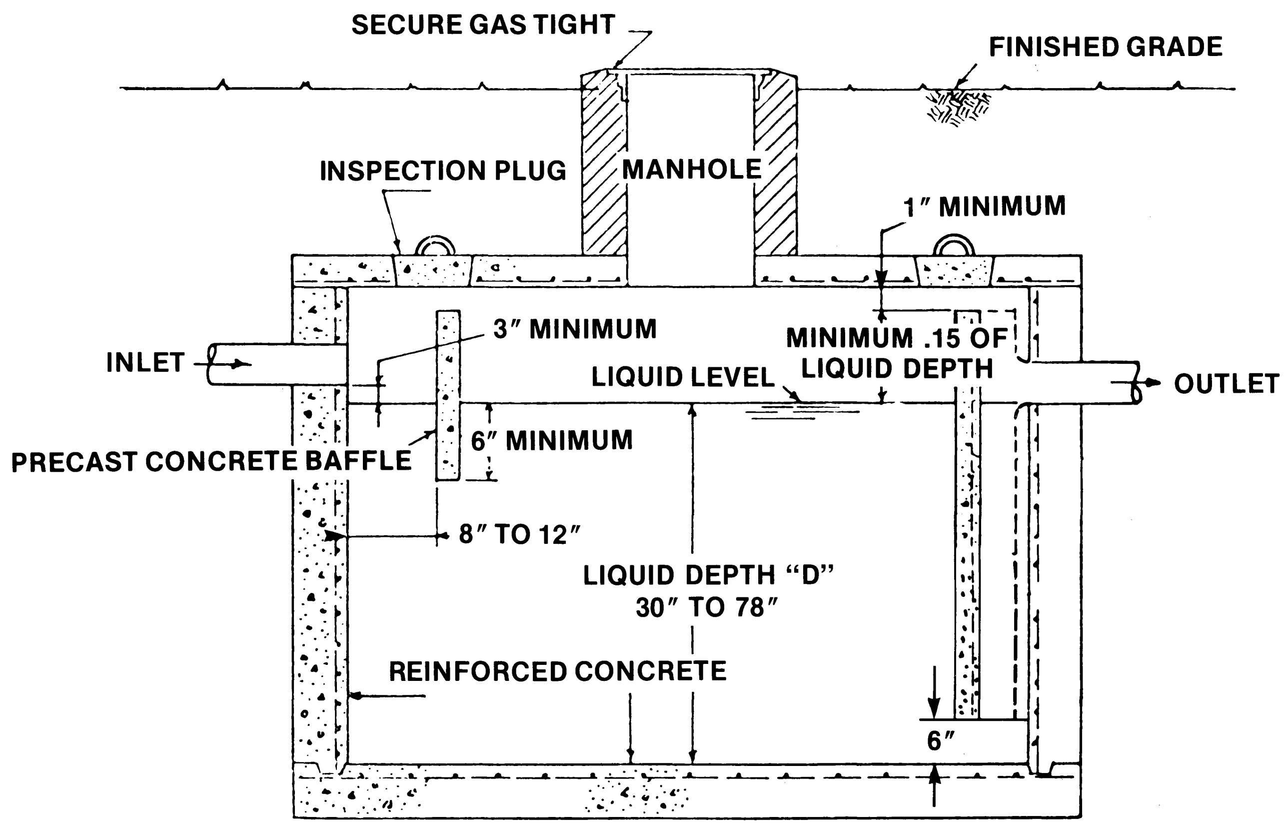
a.	Fully equipped commercial kitchen having	
	8-hour operation	1
	16-hour operation	2
	24-hour operation	3
b.	Single service kitchen	1.5

Section 502. HOLDING TANKS

Holding tanks for wastewater are not an acceptable means of permanent sewage disposal. Holding tanks are approvable, however, for vault toilets and for sanitary dump stations in campgrounds.

Plans and specifications for approvable temporary holding tanks must be submitted along with a copy of a contract with a permitted wastewater management business to pump the wastewater, indicating the sewage treatment facility which will receive the hauled wastewater. Evidence must also be submitted that the holding tank is in fact only temporary, and that a permanent means of sewage disposal will be available and used within two years of approval of the temporary holding tank.

Temporary holding tanks should be designed with 3 days holding capacity at the 95% level, and with an audio/visual alarm to operate at the 95% level.



SECTION

Figure 4. Grease trap

Section 503. SEPTIC TANKS

A septic tank provides only partial treatment. The flow from a septic tank is inadequately treated wastewater, requiring additional treatment or disposal facilities following the septic tank.

Aerobic treatment units may be substituted for septic tanks if the total liquid volume of the unit is equal to or greater than the volume required for a septic tank to serve the facility. The absorption field following an aerobic unit may not be downsized.

The use of septic tank-absorption systems will be limited to areas where the soil has acceptable absorption qualities and where seasonal groundwater problems, if any, can be overcome.

A septic tank system should not be planned where the total wastewater flow per system exceeds 4,000 gallons per day. Multiple systems may be considered for domestic wastes such as from cluster systems if sufficient space is available between fields to prevent concentrating the effluent from two or more fields. Parallel or diverging groundwater flows from field areas are required for a multifield system.

1. Location of Septic Tanks

   The location of septic tanks shall conform to at least the minimum separation distances in Table 1. Openings in tops of tanks shall be above maximum ground water elevation. Surface water drainage in the area of septic tanks shall be directed away from any water wells.

2. Use and Capacity of Septic Tanks

   The quantity of wastewater for preliminary estimates of daily flow may be taken from Table 6. Tank liquid capacities should be sufficient to allow for at least 36 hours' detention. The detention time for septic tanks serving schools and other establishments where most of the wastewater generated occurs in eight hours or less, must be a minimum of 48 hours.

   For a daily flow in excess of 500 gallons, one or two tanks may be utilized as long as the design provides two compartments in series. For lesser flows a single tank is adequate. The capacity of any tank shall not be less than 750 gallons. The larger of the two tanks must be upstream of the other. Tank lengths shall be a minimum of three times the tank width for field-erected tanks, and the compartments in combination shall have a surface settling rate no greater than 30 gallons per day per square foot.

3. Construction of Septic Tanks. See Figure 5.

   a. Septic tanks shall be constructed water-tight and of durable materials not subject to excessive corrosion or decay.

   b. The minimum tank liquid capacity shall be 750 gallons. The maximum tank capacity shall be 4,000 gallons except for field-erected tanks.

   c. Reinforced concrete tanks wherein the concrete has a compressive strength of less than 4,000 psi shall have walls of four-inch or greater thickness.

   d. Reinforced concrete tanks wherein the concrete has a compressive strength of 4,000 psi or greater shall have walls of 2 ½ inch or greater thickness.

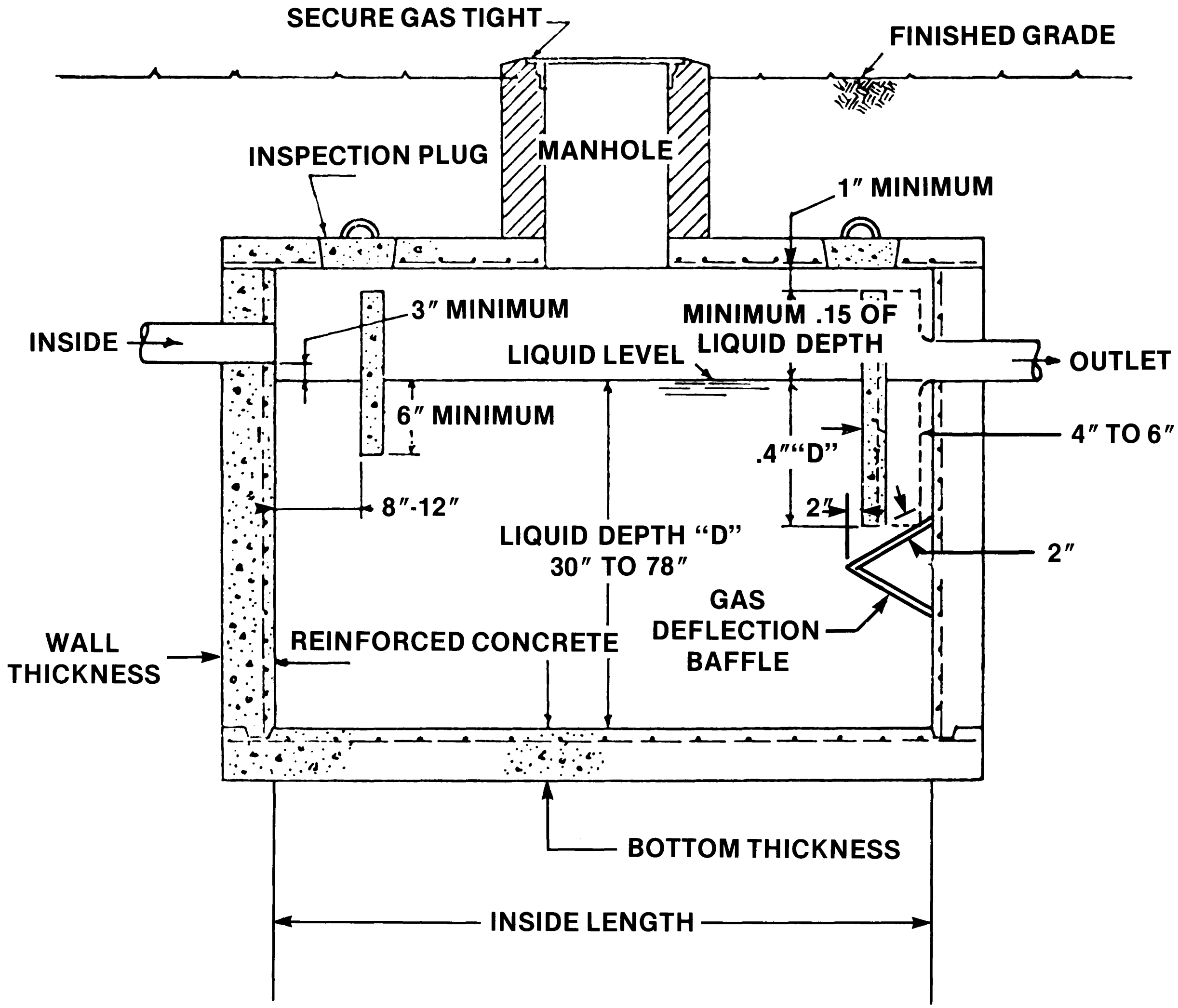


Figure 5. Septic tank

e. Cast-in place concrete tanks shall have the walls and floor at least six inches thick poured from a 1:2:3 mix in one operation.

f. Concrete block tanks shall have at least 8-inch walls with cores filled with concrete, and shall be reinforced at the corners. The blocks shall be laid with tight mortar joints. The walls shall be set on a concrete slab at least six inches thick and the wall to floor connection shall be satisfactorily sealed.

g. The liquid depth of a tank or compartment shall be not less than 30 inches. A liquid depth greater than 6 ½ feet is not advisable, as septic tank cleaners utilize vacuum pumps to remove solids from septic tanks.

h. The tank inlet baffle or sanitary tee shall extend six inches below the liquid level and above the liquid level at least to the top of the inlet sewer.

i. The tank outlet baffle or sanitary tee, and the submerged connecting pipes between compartments, shall extend below the liquid level a distance of 4/10 times the tank liquid depth. A gas deflection baffle shall be provided below the outlet. This baffle shall be constructed of durable materials not subject to corrosion or decay and shall be configured to deflect rising gas bubbles and entrained solids away from the outlet area and toward the center of the tank.

j. There shall be at least a one-inch clear space between the underside of the tank cover and the top of the inlet and outlet baffles or tees.

k. Scum storage capacity (space between the liquid level and the top of outlet baffle) shall be not less than 15 percent of the total liquid capacity of the tank.

l. The tank inlet baffle shall not be more than 12 inches nor less than 8 inches from the inside of the inlet end of the tank. The outlet baffle shall not be more than 6 inches nor less than 4 inches from the outlet end of the tank. Baffles shall be constructed of durable materials not subject to corrosion or decay.

m. The bottom of the inlet to the tank or the first compartment receiving the flow shall not be less than 3 inches above liquid level in the tank.

n. Access manholes, extending to the ground surface and fitted with safely secured, gas-tight covers, shall be provided for each tank or compartment.

o. Access plugs for inspection shall be provided in the top of the tank above each inlet and outlet baffle of a tank or compartment.

4. Multiple Compartment Tanks

a. When a septic tank is divided into two compartments, the liquid volume of the first compartment shall be between ½ and 2/3 of the total tank volume.

b. The liquid connection between compartments shall consist of two or more openings equally spaced across the width of the tank, with a combined area equal to three times the cross-sectional area of the inlet pipe. Said liquid connection shall be located at a depth between 40 and 50 percent of the liquid depth, measured down from the liquid level.

Section 504. DOSING TANKS

Dosing tanks with suitable pumps may be required for the following purposes in an on-site wastewater disposal system:

1. To overcome pipe friction losses and static head between a septic tank and absorption field.

2. To provide more even distribution of septic tank effluent in large absorption fields. Dosing is required for absorption fields having a total length of trenches greater than 1,000 lineal feet. Dosing is also required in any field with medium textured sand to prevent overloading portions of the field. For those systems using gravity-fed absorption laterals the primary distribution box will receive the dose, and must divide it equally among any secondary boxes or the distribution pipes serving the laterals.

3. To provide the design pressure and discharge rate (GPM) to a small diameter distribution system.

Dosing must be accomplished by means of submersible effluent pumps or siphons. Pumps must be mounted on guide rails and be fitted with break-away flanges and lifting chains to permit easy removal from the tank and easy reinstallation. The tank must be fitted with a suitable hatch directly above the guide rails for removal of the pumps. Electrical equipment shall include an automatic pump alternator, float level controls for pump start and stop, and a high level float to actuate an audio/visual alarm to indicate pump failure. Electrical controls other than float switches must be mounted outside the tank. See Figure 6.

Siphons may be used in lieu of pumps on a sloping site only, where the difference in elevation between the siphon discharge and the absorption field laterals is sufficient to overcome pipeline friction losses at the design flow and still meet the head requirements of the absorption field. See Figure 7.

Large absorption systems may be divided into smaller individually dosed systems. Some advantages of a smaller field are as follows:

1. A smaller absorption field will permit a more even distribution of wastewater in the trenches or bed.

2. The smaller dose volume resulting from dividing the field allows a proportionally smaller dosing tank and lower capacity pump.

3. Smaller force mains and manifolds may be utilized.

The decision to divide an absorption field into smaller fields must be based upon the physical size of the field required for the project. For absorption fields approaching 1500 square feet of trench bottom, consideration should be given to dividing the field or the distribution network into multiple units. The divided system will normally require two or more dosing pumps and force mains.

A single absorption field or distribution network may be dosed by a single pump if the estimated daily wastewater flow does not exceed 600 gallons. Dual pumps shall be installed for flows in excess of 600 GPD whether to a single absorption field or distribution network or to a multiple system.

The usable capacity of the dosing tank is directly related to the number of doses required per day and the average daily flow of wastewater from the facility served. For systems in medium textured sands and for elevated sand mounds, four doses per day per distribution system are required. For most other soils, one

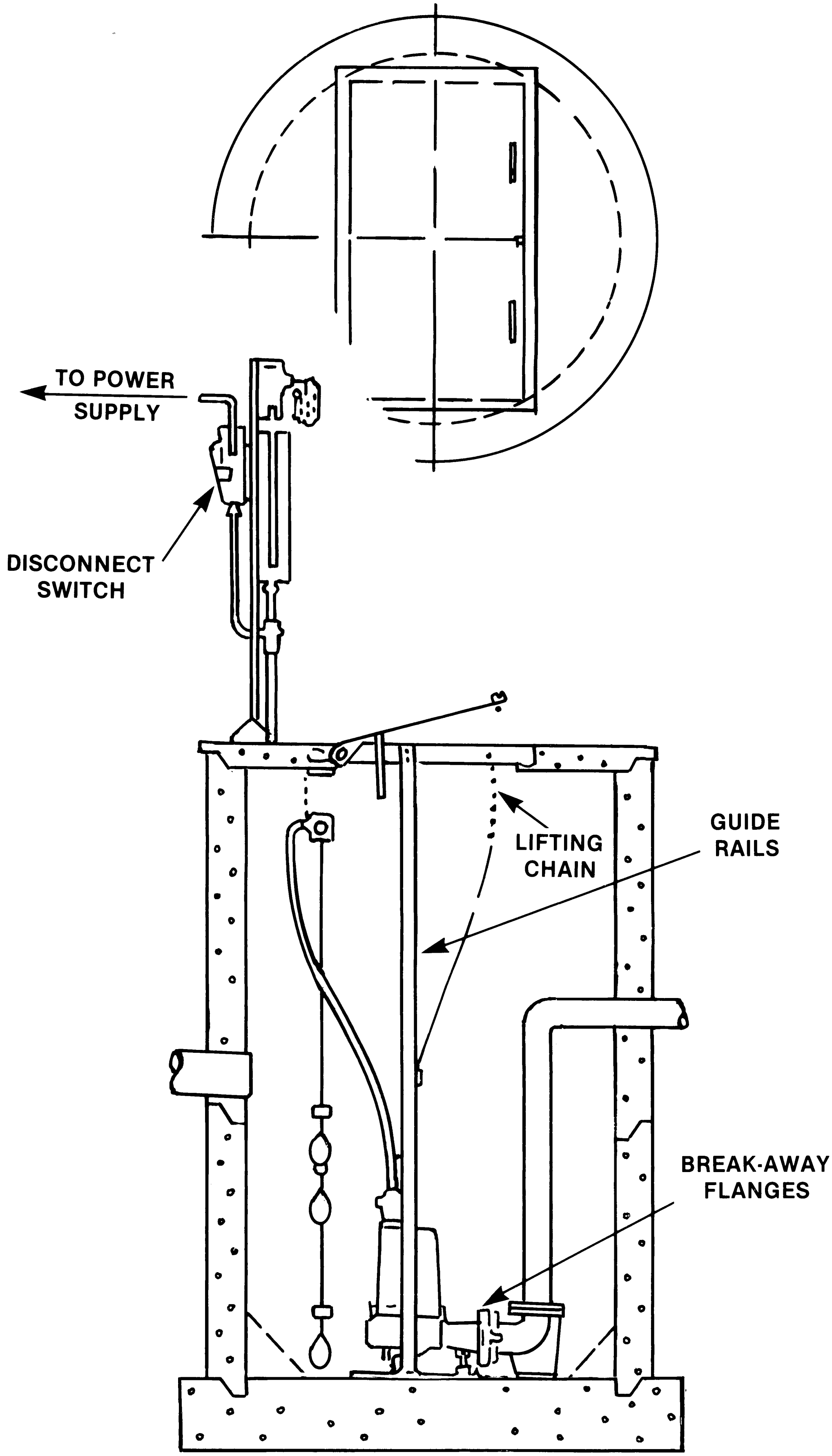


Figure 6. Dosing tank and pumps

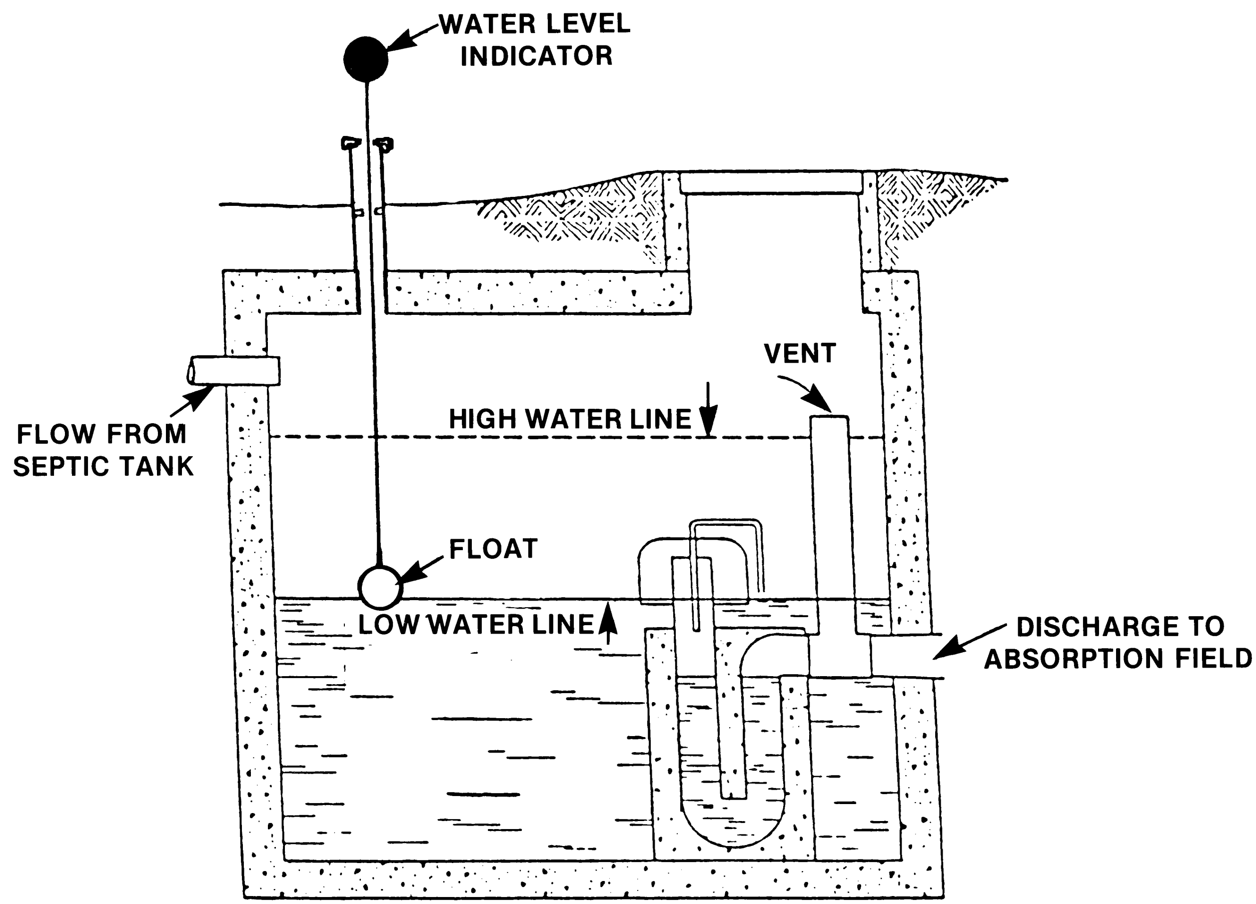


Figure 7. Dosing tank with siphon

dose per day per distribution system is required. The usable dosing tank capacity (i.e., that capacity between the pump float on/off levels) must equal the daily average wastewater flow divided by the number of doses required per day, plus the volume of liquid that will drain back from the force main. In addition to the volume of the dose, sufficient additional depth must be provided to keep the pump submerged and to provide for an audio/visual high water alarm.

The tank and the piping connections into the tank must be adequately sealed to prevent groundwater intrusion and resultant overloading of the absorption field.

Check valves should not be installed on the pump discharge piping, so as to allow drainage back to the tank if dual force mains are involved. However, if two pumps alternately dose through a single discharge main, check valves must be used, but a minimum ⅜-inch weep hole must be drilled in the bottom of the force main following the check valve to allow the force main to drain back into the tank between pumpings.

Pump or siphon capacity must be computed in accordance with the design of the distribution system. If the system is flood-dosed to the primary distribution box, the pump capacity must be adequate to apply each dose in no more than 20 minutes (preferably in less time as a greater flow rate through the system will result in more even flow distribution in the trenches). For small-diameter pressure dosing the pump capacity must be calculated to provide the design head throughout the distribution system for the calculated number of discharge holes and their required size. Most pressure systems are designed with ¼-inch diameter holes, and the average head recommended for good distribution of wastewater is 2.5 feet; in this instance the discharge from each hole would be 1.17 GPM. The minimum acceptable hole diameter is ¼-inch; this will allow the lowest pump capacity to be utilized while generally avoiding plugging of the holes. Larger holes will require more than minimum pump capacities.

Section 505. DISTRIBUTION BOXES

Distribution boxes provide a temporary reservoir for evenly dividing the septic tank effluent among the laterals in an absorption field. For use with a large absorption field it may be necessary to use a primary distribution box for distributing flow to several secondary distribution boxes. It is necessary that each secondary box serve an equal number of laterals of equal length.

A distribution box must be constructed with all outlets located at exactly the same elevation and an inlet constructed so that the flow entering the box will not flow directly to one outlet hole. This may be assured by using a down-turned elbow on the inlet or by placing a vertical baffle directly in front of the inlet so as to deflect incoming flow. This is most important with a dosed system because the high velocity created by pumping might carry liquid directly to outlets on the opposite side of the box.

Section 506. ABSORPTION SYSTEMS

Absorption systems are generally classified as conventional or alternative. Conventional absorption systems consist of multiple absorption trenches with lateral pipes connected to a distribution box, each fed by gravity through a pipeline from the septic tank. Conventional absorption systems are acceptable for only certain types of soil. Alternative systems are those which require special design and construction techniques to overcome some of the problems which would develop with conventional systems due to any of the following conditions:

1. Seasonal groundwater close to the surface.

2. Limiting layers such as bedrock, fragipan, or gravelly subsoil.

3. Excessive slope.

4. Insufficient area for conventional disposal.

Alternative construction techniques may include one or more of the following features:

1. Perimeter or upslope subsurface drains, or surface diversion drains.

2. Dosing

3. Small-diameter pressure distribution system.

4. Elevated sand mound.

The design that must be incorporated into the project is dictated by the wastewater flow and the results of the on-site soil survey conducted as described in Section 507.

Percolation tests do not provide reliable data for designing an absorption field. However, in disturbed areas, such as where construction has removed or deposited soils, percolation tests may be useful for comparison with loading rates determined by analysis of the disturbed soils.

Section 507. SOIL SURVEY

A soil survey report must be prepared by a Professional Soil Scientist, Specialist or Classifier registered with the American Registry of Certified Agronomy, Crops and Soils, or a soil scientist employed by the U.S.D.A. Soil Conservation Service, detailing his evaluation of soils observed in the area of the proposed absorption field. Said report shall name each soil type observed, map the approximate boundaries and specify slope for each soil type, and for each soil type observed provide a description of the soil textures, soil structure, soil color, and the depth to seasonal water table, in the upper five feet of soil. The soil survey report is used to develop criteria for selection and detailed design of the absorption field.

A reporting form for use by the soil scientist was developed by the Indiana State Board of Health and the U.S.D.A. Soil Conservation Service. The three-page form is shown in Figure 8. It may be copied for your use.

Loading rates for soils, in gallons per day (GPD) per square foot (SF), may be estimated by use of Table 7 and the soil textures and structures reported on the soil survey report. For trench systems the required absorption area is determined by dividing the peak daily flow of wastewater in GPD by the soil loading rate. The resulting absorption area applies to the trench bottoms only. No credit is given for sidewall area. For elevated sand mound construction two soil loading rates are involved: 1) for the sand below the gravel bed and 2) for the soils in the basal area. The required bed area is calculated by dividing the peak daily flow in GPD by the loading rate for medium sand meeting State Highway Specification No. 23 (1.2 GPD per square foot). This loading rate is fixed since the only sand fill recommended for mounds is that meeting State Highway specification No. 23. The required basal area is calculated by dividing the peak daily flow in GPD by the loading rate of the soils beneath the mound as determined by the soil survey report.

The loading rate determined from Table 7 is either the calculated weighted average of the loading rates of all horizons within 24 inches below the trench bottom, or the lowest loading rate within six inches of the trench bottom, whichever calculation results in a more conservative design. The loading rate for the basal area beneath a mound is determined by averaging the loading rates of the top 24 inches of the soil profile.

FIGURE 8 - SOIL SURVEY REPORT FORM - SHEET 1

Request for Assistance for On-Site Septic Tank-Absorption Field
Sewage Disposal System

Name of person requesting assistance: ______________________________

Address: ______________________________

Telephone No.: Home (____)______________; Work (____)______________

Location: County ______________ Town ______________
Address: ______________________________
Legal Description T. __________, R. __________, Sec. __________,
____
Soil Atlas Sheet Number(s) ______________________________

Brief Description of Site: ______________________________
____
____

Past Assistance Furnished: Local - ______________________________
State - ______________________________

Purpose for Assistance (check one)

- Residential - single dwelling (circle one - Proposed, Expansion, Repair, Replacement)
- Residential - subdivision (Project Title ______________________)
- Commercial/Semi-public (Project Title ______________________)

....
....

- Has permit or permit to repair a system that failed been issued:
  (circle one) Yes (date ______________________) or No
- Name of people at the site when assistance is given: ______________________________
  ____
  ____
- Stage of development: ______________________________
  ____
- Location of well and/or water for use of water for domestic uses:
  ____
  ____
- Observation and comments by people at site during site investigation:
  ____
  ____

FIG 8-1/SE 3

FIGURE 8 - SOIL SURVEY REPORT FORM - SHEET 2

- Soil Scientist giving assistance:

  Name: ______________________________

  Telephone No.: (______)____________________

- Date assistance given: ______________________________

- Use of site at time assistance is given: ______________________________

- Sketch or map of area showing soil boring sites, well location, slope direction, buildings, driveway, drainways, streams, etc. Show soil delineations on the sketch or map of the area if more than one soil delineation. (attach to this request).

- Position of septic field in the landscape: ______________________________

  ____

- Percent of slope at the site of the system: ______________________________.
  (If more than 12 percent is there an area on the property less than 12 percent? Yes No)

- Percent of disturbed land: __________ Draw disturbed area on the attached map.

- Depth to seasonal high water table: ______________________________ inches.
  Time of year: ____________________ Duration: ____________________ days

- Vegetation at site of sewage disposal system: ______________________________

  ____

- Landscape Position: (Circle one)

  - Upland, does it pond water? Yes No Don't Know
  - Terrace, does it pond water? Yes No Don't Know

    Does it flood? Yes No Don't Know
  - Flood plain.

- Indicate on the landscape diagram below the location of the site(s) investigated.

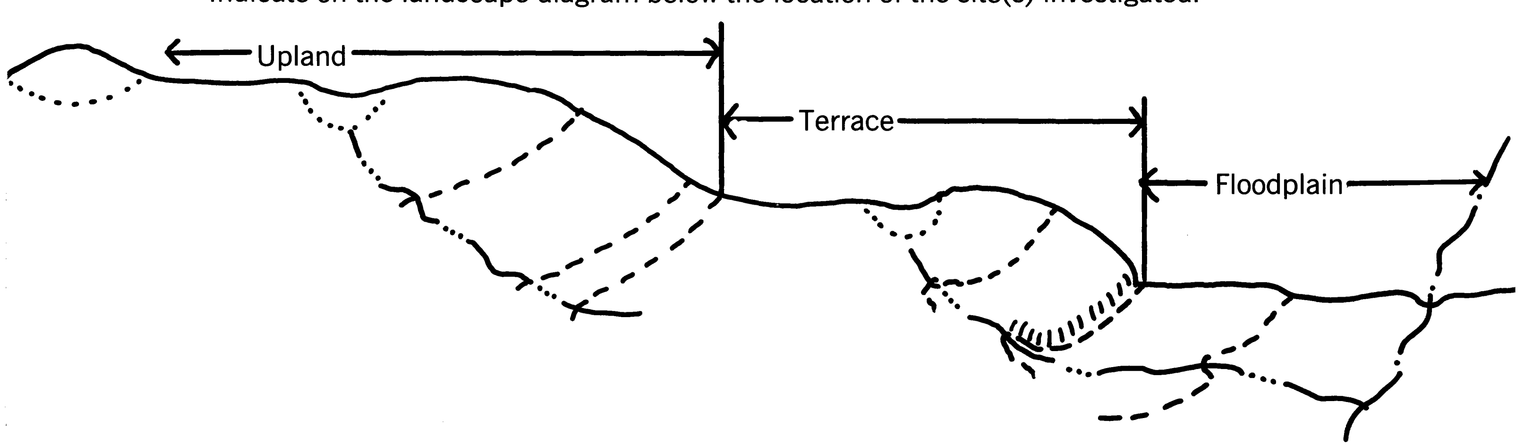


FIGURE 8 - SOIL SURVEY FORM - SHEET 3

GENERAL SITE INFORMATION	
Soil Symbol on Sketch	Landscape Position -
Present Land Use	Percent Slope -
Present Vegetation	Kind of Slope -
Depth to limiting layer: (circle one and indicate depth in inches to layer)	Shape of Slope -
Bedrock ________; Fragipan ________; Poor Filter ________;	Direction of Slope -
Tillage Pan ________; Thickness ________ inches; Compact Till ________	Slippage Potential -

SOIL PROPERTIES

Depth (inches)	Soil Horizon	USDA Texture	Color			Structure			Consis-tency	pH or Efferves-cence	Coarse Fragments		Estimated Bulk Density	Estimated Perme-ability	Parent Material
			Matrix	Mottles	Coatings	Grade	Size	Shape			2-75mm	> 3 in.			

REMARKS:

FIG 8-3/SE 3

Table 7. Estimated Hydraulic Loading Rates (GPD/FT^2)

		SOIL STRUCTURE CLASSES								
Soil Texture Code	Soil Texture Class	Single Grain	Granular	Strong or Angular Subangular Blocky	Moderate Angular Subangular Blocky	Weak Angular or Subangular Blocky	Fragipan	Structureless, Massive, Friable, V. Friable	Structureless, Massive Compact, Firm, V. Firm	Mound Infiltration Rate
1	Gravel Coarse Sand	LML	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LML
2	Loamy Coarse Sand Medium Sand	1.20	1.20	N/A	N/A	1.2	N/A	N/A	N/A	1.20
3	Fine Sand Loamy Sand Loamy Fine Sand	0.75	0.60	N/A	0.75	0.75	N/A	0.75	N/A	0.60
4	Very Fine Sand Loamy V. Fine Sand	0.50	0.50	N/A	0.75	0.60	N/A	0.60	N/A	0.50
5	Sandy Loam Coarse Sandy Loam	N/A	0.75	N/A	0.60	0.60	0.25	0.60	N/A	0.60
6	Fine Sandy Loam V. Fine Sandy Loam	N/A	0.75	N/A	0.60	0.60	0.25	0.60	N/A	0.60
7	Sandy Clay Loam	N/A	0.75	0.75	0.50	0.50	LML	0.50	LML	0.50
8	Loam	N/A	0.75	0.75	0.50	0.30	LML	0.30	LML	0.50
9	Silt Loam	N/A	0.60	0.60	0.50	0.30	LML	0.30	LML	0.50
10	Silty Clay Loam Clay Loam Sandy Clay	N/A	0.60	0.60	0.30	0.25	LML	0.25	LML	0.25
11	Silty Clay Clay	N/A	0.60	0.50	0.30	0.25	N/A	0.25	LML	0.25
12	Muck	N/A	N/A	N/A	N/A	N/A	N/A	LML	N/A	LML
13	Marl Bedrock	N/A	N/A	N/A	N/A	N/A	N/A	N/A	LML	LML

N/A - NOT APPLICABLE

LML - LIMITING LAYER

A Percentage of Less than 35% (By Volume) Coarse Fragments (2MM or Larger) Has No Effect on These Loading Rates.

Table 7/SE 3

Section 508. SELECTION OF SYSTEM

The two basic types of on-site soil absorption systems are gravity systems and dosed systems.

A gravity system may be installed where 1) the possibility of gravity flow exists between the septic tank outlet and the design elevation of the primary distribution box, 2) lineal feet of trench are less than 1,000 and 3) absorption field soils below the trench bottom range from fine sand to clay loam as listed in Table 7.

Gravity systems, frequently referred to as conventional, may be installed with trenches from 12 to 48 inches deep depending on the elevation of the high seasonal groundwater or other limiting layers. It is necessary to provide at least 24 inches vertical separation between the trench bottom and the groundwater or limiting layer.

Gravity fed absorption fields utilize 4-inch perforated pipes as laterals. Distribution boxes must divide the wastewater flow from the septic tank evenly among the laterals in the trenches.

Dosed systems require a dosing tank and pump between the septic tank and the absorption field. Dosing may be accomplished through a small diameter pressure piping network in the trenches in which small perforations in the bottom of the pipe laterals distribute the wastewater. Minimum pressure is maintained on the system at between 2.5 to 3 feet of head. Another method of dosing known as flood-dosing uses 4-inch laterals and a distribution box which receives the pump discharge.

Small diameter pressure dosing is recommended as follows: 1) in all systems installed in loamy coarse sand and medium sand, and 2) in all systems with over 2,000 lineal feet of trenches and located in soils listed in Table 7 down to silty clay loam. Flood dosing is recommended for systems with more than 1,000 lineal feet of trenches and located in soils listed in Table 7 from fine sand to silty clay loam.

The elevated sand mound is a special type of dosed system utilizing small diameter pipes. It will be described in Section 510. Such a system may be selected in areas where seasonal high groundwater or any limiting layer is closer than 24 inches beneath the surface.

Table 8 summarizes the selection requirements for on-site sewage disposal.

Table 8
Selection of System
On-Site Sewage Disposal

System	Gravity Flow Subsurface Trench	Flood Dosed Subsurface Trench	Pressure Distribution Subsurface Trench	Elevated Sand Mound	FIND ANOTHER SITE
Application	< 1000 L.F. in Texture Code 3-10 (Table 7)	≥ 1000 L.F. in Texture Code 3-10 (Table 7)	Texture Code 2 and ≥ 2000 L.F. Texture Code 3-10 (Table 7)	Texture Codes 1-11 (Table 7)	N/A
Depth to Seasonal High Water Table (in) (Notes 1,2)	≥ 36	≥ 36	≥ 36	≥ 24	< 24 or < 36 (Note 8)
Depth to Limiting Layer (LML) (in) (Note 3)	≥ 36	≥ 36	≥ 36	≥ 24	< 24 or < 36 (Note 8)
Topography Code (Note 4)	1 to 3	1 to 3	1 to 3	1 to 3	4 to 6
Slope (%) (Note 7)	≤ 12	≤ 12	≤ 12	≤ 6	> 6 or > 12 (Note 9)
Depth to Bottom of Trench (in.)	≥ 12 but ≤ 48 (Note 5)	≥ 12 but ≤ 48 (Note 5)	≥ 12 but ≤ 48 (Note 5)	≥ -12 (Note 6)	N/A

Notes:

#1) Depth to seasonal high water table is the highest elevation at which there is physical evidence that the soil has been saturated with water. This is normally noted by the color change or the presence of gray mottling as a result of saturated soil conditions during a portion of the year.

#2) Artificial internal drainage may be considered, where feasible, as a means of overcoming the limitation posed by seasonal high water table. When drainage is feasible, depth to seasonal high water table will be the predicted depth after installation of the drainage system and the sewage disposal system.

#3) Limiting Layer (LML): 1) Any subsurface layer which prevents normal vertical movement of water or air, e.g., glacial till, bedrock, fragipan, etc.; or 2) any subsurface layer which is a poor filter due to the inability to purify the wastewater effluent before it enters the ground water, e.g., coarse sand, gravel, fissured bedrock, etc.

#4) Topography Codes: 1) Convex, 2) Hill Slope, 3) Flat, 4) Toe Slope, 5) Concave, 6) Depression.

A toe slope is not indicated as an acceptable topographical position because of inherent drainage difficulties. For a toe slope position where adequate drainage can be provided, an on-site system may be considered, provided all other site criteria are favorable.

#5) $\geq$ 12 but $\leq$ 48; and must be at least 24 inches above seasonal high water table (see Note #2) and limiting layer.

#6) Distance from bottom of gravel bed to existing natural soil (depth of sand fill below gravel bed).

<u>No system may be considered if:</u>

#7) Slope exceeds 12 percent or

#8) there is a limiting layer or uncontrollable water table within 24 inches (applicable to a mound) or 36 inches (applicable to a trench system).

#9) $>$ 6 eliminates mound, $>$ 12 eliminates trench.

Perimeter drains are frequently required to lower groundwater to an acceptable depth and may influence selection of the absorption system. Such drains generally are constructed as trenches containing perforated drainage pipe surrounded by gravel. The trench should be positioned from 10 to 25 feet from the edge of the field, depending on the soil characteristics. See Table 9.

Groundwater must be lowered to at least 24 inches below grade for mound construction or 24 inches below trench bottom in trench construction.

Table 9
Perimeter Drain Clearance from Absorption Fields

Clearance ft	Soil Loading Rate GPD/SF
25	1.0 to 1.2
20	0.6 to 1.0
15	0.4 to 0.6
10	0.25 to 0.4

Section 509. CONSTRUCTION OF TRENCH ABSORPTION FIELDS

The site selected for the absorption field must be protected from vehicular traffic and must not be disturbed by grading, stripping of vegetation, storage of construction materials or by any other activity which could remove or compact the soil.

Surface water must be diverted away from the absorption area by an adequate drainage ditch or swale.

All absorption fields with the exception of elevated sand mounds are constructed with multiple trenches 3 feet wide which contain 12 inches of washed gravel or hard crushed aggregate surrounding the distribution laterals. Gravity absorption field trench depths may be from 12 to 48 inches deep and must contain 4-inch diameter distribution laterals constructed of PVC pipe with perforations in accordance with Table 4. See Figure 9.

The gravel or stone aggregate must be larger than the openings in the laterals. The aggregate must be covered with barrier material of straw or synthetic filter fabric before backfilling, to keep soil from penetrating the aggregate. Small diameter pressure dosed systems must be constructed using only synthetic filter fabric.

Distribution laterals of 4-inch diameter pipe must be connected individually to a distribution box using unperforated pipe. All laterals served by a common distribution box must be identical in length and the inverts at the outlet of the distribution box must be at the same elevation so that flow distribution is uniform throughout the field. Laterals may not exceed 100 feet in length and must slope 2 to 4 inches per 100 feet. On sloping sites, laterals must follow contours. The pipe must be laid with rows of perforations at the 4 o'clock, 8 o'clock and 12 o'clock positions.

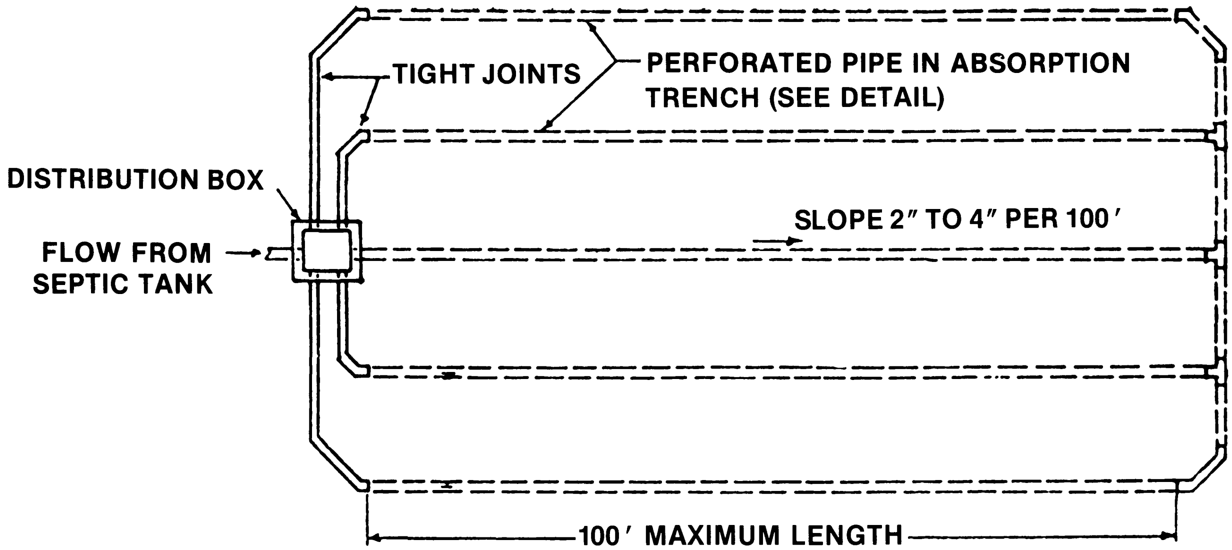
A trench spacing of at least 10 feet should be used if trucks or other equipment are to work between the trenches during construction. The minimum spacing in any other situation shall be 7 feet.

The ends of 4-inch diameter laterals must be joined with perforated pipe as shown in Figure 9 unless the absorption field site is sloped to the extent that the trenches must follow the contours. Connecting the ends of laterals at a sloping site may overload the lower trenches by means of the connecting line. The additional trench area provided by connecting the ends of the trenches may not be used to meet the total required trench area.

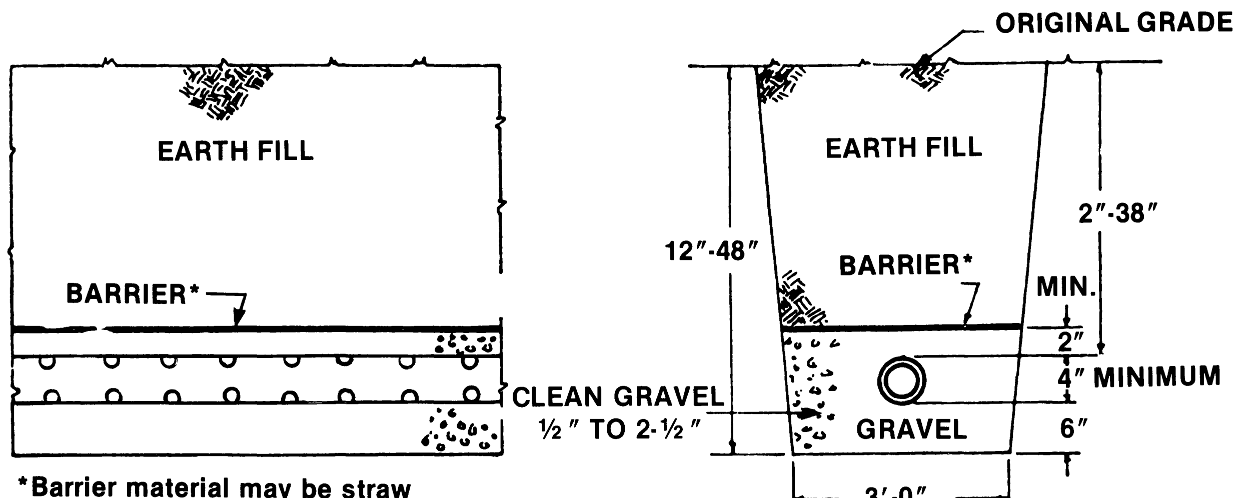
Trenches may be constructed as shallow as 12 inches but all trenches must have sufficient soil cover to provide 18 inches depth over the tiles to prevent freezing.

Since shallow trench systems are generally designed to overcome a soil or groundwater limitation, most must be pressure-dosed with a small diameter distribution system as mentioned briefly in Section 508.

The small diameter pressure dosed distribution system consists of a closed piping network using 1-inch to 2-inch diameter laterals fed through a manifold by a dosing pump. The dosing pump must have sufficient capacity and head characteristics to maintain a minimum head throughout the system of between 2 and 3 feet. The laterals must have equally spaced holes drilled in the bottom from which wastewater is sprayed into the gravel-filled trenches. The hole size and the system head determine the rate of discharge per hole, and the system must have sufficient holes to assure uniform distribution throughout the absorption field. The total dosing rate for sizing the pump is determined by multiplying the number of holes by the individual hole discharge rate. The required pump head is determined as the algebraic sum of the static head difference between the pump and distribution system elevations, pipe friction losses and required system head (again, system head must be between 2 and 3 feet). See Figure 10.

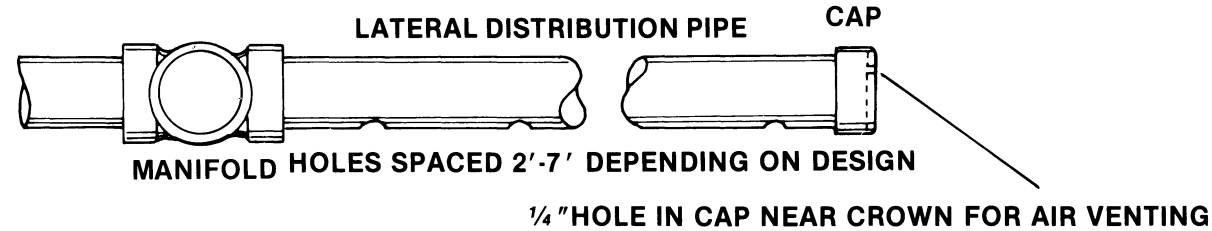


PLAN OF ABSORPTION FIELD

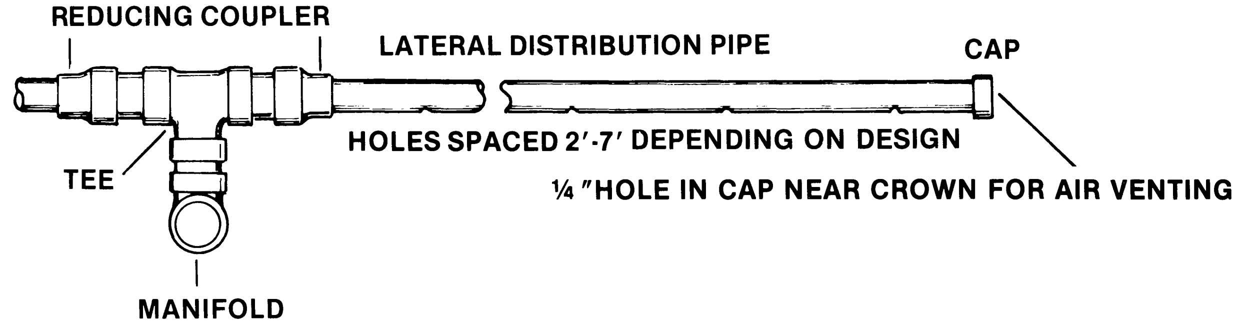


*Barrier material may be straw or synthetic filter fabric.

Figure 9. Gravity absorption field



Lateral to manifold connections by crosses



Lateral to manifold tee-to-tee connections

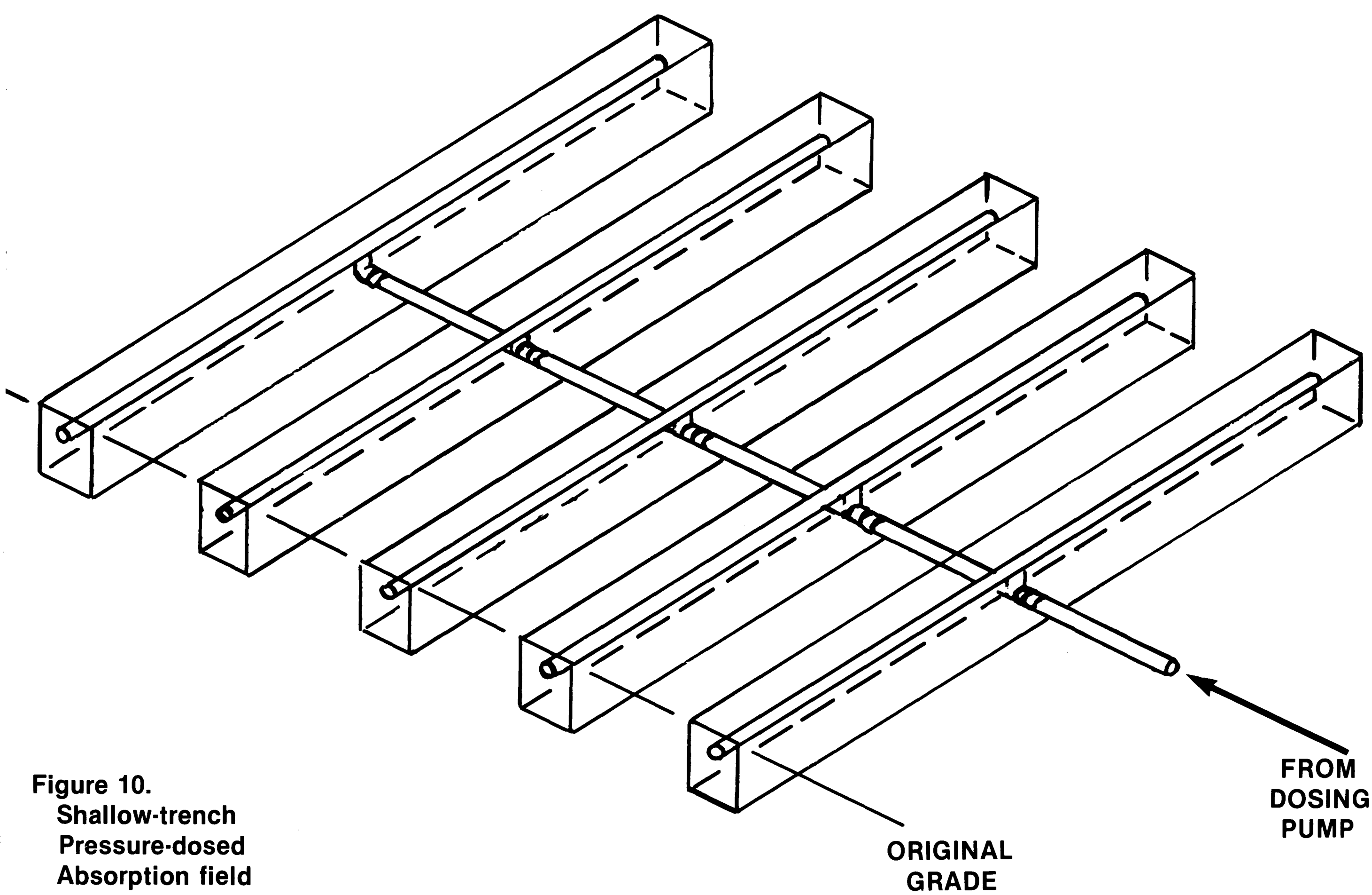


Figure 10.
Shallow-trench
Pressure-dosed
Absorption field

The spacing of holes in the pipe laterals is directly related to the type of soil underlying the trenches, specifically its soil loading rate. Table 10 should be used to determine the hole spacing and, consequently, the number of holes in the distribution system.

Table 10
Lateral Hole Spacing versus Soil Loading Rates

Lateral Hole Spacing (feet)	Soil Loading Rates GPD/SF
3	1.0 to 1.2
3 to 4	0.8 to 1.0
3 to 5	0.6 to 0.8
3 to 6	0.4 to 0.6
3 to 7	0.25 to 0.4

The range in lateral hole spacing in Table 10 allows flexibility in design. Closer spacing provides the most even wastewater coverage in the trenches but will require a higher capacity pump than a wider hole spacing. The larger systems generally utilize wider spacing for economic reasons.

Unless the distribution system can be installed level, it may be necessary to vary the number and spacing of the small-diameter holes from higher to lower elevations such that fewer holes would be specified where the laterals are lower and at greater head. This is necessary to provide equal flow to all trenches. Table 11 may be used to estimate the flow at varying heads for several hole sizes. See the example computation following Table 11 for determining hole spacing in laterals at varying elevations.

The manifold feeding the laterals in a large pressure dosed trench distribution system should be installed below the laterals to allow all laterals to fill simultaneously by means of tee-to-tee connections. This is particularly important for manifolds 12 feet or greater in length. Manifolds must be of sufficiently large diameter to virtually eliminate friction loss over the length of the manifold. Finally, the manifold and force main must drain after dosing, either back to the dosing tank or ahead to the field. This is required to prevent solids deposition and mat formation in the piping. Topography will dictate the direction of drainage.

TABLE 11
Perforation Discharge Rates (GPM)
vs Perforation Diameter at Varying Heads

In-Line Head (ft)	Perforation Diameter (in)	
	1/4	5/16
1.5	0.90	1.41
2.0	1.04	1.63
2.5	1.17	1.82
3.0	1.28	1.99
3.5	1.38	2.15
4.0	1.47	2.30
4.5	1.56	2.57

Formula to compute flow (Q) from any diameter hole (d) at in-line head (H): $Q = 11.78d \sqrt{H}$

Example calculation for determining hole configuration for a sloping site with laterals at varying elevations:

Daily Load 1200 GPD
Soil Loading Rate 0.8 GPD/S.F.
Compute Trench Area 1200/0.8 = 1500 S.F.
Compute Trench Length 1500/3 = 500 L.F.
Assume 5 laterals at 100 feet each, 10 foot spacing
Lat. #1 at 0.0 feet relative elevation
Lat. #2 at -0.5 feet relative elevation
Lat. #3 at -1.0 feet relative elevation
Lat. #4 at -1.5 feet relative elevation
Lat. #5 at -2.0 feet relative elevation

Design for minimum system head of 2.5 feet at Lat. #1. Total head and flow per hole:

Lat. #1	2.5 ft.,	1.17 GPM/hole
Lat. #2	3.0 ft.,	1.28 GPM/hole
Lat. #3	3.5 ft.,	1.38 GPM/hole
Lat. #4	4.0 ft.,	1.47 GPM/hole
Lat. #5	4.5 ft.,	1.56 GPM/hole

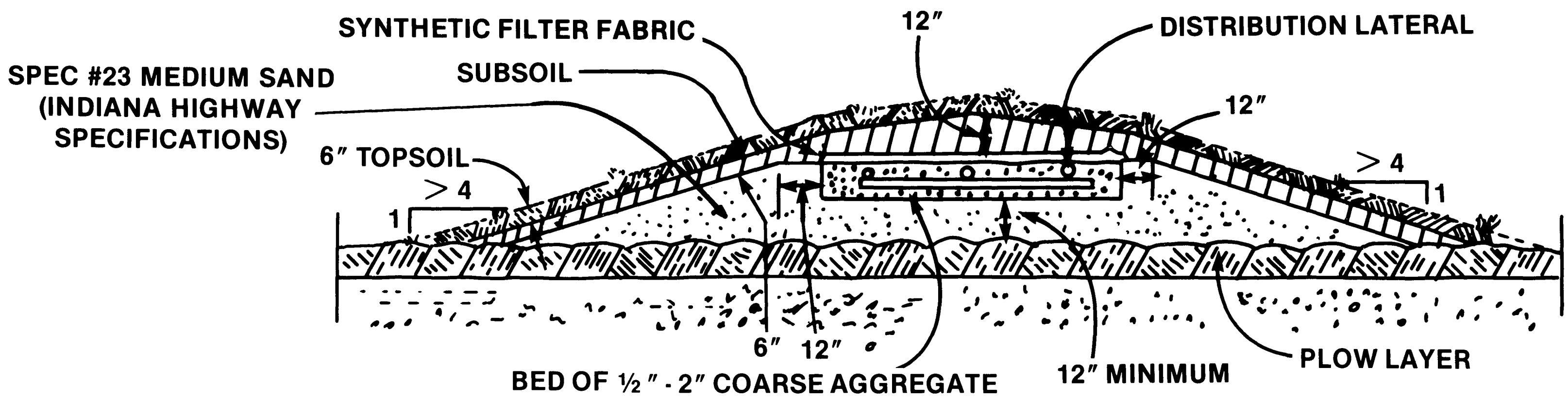
To provide equal flows to all trenches, determine the number of holes per 100 foot lateral as follows:

Design Lat. #1 with hole spacing at 4 feet.
Lat. #1 100/4 = 25 holes x 1.17 GPM/hole = 29.3 GPM
Lat. #2 29.3/1.28 = approx. 23 holes x 1.28 GPM/hole = 29.4 GPM
Lat. #3 29.3/1.38 = approx. 21 holes x 1.38 GPM/hole = 29.0 GPM
Lat. #4 29.3/1.47 = approx. 20 holes x 1.47 GPM/hole = 29.4 GPM
Lat. #5 29.3/1.56 = approx. 19 holes x 1.56 GPM/hole = 29.6 GPM
Total pumping rate required 146.7 GPM

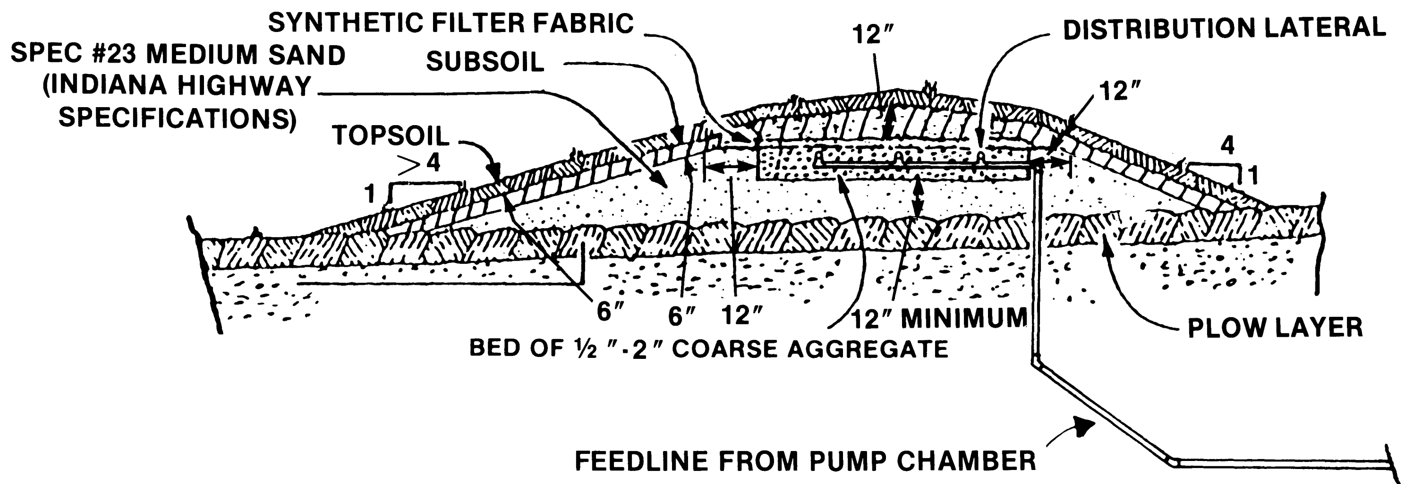
Hole Spacing:
Lat. #1 100 feet/25 holes = 4.0 feet
Lat. #2 100 feet/23 holes = 4.35 feet
Lat. #3 100 feet/21 holes = 4.76 feet
Lat. #4 100 feet/20 holes = 5.0 feet
Lat. #5 100 feet/19 holes = 5.26 feet

Section 510. CONSTRUCTION OF ELEVATED SAND MOUNDS

An elevated sand mound is an alternative on-site wastewater disposal system acceptable for certain sites where soils are unsuited for other types of soil absorption systems. Due to special construction requirements, sand mounds can be rather expensive to construct. The system consists of an elevated sand mound containing a gravel bed on top of fill, all placed over the original soil. The soil must be tilled to provide an intimate interface between the soil and sand. See Figures 11 and 12. At sites with excessively permeable or shallow soils the sand mound treats and disperses the wastewater before it reaches groundwater. At sites with slowly permeable subsoils, the sand mound utilizes the more permeable natural topsoil near the surface, and prolongs the useful life of the soil for absorption by filtering out solids that would otherwise plug soil pores.



Mound on Level Site
(Slope ≤ 0.5%)



Mound on Sloping Site
(Slope 0.5% to 6%)

Figure 11. Cross-section of elevated sand mound

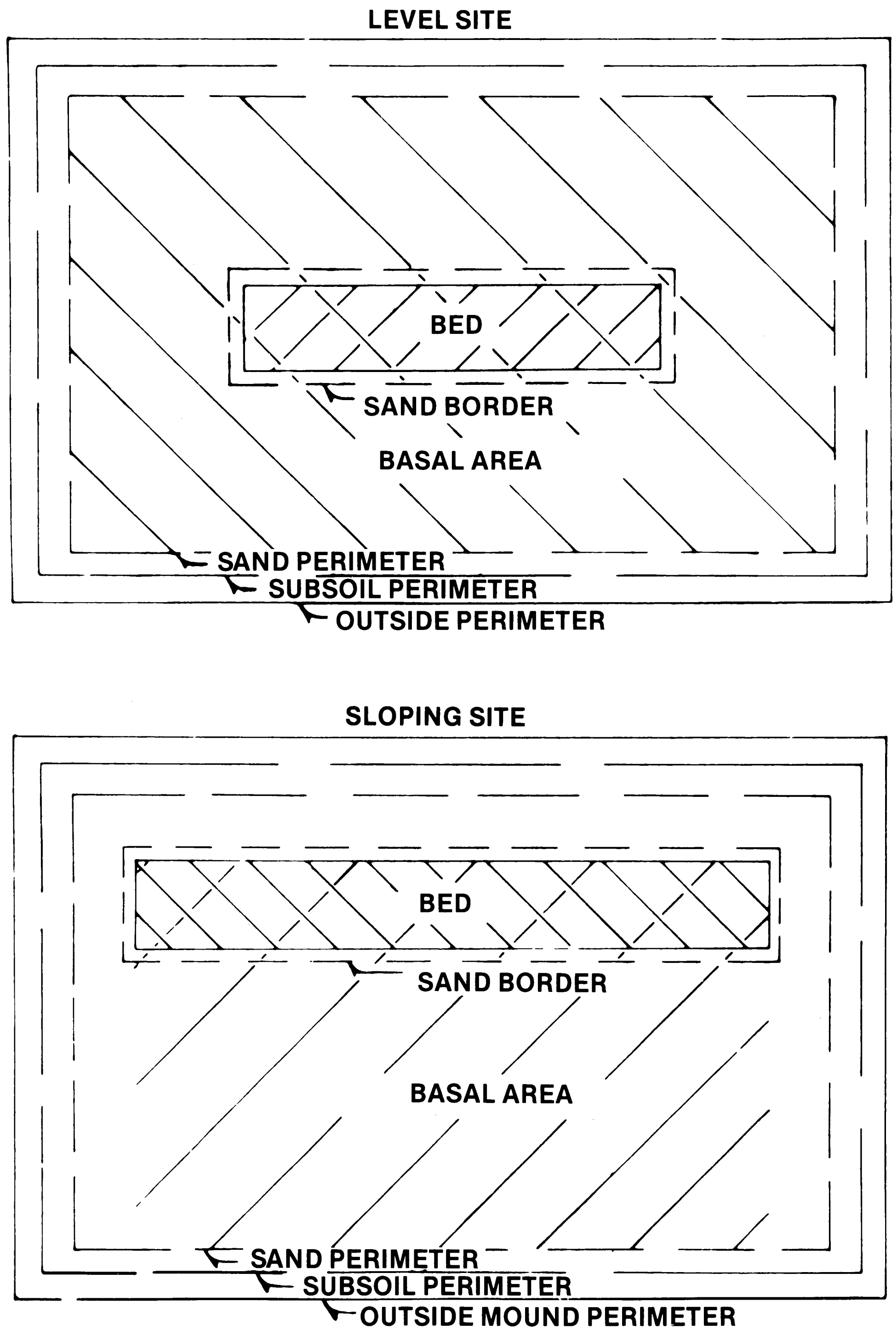


Figure 12. Plan view of elevated sand mound

Before the mound may be designed, a topographic survey is necessary at the selected site, as the ideal mound should be long and narrow and oriented parallel to the contours of the slope. Care must be taken to place the mound or mounds in an area where groundwater flow is essentially parallel or diverging, not converging. See Figure 13. An on-site soil survey must be completed to determine the design loading rate of the basal area so that the mound dimensions may be determined for a given daily wastewater load. The flow in gallons per day divided by the loading rate provides the square feet of basal area necessary. The sand fill must meet Indiana State Highway Specification No. 23; this sand has an allowable loading rate of 1.2 GPD per square foot.

The mound is constructed with an aggregate bed instead of trenches, and the required bed area is computed by dividing the daily wastewater flow by the sand loading rate of 1.2 GPD/SF. The bed width should generally be a maximum of 15 feet for the largest mounds (approaching 4,000 GPD loading) and proportionately less for smaller mounds. The bed width should be less for soils with higher seasonal groundwater and lower permeability. The shape of the basal area will usually be similar to that of the bed, with the bed centered over the basal area for flat sites (slope less than 0.5 percent), and upslope from the center of the basal area for sloping sites (slopes up to 6 percent). See Figure 12.

The length to width ratio (N) of the mound basal area should vary with the peak daily wastewater load (Q) as follows:

Load Q	Length/Width Ratio N
$\leq$ 1500 GPD	3
1500 to 3000 GPD	4
3000 to 4000 GPD	5

The maximum bed width may be determined by applying Q and N as determined above, in the following relationship:

Maximum Bed Width = $0.83 \sqrt{QR/N}$
where R = soil loading rate in GPD/SF

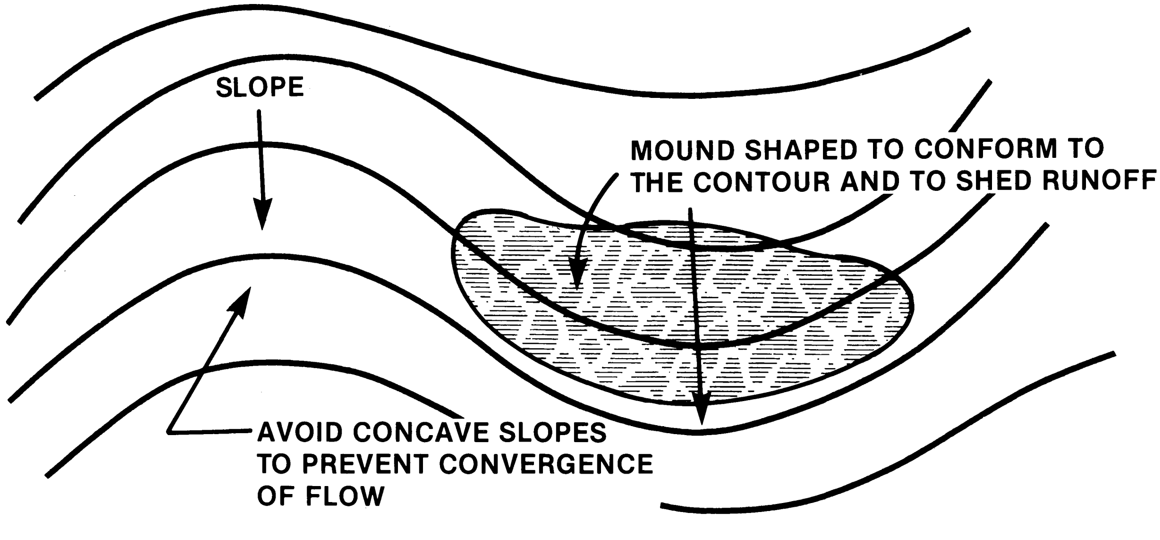
An elevated sand mound should be dosed 4 times per day through a small diameter pressure dosed distribution system. The laterals should have ¼-inch perforations along the bottoms at 3-foot intervals and the individual laterals should be spaced no more than 3 feet apart. See Figure 14. The manifold and force main must drain after each dosing, either back to the dosing tank or ahead to the field. This is required to prevent solids deposition and mat formation in the piping. Topography will dictate the direction of drainage.

Lateral diameters should be selected to produce negligible pressure drops over their lengths. This is necessary in order to provide an equal distribution of wastewater over the system. Table 11 illustrates the variable discharge rates from laterals installed at different heads. The same is true with heads varying because of head loss due to friction in small laterals.

Recommended procedure for mound construction follows:

1. All work on the mound involving heavy equipment must be done upslope of the mound or from one end. IT CANNOT BE EMPHASIZED ENOUGH HOW IMPORTANT IT IS TO THE SUCCESS OF A MOUND THAT SOIL COMPACTION IN THE MOUND AREA NOT TAKE PLACE.

2. Before construction commences, the site should be mowed and all excess vegetation removed. Trees should be cut at ground level.



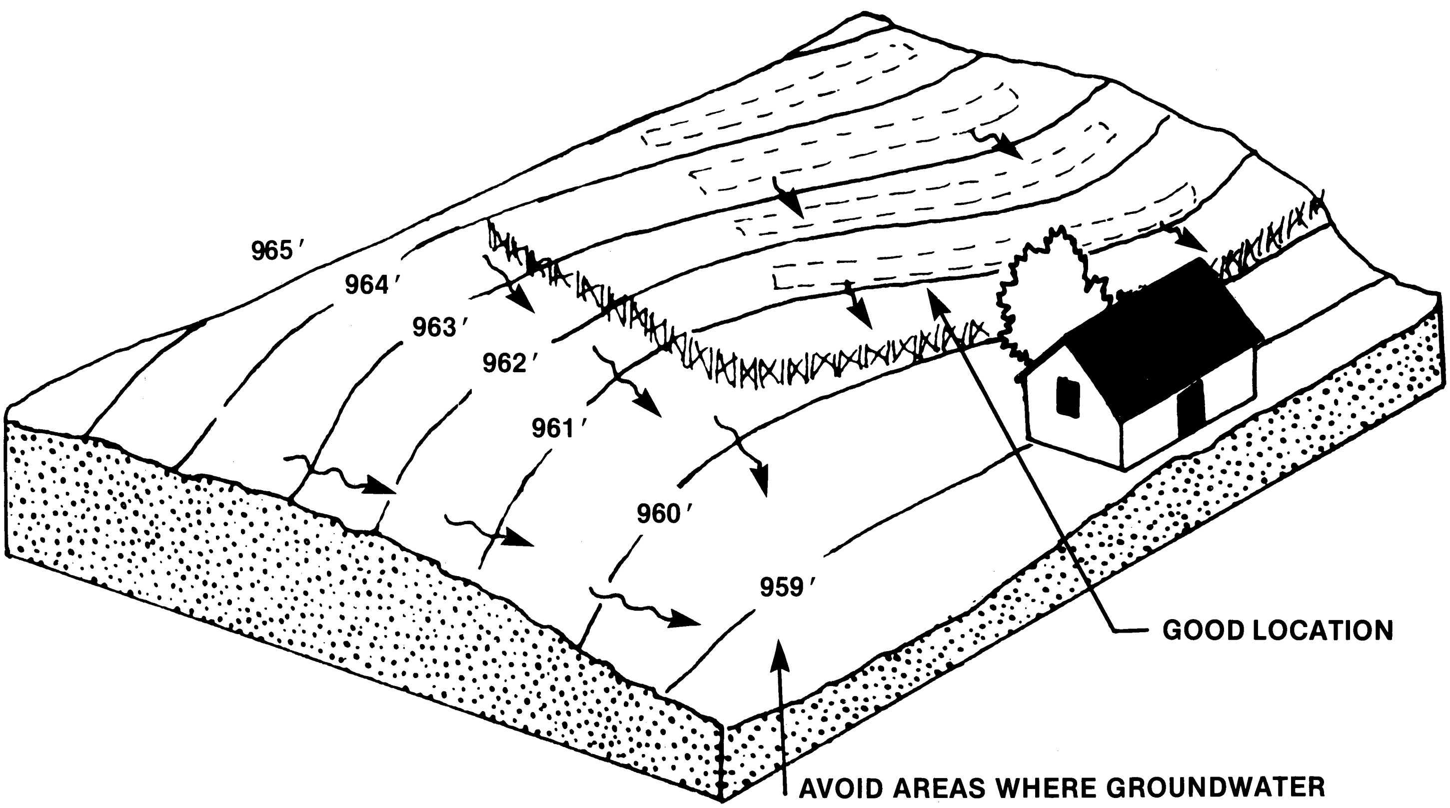


Figure 13. Proper orientation of mound and trenches with respect to topography

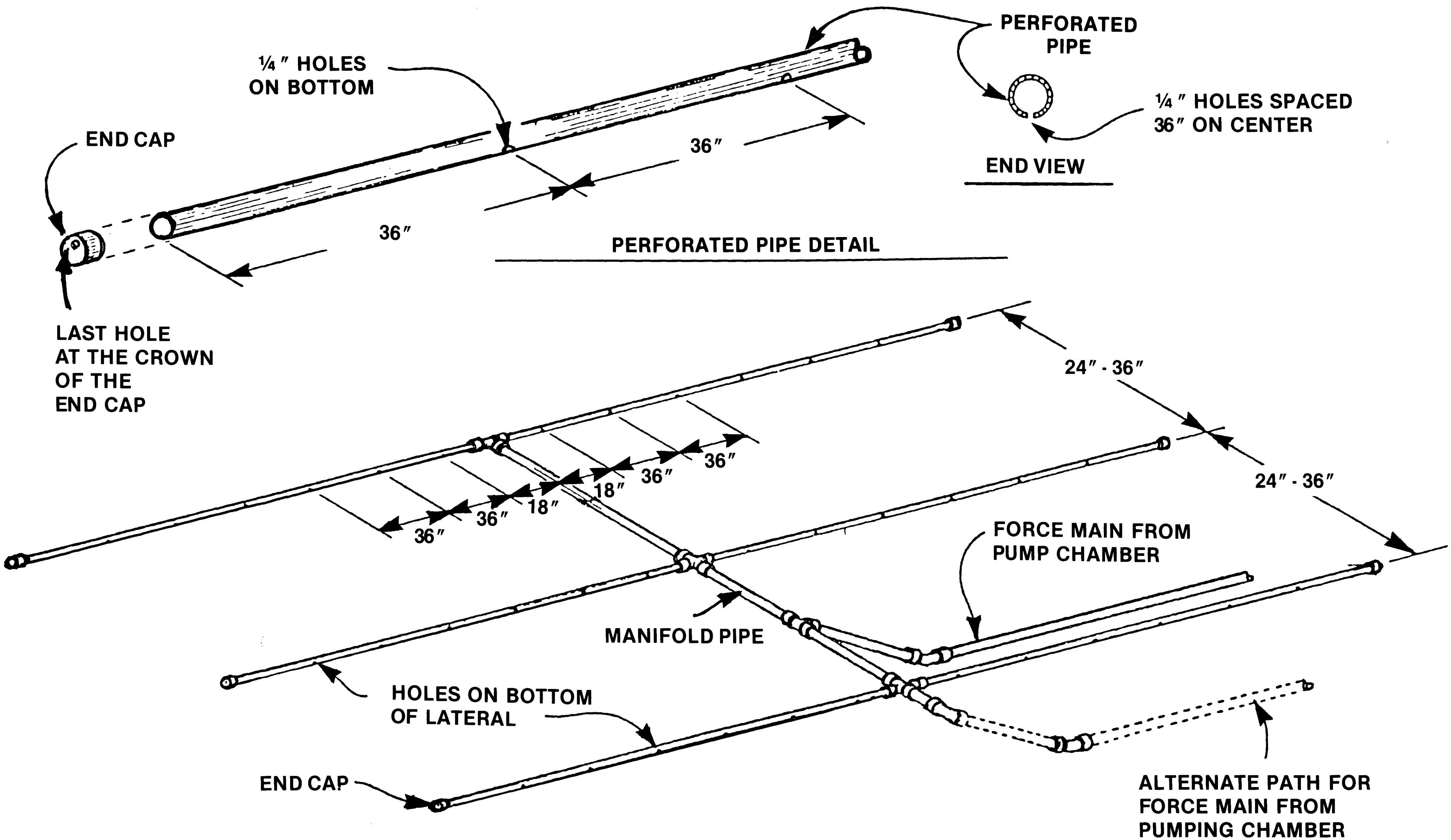


Figure 14. Small diameter pressure distribution system for mounds

3. The soil in the basal area must be tested for wetness before tilling. If a soil sample will form a ⅛-inch diameter ribbon when rolled between the palms, the soil is too wet for tilling. If it crumbles, tilling may proceed. If the soil is powdery, it is too dry and should be carefully moistened with sprinkling equipment and let dry to the proper consistency.

4. The force main and riser pipe to serve the manifold should be installed at the site of the mound before tilling, and the backfill should be compacted slightly around the force main, only enough to minimize seepage along the exterior of the pipe. The riser pipe should extend well above ground so it will be seen and avoided during tilling.

5. The basal area should be tilled 7 to 8 inches deep, parallel to the contours using a moldboard or preferably a chisel plow. Each furrow slice should be thrown upslope. If a chisel plow is used, make two passes. Care should be exercised to avoid damage to the riser pipe. If stumps exist which prevent tilling, roughen the surface to a depth of 7 to 8 inches with backhoe teeth.

6. Sand is placed over the tilled area starting at the upslope edge or end. Placing of the sand must be coordinated with the tillage operation so that the soil will not be exposed to weathering. Sand should be moved by means of a track-type tractor with blade, always keeping at least six inches of sand beneath the tracks of the tractor to minimize compaction. Continue to work the sand fill until the correct predetermined elevation coinciding with the top of the gravel absorption bed is reached.

7. Shape a depression for the absorption bed within the mound to the proper depth by hand or with a tractor blade so at least one foot of sand is maintained above the tilled surface. Carefully place aggregate to a minimum depth of 6 inches.

8. Connect the manifold and all pipe laterals to the riser pipe in accordance with the approved plans. The lateral piping should lay on top of the aggregate and all laterals should be level. Cover the piping network with an additional two inches of aggregate. Place a synthetic filter fabric over the aggregate as a barrier to intrusion of cover soil.

9. Cover the entire mound with at least 6 inches of a clayey textured soil, mounding the soil over the bed to a minimum depth of one foot to promote drainage away from the mound area.

10. Place 6 inches of good quality topsoil over the entire mound and sow grass seed or lay sod, again taking care to round the top of the mound to promote drainage.

Monitoring wells should be installed in the mound bed and in the sand-soil interface downslope of the bed to observe the operation of the mound. Figures 15 and 16 show typical monitoring wells and possible locations.

Section 511. MAINTENANCE OF ON-SITE SEWAGE DISPOSAL SYSTEMS

An on-site wastewater disposal system is constructed only because public sanitary sewage collection and treatment systems are not available at the location selected for the particular establishment. As such it is a vital part of the construction project, as the project could not be constructed without an acceptable means of wastewater disposal.

Design and construction of on-site systems must utilize the best technology available so the sewage disposal system will last as long as the establishment it serves. The preceding sections of this Bulletin have described the best design technology. After design the disposal system must be carefully constructed in

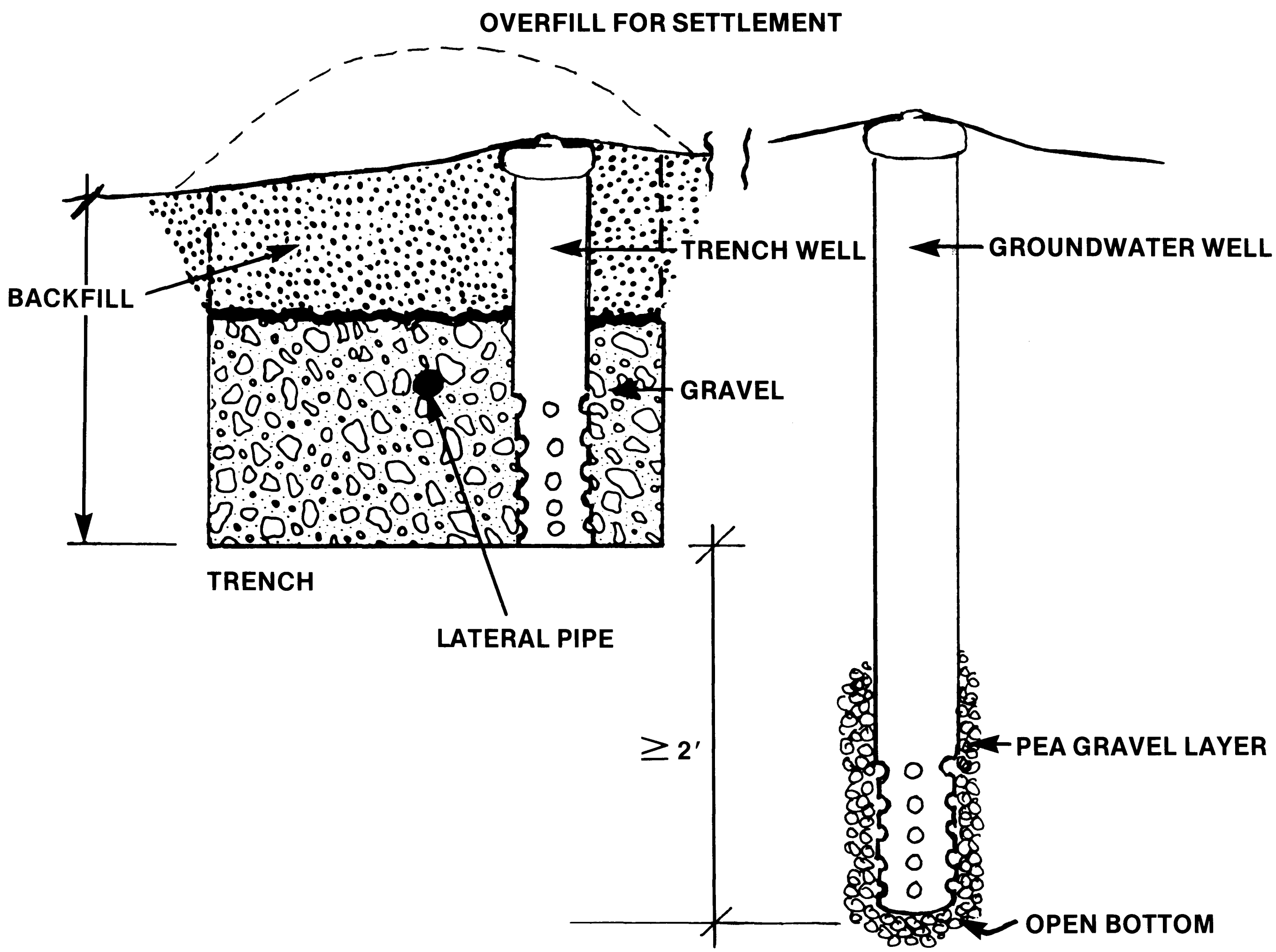


Figure 15. Monitoring wells inside and outside trenches

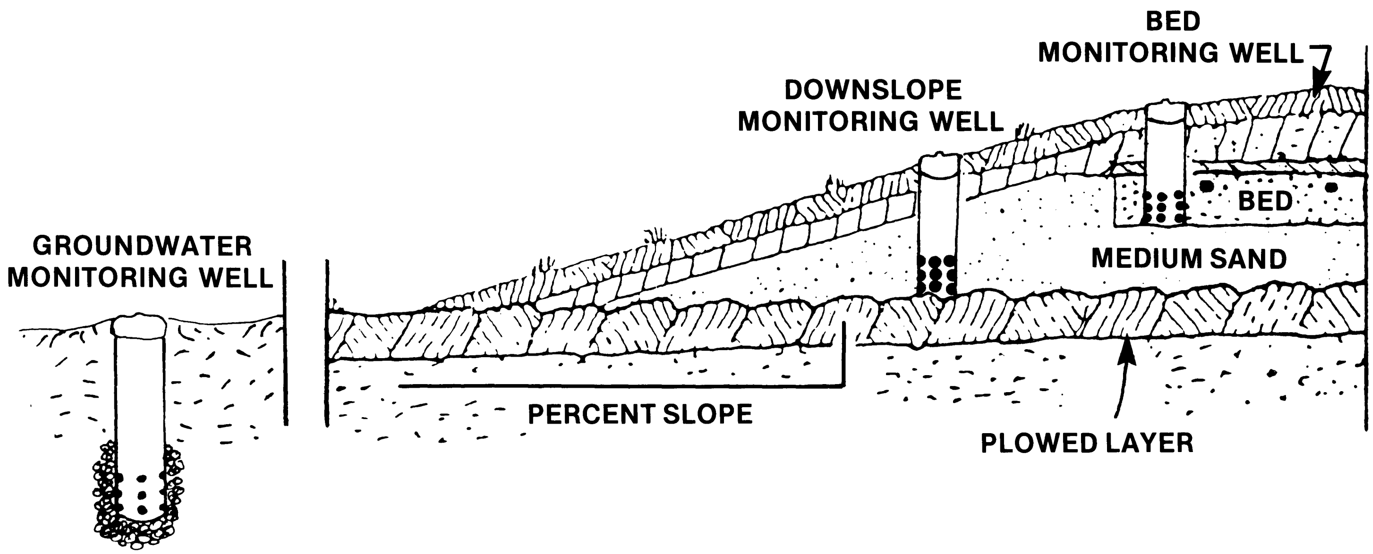


Figure 16. Placement of monitoring wells inside and outside mounds.

accordance with the approved plans and specifications. Just as important as design and construction, correct maintenance of the total system is necessary to assure long life.

As mentioned in Section 402, maintenance of the system includes mechanical equipment maintenance and periodic inspection and removal of solids from the septic tank and dosing tank. Mechanical equipment maintenance and repair will normally not be neglected since failure of such equipment would generally soon become evident. Inspection and cleaning of tankage, unless performed on a regular schedule, may be neglected and the absorption field trenches or beds may become plugged by carryover of solids from the septic tank. The timing of septic tank cleaning will vary with the type (source) of wastewater, daily load and the type of absorption field. However, cleaning every 3 to 5 years is usually sufficient. More frequent cleaning is necessary for restaurants and for residential units with garbage disposals, because of the higher percentage of solids to be disposed of. In those instances the septic tank should be checked for depth of the accumulated solids at least once per year. Grease traps may require monthly or even biweekly cleaning. Small diameter distribution systems are more likely to plug by high solids wastewater due to the smaller holes in the laterals.

Measurement of both sludge and scum depths should be made at the outlet end of the septic tank. For sludge depth wrap a long measuring stick with a rough-textured towel (e.g., terry cloth) to a height of about 4 feet. Remove the manhole cover and notice the location of the outlet baffle. Make a hole in the scum mat on the side of the baffle away from the tank end with another stick and lower the measuring stick through the hole to the bottom of the tank being careful to avoid disturbing the gas deflection baffle. Then, slowly remove it. The sludge layer can be distinguished from the liquid depth by the black particles clinging to the towel. Simply measure the black portion to determine sludge depth.

To determine scum accumulation, use a 3-inch square piece of wood attached at the end of a long stick. Push the device through the scum layer into the liquid layer. As the stick is carefully moved up and down, a change in resistance on the piece of wood indicates the bottom of the scum layer. At that point mark the stick at a convenient reference point such as the top of the manhole. With the same device locate the bottom of the outlet baffle, again being careful not to disturb the gas deflection baffle, and mark the stick with respect to the reference point used previously. Measure the distance between the marks to determine the space between the bottom of the scum layer and bottom of the outlet baffle.

The septic tank should be cleaned before the sludge layer is within 12 inches of the bottom of the outlet baffle, or when the scum layer is within 3-inches of the bottom of the baffle.

If an absorption field fails due to plugging or matting, quick repair of the system is not possible. The plugging or matting may diminish enough for the system to once again be usable, but this will occur only after months or years of resting and aeration (i.e., no use). In the meantime, a new absorption field must be constructed in another location to dispose of the wastewater.

Upon inspection of a septic tank it is important to check the condition of the inlet and outlet baffles as they may have been damaged or have fallen from their original location. Baffles must be in place in order to prevent excessive solids from leaving the tank. The gas deflection baffle must likewise be intact below the outlet of the tank to direct solids away from the outlet.

If it is necessary to construct a new absorption field the owner must contact the State Board of Health to arrange for an on-site soil survey at the new site and to obtain criteria for design and construction of a new system. This is particularly important if the system had been constructed before present standards were established. Absorption fields designed on the basis of percolation tests or general soil data books for the area are likely to require greater trench area or different construction techniques. Plans for the new system must be approved by the State Board of Health before construction may proceed.