Ohio EPA

State of Ohio Environmental Protection Agency

Sewage: Collection, Treatment & Disposal

Where Public Sewers Are Not Available

Note: This document is considered guidance. Portions of this guidance document have now been updated and adopted into rule. To view the these rules, please view Chapter 3745-42 of the Ohio Administrative Code at the following Web page: http://www.epa.ohio.gov/dsw/rules/3745_42.aspx

1993 Edition

Table of Contents

Note: The highlighted line items below have been updated.

District office contacts can be located on the following Web page: http://www.epa.ohio.gov/directions.aspx

Administration

Laws and Rules for Submittal of Plans

Section 6111.44 of the Revised Code requires that all plans for sanitary sewers and sewage treatment devices for all buildings and places other than a private residence or dwelling (one, two, or three family) be submitted to and approved by the Ohio Environmental Protection Agency before construction is begun.

Section 6111.45 of the Revised Code requires that all plans for the disposal of industrial wastes be submitted to and approved by the Ohio Environmental Protection Agency before construction is begun.

The following rules of the Administrative Code contain sewage treatment requirements which are administered by the Ohio Environmental Protection Agency in conjunction with the Ohio Department of Health:

Please see Chapter 3745-42 of the Ohio Administrative Code and Rule 3745-1-05 of the Ohio Administrative Code for the most up-to-date requirements for a permit-to-install application.

Chapter 3701-25 of the Administrative Code, Recreation Vehicle Parks, Recreational Camps and Combined Park-Camps.

Chapter 3701-27 of the Administrative Code, Mobile Home Parks.

Chapter 3701-31 of the Administrative Code, Swimming Pools.

Chapter 3701-35 of the Administrative Code, Marinas.

The following rules have been adopted by the Ohio Environmental Protection Agency in accordance with state administrative procedures:

Chapter 3745-01 of the Administrative Code, Water Quality Standards.

Chapter 3745-07 of the Administrative Code, Wastewater Works Personnel.

Chapter 3745-31 of the Administrative Code, Permits to Install New Sources of Pollution.

Chapter 3745-33 of the Administrative Code, Ohio NPDES Permits.

These rules are subject to change by the director after public hearing in accordance with state administrative procedures. Regular users of this policy are encouraged to inquire about changes to avoid reliance on superseded rules. Copies of all Ohio Environmental Protection Agency rules may be obtained from W. H. Anderson Publishing Company, 2035 Reading Road, Cincinnati, Ohio 45201, (513) 421-4142. Copies of the Ohio Environmental Protection Agency individual rules, Chapter 3745 of the Administrative Code, are available from the Hearing Clerk, Ohio EPA, P. O. Box 1049, Columbus, Ohio 43266-0149, (614) 644-2115. Copies of the Ohio Department of Health individual rules, Chapter 3701 of the Administrative Code, are available from the Ohio Department of Health, 246 North High Street, Columbus, Ohio 43215, (614) 466-5190.

The addresses for the Ohio EPA and the Ohio Department of Health have changed. Please visit their respective Web page for the most current mailing addresses.
ODH: http://www.odh.ohio.gov/
CDO: http://www.epa.ohio.gov/cdo/

Other state statutes and rules of interest to users of this policy include the following:

Sections 3703.01-09 of the Revised Code and Chapter 4101:2-51 of the Administrative Code cover submittal of plans for plumbing to the Ohio Department of Health or proper local authorities.

Sections 3732.01-08 of the Revised Code and Chapter 3701-21 of the Administrative Code cover the submittal of plans for food service operations and equipment to the local health department.

Section 3745.11 of the Revised Code covers fees which must be paid for permit to install and plan review submittals.

Section 3791.04 of the Revised Code and Chapter 4101:2-1 of the Administrative Code (Ohio Basic Building Code) cover submittal of plans for buildings to the Division of Factory and Building Inspection, Ohio Department of Industrial Relations or to the local certified building departments.

Antidegradation

Please see Rule 3745-1-05 of the Ohio Administrative Code for the most up-to-date Antidegradation requirements.

New source discharges to waters of the state will require an antidegradation review that may result in a public notice and hearing process. As a result of the review, discharge may not be allowed or more stringent treatment may be required. Contact the district office for details prior to submitting plans.

Procedure

Before procuring the site for a building where public water and/or sewer services are not available, contact the district office of the Ohio Environmental Protection Agency (see map of districts, appendix page 47). The district office can give advice on the relative merits of a site or sites with regard to sewage disposal. Satisfactory location for the discharge of the effluent from sewage treatment plants may not be feasible. The investigation should be made before plans are started. Some sites are not acceptable for sewage disposal.

Plans shall be prepared by a professional engineer familiar with sewerage systems in compliance with Sections 4733.01 through 4733.25 and 4733.99 of the Revised Code.

How To Submit Plans

Please see Rule 3745-42-02 and Rule 3745-42-03 of the Ohio Administrative Code for the most up-to-date requirements for submitting a permit to install.

Plans must be submitted by the owner, his engineer, or agency of the owner to the district office having jurisdiction, in the following manner:

1) An application for a permit to install and appropriate appendices shall be submitted in accordance with information provided by the Ohio EPA district office for the project.

2) Appropriate application and plan review fees in accordance with Chapter 3745.11 of the Revised Code shall be paid.

3) Four (4) sets of plans for sewage treatment (additional copies may be necessary if local agencies, communities, engineers, etc., require approved copies. Contact the district office having jurisdiction for the proper number of plans to be submitted.)

4) Letter of transmittal or owner's signature on plans to indicate evidence of the owner's approval.

5) If the finished project will be owned by anyone other than the applicant for the permit to install (i.e., city, county, sewer districts, etc.), a signed contract or similar indication of approval of plans and acceptance of the project by the final owner shall be submitted with plans.

6) Design data, specifications, and other pertinent information (design data may be shown on the plans or in the specifications).

7) Certificate of Supervision for Installation and Operation of Treatment Plant with wastewater discharge.

8) NPDES permit application.

9) Estimate of construction costs of sewerage system.

10) Appropriate data sheets (sanitary sewer, pump station, wastewater facility).

11) Public Utilities Commission (PUCO). If a privately-owned, public utility, as specified in Sections 6112.03 and 4933.75 of the Ohio Revised Code, applies for a PTI or an NPDES permit, a PUCO certificate of Public Convenience and Necessity or a PUCO notification of relief from jurisdiction is required. Contact the appropriate Ohio EPA district office for clarification.

12) An engineering report describing any unusual design features or operation features necessary to enable the plant to achieve the required effluent quality.

Information Required on Plans

Please see Rule 3745-42-02 and Rule 3745-42-03 of the Ohio Administrative Code for the most up to date requirements for submitting a permit-to-install.

1) Name and type of building or project.

2) Owner's name and address.

3) Location by:
   a) county and municipality or township and sewer district;
   b) highways or streets;
   c) north arrow; and
   d) vicinity map.

4) Engineer's name, address, and registration number.

5) Date plans were prepared and/or revised.

6) Scale or scales to which plans are drawn.

7) Plans must consist of the following drawings:
   a) site plan showing:
      1) Immediate area concerned indicating contours, elevations, property lines, drainage courses, and outfalls from treatment works and curtain drains;
      2) Outline of existing and proposed buildings, driveways, parking areas, etc., and designation by distance or outline of buildings on adjacent property;
      3) Sewage treatment plant location (new and/or existing plant);
      4) Existing and proposed water supply - show the location of all wells up to 10,000 gpd within 150 feet and all wells over 10,000 gpd within 300 feet of the proposed sewage treatment plant. If well is on adjacent property, show name and address of property owner;
      5) Future sewage treatment plant and water supply additions - properly designated; and
      6) Water lines plus storm and sanitary sewers, including manholes with elevations, sizes, material, and gradients, and location of all hydrants and valves.

   b) construction details, including:
      1) Sewer profiles, manhole details, normal stream elevations, flood level, existing grade elevations, and finished grade elevations;
      2) Existing and proposed utilities; and
      3) Sewage treatment system - complete detail of construction, elevations coordinated with site plan evaluations, and plant equipment and piping in detail; detailed drawings of each wastewater treatment unit process are required.

Plans should be clearly drawn and be complete. Submit only those drawings pertaining to the water supply or sewage treatment. It is suggested that details pertaining to these items be included on the plans of these items. The more complete and comprehensive the plans, the more rapidly they can be reviewed.

Supporting Data

Submit with the plans only those sections of the specifications pertaining to water supply, sewerage, and sewage treatment. Delete all other sections not applicable to these works. Where data sheets are prescribed, they should be completed in full detail. Materials, particularly, should be listed by standards designation as they would in a specification.

SEWERAGE AND SEWAGE TREATMENT

NOTE:

Requirements for sludge handling facilities can now be found in Chapter 3745-40 of the Ohio Administrative Code.

Acceptable methods of sewage treatment for small facilities are in a continuous state of development. Because the extended aeration activated sludge process has become well accepted for most domestic wastewater except commercial laundry waste or wastewater from vehicle washes, this policy emphasizes Ohio EPA requirements for that process. This does not preclude the use of other sewage treatment processes, where adequate justification exists for their use.

Where discharge to a receiving stream is precluded due to strict effluent limits or the lack of a suitable stream, biological treatment followed by a land application alternative might be possible.

It is not the intent of this policy to stifle new technology. However, it must be realized that processes requiring sophisticated controls or operator skills will fail more often than they will succeed, when applied to small scale sewage treatment. Development should be directed toward those processes that will perform effectively with minimal attention. The Ohio EPA will always be interested in the development of such processes.

Treatment Requirements

All sewage must be treated before discharge into the waters of the state of Ohio or any drainage facility. Sewage includes the drainage from:

The definition for "sewage" can be found in Section 6111.01 of the Ohio Revised Code.

Toilet and bath fixtures	Floor drains
Kitchen fixtures	Drinking fountains
Service fixtures	Laundry equipment
Laboratories	Manufacturing wastes
Swimming pool filter backwash	Etc.

Wastes from commercial laundries, vehicle washing, and manufacturing processes are considered as industrial wastes and must be given special treatment and consideration. Wastes from laboratories are corrosive wastes and must be given special consideration. (See Rule 4101:2-51-53 of the Administrative Code.)

Roof drainage, foundation drainage, cooling water, swimming pool water, or other clean water connection shall not be made to the sanitary sewerage system.

In general, the type and degree of treatment will be determined by the location, condition, volume of flow, and use of the receiving stream. The type of soil and the extent and type of development of the surrounding area must be considered in the selection of the type of treatment system.

Where sewage collection systems are available or may be made available by feasible and reasonable extension of the system, such facilities shall be used.

Sewers

Sanitary sewers shall be designed on a peak flow basis using a peak factor of three and one-third (3.33) times the total calculated average daily wastewater flow for lateral sewers. Pumps and force mains should be designed to carry the peak flow of all the sewers that discharge into the lift station. The peak sanitary sewer design daily flow for areas which do not have a 24-hour run-off period shall be calculated as follows:

$$\text{Peak Factor} = \frac{3.33 \times 24 \text{ (hours)}}{\text{Run-off period (hours)}}$$

Peak daily design flow (gpd) = peak factor x average daily flow

Entity	Run-Off Period
Municipality	24 hours
Factories	Length of work day
Subdivisions $\geq$ 250 homes	24 hours*
Subdivisions < 250 homes	16 hours*
Hospitals, Nursing and Rest Homes	16 hours*
Camps	16 hours*
Public schools	8 hours*
Restaurants	8 to 12 hours*
Boarding schools	16 hours*
Mobile home parks	16 hours*
Apartments	16 hours*
Motels	16 hours*

* All entities with run-off periods 16 hours or less shall have flow equalization.

(Other run-off periods must be documented.)

All sanitary sewers should be designed to give a mean velocity of at least two feet per second at peak design flow based on Manning's formula with n = 0.013, or in accordance with the following table.

Sewer Size	Minimum Slope feet/100 feet	Approximate Capacity at Minimum Slope (gpd)	Approximate Capacity at Minimum Slope (cfs)
6"	0.60	271,000	0.42
8"	0.40	520,000	0.80
10"	0.28	750,000	1.16
12"	0.22	1,100,000	1.70

Sewers on 20 percent slope or greater shall be anchored with concrete anchors spaced as follows:

1) Not over 36 feet center to center on grades 20 percent to 35 percent.
2) Not over 24 feet center to center on grades 35 percent to 50 percent.
3) Not over 16 feet center to center on grades 50 percent and over.

When velocities greater than 15 feet per second are expected, provisions should be made to protect against displacement and erosion of the pipe.

In general, the minimum size of sanitary sewers shall be eight (8) inches. However, six (6) inch sanitary sewers may be used as sewers for apartments, mobile home parks, camps, schools, restaurants, and other semi-public operations, provided their hydraulic capacity is not exceeded because of short run-off periods (high peak flows).

The lateral connections shall comply with standards shown in this policy and should be made of the same material as the street sewer whenever possible to minimize infiltration from the connection between the street main and house lateral. When joint material and/or dimensions are not compatible, a commercial adaptor shall be provided.

When a smaller sewer discharges into a larger one, the invert of the larger sewer should be lowered sufficiently to maintain the same energy gradient. An approximate method for securing this result is to place the 0.8 depth point of both sewers at the same elevation. When a larger sewer discharges into a smaller one, the invert of the smaller sewer should not be raised to maintain the same energy gradient.

Roof drains, foundation drains, and all other clean water connections to the sanitary sewer are prohibited.

There shall be no physical connection between a public or private potable water system and a sewer, or appurtenance thereto, which would permit the passage of any sewage or polluted water into the potable supply.

If possible, sanitary sewers and sewage force mains should be laid with at least a 10 foot horizontal separation from any water line. Sewers (or sewage force main) may be laid closer than 10 feet to a water line if it is laid in a separate trench and elevation to the crown of the sewer (or sewage force main) is at least 18 inches below the bottom of the water line. If it is impossible to maintain the 18-inch vertical separation when the sewer is laid closer than 10 feet to the water line, the sanitary sewer shall be encased in concrete or constructed of water line type materials which will withstand a 50 psi water pressure test.

If a sewage force main is laid closer than 10 feet to a water line, in no case shall the sewage force main be laid such that the crown of the sewage force main is less than 18 inches below the water line.

Whenever a sanitary sewer and water line must cross, the sewer shall be laid at such an elevation that the crown of the sewer is at least 18 inches below the bottom of the water line. If it is absolutely impossible to maintain the 18-inch vertical separation, the sanitary sewer shall be encased in concrete or constructed of water line type materials which will withstand a 50 psi pressure test. These requirements will extend for a distance of 10 feet, measured perpendicular, on both sides of the water line.

Construction of sewers in stream beds is not acceptable except for stream crossings.

Whenever a sewage force main and water line must cross, the sewage force main shall be laid at such an elevation that the crown of the sewage force main is at least 18 inches below the bottom of the water line.

Manholes shall be installed at the end of each line 150 feet or greater length, at all changes in grade, size, alignment, and at all pipe intersections. Manholes shall also be installed at distances not greater than 400 feet. Cleanouts may be installed at the ends of lines which are less than 150 feet in length. Cleanout(s) may be installed in lieu of manhole(s) on sewage treatment plant effluent discharge lines.

Drop manholes are to be used when the sewer entering the manhole is two (2) feet or greater above the manhole invert. When the difference in elevation between the incoming sewer and the manhole invert is less than two feet, the manhole invert should be filleted to prevent solids deposition.

Manholes may be either poured in place or precast concrete. Concrete construction shall conform to ASTM C-478 with joints between sections conforming to ASTM C-443.

The minimum diameter of manholes shall be 48 inches.

The flow channel through manholes should be made to conform in shape, slope, and smoothness to that of the sewers. A bench shall be provided on each side of the manhole channel. The bench should be located one (1) pipe diameter above the invert and slope no less than ½" per foot to the channel.

Manhole covers can be adjusted to grade by the use of no more than 12 inches of precast concrete adjusting collars. Watertight manhole covers should be used in street locations. In other areas, the manhole casting should be adjusted so that the top is slightly above grade to prevent the entrance of surface water. Watertight manhole covers shall be used in all locations which may be flooded by run-off or flooding.

Acceptable gravity sewer pipe materials include: acrylonitrile butadiene styrene (ABS), clay, concrete, ductile iron (DI), polyvinyl chloride (PVC), styrene rubber (SR), or any other material specified in ASTM specifications as being suitable for this use.

Proposed sewer pipe for gravity sewers, force mains, and tile fields shall be limited to pipe specified for the proposed use by ASTM, AWWA, or a similar national consensus standards organization. Type, depth, and existing soil conditions shall be considered in selecting the type, strength, and stiffness of pipe. Installation details shall be in compliance with the selected specification, except bedding and backfill for rigid pipe shall comply with class A, B, or C in ASTM C-12 and bedding and backfill for flexible pipe shall comply with class IA or IB, II, or III in ASTM D-2321. All bedding material shall have 100 percent passing a 3/4" sieve. Commercial fittings meeting specified ASTM specifications shall be used when joining different type, class, or size pipe.

Raw Sewage Pump Stations

Use

Raw sewage pump stations should only be proposed after careful consideration has been given to alternative sewer planning. All pump stations require operation and maintenance, the cost of which, when capitalized, frequently will justify a considerable first-cost expenditure to build a gravity sewer. Frequently, the use of a pump station can be avoided by placing the sewers at a shallow depth, or by locating the treatment plant at a lower elevation. When shallow sewers are used, the wastewater generated on the floors of buildings which are located below grade may need to be pumped. Sound designs call for serving the majority of the service area by gravity with only limited low areas served by pump stations.

General

All raw sewage pump stations must include at least two pumps in each wet or dry well with motors, dual controls, automatic alternators, and alarm. Each pump in a two-pump station shall be capable of handling flows in excess of the expected maximum flow. The alarm system shall be activated when the standby pump comes on. An alarm light circuit shall be provided and remain on until manually turned off. A battery operated, visual and audible alarm (or automatic dialer) will also be required. Any time a pump station is not readily visible, a visible alarm and either an automatic dialer or audible alarm type system shall be provided in an approved location. See Appendix page 33.

Alternate sources of power or standby pumping or generating equipment may be required, depending upon the proposal.

No overflows or bypass will be permitted.

Rate of Discharge

Pump stations on small treatment plants produce surges which may affect the plant. To reduce the surging effect, the pumped discharge to the plant must not produce an overflow rate on the settling tanks in excess of 1,000 gpd/sq. ft., and this maximum must be limited to short periods only. Pump discharges in excess of this rate should be returned to the wet well, or a flow equalization tank should be installed ahead of the plant. If one pump has failed, the remaining pump(s) shall be capable of pumping the peak design flow.

Acceptable Types of Pump Stations

All raw sewage pump stations shall be equipped with rails, hoists, and other means for lifting the pump, motor, or pump motor units above ground without entering the wet well.

All raw sewage pumps other than grinder pumps shall be capable of passing three-inch (3") solids.

Grinder pumps are an acceptable type of submersible pump for raw sewage pump stations.

Wet well, dry well, and submersible pumps are acceptable. Submersible pumps will be approved provided that:

1) Pump and motor unit can be removed and installed from above ground without dewatering or having a man work in the sewage wet well;

2) Valves are installed in an enclosure outside the wet well. Valves shall be located in a separate valve pit. Valve pits may be dewatered to a wet well through a check valve or other automatic closing valve without using a manually operated valve or liquid seal. Check valves that are integral to the pump need not be located in a separate valve pit provided that the valve can be removed from the wet well without entering the wet well;

3) Electrical controls are installed outside the wet well;

4) Access openings shall be provided, sized, and located to allow easy removal of pumps and equipment; and

5) Explosion-proof submersible pumps shall be used for raw sewage unless a "pump off" switch is installed and maintained above the motor. A separate backup pump-off switch wired to the control panel shall be provided.

Unacceptable Types of Pump Stations

A) Pump stations which are a hazard to maintenance personnel are not acceptable.

B) Pump stations which require bypassing while repairs are being made are not acceptable.

C) Extended shaft type pump stations are not acceptable.

Flow Equalization

Use

Flow equalization facilities shall be required for plants with runoff time period of 16 hours or less (see page 6) or when the need for a consistently high degree of treatment has been identified. Generally, the desired equalized flow rate should approximate the average flow rate and shall not exceed 1.5 times the average flow rate.

Location

If trash traps or comminuters are used, equalization tanks must be located downstream of these preliminary treatment facilities.

Acceptable Methods

A variety of methods may be employed to achieve flow equalization. Consideration may be given to in-line units, where all the flow passes through the equalization basin(s); and side-line units, where only that amount of flow above the desired flow rate (usually design average flow) is diverted through the equalization tank(s). In addition, in-line treatment units may be utilized to dampen flow variations provided that such units are also capable of providing the required treatment throughout the entire range of operating wastewater depths.

Tank Design

A) Equalization tank size should be based upon a representative diurnal flow pattern derived from flow records or an acceptable approximation technique.

For new plants or where existing flows are not available to establish a representative diurnal flow pattern, the table on Appendix page 32 may be used to establish the required equalization tank volume.

B) When pumps are utilized, duplicate pumps shall be provided that can pass two (2) inch solids. With air lift pumps, the duplicate pump requirement may be fulfilled by a standby air supply. Comminutors should be used in pretreatment works when air lift pumps are being used.

C) Aeration or mechanical mixing must be provided to prevent deposition of solids in the tank(s) and to maintain aerobic conditions. Minimum air requirement is four (4) cfm per 1,000 gallons of storage. The air supply shall be independent of plant process aeration facilities to ensure proper control and shall be run continuously.

D) Corner fillets shall be provided to facilitate the periodic removal of any accumulated sludge or grit.

E) Equalization tanks shall be suitably equipped with accessible external valves, stop plates, weirs, or other devices to permit flow control and ensure proper flow equalization. Devices to measure the equalized flow may also be required.

F) The equalization tank should be equipped with an overflow to insure that all wastewater flow will pass through the secondary treatment facility before being discharged. The overflow shall be installed at the normal high level in the equalization basin which shall be not less than ten (10) inches above the normal maximum liquid level in the aeration tank and shall interconnect the flow equalization tanks with the aeration chambers of the secondary treatment facility.

When a flow equalization tank and a raw sewage pump station are combined, the recommendation concerning an overflow in the preceding paragraph does not apply. Audible and visual high water alarms shall be required for pumps in equalization basins.

G) Equalization tank volume shall be the volume between pump-off and overflow pipe, if gravity overflow into the aeration basin can be achieved, or the lag pump-on elevations.

Extended Aeration

Use

The extended aeration plant is of the activated sludge type in which primary settling tanks are omitted and where prolonged aeration, typically at least 24-hour detention time, consumes some of the sludge and produces a relatively stable effluent. Frequent wasting of the sludge is required to maintain solids balance. In plants of this type, almost complete stabilization of biodegradable organic matter takes place in the aeration unit in the presence of excess air and aerobic bacteria.

Extended aeration plants require proper daily operation and maintenance by trained personnel to accomplish the required treatment with little or no odor problems. A representative of the manufacturer or designer of a new or revised plant shall furnish an operation and maintenance manual to the owner/operator as part of the design/installation, prior to the start of operations.

"Home aeration" type treatment systems in the past have not conformed to Ohio EPA design standards. When proposed for commercial uses, they shall be evaluated according to design standards in this publication.

Location

Please refer to Rule 3745-42-08 of the Ohio Administrative Code for the most up-to-date isolation distance requirements.

Plants should be located close enough to the building being served so as to optimize maintenance of the plant. They should be located closer to the building(s) being served than to existing or reasonably anticipated future buildings to minimize nuisance on adjacent property. Extended aeration plants should be located at least 250 feet from neighbor occupied buildings. A housed treatment plant component shall be located no less than 150 feet from existing or future residences. Housed treatment plant components or a treatment plant with oversized muffled blowers should be considered when noise may be objectionable. See appendix, page 34.

Topography, direction of prevailing winds, noise, and plant capacity are other factors to be considered.

Acceptable receiving streams are of prime concern and each proposed plant location will need to be evaluated for antidegradation and the ability of that stream to assimilate the discharge.

General Design

The treatment works structures, electrical, and mechanical equipment shall be protected from physical damage by the one hundred (100) year flood. Treatment works should remain fully operational and accessible during the twenty-five (25) year flood. This requirement applies to new construction and to existing facilities undergoing major modification. Flood plain regulations of local, state, and federal agencies shall be considered.

Erosion protection and drainage of the area surrounding the plant must be provided.

In order to prevent surface water from flowing into the plant, the walls should extend at least six inches above the surrounding ground and surface drainage shall be diverted from the plant.

Riser wall sections may be used on plants where the invert of the influent sewer line has a maximum depth of four (4) feet below the rim of the depression in which it is located. Blower housing and electrical controls must be placed above the riser section and above ground. All valve handles and cleanouts must be brought up to a minimum of one (1) foot from the top of the riser for easy maintenance. Where the invert of the influent sewer is deeper than four (4) feet, either: 1) a lift station should be provided and the plant set at grade, or 2) a retaining wall or excavation with four (4) feet clear distance around the plant with free outfall of the drainage therefrom may be provided. In the latter case, steps must be provided.

When phased development is proposed, one-half the total ultimate capacity shall be installed initially. Initial plans shall indicate all future phases of tributary development and ultimate plant capacity.

All treatment plant components should be protected by one of the following methods:

A) A rugged fence of chain-link, wood, or block at least six (6) feet high with locked entrance gates. Plants located in areas where thrown objects or falling leaves might be a problem should be equipped with lightweight open grating over all tanks in addition to the fence described above. A minimum of four (4) feet working room must be provided around the plant.

B) If a building is provided, seven (7) feet of headroom and adequate lighting and ventilation shall be provided. Intake and discharge vents should be muffled to minimize noise to adjacent lots. Plants within buildings or housings should be equipped with safe walkways providing access to all equipment and working areas housed therein. Access to the plant in a building should be by a door equipped with a lock. A minimum of four (4) feet working room must be provided around the plant. Translucent roof panels can help provide adequate lighting.

C) Weatherproof enclosures and muffled blowers.

Plant equipment (blowers, electrical controls, non-submersible pumps) should be protected from foam and moisture. Equipment located on the top of the plant shall be designed to resist corrosion and vibration to settling tanks. Otherwise, equipment should be located on an adjacent pad or in an adjacent enclosure.

Guardrails with kickplates shall be provided at open tanks and along walkways; sturdy grating may be substituted over open tanks. Control valves shall be safely accessible from a position where firm footing is available. Motor shafts, pulleys, belts, etc., shall be guarded. Above or below ground treatment units shall be accessible by stairways. When applicable, OSHA rules should be met.

Detail Design

Plants should be designed on the basis of a 24-hour aeration period for average or normal domestic sewage which has a BOD_5 of 0.17 lbs. per 100 gallons or approximately 200 ppm BOD_5.

The treatment plant peak design flow should be based upon representative diurnal flow records. See Appendix, page 30. The minimum peak plant daily design flow shall be calculated as follows:

$$\text{Peak Factor} = \frac{3.33 \times 24 \text{ (hours)}}{\text{Run-off period (hours)}}$$

Peak daily design flow (gpd) = peak factor x average daily flow

Stronger wastes from food service operations and waste containing garbage or other organic matter increases both the hydraulic and BOD_5 loadings and require special consideration. Excess organic materials, such as ground vegetables produced by supermarkets, should not be tributary to this type of plant. Garbage grinders are not permitted in commercial facilities tributary to a private on-lot wastewater treatment plant.

Grease interceptors are to be provided in compliance with plumbing requirements of 4101:2-51 of the Administrative Code.

The plant will normally consist of the following elements.

A) Preliminary treatment devices to screen, comminute, or otherwise prevent coarse solids from entering the aeration tank. Acceptable devices include:

1) Trash traps sized according to the Appendix, page 35. Outlet T's shall be extended down to between 30 and 50 percent of the liquid depth.

2) Comminuting devices with bar screen bypass may be substituted for trash traps on plants designed for 40,000 gpd or larger. Duplicate grinder pumps with automatic alternator and alarms may be substituted for comminuting devices. Field conditions (e.g., a lack of space) may be reason for considering installation of comminutors on smaller plants.

3) Bar screens and trash baskets are not permitted as the only means of pretreatment.

B) Aerated flow equalization should be provided per Flow Equalization.

C) Where parallel aeration unit arrangements are planned initially or as part of a future expansion, proportionate distribution of incoming flow and return sludge should be provided. The screening, comminuting device, or trash trap must precede the flow division. Division of the total plant flow into more than two parallel arrangements is generally unacceptable.

D) The design of aeration tanks should be based upon the following criteria.

1) A 24-hour detention time based on the expected 24-hour sewage flow of average strength domestic sewage. For high strength wastes, such as those from restaurants, etc., the detention time should be increased. A minimum eighty (80) cubic feet capacity per pound of BOD_5 applied shall be provided. This will require a 24-hour detention for wastes having a BOD_5 of 200 ppm (average domestic waste).

2) Shape and design of tank should maintain an effective mixture and utilization of air and prevent deposition of solids or short circuiting.

3) 2,600 cubic feet of air per pound of applied BOD_5 for diffused air plants. Additional capacity should be provided for nitrification and to operate air lifts, skimmers, sludge wasting facilities, and tertiary treatment facilities.

4) Stand-by blower unit must be installed and operable.

5) Easily removed aeration drop-pipes with shut-off valves for each drop pipe should be provided.

6) Dual aeration tanks are required for plants treating over 50,000 gallons per day.

7) Multiple tank arrangements may be approved as follows: a) maximum of six (6) tanks in series; or b) maximum of two (2) parallel arrangements of four (4) tanks each in series (total of eight (8) tanks). In these cases, ports between tanks must be large enough to prevent liquid level buildup within any tank. Means for balancing air supply to each header must be provided. Means for varying the amount of return sludge, as well as the location of the return sludge discharge, must be provided. Separate blowers and piping for each series of tanks plus stand-by blower or blowers must be provided for parallel arrangements. Consult with the Ohio EPA district office prior to the preparation of plans for multiple aeration tanks.

8) Time clocks will not be installed or operated unless: a) the timing controls are specifically authorized in writing by the Ohio EPA district office to improve the operation of the wastewater treatment plant; and b) the wastewater treatment plant is operated by a certified operator.

E) Final settling tanks following the aeration units shall be designed to give effective settling and continuous return of sludge. Detention time should be not less than four (4) hours based on the average daily flow. Six (6) to eight(8) hours may be required to handle peak flows. Deviation from the minimum detention time will be considered when flow equalization tanks are installed. Design of the settling tank should be based on the following requirements.

1) Duplicate settling tanks are required for plants treating over 50,000 gallons per day. Smaller plants may be required to have duplicate settling tanks. The installation of multiple settling tanks in series will not be accepted.

2) Collecting mechanisms are required for any settling tank with a capacity greater than 10,000 gallons. Tanks equipped with collecting mechanisms should have effective depths of not less than seven (7) feet.

3) Final settling tank effective surface settling area for average 24-hour design flow should not be less than the area shown in the Appendix, page 36.

4) The area upstream of any part of the inlet baffle shall not be used in calculating the effective surface settling area. The maximum surface settling rate at **peak** hourly rate of flow, with or without flow equalization, shall not exceed 1,000 gpd/sq. ft.

5) Tank hoppers shall have a minimum side slope of 60° to the horizontal, and bottoms not in excess of one (1) foot square or one (1) foot in diameter. In computing detention capacity of non-mechanical hopper tanks, only the upper one-third (by height) of the hopper(s) may be included. Tank hoppers should be considered as commencing when two or more sides have a side slope of 60° to the horizontal. Multi-hoppered tanks should provide a

minimum water depth of two (2) feet over the junction of 60° walls between hoppers. The installation of more than four (4) hoppers per settling tank or more than three (3) hoppers in a row per settling tank will not be accepted.

6) Baffles shall be provided as follows.

   a) At the inlet to prevent turbulence and short circuiting and to entrap grease and floatable materials (surface skimmer shall be downstream of this baffle). The inlet baffle shall extend across the width of the settling tank and shall extend continuously from a minimum six (6) inches above normal water level to a minimum two (2) inches beneath the invert of the inlet port to the settling tank. It shall be located no less than twelve (12) inches from the tank end wall nor more than twenty (20) inches to allow effective collecting area for floatable materials without infringing on the clear surface settling area of the settling tank.

   b) At the outlet within six (6) inches of the effluent trough and extending four (4) to eight (8) inches below and six (6) inches above the liquid level.

7) Outlet should consist of an overflow trough equipped with adjustable weir plate.

   a) The weir length shall be at least twice the narrow dimension of the settling tank and the weir overflow rate shall in no case exceed 2,500 gpd/lf at 24-hour design flow, nor 7,500 gpd/lf at peak flow.

   b) The overflow trough should be located a sufficient distance from the end wall of the final tank to offset the effect of end wall currents and permit cleaning the wall.

8) Sludge withdrawal shall be based on a return rate of 100 percent of the average daily flow with variable control of the return rate provided. Positive visible return should be provided. Each hopper should have separate sludge withdrawal and transfer equipment. Piping and valving shall not be less than two (2) inches in diameter and should be located at least six (6) inches above the liquid level.

9) Scum skimmers shall be provided. On food service operations, skimmers must discharge to a separate scum holding tank of at least 500 gallons, but not less than 5 percent of the food service daily hydraulic flow and be provided with a means of recirculating the supernatant to the aeration tank.

F) Upward flow fixed media clarifiers shall comply with standards specified on page 19. These treatment units will be approved only for plants supervised by a certified operator.

G) Froth control equipment may be required on installations subject to seasonal or intermittent use.

H) Hosing facilities for routine flushing of walls and walkways at all plants over 5,000 gpd shall be provided. Where a water supply is not available, a pump equipped with house connection may be used to pump clarified water from the chlorine contact tank for this purpose. If a potable water supply is used, then frost proof hydrants with backflow preventers shall be used.

I) Sludge handling facilities will be required on all plants with a design flow exceeding 10,000 gallons per day or exceeding a BOD_5 population equivalent of 100. Sludge handling facilities may also be required on smaller plants requiring a consistently high quality effluent either due to downstream conditions or to facilitate the operation of advanced waste treatment facilities. The design flow will be based upon the aeration capacity required by the BOD_5 loading rather than the hydraulic load.

Sludge handling facilities shall consist of sludge storage and a means of wasting accumulated sludge. General design considerations are as follows.

1) A sludge storage tank having a volume at least equal to ten (10) percent (15 percent for fixed media) of the daily design flow shall be required for all plants with sludge drying beds. Plants without sludge drying beds shall have a sludge storage tank having a volume at least equal to twenty (20) percent of the daily design flow. A minimum storage volume of 1,000 gallons will be required for plants with a design flow of less than 10,000 gallons per day. An additional 90-day sludge storage will be required for all plants with land application programs. The plant piping arrangement should provide flexibility for diverting all or a portion of the return sludge to the sludge storage tank, the aeration tank, or to approved disposal.

   A positive means for decanting supernatant to the aeration tank shall be provided; an overflow port is not acceptable.

   Aeration of the sludge tank is required at the rate of four (4) cfm/ 1,000 gallon capacity.

2) Sludge disposal - waste sludge may be hauled away by tank truck or dewatered by sand beds. Where sludge drying beds are utilized, a sludge pump or other positive means is required to waste sludge from the storage tank. Sludge drying beds shall be provided for all plants more than 10,000 gallons per day design flow unless hauled to an approved disposal site by a registered or approved sewage tank cleaner. A copy of the signed contract must be provided. Provisions in the plant design must allow for the future installation of sludge drying beds. An all weather access road shall be provided to allow trucks access to the sludge holding tanks and drying beds.

   Other means of disposal will be considered only in specific cases.

3) Sludge drying beds shall be sized on the minimum basis of one and one-half (1½) square feet per population equivalent or one and one-half (1½) square feet per 100 gallons of plant design flow (200 ppm BOD_5 sewage). Dual beds shall be provided. Construction shall provide at least nine (9) inches of sand over the gravel above the underdrains. Gravel shall be placed in conformance with the drawing, Surface Sand Filters, Appendix, page 38. The sand should have an effective size of 0.25 mm to 0.5 mm with a uniformity coefficient less than 4.0. Sand beds may be used for storage of up to 24 inches of sludge for winter operation if designed for such use. Effluent from the underdrains shall be returned to the treatment plant headworks. The bottoms of the beds shall be provided with an impervious liner.

4) Where fixed media clarifiers, phosphate removal, or other chemical treatment processes are deemed necessary, design of sludge handling facilities shall consider increased sludge production.

5) Provision for ultimate disposal of sludge must be clearly indicated on treatment plants of 25,000 gpd capacity or greater.

J) Flow measurement devices for indicating, recording, and totalizing sewage flow should be provided on all plants over 100,000 gpd capacity. Plants over 25,000 and up to 100,000 gpd capacity should have a recording or totalizing flow measuring device. Flow measurement devices may also be required on plants under 25,000 gpd capacity. Flow measurement devices should be located so as to prevent errors caused by recycle flows or loss of water in surface sand filters.

Upward-Flow Fixed Media Clarifiers

Design Requirements

Fixed media clarifiers will be approved only for plants with flow equalization tanks and pumps (see page 10) which will be supervised by a certified operator.

The following design rate requirements shall be provided to qualify for the slow sand filter loading rate shown in the Appendix, page 37. Fixed media design flow rates may exceed the following rate when the slow sand filter loading rate and area "Without Fixed Media Clarifier" (page 37) is provided.

A) The fixed media clarifier design upward peak flow rate shall not exceed 0.42 gpm/sq. ft. (Note: 600/24x60). If flow equalization is provided, use the equalized flow rate through the plant to size the fixed media clarifier. Lower fixed media or surface sand filter loading rates may be required on a case-by-case basis for plants treating commercial or industrial wastewater.

The total area of fixed media decking shall be divided equally between two compartments.

B) The fixed media shall be mounted parallel with the surface of the water and not less than six (6) inches below the normal operational water level. An inlet zone shall be provided having an area not less than ten (10) percent of the fixed media area.

C) A vertical baffle shall rise up from the fixed media decking adjacent to the inlet zone. This baffle shall be watertight where it abuts the walls and/or the clarifier decking.

D) The weir length shall be at least twice the narrow dimension of the tank. The weir overflow rate shall in no case exceed 3,000 gallons per day/lineal foot based on 24-hour design flow, nor 9,000 gallons per day/lineal foot based on peak flow. No point of the fixed media decking shall be more than 15 feet from the centerline of the weir trough.

E) Fixed media clarifiers shall be no less than three (3) feet deep at the shallowest point and the base shall slope downward toward the sludge collection zone of the tank to facilitate sludge removal.

F) Adequate hosing facilities using potable or clarified water shall be provided to routinely clean the fixed media.

G) Plant design shall allow for the removal of sludge and clean-up water to the sludge storage or sludge digestion tank. The sludge storage tank shall have a total volume not less than 15 percent of the daily design flow. Arrangements should be provided to enable 60 percent of the clarifier contents to be drawn down and directly recycled to the flow equalization tank. Only substantially settled sludge should be transferred to the sludge storage or sludge digestion tank.

H) Fixed media clarifiers must be protected by upstream means to remove trash and grease from the flow.

I) Fixed media supports shall be structurally adequate to facilitate maintenance and replacement of individual panels.

Dosing Device

Use

The dosing device can be used to accumulate a sufficient volume of settled sewage to properly dose the tile field, surface, or subsurface sand filters. It prolongs the life of filters by allowing "rest" periods between doses. Dosing of tile fields provides equal distribution of sewage in the tile field. A dosing device is required preceding surface sand filters.

Design Data

A) Operating capacity of the dosing device should be such that:

1) Distribution tiles in leaching systems and subsurface sand filters are completely filled; and

2) One-half the total surface sand filter area in a two bed system is to be theoretically flooded to a depth of three inches (1.87 gallons/sq. ft.) in 10 minutes or less. If more than two beds are provided, it is permissible to have one pump dose one bed to a theoretical depth of three inches in 10 minutes or less and the second pump, when automatically alternated, to

dose another bed to a theoretical depth of three inches in 10 minutes or less, with at least one bed off-line for cleaning and resting.

B) Dosing Equipment

1) Two pumps or two siphons are required that automatically alternate when dosing subsurface or surface sand filter devices.

2) One pump or siphon will be permitted for septic tanks dosing leaching pipe providing a stand-by pump is available on-site and a high level alarm system is installed with an alarm inside the building being served.

3) Submersible pumps must be provided with access openings sized and located to allow easy removal of pumps and equipment. Work platforms must be provided below pipe connections.

4) All dosing devices shall have as a minimum a visual high water alarm.

Influent Chamber

Use

To direct or divert the flow going to the tertiary treatment devices.

Design Data

A) Equipped so that the flow may be directed to any cell of the tertiary device. A means of positive shut-off to each distribution line shall be provided. Threaded caps or watertight plugs are preferred.

B) Designed hydraulically to not overflow during operation of the dosing device.

C) Equipped with a cover.

D) Unit drawings. See Appendix, page 42.

Tertiary Treatment Systems

Tertiary treatment is an additional (third) stage of treatment following biological (secondary) treatment. The primary purpose of tertiary treatment is to provide a greater degree of treatment. Such facilities may also serve to prevent excess solids from discharging into the receiving stream during periods of peak flow to the treatment plant. The higher degree of treatment demanded by enhancement of water quality makes tertiary treatment the rule rather than the exception in most locations to comply with water quality standards.

The topography of the treatment site, cost of land, and the degree of treatment required are often factors in determining which method of tertiary treatment to use. Means of achieving tertiary treatment include, but are not limited to, slow sand filters, lagoons, and rapid sand filters. Two different means of tertiary treatment may be used in series to ensure an extremely high degree of treatment.

Design Data

A) Surface sand filters (slow sand filters) - See Appendix, page 38, for method of construction and configuration. A minimum of two (2) beds are required, each capable of independent operation. Generally, one-half the total filter area is to be intermittently dosed while the other half "rests."

1) Hydraulic loading - See Appendix, page 37, for minimum total filter area and total area loading rates. Per the dosing criteria above, only one-half of this total area is to be dosed at any one time.

2) Recommended maximum size of bed is 25 feet square. If the required size of each bed exceeds 25 feet square (625 square feet), multiple points of discharge on the sand should be provided. Coordinate with dosing devices in the preceding section.

3) Filters should be located in well drained areas to ensure proper filter operation. An impervious bottom liner is required. Flow meters should be located upstream of the dosing device to prevent errors caused by instantaneous peaks and infiltration/exfiltration in the filter.

4) Filter walls shall be constructed of eight (8) inch concrete block, reinforced precast concrete, reinforced poured-in-place concrete, or other suitable material. Where concrete block walls are specified, the voids shall be filled with concrete, reinforcing steel shall be installed in every other void, and both sides of the block shall be waterproofed. An 18-inch free board is required.

5) Protection - a fence around the filter is required to deny access to unauthorized persons.

6) Isolation from occupied buildings - minimum - 150 feet if covered and 250 feet if uncovered.

Please refer to Rule 3745-42-08 of the Ohio Administrative Code for the most up-to-date isolation distance requirements.

7) Filter sand - sand shall be clean and washed with an effective size between 0.4 and 1.0 mm, with a uniformity coefficient not greater than 3.0.

Please refer to Rule 3745-42-09 of the Ohio Administrative Code for the most up-to-date filter sand requirements.

Sand shall be adequate to provide sufficient tertiary treatment to achieve established effluent limits.

The effective size is that size of grain in a sample of sand above which 90 percent by weight is larger or retained by the sieve, and 10 percent is smaller passed by the sieve.

The uniformity coefficient is the theoretical size in millimeters of the sieve that would pass 60 percent of the sample, divided by the effective size.

B) Rapid sand filters - rapid sand filters will be approved only when the operating authority can demonstrate that a certified operator will be in responsible charge. Generally, only plants larger than 100,000 gpd will be considered for rapid sand filters. Use of rapid sand filter(s) will generally require the services of a class II operator experienced with the operation of wastewater rapid sand filters.

Design criteria for rapid sand filters shall be in accordance with Recommended Standards for Wastewater Facilities (Ten States Standards).

Each filter unit shall be designed and installed so that there is convenient access to all components and the media surface for inspection and maintenance without taking other units out of service. The filter must be located in a building of sufficient size to provide at least four (4) feet access around the filter and with adequate head room (seven feet) to permit required maintenance. Lighting will be required. Consideration should be given to heating and ventilating the building.

Disinfection

Use

All plants shall provide disinfection capability regardless of location. Disinfection will be required when necessary to obtain compliance with Ohio's water quality standards and NPDES permit conditions. Some examples of situations where disinfection will be required are effluent discharges to intermittent streams, streams which flow through developed areas, streams where there is downstream use for recreation or public water supply, and for treatment plants serving medical facilities (doctor/dentist office, veterinary clinics, medical labs, etc.).

Location

The disinfection equipment should be readily accessible and designed for proper operation during all seasons of the year. Equipment may be located in the building being served or in a suitable structure or enclosure at the plant site. Handling of chlorine gas is extremely hazardous and requires special design and operation considerations. The use of chlorine gas for disinfection is not recommended at small plants.

Design Data - Chlorination

A) Contact chamber - a minimum detention period of 15 minutes shall be provided at peak flow rate to the contact chamber. The chamber shall be baffled so that the flow path approaches plug flow (no short circuiting).

The contact chamber should be adjacent to the plant, be accessible, and have an open top or an easily removed cover.

B) Mixing - initial mixing of the chlorine solution and the wastewater should be as rapid and complete as possible. The ideal design calls for complete mixing before the effluent enters the contact chamber.

C) Chlorinator capacity - sufficient total chlorination capacity shall be installed to provide a chlorine dosage of 8 mg/l, based on maximum plant flow.

D) Chlorination should generally be introduced prior to lagoons and following tertiary sand filters.

E) Dechlorination may be required.

On-Site Disposal Systems

Tile field systems are not generally recommended for installations with design flows in excess of 1,000 gpd, and only then where soils are suitable. Soil texture which is too coarse will not remove contaminants and soil texture which is too fine will not accept effluent at an adequate rate. Wastes containing large amounts of greases or detergents, such as from food establishments, should not be treated in this type of system.

Septic Tanks

Use

Septic (settling) tanks are intended to remove solids, such as scum or sludge, and provide a place for storage and decomposition of these solids.

Septic tank systems have a limited application for the disposal of wastewater from public buildings and will not be accepted except in cases where the daily flow is small, or where the use of the facility is seasonal or infrequent. Septic tanks must be followed by a tile field system. To prolong the life of the tile field, surface or subsurface filters may be required. Garbage grinders are not permitted.

Location

Septic tanks must be accessible for cleaning and maintenance and be located at the following minimum distances (depending on soil conditions and design flow).

A) At least 10 feet from buildings and lot lines.

B) At least 50 feet from residential water supply wells or other potable sources that supply less than 2,500 gpd; or at least 100 feet from any water supply well over 2,500 gpd or per the isolation distances in Tile Fields, Location, I.

Design Data

A) Capacity - The minimum tank capacity for any system shall be 1,000 gallons. In addition, the tank(s) capacity must be at least 2-1/2 times the daily design flow. If only tank is provided, it must be a dual compartment tank.

B) Dimensions - Effective settling and flotation shall be provided. In general, the following criteria should be followed.

1) Ratio of length to width to depth, 2:1:1. If dual compartment tanks are used, this may be increased to 4:1:1 overall.

2) Maximum width - 10 feet.

3) Minimum liquid depth - 4 feet.

4) Maximum liquid depth - 10 feet.

5) Minimum free board - 9 inches.

C) Construction details.

1) See Appendix, pages 39 and 40, for typical settling (septic) tank.

2) The invert level of the inlet shall be not less than two inches above the liquid level of the tank.

3) A vented inlet baffle or tee shall be provided to divert the incoming sewage downward. The baffle or tee shall penetrate at least six inches below the liquid level, but the penetration shall not be greater than that allowed for the outlet device.

4) The outlet shall be fitted with a vented tee, vented ell, or baffle which shall extend not less than six inches above and not less than eighteen inches below the liquid level of the tank.

5) Access riser of not less than 18-inch diameter must be provided at each end of tank and adjusted to ground surface for ease of cleaning and inspection. Additional access may also be required above midwall opening of dual compartment tank.

6) Tanks must be watertight and constructed of durable material.

Subsurface Sand Filters

Use

Subsurface filters should not be used where a discharge to surface waters is proposed.

Wastes containing large amounts of greases or detergents such as from food establishments cannot be treated in this type filter.

Design Data - Conventional Subsurface Filter

A) Loading - the total area of the filters should be based on a loading rate not to exceed 1.15 gal/sq. ft./day.

B) Size of units - a minimum of two equal-sized beds should be provided so that they may be dosed alternately.

C) Influent chamber - should be equipped with shut-off devices to the distribution lines; an easily removable cover is recommended.

D) Filter sand - should be washed sand placed with a minimum depth of 18 inches, having an effective size between 0.4 and 1.0 mm, and a uniformity coefficient not greater than 3.00.

Please refer to Rule 3745-42-09 of the Ohio Administrative Code for the most up-to-date filter sand requirements.

E) Distribution lines - should be four (4) inches minimum diameter pipe, perforated or laid with open joints. Lines to be spaced not less than three (3) feet on centers for four (4) and six (6) inch lines or four (4) feet for eight (8) inch lines.

F) Cover - the filter should be covered with twelve (12) to twenty-four (24) inches of earth backfill with geotextile fabric or a three (3) inch layer of straw between the filter and the backfill soil.

G) Venting - ventilation should be provided on large subsurface sand filters to reduce back-pressures when dosing and to induce aerobic conditions within the filter, thereby prolonging its life. One or more capped vents should extend above the surface of the ground from each bed.

H) Construction detail - see Appendix, page 41.

Tile Fields

Use

Tile fields follow the septic tank and are designed to obtain treatment by the soil and aerobic microorganisms. Tile fields are limited by criteria discussed under "On-Site Disposal Systems."

Filters may be required to prolong the life of a tile field. Surface sand filters shall be installed between standard aeration treatment plants and tile fields.

The types of tile fields presently used include the leaching tile field and the evapo-transpiration tile field.

Location

Tile fields shall not be located:

A) In any area which has been disturbed or re-graded unless sampled and certified as required in General Design, Data, H, page 28.

B) In areas that have been or may be subject to passage, parking, or storage of heavy equipment, construction equipment, vehicles, or materials.

C) Beneath driveways, parking, or other paved areas.

D) Beneath buildings or other structures.

E) In swampy areas nor where ponding or flooding may occur.

F) Where depth to normal ground water or to rock strata is less than four (4) feet below the bottom of the trench.

G) Within 20 feet from any occupied building.

H) Within 10 to 50 feet (dependent on the soil permeability, adjacent land use, and degree of pretreatment) from a property line.

I) Within the following distances from existing well sites. Check with the Division of Drinking and Ground Waters to determine the approved radius of public water supply wells.

1) 50 feet up to 2,500 gpd well
2) 100 feet up to 10,000 gpd well
3) 200 feet up to 25,000 gpd well
4) 300 feet up to 50,000 gpd well and over

General Design Data

A) Tile fields should be preceded by an influent drop box or distribution box for diversion of the flow to the individual tile lines. See Appendix, pages 43, 44, 45 and 46. Tile fields should be divided into two equal sized sections.

B) Relatively shallow fields should be used since this increases evapo-transpiration and promotes aerobic conditions in the system. Permeability rates are usually more rapid in the upper part of the soil where pores are more common and biological action is greatest.

C) Tile lines shall be laid relatively level. Tile lines shall be not less than four (4) inches in diameter and laid not more than three (3) inches slope in fifty (50) feet. For sloped areas, field tiles should follow the contours and it is recommended that a drop box distribution be used so that each component is forced to pond before liquid flows to the succeeding component. See Appendix, page 46.

D) Maximum length of lines - 100 feet.

E) Minimum distance between centerline of trenches - 6 feet.

F) Fill material - a minimum depth of 18 inches of clean gravel or stone (3/8" to 1½") required with 12-inch depth below and 2 inches above the tile as a minimum. Cover top of fill with a 2-inch layer of hay, straw, or geotextile fabric before placing earth fill to surface.

G) Conventional leaching systems may not be appropriate in soils with a seasonally high water table. Poorly drained soils often indicate other conditions which may make the site unsuitable for conventional leaching. Gravity curtain drains, pumped curtain drains, or appropriately designed mound systems may be necessary to solve such problems. Curtain drain outlets to streams or ditches shall include an appropriate animal guard.

H) A certified soil scientist, geologist, or other specialist in a related field shall evaluate the site and submit a signed certificate of test results with the plans. Soil classification shall be shown on detail plans using USDA soil conservation service soil series, texture, effective size, and permeability limitation. On-site disposal systems should be located in areas of undisturbed soils. Percolation tests and sieve analysis may be required.

I) Test holes - test holes eight (8) feet in depth should be made in the area of the proposed tile field and the results submitted, indicating depth to rock, seasonal ground water, normal ground water, and soil effective size where Soil Conservation Service data has not been verified.

Detail Design Data

A) Leaching systems (see Appendix, pages 43, 44, 45 and 47).

1) Leaching tile fields may be used only where the soils are suitable.

2) Minimum trench width shall be twelve (12) inches.

3) Minimum trench depth 24 inches; maximum 30 inches.

4) Tile field size - for septic systems, at least one (1) lineal foot per gallon per day - minimum length four hundred linear feet (400').

5) Inspection vents should be provided at the end of each trench to observe the depth of ponding. The vent shall extend from the base of the gravel and extend to final grade with a cap at the ground surface. The vent pipe must be perforated within the gravel layer and either may be attached to the distribution pipe or be separate from it.

B) Evapo-transpiration systems (contact district office for details and see Appendix, page 45)

1) When the soils are not suitable for a conventional leaching system and for low flow projects on sites with sufficient land area, an evapo-transpiration tile field following contours may be installed.

2) Minimum trench width 24 inches.

3) Trench depth shall be 24 inches maximum.

4) Minimum tile field - at least one (1) lineal foot per gallon per day for filtered effluent and two (2) lineal feet per gallon per day for non-filtered effluent. Minimum length six hundred linear feet (600'). Where severe soil conditions exist, the required minimum size for a tile field may be larger.

5) The maximum cover over the tile line shall be six (6) inches.

C) Mound systems

Mound systems will be evaluated on a case-by-case basis. Use the Ohio Cooperative Extension Service, Ohio State University, Bulletin 813, Mound Systems for On-Site Wastewater Treatment, Siting, Design, and Construction in Ohio, December, 1990, as a guide.

APPENDIX

Please see Rule 3745-42-05 of the Ohio Administrative Code for the most up-to-date requirements for design flow values.

Suggested Sewage Flow Guide

These estimated flows are empirical and are intended only for design of sewerage works.

Place		Estimated Sewage Flow Gallons Per Day
Apartments		250 one bedroom 300 two bedroom 350 three bedroom
Assembly Halls	Note a	2 per seat
Beauty Shop, Styling Salon		200 per basin
Bowling Alleys (no food service)	Note a	75 per lane
Churches (small)	Note a	3-5 per sanctuary seat
Churches (large with kitchen)	Note b	5-7 per sanctuary seat
Country Clubs		50 per member
Dance Halls	Note a	2 per person
Doctors/Dentists		75 per doctor 20 per employee 10 per patient
Drive-In Theaters		5 per car space
Factories (no showers)		25 per employee
Factories (with showers)		35 per employee
Food Service Operations Ordinary Restaurant (not 24-hour) 24-Hour Restaurant Banquet Rooms Restaurant Along Freeway Tavern (very little food service) Curb Service (drive-in) Vending Machine Restaurants	 Note c Note c Note c Note c Note c Note c	 35 per seat at 400 ppm BOD_5 50 per seat at 400 ppm BOD_5 5 per seat at 400 ppm BOD_5 100 per seat at 400 ppm BOD_5 35 per seat at 400 ppm BOD_5 50 per car space at 400 ppm BOD_5 100 per seat at 200 ppm BOD_5
Homes in Subdivision		400 per dwelling
Hospitals (no resident personnel)	Note b	300 per bed
Institutions (residents)	Note b	100 per person
Laundries (coin-operated)	Note e	400 per standard size machine
Laundry wastes require special consideration		Consult district office
Marinas (restrooms and showers only)		15 per boat mooring/slip/dock
Migrant Labor Camps	Note g	50 per person
Mobile Home Parks		300 per mobile home space
Motels		100 per unit
Nursing and Rest Homes	Note b	200 per patient at 300 ppm BOD_5 100 per resident employee 50 per non-resident employee
Office Buildings		20 per employee
Recreational Vehicle Dumping Stations		Consult District Office
Recreational Vehicle Parks and Camps		See DWPC Policy 2.07
Retail Store		20 per employee
Schools - Elementary - High and Junior High	Note b Note b	15 per pupil 20 per pupil

Place		Estimated Sewage Flow Gallons Per Day
Service Stations	Note d	1000 first bay or pump island 500 additional bay or pump island
Shopping Centers (no food service or laundries)	Note f	0.2 per sq. ft. of floor space
Swimming Pools (average) (with hot water showers)		3-5 per swimmer (design load) 5-7 per swimmer (design load)
Vacation Cottages		50 per person
Veterinarians and Animal Hospitals	Note h Note h	10 per run 10 per cage 20 per employee
Youth and Recreation Camps	Note b	50 per person

Note a: Food service waste not included.
Note b: Food service waste included, but without garbage grinders.
Note c: Aeration tanks for these require 48 hour detention period. Garbage grinders not permitted.
Note d: Truck parking areas will require consideration for treatment of runoff at large truck stops.
Note e: Laundry (coin operated); temperature may be critical if not diluted with other sewage. Laundry flow shall not be more than 20 percent of the flow of a treatment plant. Commercial laundries will not be permitted for treatment plants designed for less than 30,000 gpd.
Note f: Add laundries or other high flow or high strength uses.
Note g: 20 gpd if vault latrine is used for toilet wastes.
Note h: Assumes manual hosing and solids (food droppings, etc.) removal prior to hosing.

Recommended Flow Equalization Tank Volumes as a Percent of the Average Daily Flow

Q max/Q avg	≤ 3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Tank Volume	37	40	44	48	50	52	53	55

Note: Q max = Design peak flow rate tributary to the equalization tank including all backwash.
Q avg = 24-hour average design flow rate.

EXAMPLE: A new high school is proposed with a projected average daily flow of 30,000 gpd. The desired equalized flow rate at the proposed treatment plant is 30,000 gpd.

Step 1: Determine Q max/Q avg
Peak flow factor = 3-1/3
Run off period (hours) = 8
Q max/Q avg = 3-1/3 x 24 hours/8 hours = 10

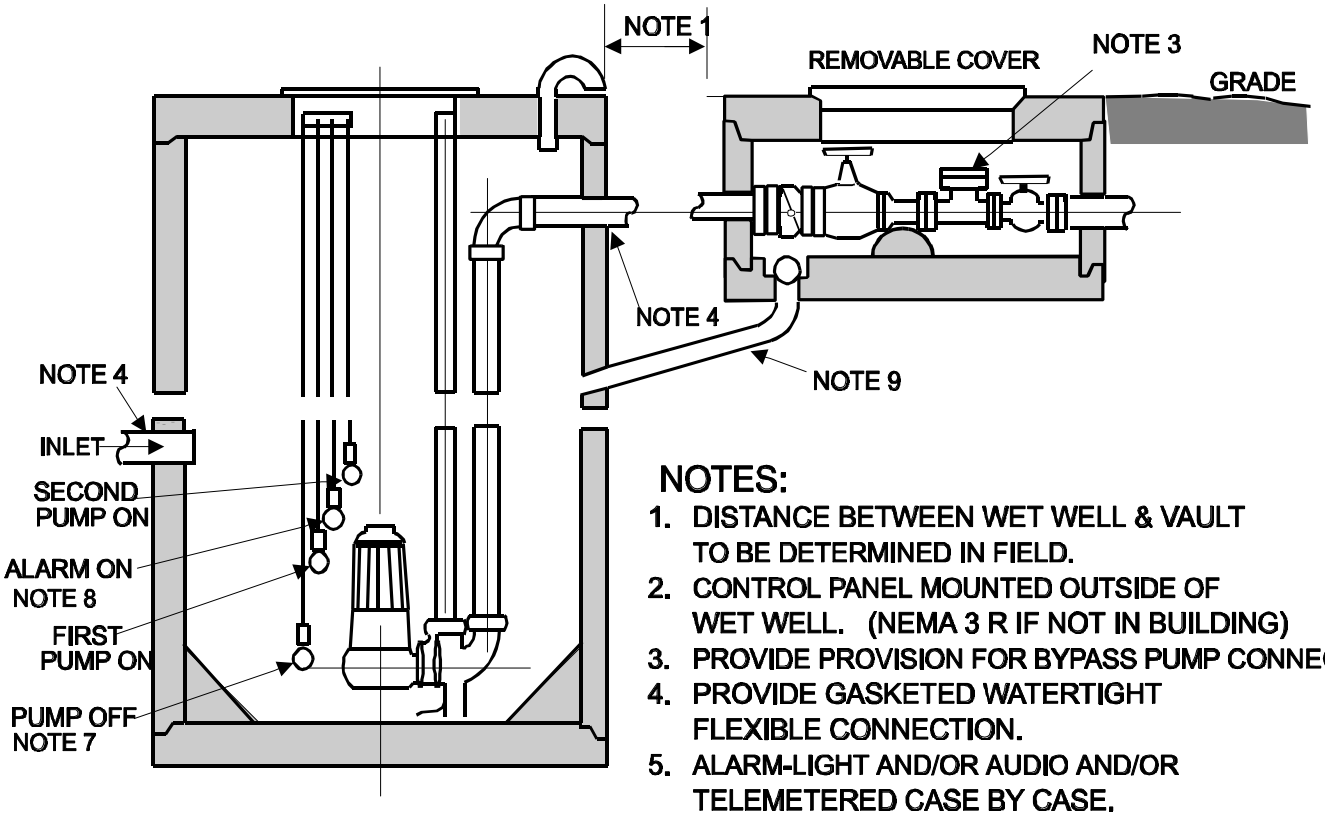
Step 2: Determine the desired percent volume required. Use 10 as computed above and obtain 55 percent from table.

Step 3: Calculate required equalization volume: EV = percent x average daily flow (EV = .55 x 30,000 = 16,500 gallons)

APPENDICES:

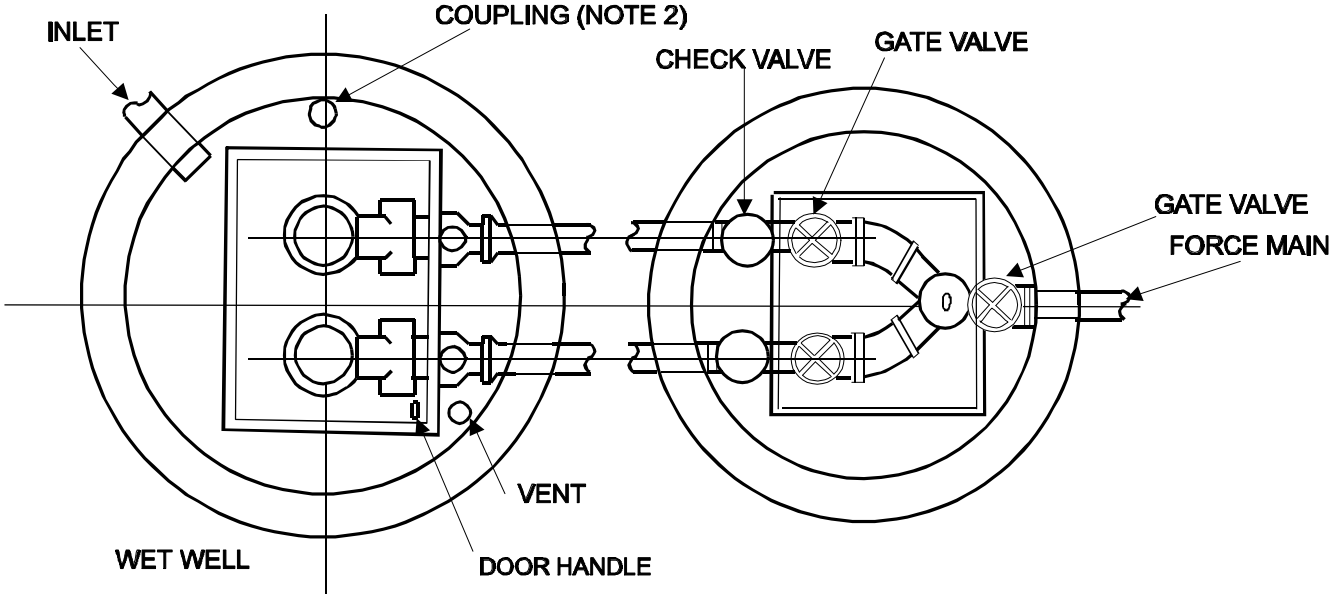
Drawings, Charts and Graphs

APPENDIX

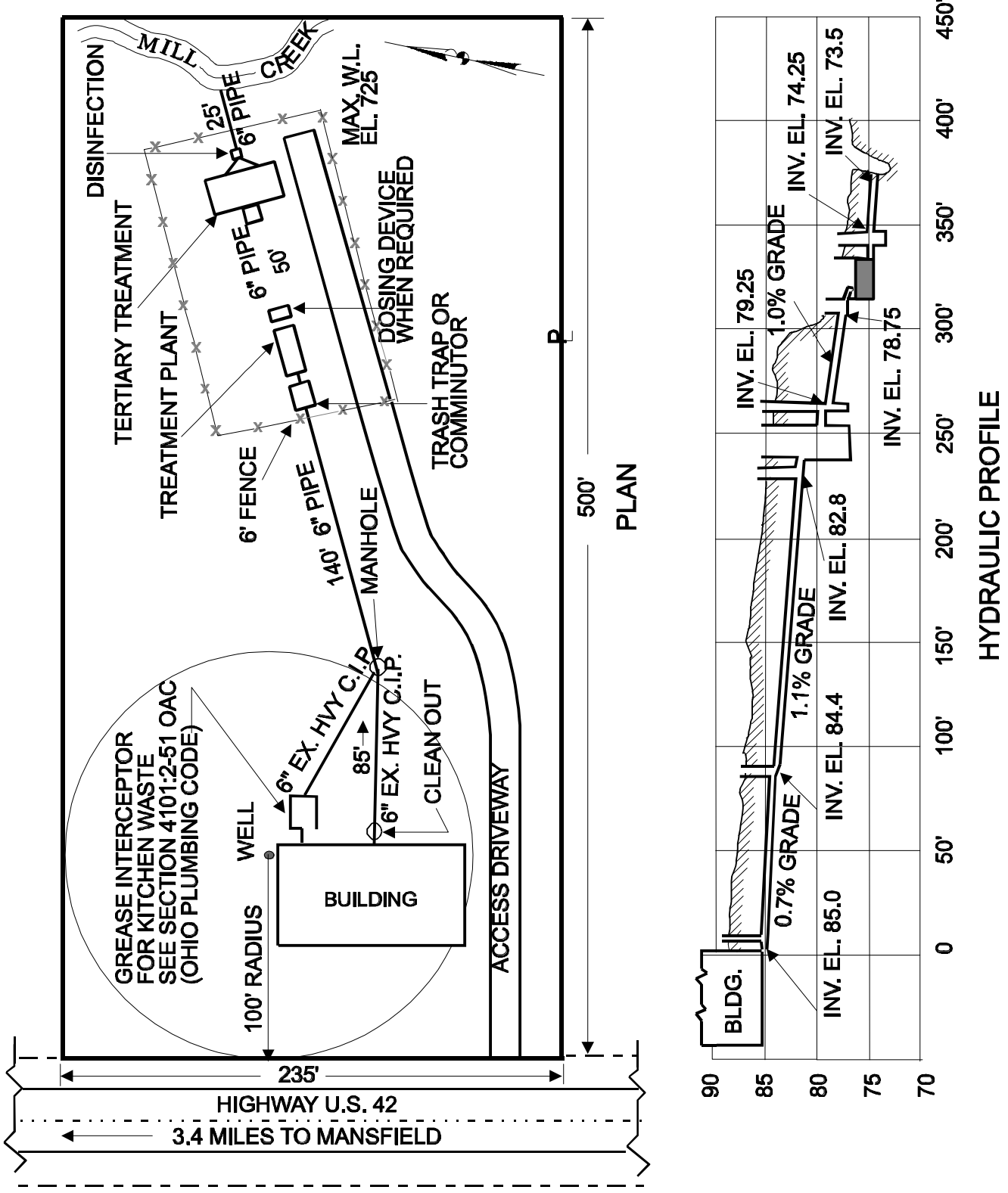


NOTES:

1. DISTANCE BETWEEN WET WELL & VAULT TO BE DETERMINED IN FIELD.
2. CONTROL PANEL MOUNTED OUTSIDE OF WET WELL. (NEMA 3 R IF NOT IN BUILDING)
3. PROVIDE PROVISION FOR BYPASS PUMP CONNECTION.
4. PROVIDE GASKETED WATERTIGHT FLEXIBLE CONNECTION.
5. ALARM-LIGHT AND/OR AUDIO AND/OR TELEMETERED CASE BY CASE.
6. PROVIDE HOIST TO REMOVE PUMP.
7. MAINTAIN "PUMP OFF" SWITCH ABOVE MOTOR UNLESS EXPLOSION PROOF MOTORS ARE INSTALLED.
8. DO NOT SET "ALARM ON" SWITCH ABOVE "SECOND PUMP ON" SWITCH.
9. PROVIDE AIR SEAL WITH CHECK VALVE OR OTHER AUTOMATIC CLOSING VALVE WITHOUT USING A MANUAL VALVE OR A LIQUID SEAL.

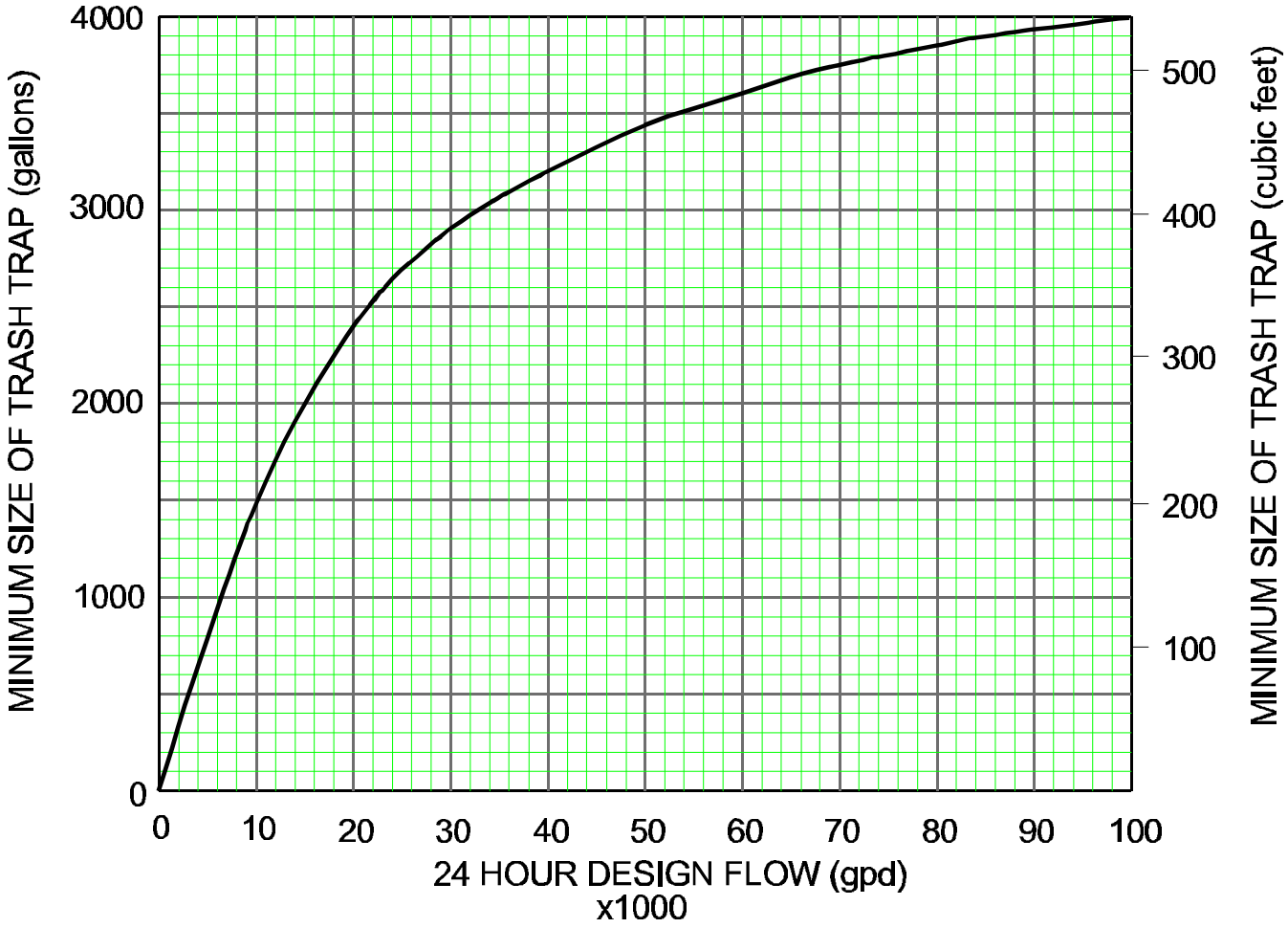


RAW SEWAGE LIFT STATION



TYPICAL SITE PLAN & PROFILE

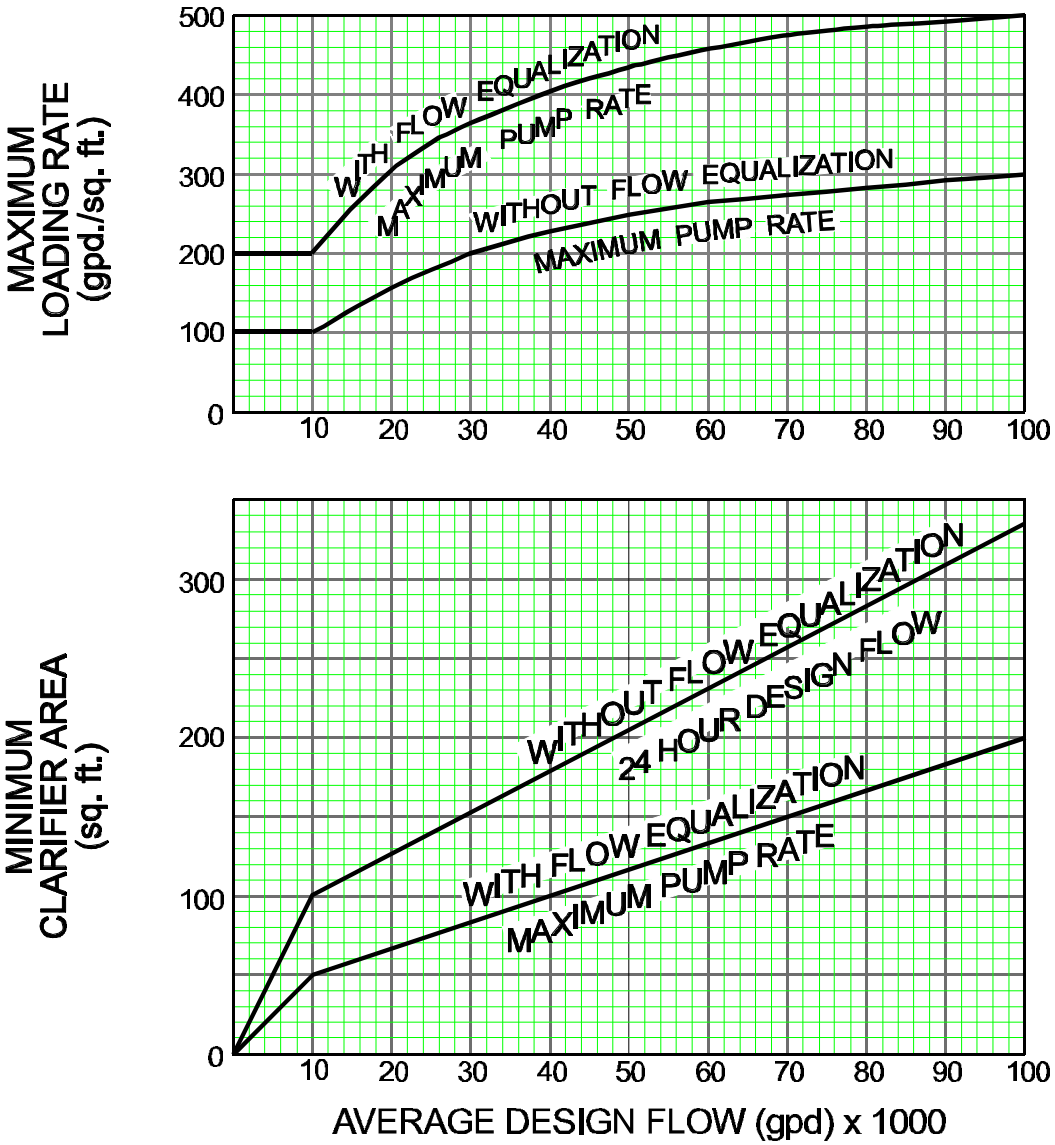
APPENDIX



24 HOUR DESIGN FLOW (gpd)	MINIMUM SIZE OF TRASH TRAP (gallons)	(cubic feet)	24 HOUR DESIGN FLOW (gpd)	MINIMUM SIZE OF TRASH TRAP (gallons)	(cubic feet)
1,000	150	20	10,000	1,500	200
2,000	300	40	20,000	2,400	321
3,000	450	60	30,000	2,900	388
4,000	600	80	40,000	3,200	428
5,000	750	100	50,000	3,430	459
6,000	900	120	60,000	3,600	481
7,000	1,050	140	70,000	3,740	500
8,000	1,200	160	80,000	3,840	513
9,000	1,350	180	90,000	3,920	524
10,000	1,500	200	100,000	4,000	535

MINIMUM SIZE TRASH TRAP

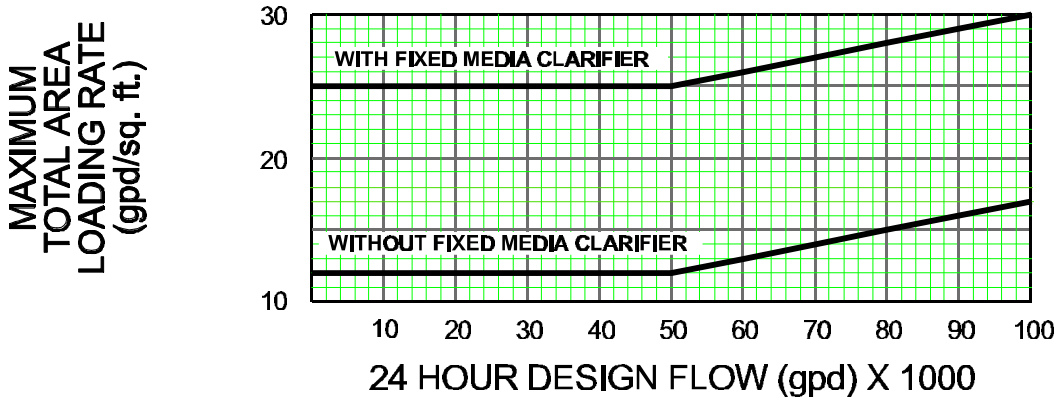
APPENDIX

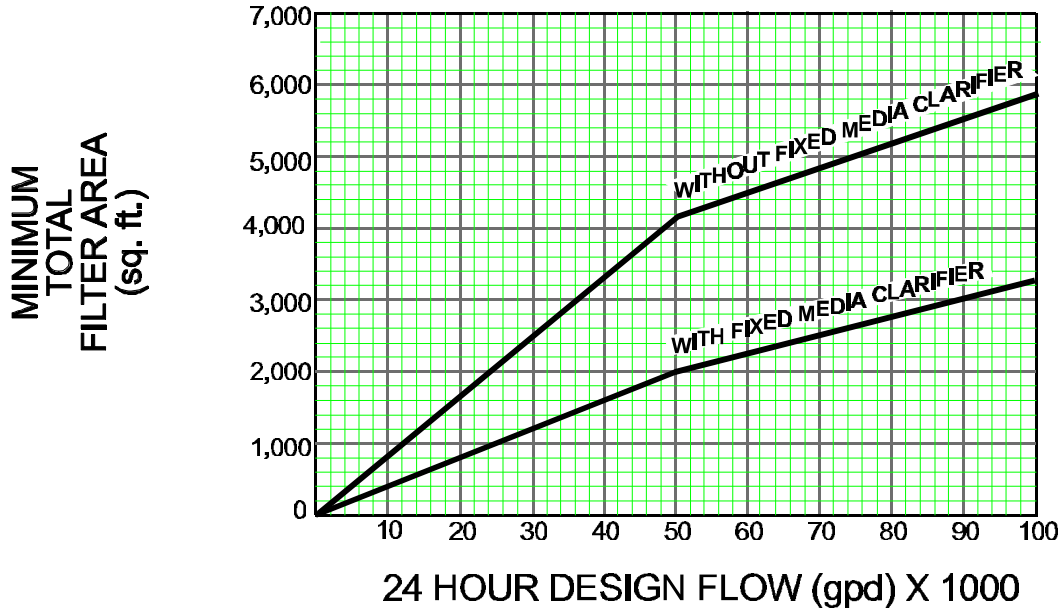


AVERAGE 24 HOUR DESIGN FLOW (gpd)	WITH FLOW EQUALIZATION MAXIMUM LOADING RATE (gpd/sq. ft.)	WITH FLOW EQUALIZATION MINIMUM SURFACE AREA (sq. ft.)	WITHOUT FLOW EQUALIZATION MAXIMUM LOADING RATE (gpd/sq. ft.)	WITHOUT FLOW EQUALIZATION MINIMUM SURFACE AREA (sq. ft.)
10,000	200	50	100	100
20,000	300	67	159	126
30,000	360	83	198	152
40,000	400	100	225	178
50,000	429	117	245	204
60,000	450	133	261	230
70,000	467	150	274	256
80,000	480	167	284	281
90,000	491	183	293	307
100,000	500	200	300	333

CLARIFIER - LOADING RATE & AREA

APPENDIX

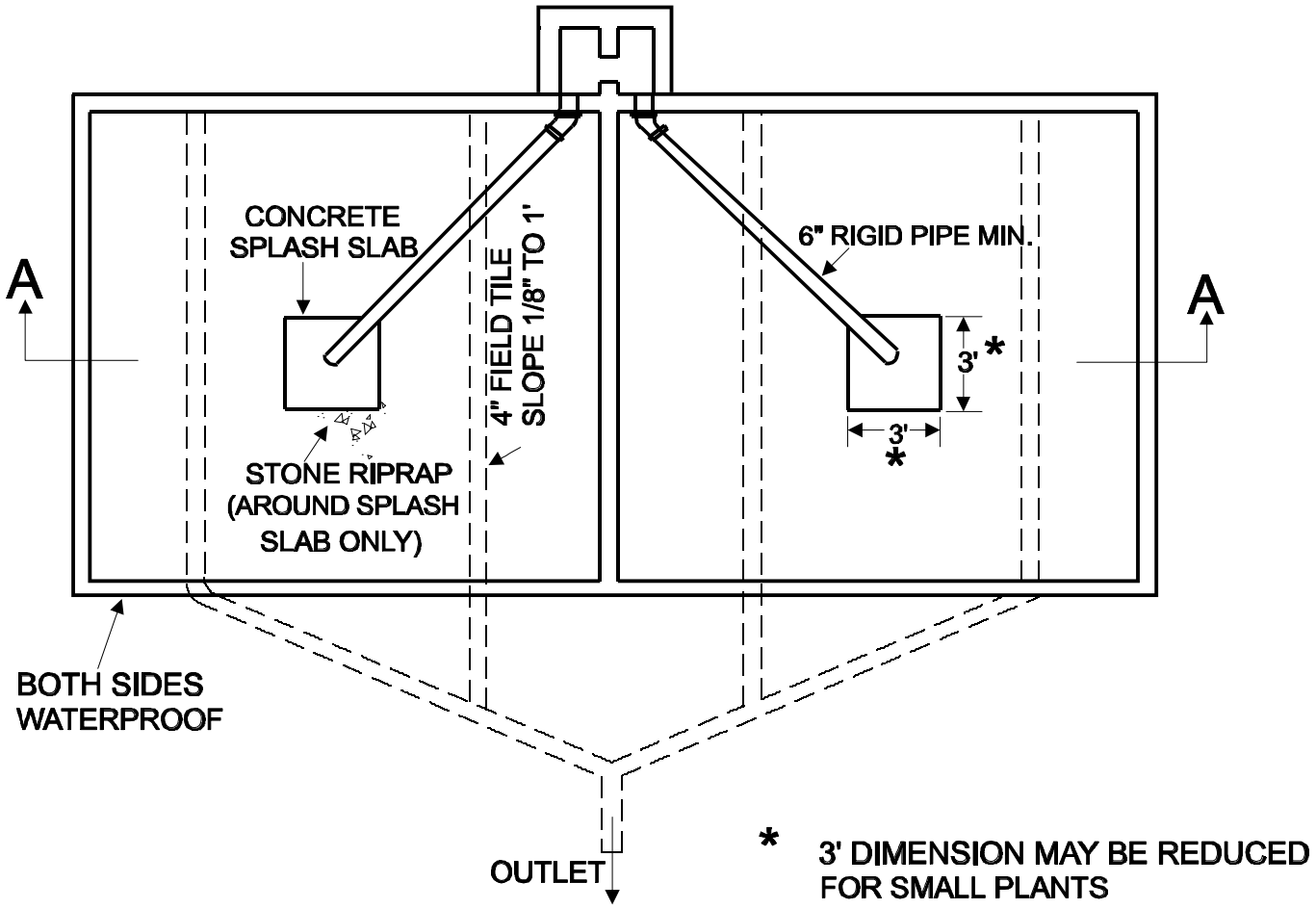


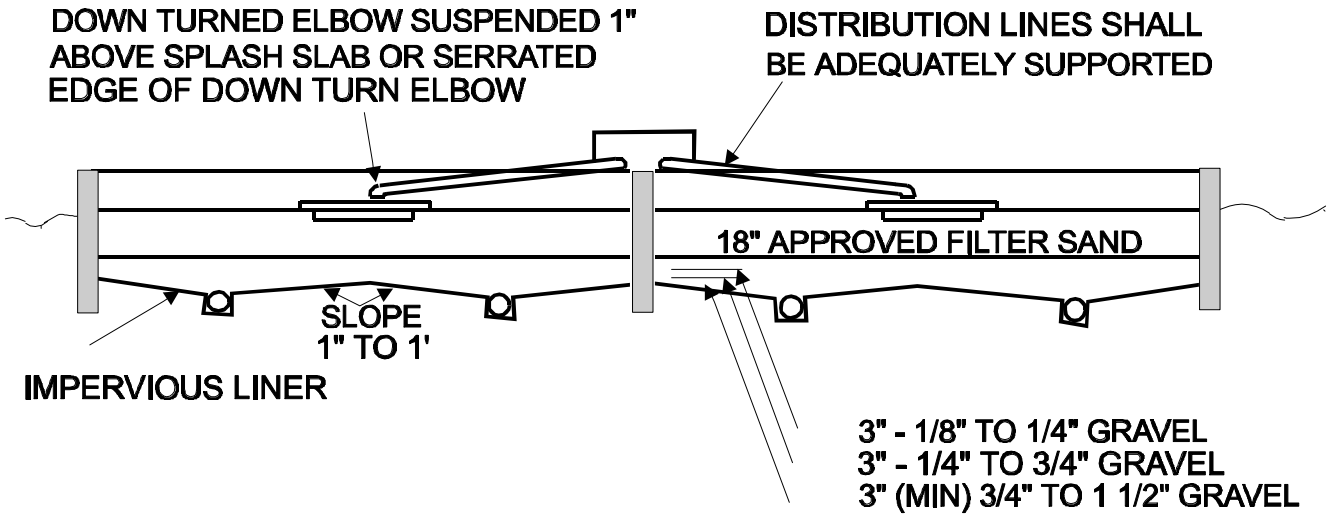


FOR EXTENDED AERATION TREATMENT PLANTS

24 HOUR DESIGN FLOW (gpd)	WITH FIXED MEDIA CLARIFIER LOADING RATE (gpd/sq. ft.)	WITH FIXED MEDIA CLARIFIER MINIMUM SURFACE AREA (sq. ft.)	WITHOUT FIXED MEDIA CLARIFIER LOADING RATE (gpd/sq. ft.)	WITHOUT FIXED MEDIA CLARIFIER MINIMUM SURFACE AREA (sq. ft.)
10,000	25	400	12	833
20,000	25	800	12	1,667
30,000	25	1,200	12	2,500
40,000	25	1,600	12	3,333
50,000	25	2,000	12	4,167
60,000	26	2,308	13	4,615
70,000	27	2,593	14	5,000
80,000	28	2,857	15	5,333
90,000	29	3,103	16	5,625
100,000	30	3,333	17	5,882

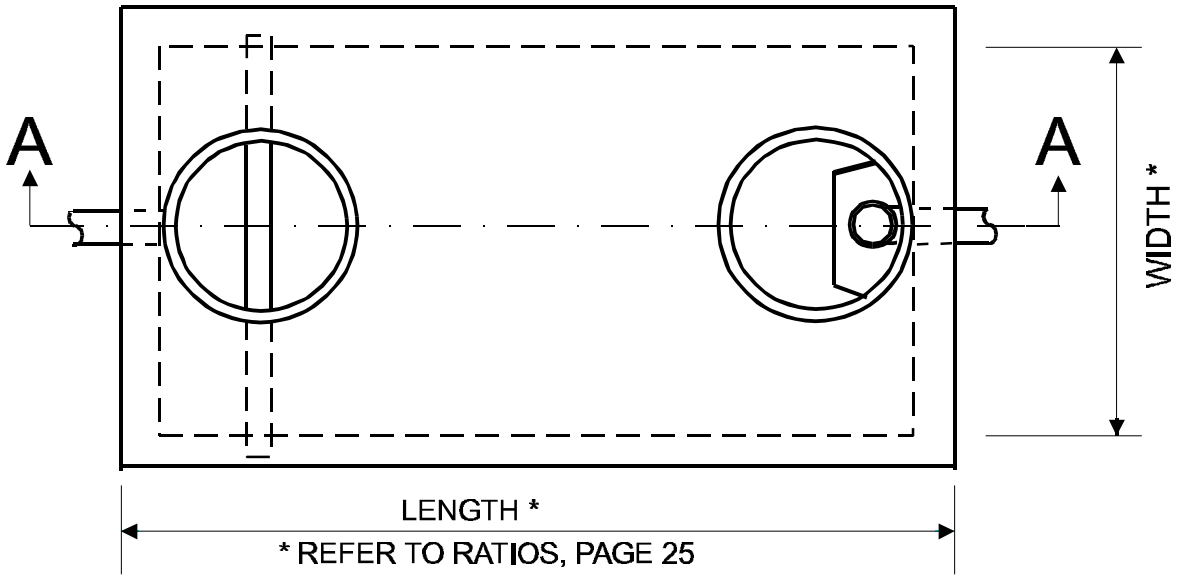
SLOW SAND FILTERS-LOADING RATE & AREA

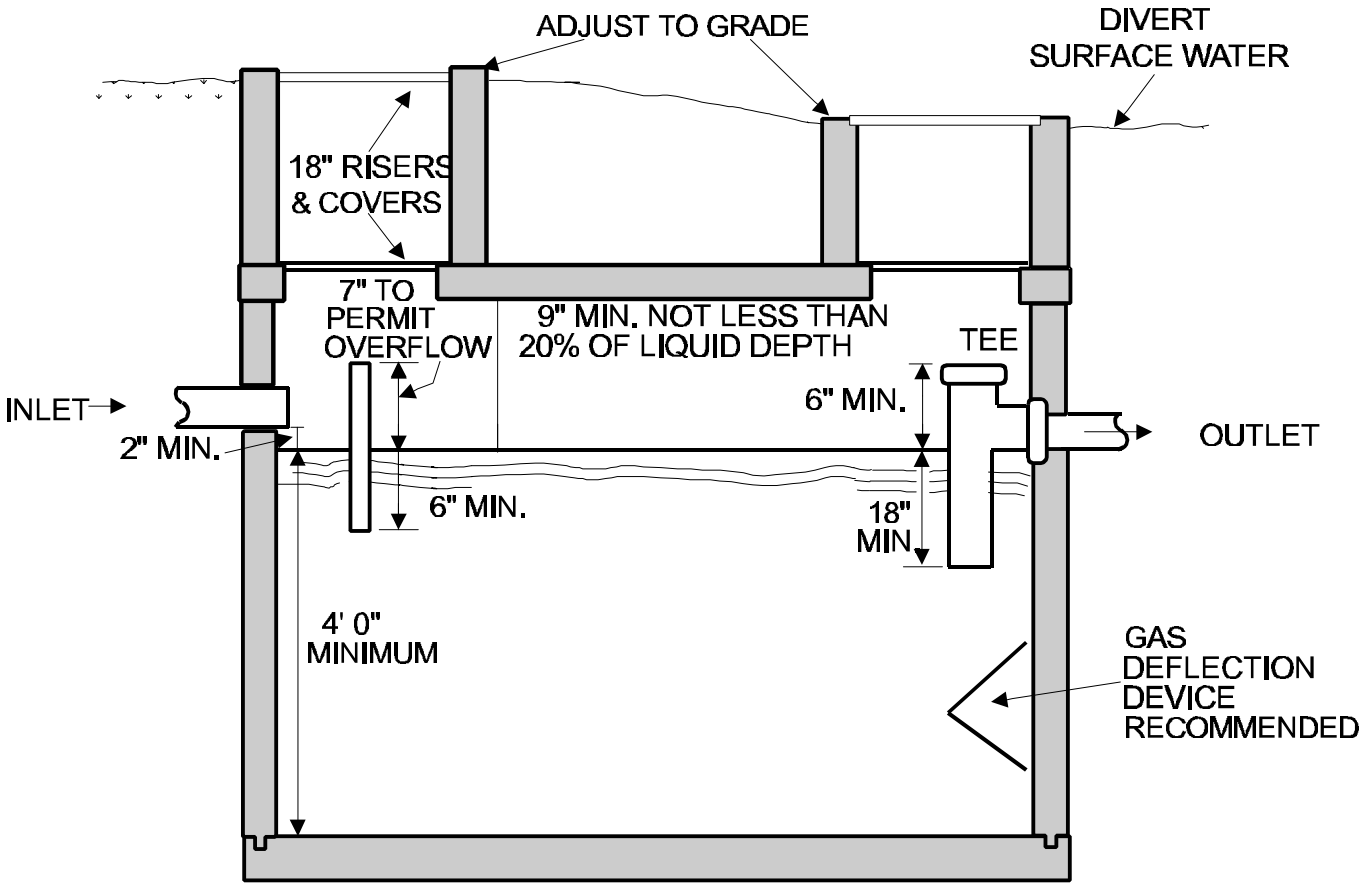




SECTION A-A

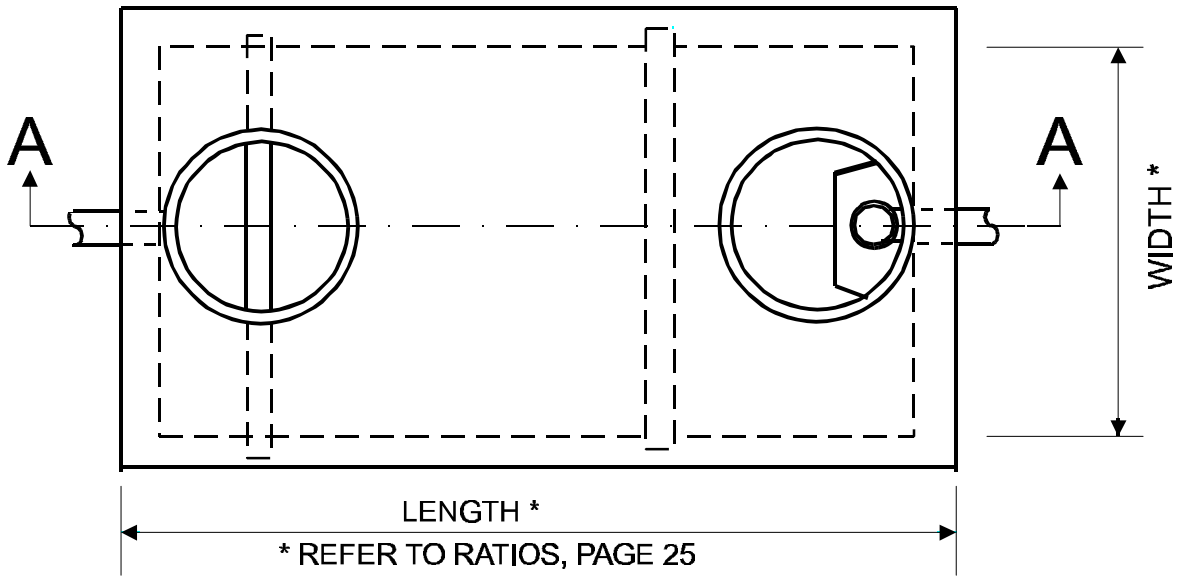
SURFACE SAND FILTERS

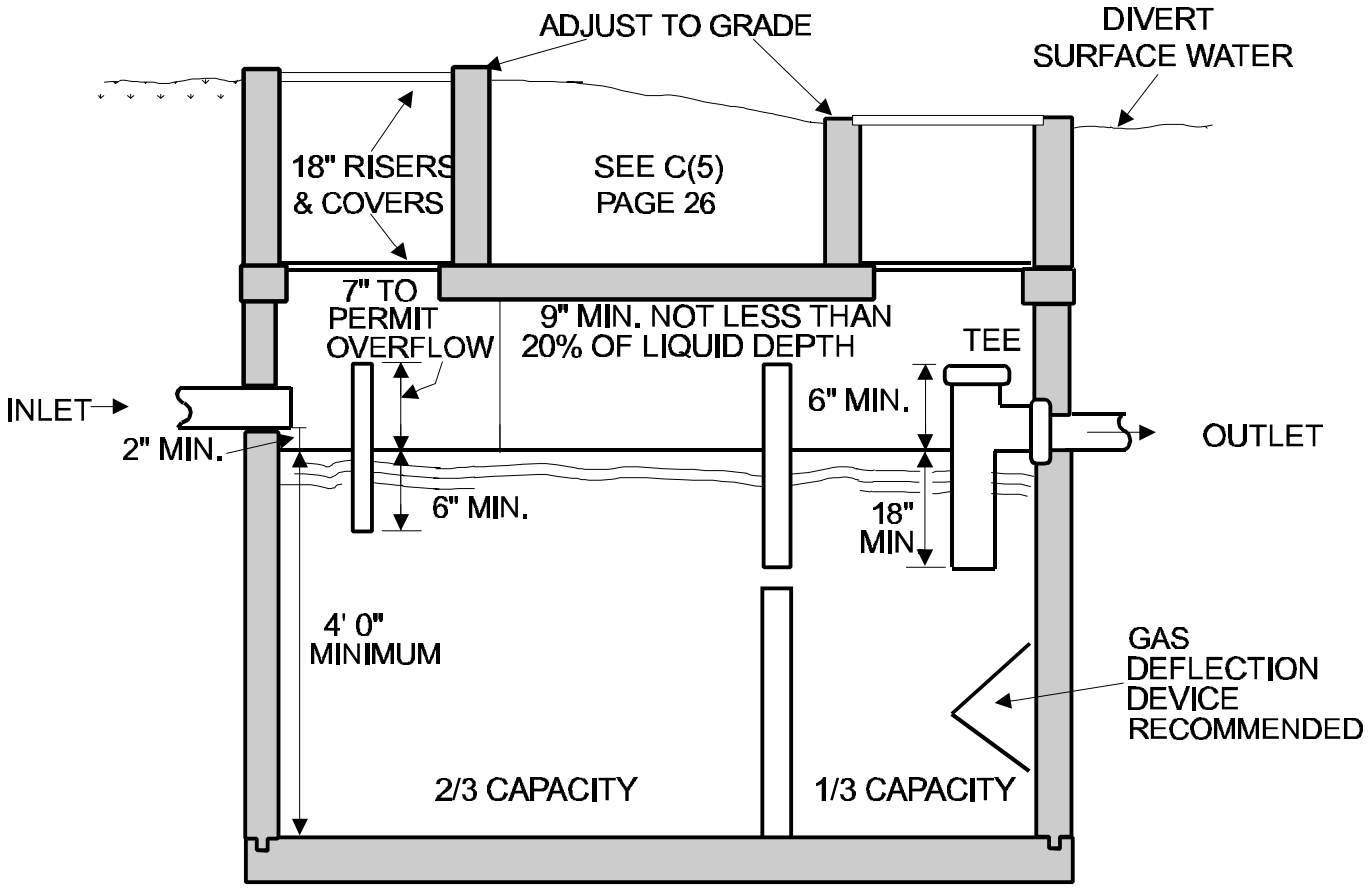




SECTION A - A

SINGLE COMPARTMENT SEPTIC TANK

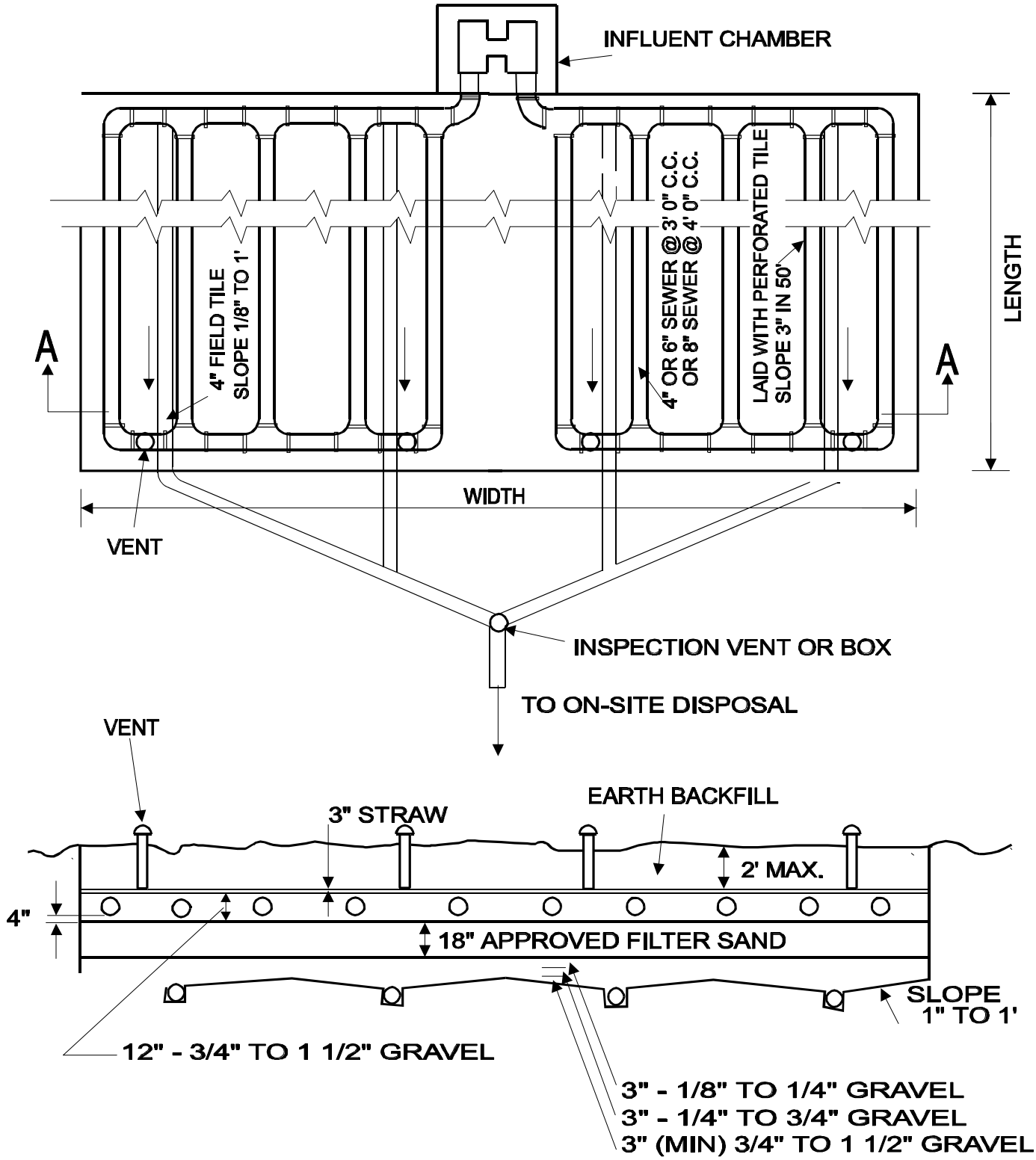




SECTION A - A

DUAL COMPARTMENT SEPTIC TANK

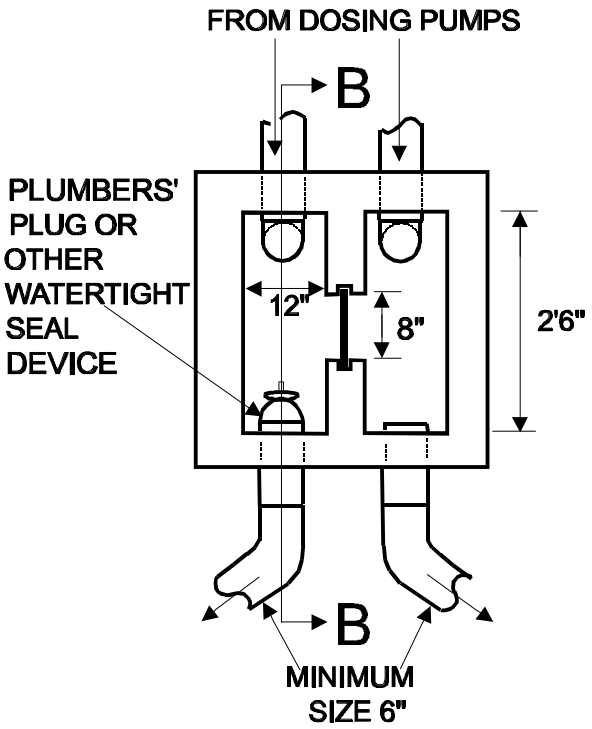
APPENDIX

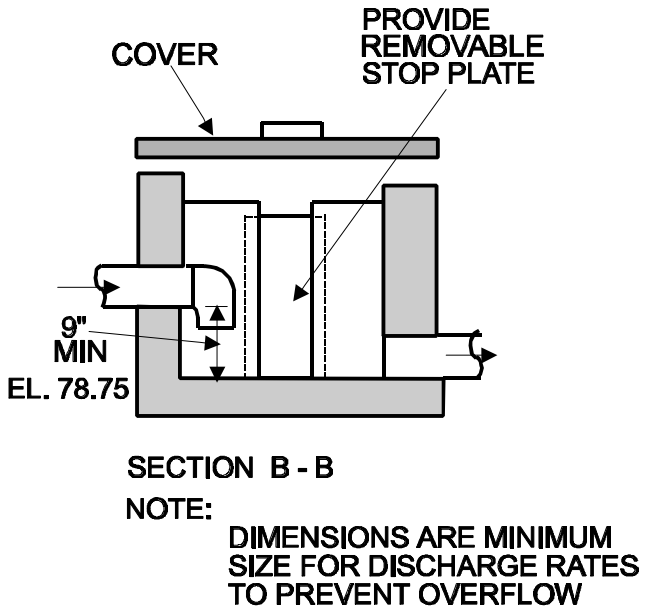


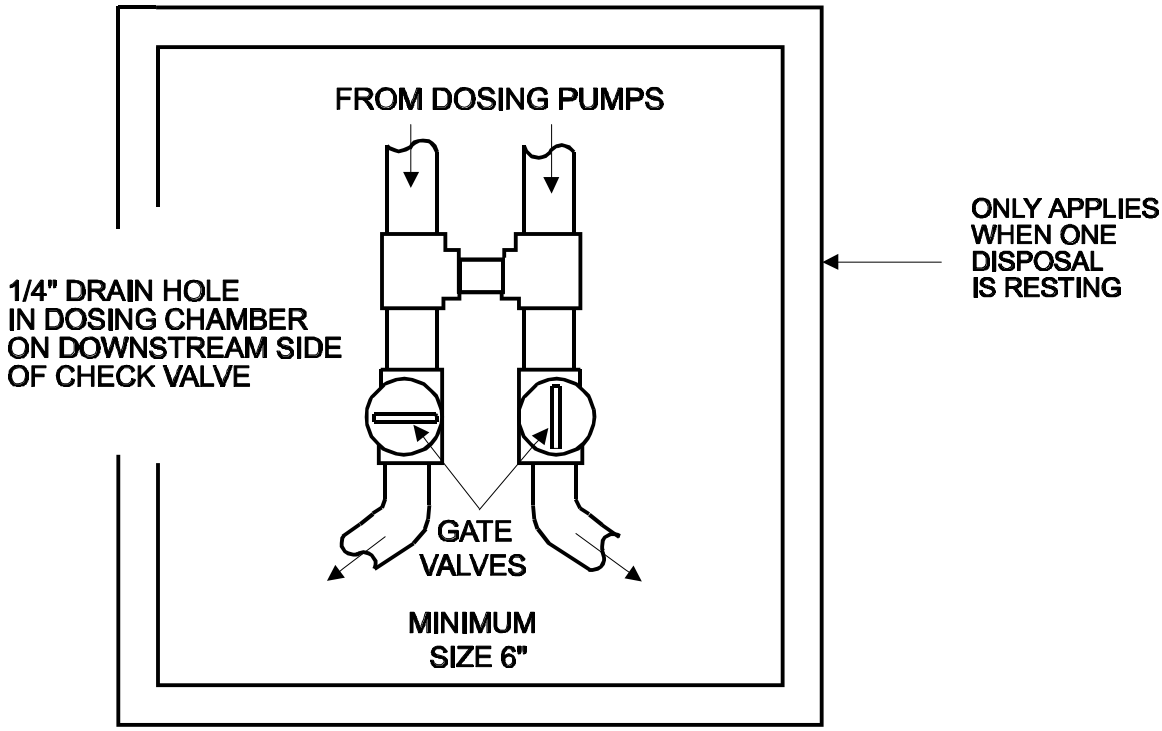
SECTION A-A

SUBSURFACE SAND FILTERS

APPENDIX

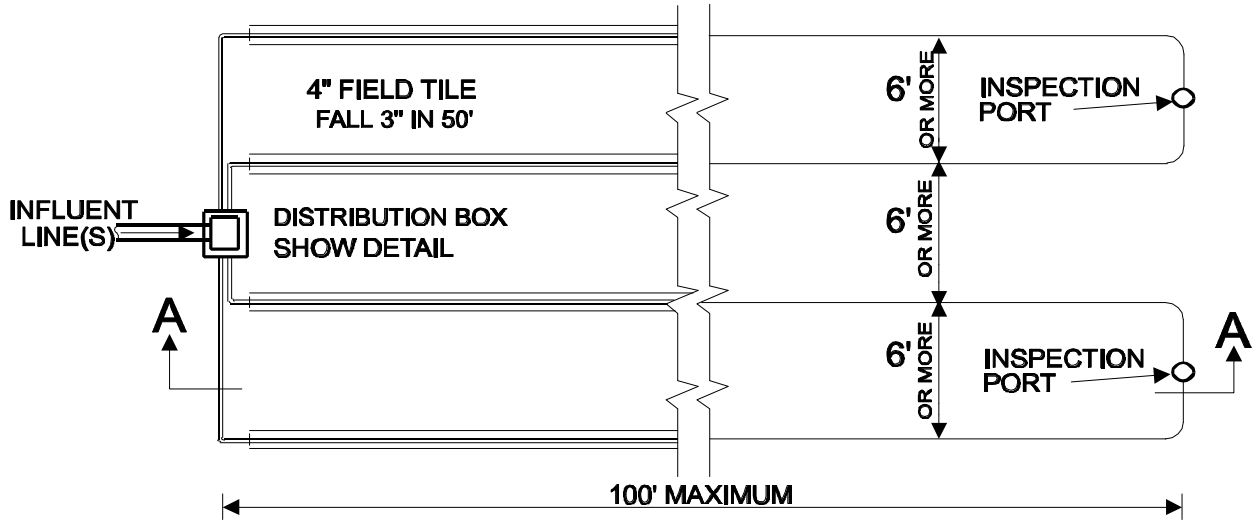






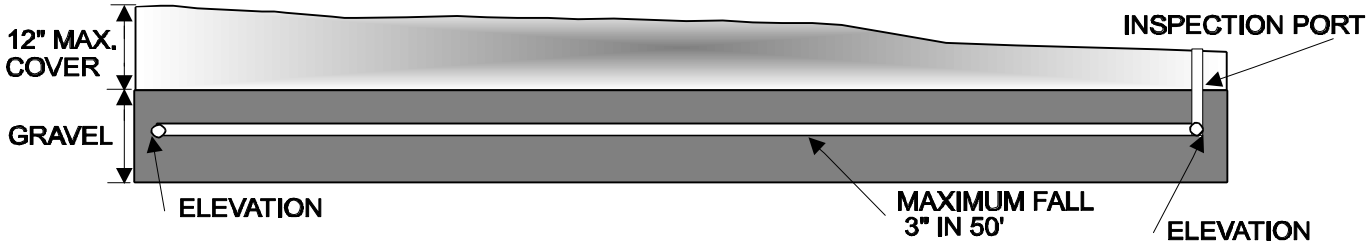
INFLUENT CHAMBER

APPENDIX

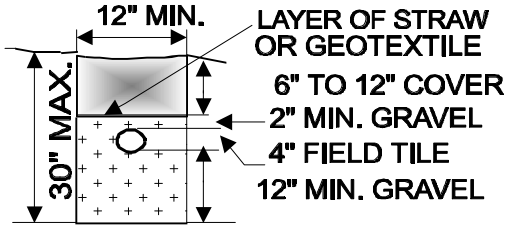


PLAN

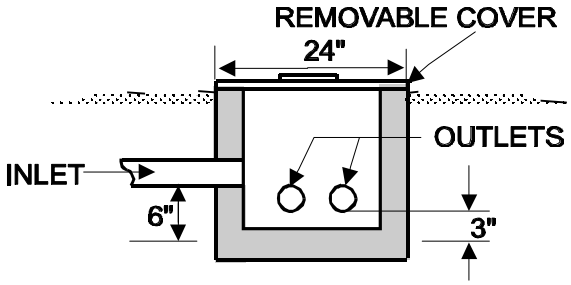
NOTE:
IN HILLY AREAS, FIELD TILES SHOULD FOLLOW CONTOURS. USE DROP BOXES OR OTHER SUITABLE ARRANGEMENTS TO PROPERLY FLOOD EACH LINE IN SEQUENCE.



SECTION A-A



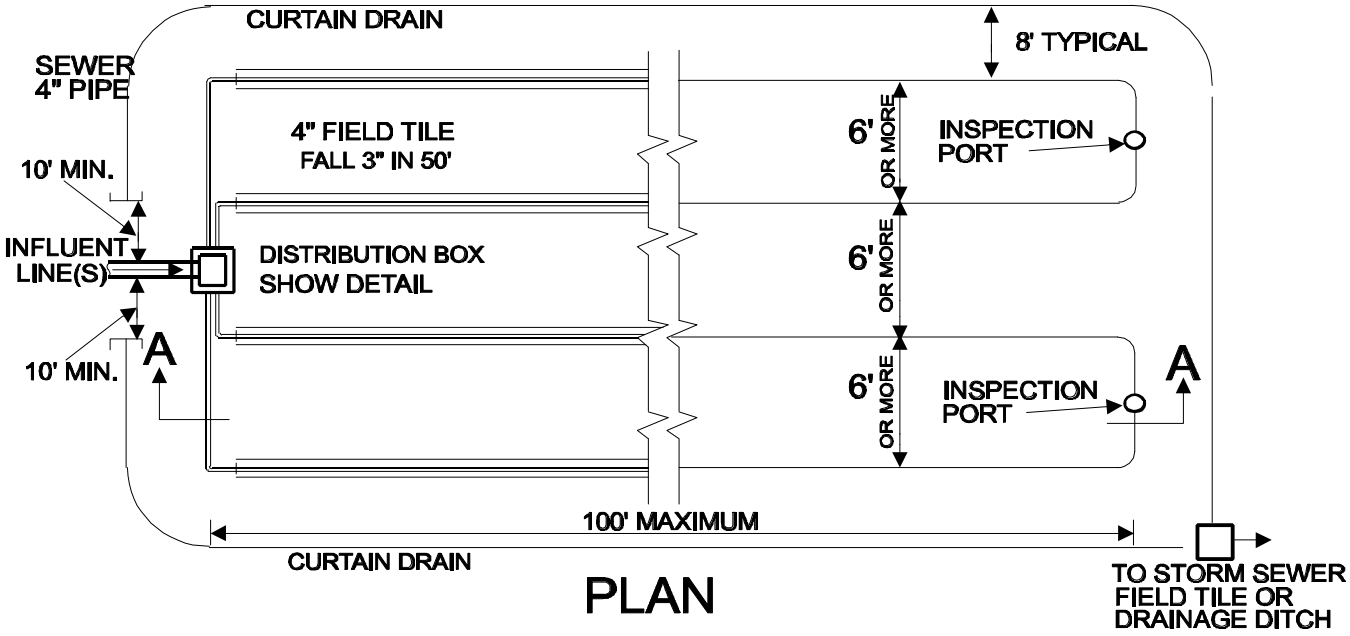
TRENCH SECTION



DISTRIBUTION BOX SECTION

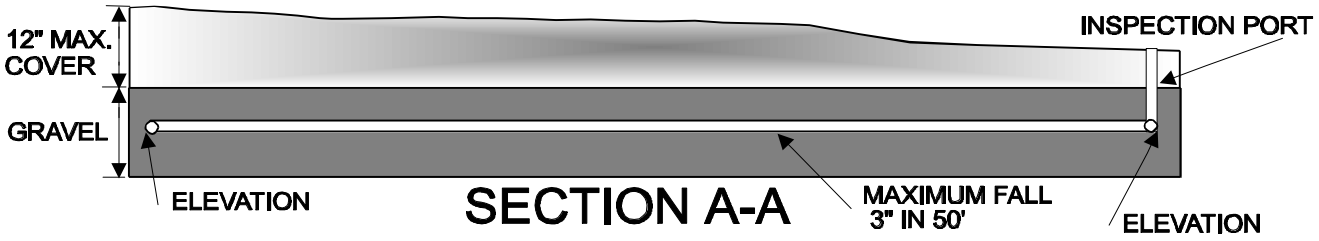
LEACHING TILE FIELD
(FLAT LAND)

APPENDIX

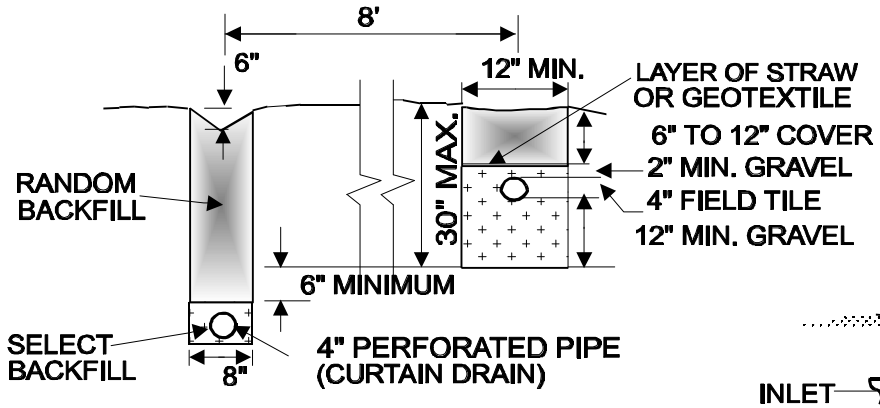


PLAN

NOTE:
IN HILLY AREAS, FIELD TILES SHOULD FOLLOW CONTOURS. USE DROP BOXES OR OTHER SUITABLE ARRANGEMENTS TO PROPERLY FLOOD EACH LINE IN SEQUENCE.



SECTION A-A



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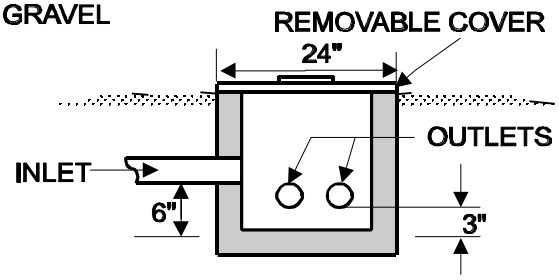
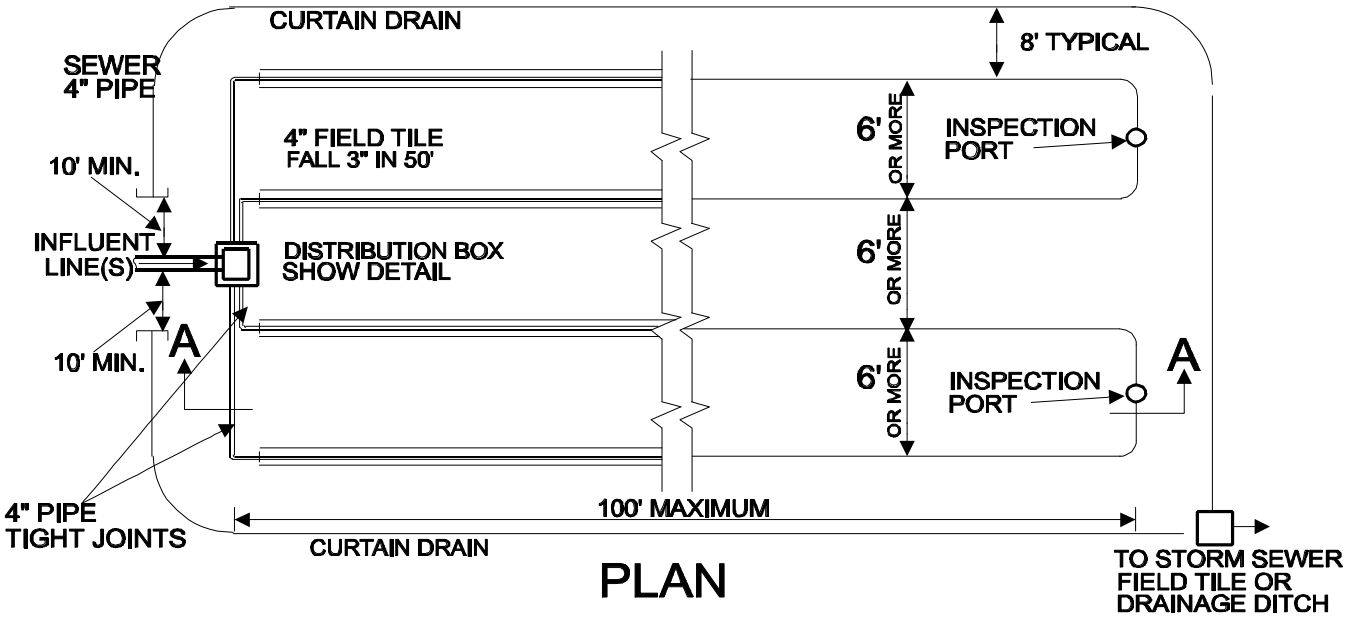


DISTRIBUTION BOX SECTION

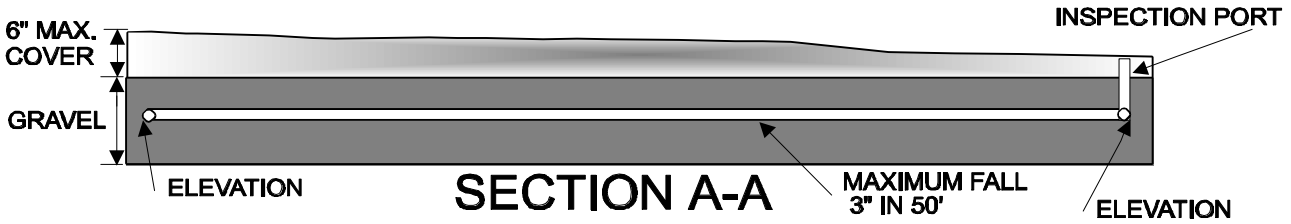
LEACHING TILE FIELD WITH CURTAIN DRAIN (FLAT LAND)

APPENDIX

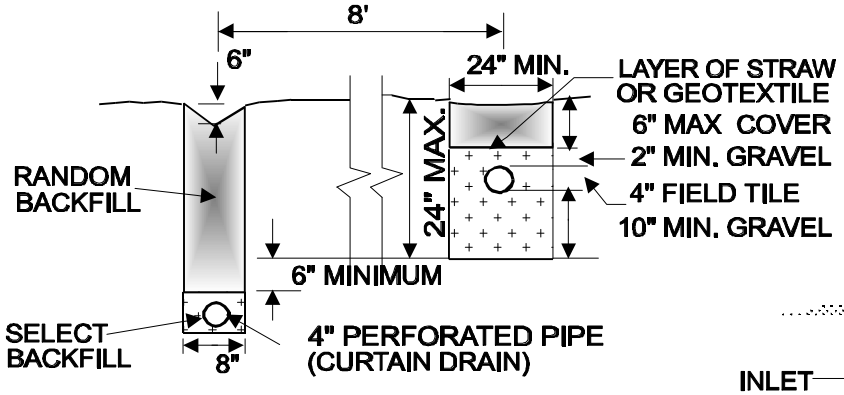


PLAN

NOTE: TILES SHOULD FOLLOW CONTOURS



SECTION A-A



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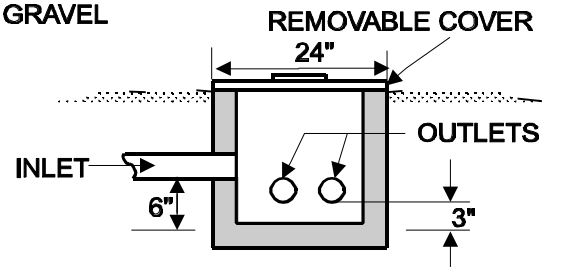
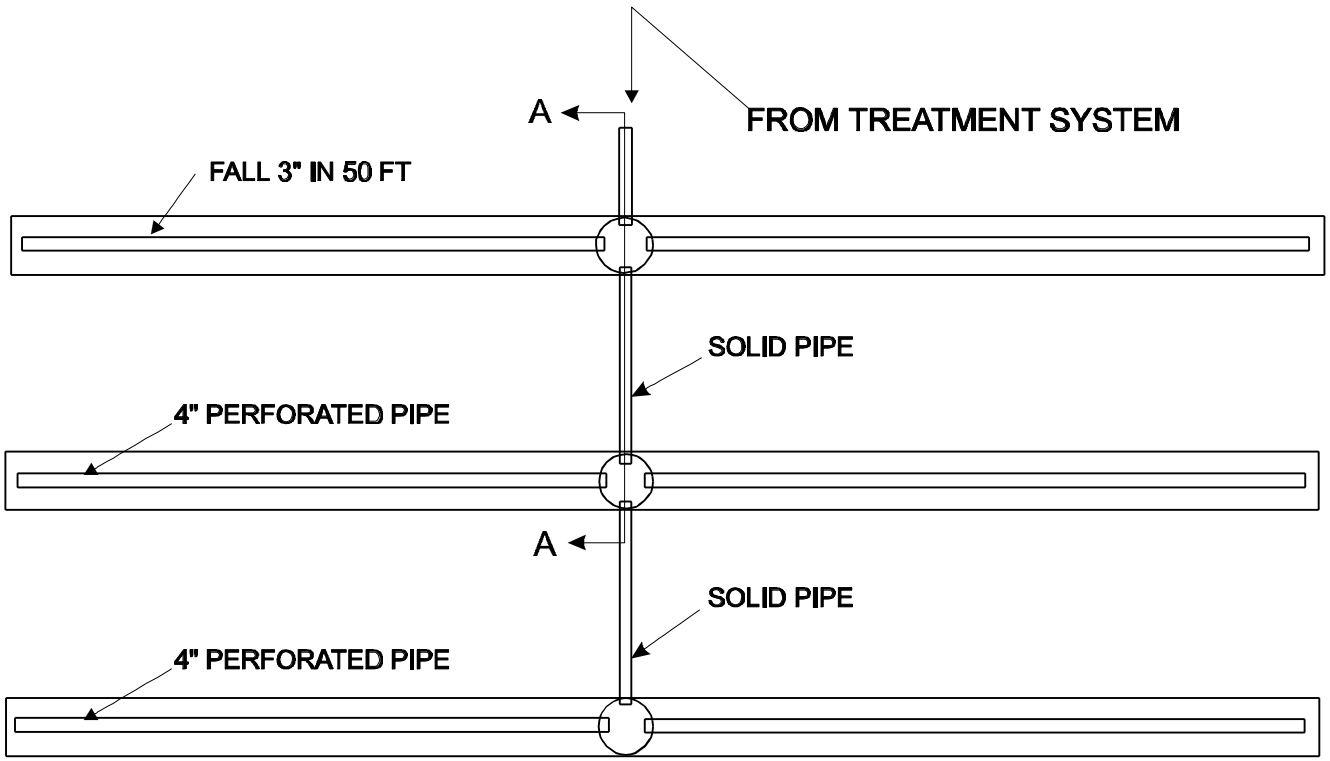


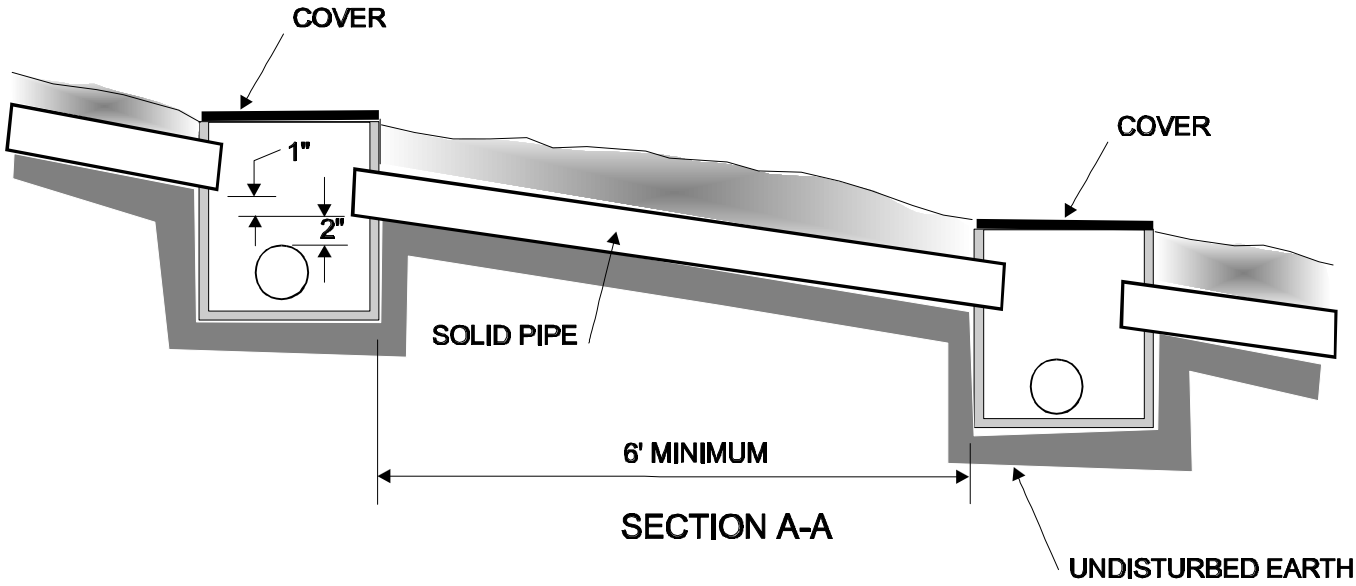
DISTRIBUTION BOX SECTION

EVAPO-TRANSPIRATION TILE FIELD
(FLAT LAND)

APPENDIX



NOTE: DIFFERING GROUND SLOPES OVER SUBSURFACE DISPOSAL FIELD MAY REQUIRE USE OF VARIOUS COMBINATIONS OF FITTINGS.



SERIAL DISTRIBUTION