Commonwealth of Massachusetts
Department of Environmental Protection

NEIWPCC

TITLE 5 SYSTEM INSPECTOR MANUAL

MAY 2021

CHAPTER 1
INTRODUCTION

Subsurface sewage disposal is a proven method of wastewater treatment in areas without centralized sewers and where site conditions are appropriate. However, systems will not continue to function as intended without proper maintenance, and proper maintenance practices can be advanced only through a well-planned inspection process. Many states throughout the country have instituted comprehensive inspection programs. With that in mind, Title 5 of the State Environmental Code (310 CMR 15.000) mandates inspections of sewage disposal systems in accordance with 310 CMR 15.300.

In order to implement the inspection program, it is necessary to have properly trained and approved inspectors. To this end, Title 5 requires that the Department of Environmental Protection provide or authorize training for System Inspectors. This manual is designed to accompany and augment the training course that you are now taking. It will also serve as a reference after the course is complete.

Massachusetts Registered Professional Engineers, Massachusetts Registered Sanitarians and Certified Health Officers must apply to MassDEP to be approved as System Inspectors but are not required to take this course or the accompanying examination. Board of Health members and agents with one year of experience, Engineers-in-Training (EITs) with a concentration in civil, sanitary or environmental engineering, licensed home inspectors, associate home inspectors, licensed septage haulers, licensed system installers or other individuals with a minimum of one year's demonstrated experience in septic system inspection or design must take a course conducted or authorized by the Department and pass a written examination with a grade of 75% or higher.

System inspectors play a vital role in the success of any onsite sewage disposal system. The inspection program mandated by Title 5 will help insure that systems are repaired or upgraded as needed which, in turn, will help insure adequate protection of the public health and the environment.

Good luck as you embark on a career as an approved System Inspector.

CHAPTER 2
ON-SITE SEWAGE TREATMENT & DISPOSAL SYSTEMS

ON-SITE SEWAGE TREATMENT AND DISPOSAL SYSTEMS

This chapter provides an overview of construction considerations and the proper function of various components of on-site sewage treatment and disposal systems. The first section summarizes various components of conventional subsurface systems. Components which are discussed include: septic tanks, distribution boxes, siphons, pumps, dosing tanks, grease traps and the types of leaching facilities allowed under Title 5, such as: leaching pits, trenches, galleries, chambers and fields.

SUGGESTED READING ASSIGNMENTS

Title 5: Standard Requirements For The Siting, Construction, Inspection, Upgrade, and Expansion of On-Site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage (see subparts B and C).

EPA Design Manual Onsite Wastewater Treatment and Disposal Systems, II Office of Water Program Operations, U.S. Environmental Protection Agency, Washington, DC 20460 (see Chap. 6-8)

State of the Art Manual of Onsite Wastewater Management, National Environmental Health Association, 720 S. Colorado Blvd., Suite 990, So. Tower, Denver, CO 80222 (see Chap. 5-8)

CONVENTIONAL SYSTEM COMPONENTS

The septic tank is usually the first in a series of components that make up the subsurface sewage disposal system (see Figure 2-1).

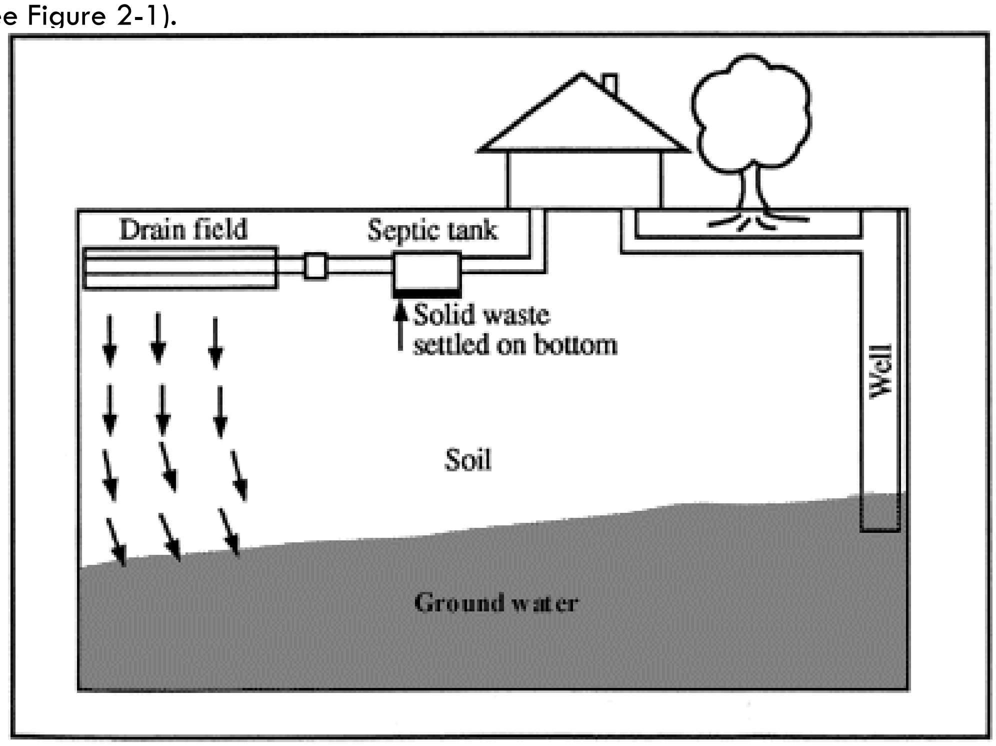


Figure 2-1: Typical Septic/On-site System

The **septic tank,** a watertight container of concrete or other durable material, is usually precast, but in particular circumstances may be constructed on the site. New metal tanks are not allowed. Tanks may be constructed of fiberglass or polyethylene. The most common design is a rectangular box; however, the tank may come in other configurations.

The septic tank is a pretreatment unit and its purpose is to receive raw household wastewater from the plumbing system, separate solids from the liquid portion, and discharge the clarified liquid to a soil absorption leaching facility for further treatment and disposal. When raw sewage enters the tank from the building sewer, the flow is directed downward through the septic tank tee. The heavier solids drop to the bottom of the tank where a layer of sludge forms. Lighter solids and floatable grease will float to the top of the liquid to form a scum layer.

The floating scum layer is prevented from exiting the septic tank with the reasonably clear liquid because of the outlet tee that extends below the bottom of the scum in a properly constructed and operating tank. Some decomposition of the solids occurs during the retention period that the sewage remains in the tank and the reduced material passes into the liquid where it exits the tank through the outlet tee.

The septic tank is a water tight vault that for single-family dwellings must have an effective liquid capacity of at least 200 percent of the design flow of sewage from the building that it serves. The minimum size tank permitted under Title 5 for new construction is 1,500 gallons. The septic tank is connected directly to the building sewer and is usually located below the surface of the ground except in extreme circumstances (as in a velocity zones).

Two compartment tanks or two tanks in series are required by Title 5 when designed to serve facilities other than single family dwellings and whenever the calculated design flow is greater than 1000 gallons per day. When a domestic garbage grinder is proposed or installed, the minimum effective capacity of the septic tank must be 200% of the design flow with a minimum tank size of 1500 gallons. In addition, septic tanks receiving waste from garbage grinders must also be designed to include a two-compartment tank or two tanks in series. Garbage grinders are prohibited in systems that include elevated septic tanks.

Septic tanks must be installed level and true to grade. If placed in fill, proper compaction is required to ensure stability and minimize uneven settling. All tanks must be covered with a minimum of 9 inches of soil. At least three 20 inch diameter manholes with readily removable covers must be provided for each septic tank. Access ports must be placed at the center and over each inlet and outlet tee for inspection and cleaning. Title 5 (section 15.228 (3)) also prohibits the placement or construction of a structure on or over a septic tank where it may interfere with tank access. Please refer to section 15.228 for additional detail. Figure 2-2 provides a cross sectional view of a typical septic tank.

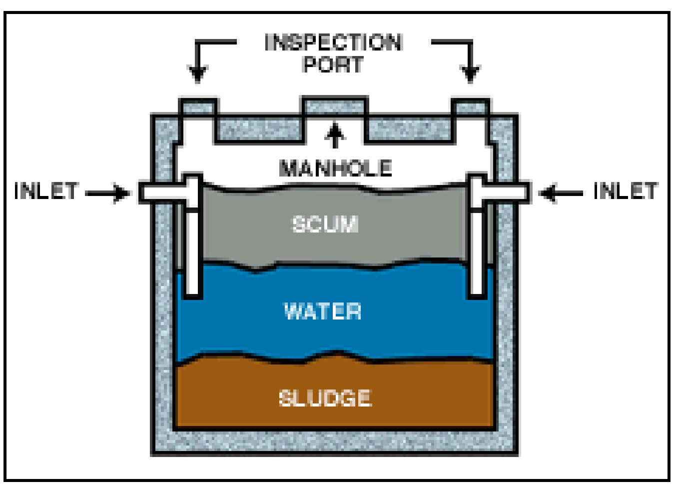


Figure 2-2: Cross Sectional View of a Typical Septic Tank

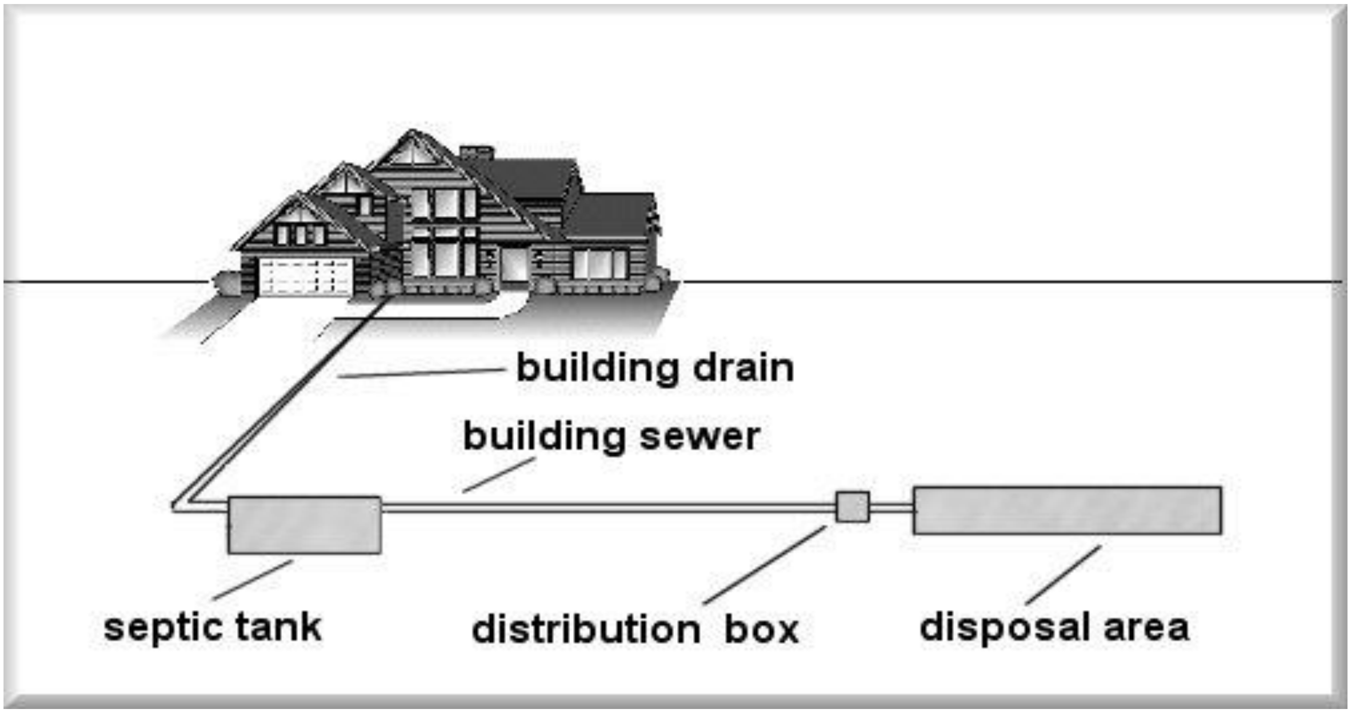


Figure 2-3: Distribution box relative to other treatment units.

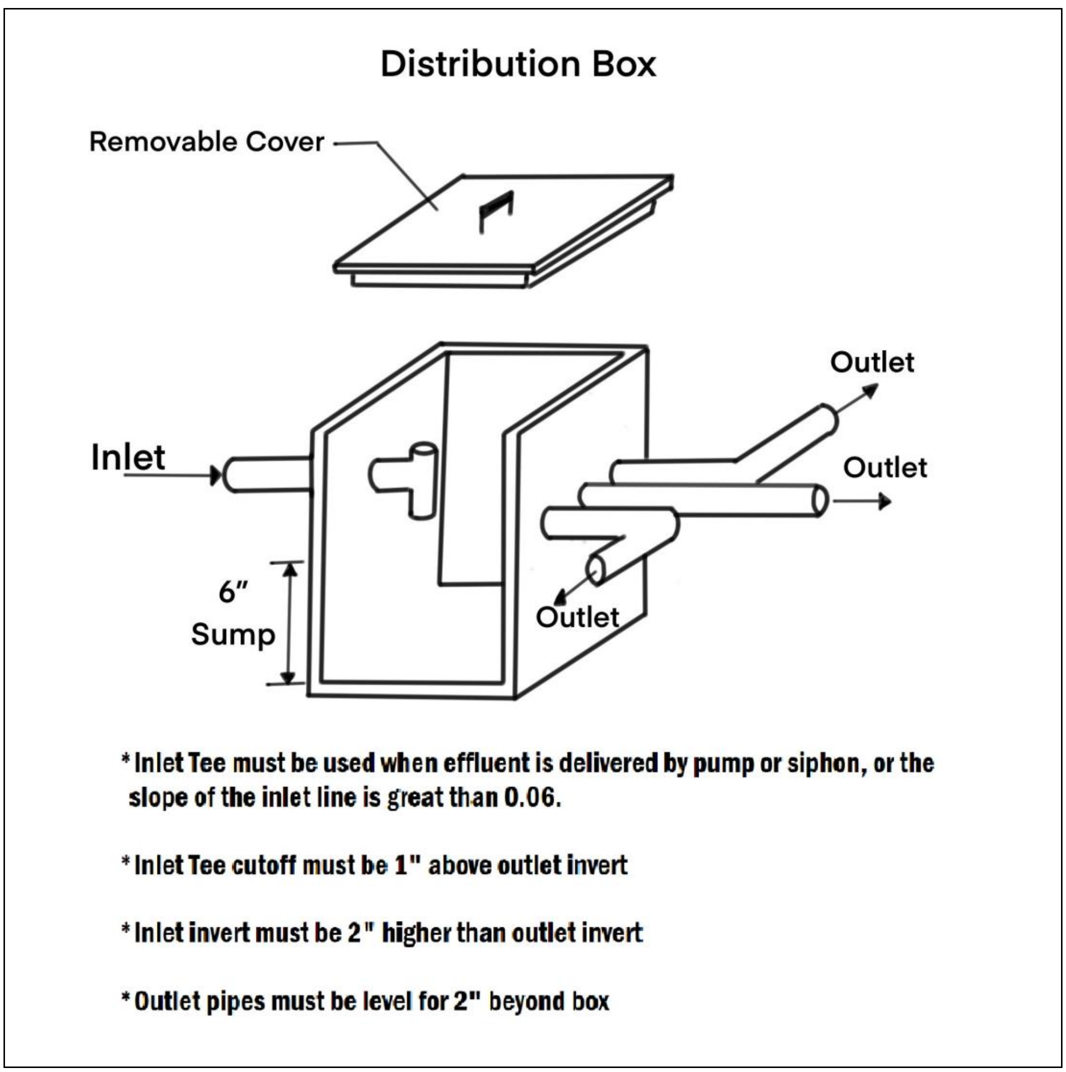


Figure 2-4 Typical D-Box Detail

A **distribution box** (d-box) is the next component in the typical subsurface sewage disposal system and is located between the septic tank outlet and the leaching facility. The distribution box, made of concrete or other durable material, must be watertight and easily accessible for inspection and cleaning. The purpose of the distribution box is to receive the flow of clarified liquid waste from the septic tank and to distribute this liquid evenly through a series of outlets discharging the wastes into the leaching facilities. They should be installed level and on a stable base with 6" of crushed stone underneath. D-boxes that are more than 9" below grade must be equipped with risers. Figure 2-3 shows the location of the D-box in relation to other treatment units and Figure 2-4 presents details of a typical distribution box.

As with septic tanks, d-boxes are generally constructed out of concrete but may also be constructed of plastic or other materials approved by DEP, if anchored in place or on a concrete pad which is at least 6 inches in thickness and 1.5 times the bottom surface area of the box. The d-box must have an inside minimum dimension of 12 inches with a minimum wall thickness of 2 inches as described in 310 CMR 15. 232 and have a water tight cover. It is extremely important that the d-box be level for proper distribution of the effluent to the soil absorption system.

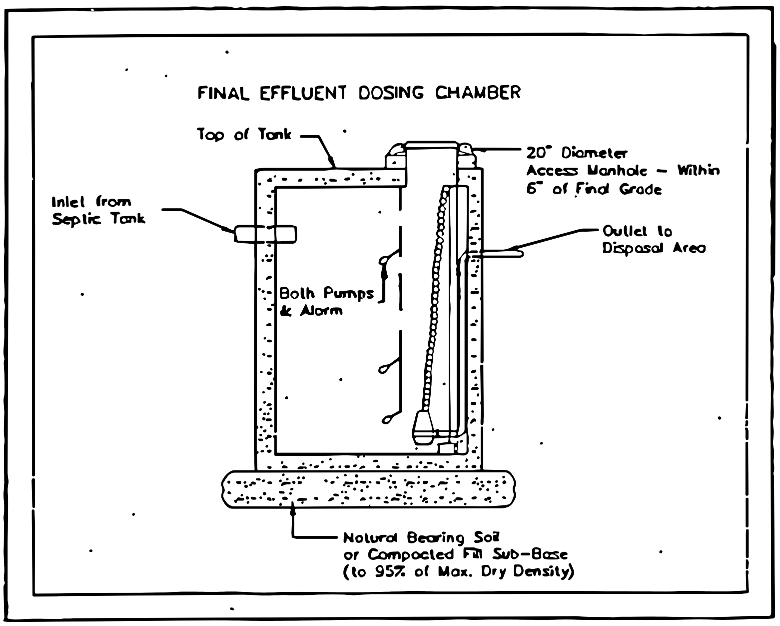


Figure 2-5 Cross Section of a Typical Dosing Chamber

Dosing/ Pump tanks or chambers are used in particular situations where it is necessary to elevate wastewater for further treatment or disposal. Dosing/pump tanks are required for any system designed for intermittent discharge of septic tank or recirculating sand filter effluent, in conjunction with pressure distribution, for any system with a design flow of greater than or equal to 2,000 gallons per day or where multiple soil absorption systems are proposed.

All dosing/pump tanks must be water tight and have an emergency storage capacity above the working level equal to the daily design flow of the system. They must also be equipped with sensors and high water alarms to protect against overflow due to failure of the pump or pump controls. A Department approved effluent filter is required prior to or within the dosing tank.

The dosing tank should be constructed of concrete or other approved material and vented through the building sewer or other suitable outlet. A single pump is required for each tank serving two dwelling units or less. Tanks serving more than 2 dwelling units must be equipped with two alternating pumps with discharge lines properly valved to allow dosing of the entire absorption system by either pump. Tanks must also be equipped with at least one 20 inch manhole located at final grade as described in 310 CMR 15.231. A cross section of a typical dosing chamber is provided in Figure 2-5.

The use of **siphons** for on-site systems, including shared systems is not allowed unless approved as a component of a recirculating--sand filter or other alternative technology. Siphons operate by building up a head of wastewater and then releasing it much like sucking water through a hose to drain a flask or barrel.

Pumps are used in a dosing tank where the dosing tank is at a lower elevation than the disposal field or the discharge point. Pumps are usually installed between the septic tank and the distribution box or leaching facility. System designs specifying pumping of sewage to a septic tank may be approved for single-family dwellings. This is acceptable where the pump discharges a volume of sewage less than 25% of the design flow of the system provided the pump discharge pipe is connected to the building sewer. For non-grinding pumps the flow rate is less than 60 gallons per minute and the septic tank has a minimum effective volume of 1,000 gallons. . For systems where grinder pumps are proposed, the discharge flow rate must be less than 20 gallons per minute and the septic tank must be at least 1500 gallons. Pumping systems designed to pump to the septic tank not meeting these minimum specifications are prohibited.

As previously stated, at least two pumps must be installed, except for systems serving two dwelling units or less. Pumps must be capable of passing a minimum solid size of 1 1/4 inch diameter and shall be installed in strict conformance with the manufacturer's specifications. Pumps must also have approved controls to ensure the correct pumping sequence:

a. Pump off
b. Lead pump on
c. Backup (lag) pump on and alarm on
d. Pumps must alternate.

All pumps must be equipped with an alarm located in the building served which is powered by a circuit separate from the circuit to the pumps. Standby power should be provided at apartment houses, condominiums, elderly housing and all either premises, which are not vacated during power failures. Pumps, alarms, and other equipment requiring periodic or routine inspection and maintenance must be maintained in strict conformance with manufacturers specifications. Inspections are required, at a minimum, once every three months for pressure distribution systems over 2000 gpd and annually for systems less than 2000 gpd as stated in 310 CMR 15.254.

Grease traps are required for some subsurface sewage disposal systems, such as those of restaurants, nursing homes, hospitals, schools and other installations likely to be discharging wastes with a high content of grease. Grease traps are to be installed on a separate building sewer serving that part of the plumbing system into which the grease will be discharged. The discharge from the grease trap must flow to a properly designed septic tank or a building sewer prior to the septic tank. The purpose of a grease trap is simply to remove grease from wastewater prior to treatment. Grease traps are small watertight flotation chambers where grease floats to the surface of the liquid and is retained while the clearer liquid below exits the tank or chamber. The grease trap design is similar to that of the septic tank (see Figures 2-6 & 2-7).

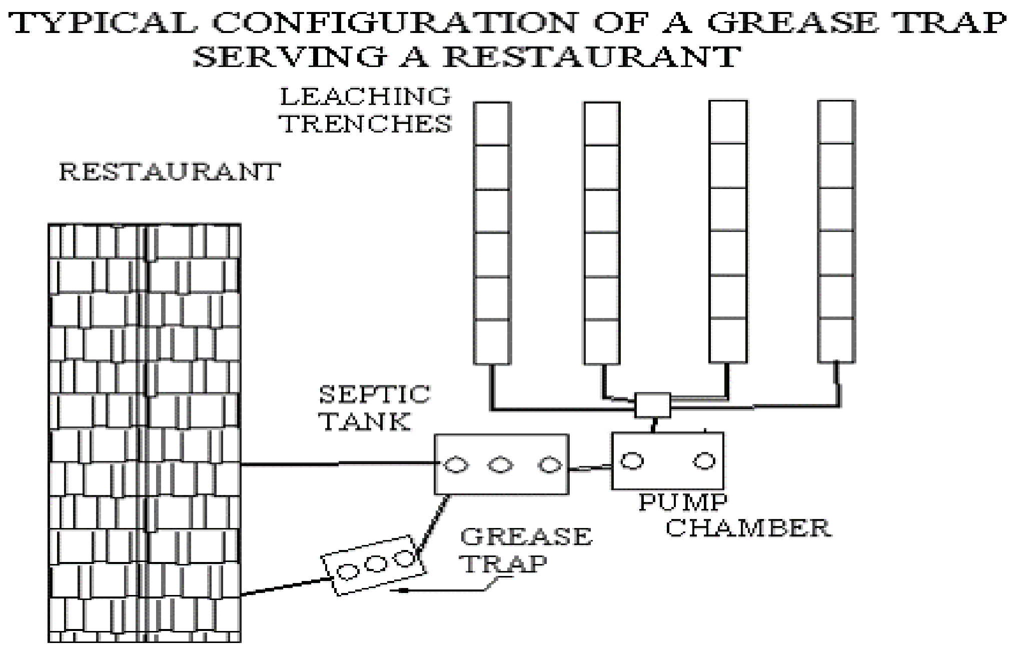


Figure 2-6

Grease traps must have a minimum depth of 4 feet and have a minimum capacity of 1000 gallons. *(310 CMR 15.230)* Sufficient capacity must be provided for the kitchen flow equal to at least a 24-hour detention period. Constructed tees must be schedule 40 PVC and properly supported by a hanger, strap, or other device. The inlet tee must extend to mid depth of the tank and the outlet tee must extend to within 12 inches of the bottom of the tank. The invert of the inlet tee must be at least two inches above the invert of the outlet tee. Access to each tee must be provided with a minimum manhole frame diameter of 20 inches that is located at final grade. All grease traps must be accessible for inspection and maintenance.

All grease traps must be inspected monthly and must be cleaned every three months by a licensed pumper or whenever the grease is 25% of the effective depth, whichever is sooner.

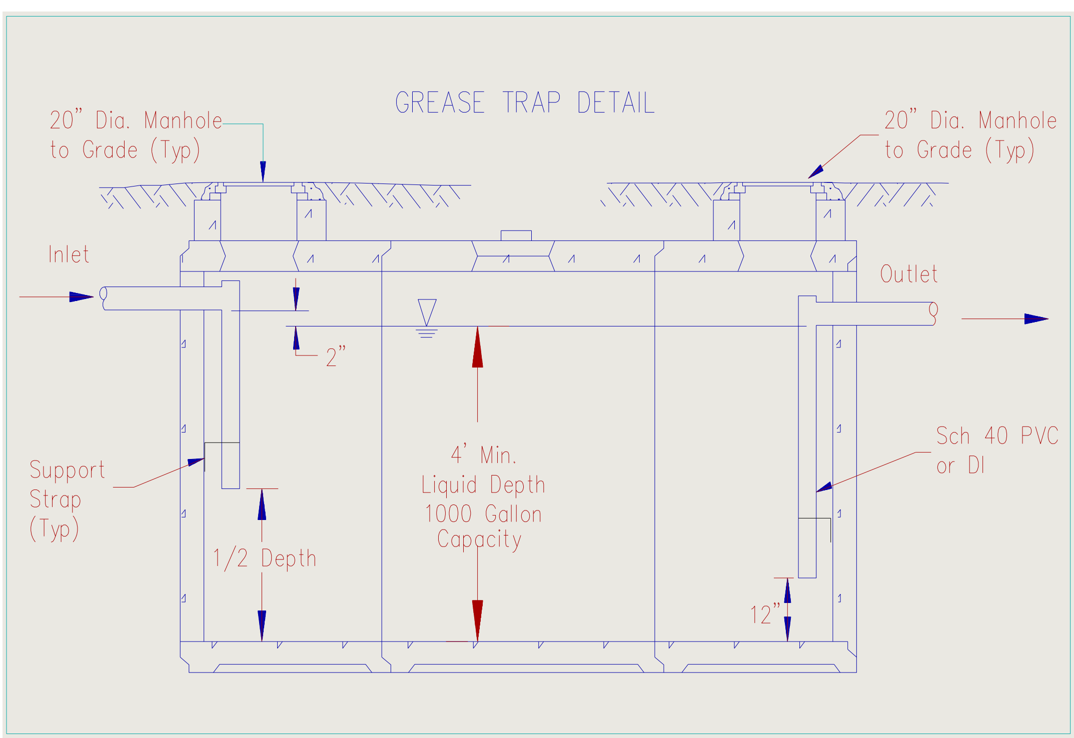


Figure 2-7

SOIL ABSORPTION SYSTEMS (SAS)

The effluent, or sewage, exiting from the septic tank has undergone primary treatment in that unit. The heavier solids have settled out at the bottom of the tank and the lighter solids, floating at the top of the liquid portion, are retained in the tank as the effluent passes under the lower opening of the outlet tee and is discharged through the outlet pipe. The partially treated sewage is carried by this watertight pipe to the leaching facility where it will undergo final treatment and disposal. The watertight pipe may carry the effluent directly into the soil absorption system (as in the leaching pit), to a distribution box (as in leaching trenches or beds), or through distribution outlets in galleries and chambers.

As the partially treated effluent enters the leaching facility, it begins to percolate through the stones placed in the soil absorption system (SAS) and then into the surrounding soil. Very shortly after the SAS is placed in use, a biological "mat" begins to form at the interface between the stones and the soil. This biological mat, or "slime area", is made up of millions of bacteria whose role is to break down the organic matter in the sewage. This mat enlarges in time as the system receives more use. The mat slows the infiltration of the liquid into the soil, thus maintaining unsaturated soil conditions below the mat. As effluent passes through the mat and then through the unsaturated soil below, pathogenic organisms and other pollutants are removed 'from the liquid before it reaches the groundwater. Final treatment of effluent in the subsurface sewage disposal system occurs in the SAS and its surrounding soil.

If the SAS is properly located, designed and constructed in acceptable soil, the pathogenic bacteria and fine solids will be removed from the sewage as it passes through the leaching facility and surrounding soil. The liquid may eventually pass into the water table without a public health risk. A much lesser amount of the liquid sewage may pass into the atmosphere from the SAS and soil, by evaporation, again without a risk to public health.

There are several types of SASs that are acceptable for use under Title 5. Each type of SAS must provide a temporary retention area for the liquid sewage and a stone interface with the surrounding soil to allow for development of the biological slime layer that builds up in a functioning sewage system. The SAS must be located in pervious soil that is capable of accepting and dispersing the liquid sewage being discharged into the facility from a septic tank. In order to assure this, the code is now requiring a soil evaluation for each system that must be conducted by soil evaluators certified by DEP.

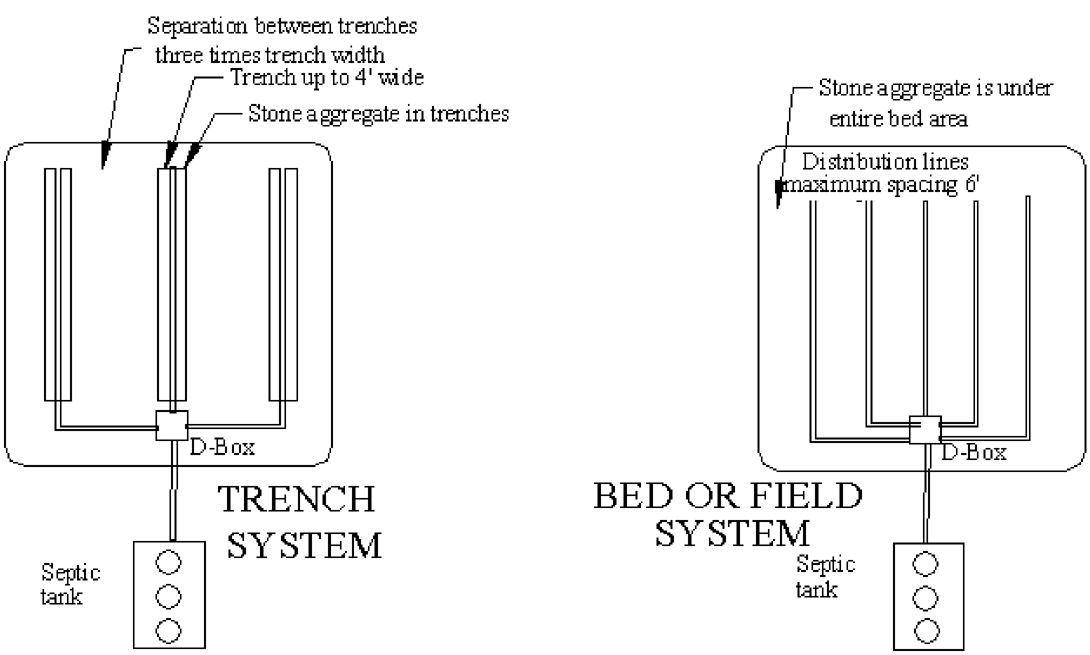


Figure 2-8

Leaching trenches are the preferred system for soil absorption whenever feasible. When trenches cannot be used because of area limitations, other soil absorption system configurations may be proposed. Leaching trenches, like **leaching fields** (sometimes called leaching beds), differ from other designs in that they have no cavernous interior for the temporary retention of sewage while it is dispersed into the surrounding soil. The leaching trenches and fields are filled with 3/4 to 1-1/2 inch size washed stone and it is within the spaces between these stones that the sewage is retained temporarily pending absorption by the soil that surrounds the facility (see Figures 2-8 & 2-9). The leaching area used in conjunction with the long-term acceptance rate (LTAR) determined in accordance with section 15.242, shall be considered as the pervious area of the bottom of each trench and up to two feet of the sidewall of the excavation below the invert of the inlet. Impervious areas of sidewall below the inlet shall not be considered as available leaching area. However, the leaching area of the leaching field, determined under section 15.252, is limited to the pervious bottom area of the excavation only and shall not include any sidewall area.

The minimum separation distance between any two trenches must be two times the effective width or depth of each trench, whichever is greater. When the area between trenches is designated as the reserve area, the minimum separation distance is at least three times the effective width or depth of each trench, whichever is greater. Trenches can have a minimum width of 2 feet and a maximum of 3 feet and must be situated, wherever possible with their long dimension (100 feet maximum length) perpendicular to the slope of the natural soil.

A reserve area sufficient to replace the capacity of the original leaching area must be provided in all installations with no permanent structures over it. *(310 CMR 15.248*) The area between leaching trenches may be used for part of the reserve area only where the separation distance between the excavation sidewalls of the primary trenches is at least three times the effective width or depth of each trench, whichever is greater.

The use of leaching fields or beds is restricted to systems with a calculated design flow of less than 5,000 gallons per day per field. In field designs there must be a minimum of 2 distribution lines. A maximum separation distance between lines of 6.0 feet is required and a distance of 10 feet must be maintained between fields. The maximum length of each field allowed by the code is 100 feet. Additional specifications for the design of fields or beds can be found in section 15.252.

Common to both trench and field systems are the transmission or distribution lines that convey the septic tank effluent to the absorption system. One or more d-boxes with unperforated pipes are used as conveyance pipes between the d- box and the SAS. Unperforated pipes with tight joints are also used as distribution pipes between the septic tank and the distribution box. Closed pipes are also used between trenches.

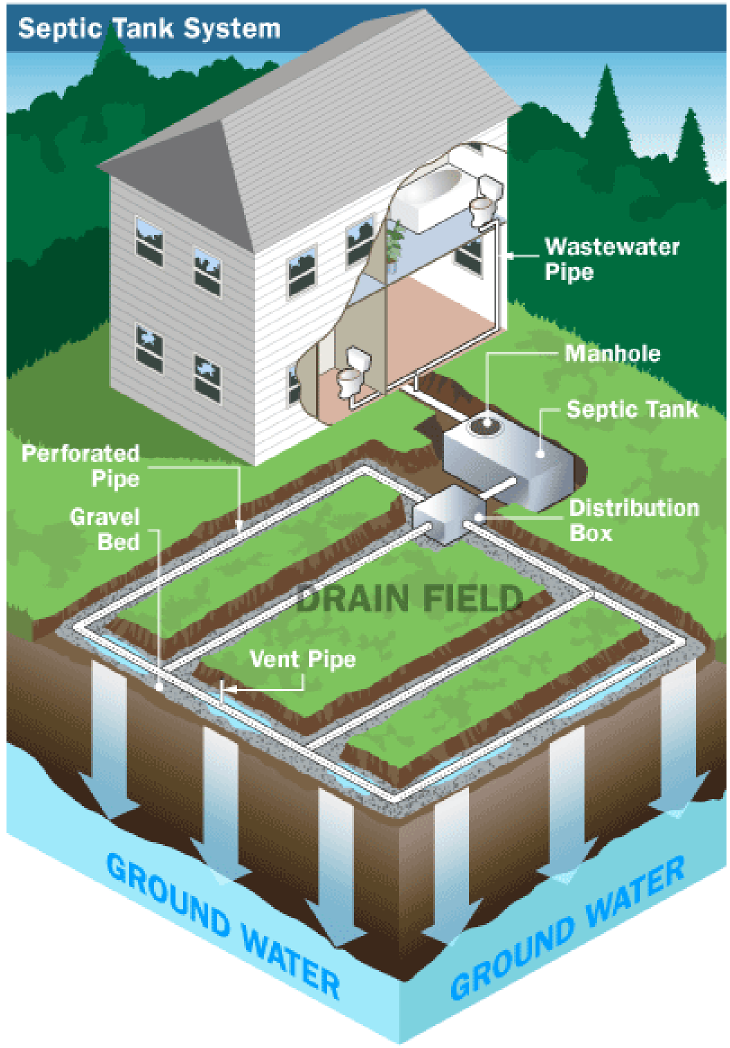


Figure 2-9

Sewage discharged from the septic tank is carried by closed pipe to a distribution box where the sewage flows into the box through an inlet. A series of outlets, all at the same elevation carry the sewage from the distribution box by closed pipes to the leaching trenches or fields. Within the leaching trench, perforated or open joint pipe is used to transport the sewage along the entire length of the trench while allowing some portion of the sewage to drain out of the perforations or open joints along the way. The sewage is thus evenly distributed among multiple trenches and over a large area of stone.

The sewage drains into the spaces between the stones where it comes into contact with the biological slime layer where biological and chemical reactions result in further treatment of the sewage. The sewage then passes into the surrounding soil where more organic and inorganic matter is removed. Some sewage is removed through capillary action and evaporation at the same time. The process in a leaching field is essentially the same, except that the distribution box is usually located within the leaching field and therefore the pipes exiting from the distribution box are not closed pipes. These are the open joint or perforated pipes that carry the sewage over the entire field. Distribution lines can be constructed of either PVC or ABS materials and must be at least 3 inches in diameter. Lines exceeding 50 feet in length must be properly vented in accordance with the provisions provided in section 15.241.

On sloping lots it is often necessary to locate leaching trenches at different elevations. This may be accomplished by using distribution boxes connected by closed pipes but must meet critical slope requirements. Sewage may be discharged into one or two trenches at an upper level from openings in a distribution box, while one or more additional openings in the same box may be used to carry sewage in a closed pipe to a second distribution box at a lower level, which in turn may service one or more additional trenches. Sewage may be disposed of in trenches on the upward slope of a septic tank in a similar manner. It would be necessary to add a pump to force the sewage exiting from the septic tank up to a distribution box at a higher elevation where it could flow by gravity to one or more leaching trenches. Where trenches are constructed at different elevations they must be designed to prevent effluent from the higher trenches from flowing into the lower trenches.

When area requirements do not permit the use of a trench system a **leaching pit** provides another alternative. A large excavation is required for the leaching pit. The lining of the pit is usually constructed in a cylindrical fashion. Pits must be constructed of precast perforated concrete or interlocking concrete blocks laid dry with open joints in a manner to prevent displacement. The cylinder may be brought to a cone at the top with a manhole, or covered with a large slab containing a manhole. The liner is surrounded on the outside with 12 to 48 inches of 3/4 to 1-1/2 inch size washed stone (see Figure 2-10). Covering this stone is a two-inch layer of washed stone ranging from 1/8 to 1/2 inch in size. The interior of the liner, along with .the spaces in between the stones surrounding it, provides storage space for the sewage while it is being dispersed into the soil at the bottom and through the open- jointed and rock filled sides.

Leaching pits may not be constructed in areas where the maximum groundwater elevation is less than four feet below the bottom of the excavation. Excavations into or fill upon impervious material are not allowed. Excavations through impervious material may be allowed if at least four feet of naturally occurring pervious material, as demonstrated by a percolation test and soil evaluation, remains beneath the lowest point of the excavation. When more than one leaching pit is installed, they must function in parallel and the distance between excavation sidewalls may be no less than twice the effective width or twice the effective depth of the pit, whichever is greater. When pits are built at different elevations, construction shall be such as to prevent sewage from upper pits from flowing into lower pits.

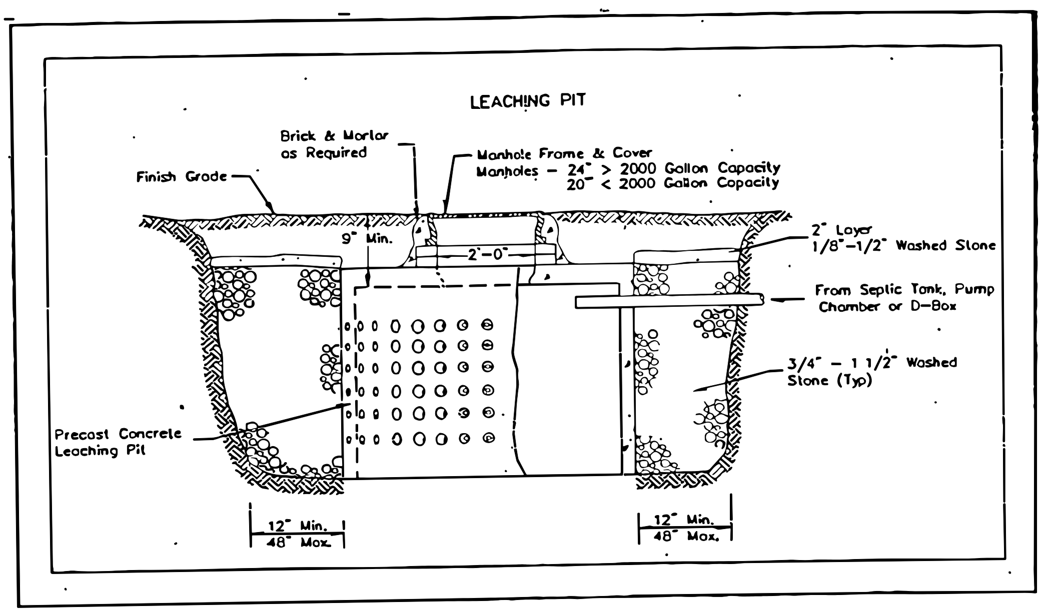


Figure 2-10

The leaching area required must be determined in accordance with the provisions of section 15.242. The leaching area shall be considered as the pervious bottom area of the excavation and a maximum of two feet of side-wall depth below the invert of the inlet per unit. Impervious area of the sidewall below the inlet may not be considered as available leaching area.

A reserve area sufficient to replace the capacity of the original leaching area must be provided in all designs and construction of subsurface sewage disposal systems. The area between leaching pits may be used for part of the reserve area.

For further specifications for leaching pits, refer to section 15.253.

Leaching galleries and **leaching chambers**, like the leaching pit, provide a large interior for visual observation to determine proper functioning, except that they are usually constructed in a rectangular or square manner and are generally shallower than the leaching pit (see Figure 2-11). Leaching galleries and chambers have open joints and are surrounded with washed stone as in the leaching pit. The sewage entering these facilities is dispersed in the interior and in the spaces between the surrounding stones, temporarily, as it is dispersed into the soil. Construction specifications for these systems are provided in section 15.253.

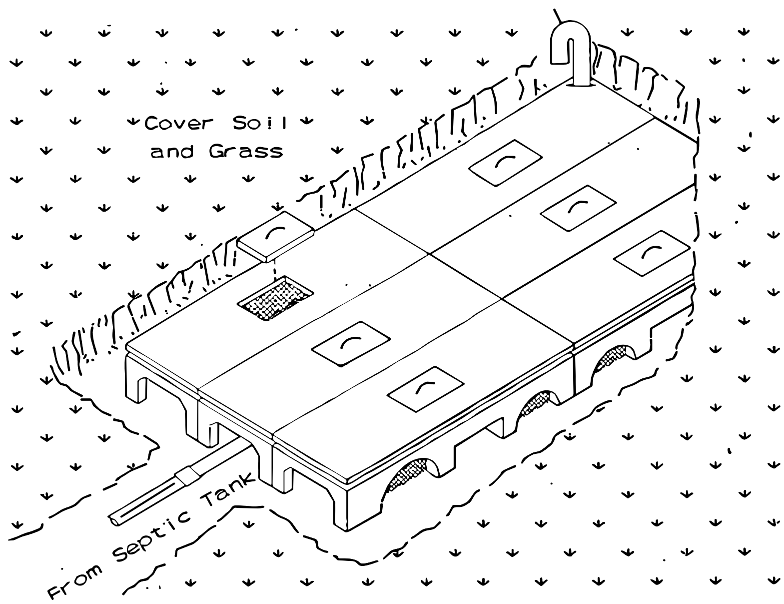


Figure 2-11

Construction in fill is allowed provided there is at least 4 feet of naturally occurring pervious material present beneath the proposed soil absorption system. Soil absorption systems constructed in fill must be sized using the 'soil type of the underlying naturally occurring pervious material. Systems constructed in fill that extend either wholly or partially above natural grade for the purpose of complying with the 4 foot separation to groundwater are considered mounded systems. It is important to note here that there are two separate 4 foot separations required by the code (i.e. depth to groundwater AND depth of naturally occurring pervious material beneath the soil absorption system) These requirements are independent of each other and as such much be evaluated independently. A typical mound system used to maintain the 4 foot separation to groundwater is presented in Figure 2-12.

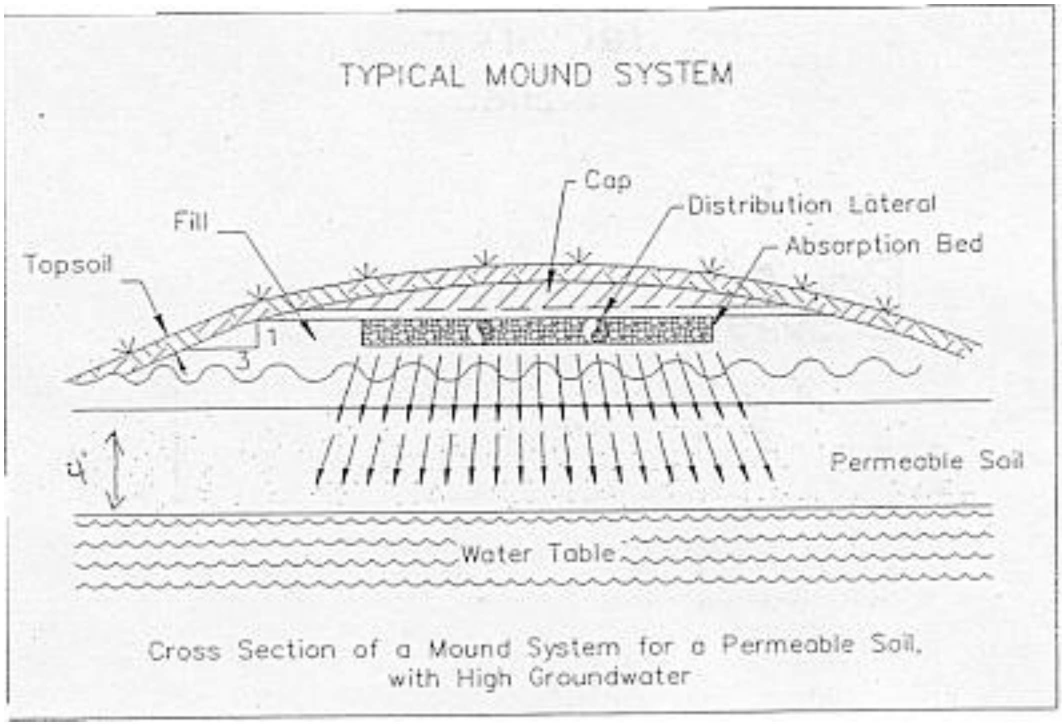


Figure 2-12

Where fill is required to replace unsuitable or impermeable soils (not including the 4 feet of naturally occurring pervious material) the excavation of the unsuitable material must extend a minimum of five feet laterally in all directions beyond the outer limit of the soil absorption system to the depth of naturally occurring pervious material. Replacement fill must meet the specifications provided in section 15.255(3) .For mounded systems the side slopes cannot be steeper that 3:1 (horizontal: vertical) and a minimum horizontal separation distance of 15 feet must be provided between the soil absorption system and the adjacent side slope, as measured from the edge of the top of the two inch layer of 1/8 to ½ inch stone aggregate. In addition, the toe of the slope must be at least five feet from any adjacent property line or a swale or other drainage system provided to prevent runoff from migrating to the adjacent property. Adjustments to the side slope criteria may be allowed if a suitable impervious barrier, such as a vertical concrete retaining wall is provided that meets the specifications provided in section 15.255(2). Figure 2-13 illustrates the necessary slope requirements.

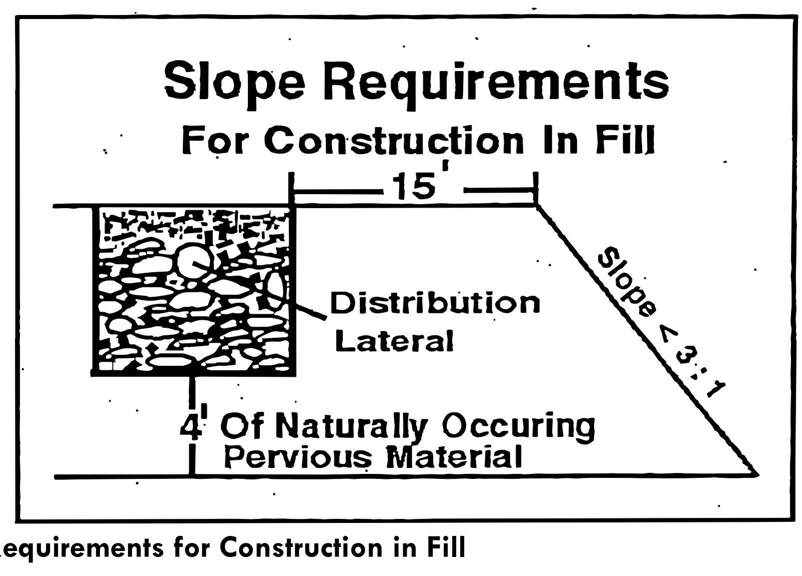
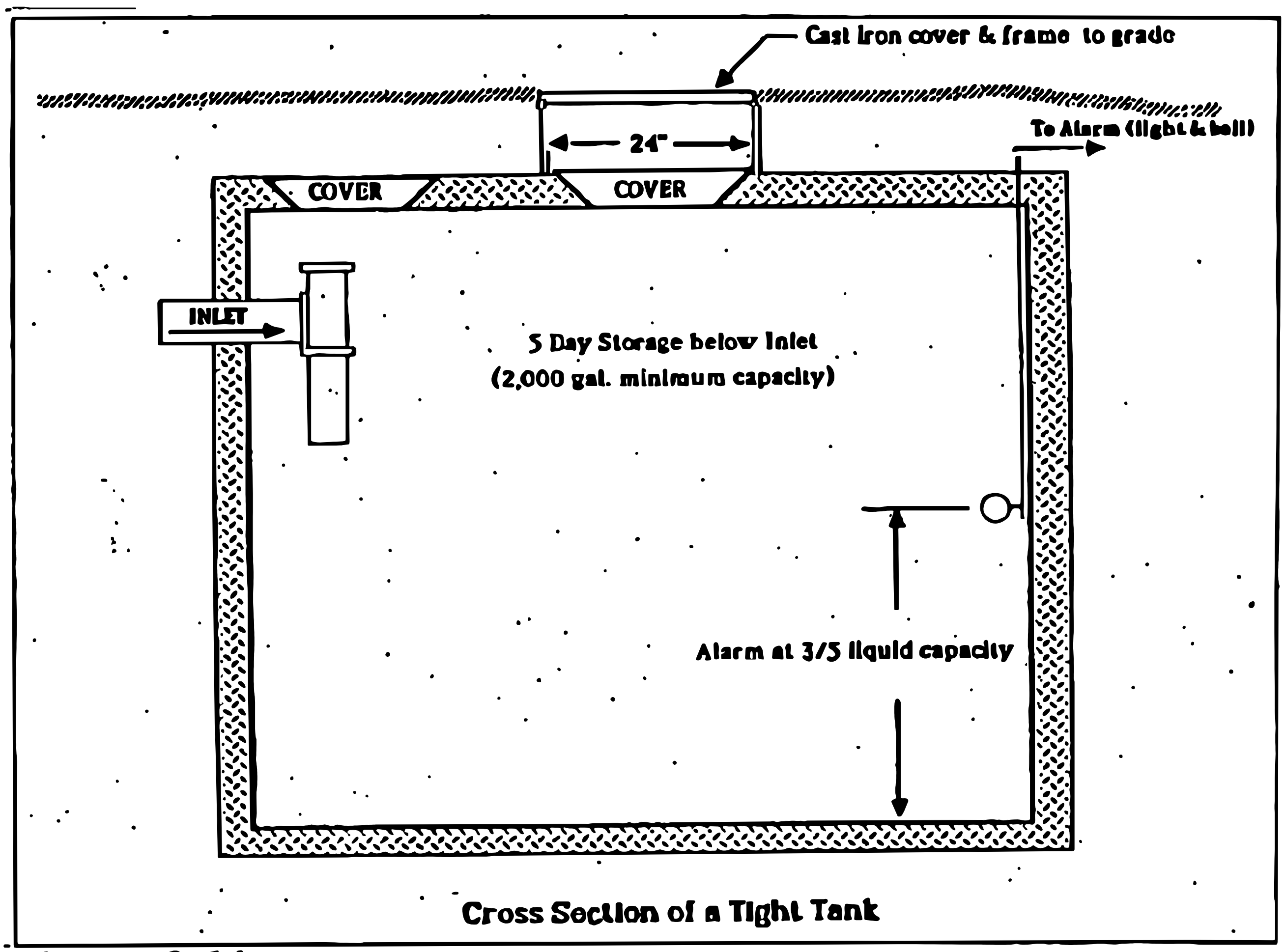


Figure 2-13: Slope Requirements for Construction in Fill

A **tight tank** is a large water tight tank used for storage of sewage. It has an inlet but no outlet. Tight tanks <u>cannot</u> be approved for new construction or for increased flow to existing_systems. Tight tanks may be used only with DEP and/or Approving Authority prior approval to eliminate a failed on-site system when no other feasible alternative to upgrade the system exists. Tight tanks must be sized at a minimum of 500 % of the sewage system design but in no case less than 2000 gallons. Tanks also must be equipped with audio and visual alarms set to activate at 3/5 of the tank capacity. Applications must indicate the method and frequency of removal of the contents as well as the specific location and method of disposal. At least one 24-inch diameter frame and cover at finished grade must be provided for year round access for pumping. (310 CMR 15.260)

Prior to the issuance of a permit for installation, the facility owner will record the Department and/or Approving Authority approval. No tight tank shall be constructed in a velocity zone on a coastal beach, barrier beach, or dune or in a regulatory floodway.

Figure 3-14 provides a cross sectional view of a typical tight tank configuration.



Cross Section of a Tight Tank

Figure 3-14

CHAPTER 3
NON-CONVENTIONAL TREATMENT SYSTEMS

Title 5 describes design and construction standards for conventional septic tank/soil absorption systems; however, it also provides quite a bit of flexibility for the testing, approval and use of non-conventional systems, including innovative and alternative (I/A) technology. In fact, certain non-conventional systems are required for systems located in nitrogen sensitive areas with design flows greater than 2000 gpd or with design flows that exceed certain density restrictions. As such, System Inspectors should become familiar with these technologies. This section will provide a brief overview of several of these systems. It is not intended to provide detailed information on each type of system; however, design guidances for Recirculating Sand Filters and pressure distribution are provided as appendices to this manual. It is strongly recommended that any System Inspector who anticipates dealing with these types of systems seek appropriate training in the operation and maintenance of them. Otherwise, the inspector, as a matter of ethics, should not inspect these systems.

Recirculating Sand Filters

Title 5 approves recirculating sand filters (RSF) as nitrogen reducing systems and sets the standards of performance for other enhanced treatment technologies.

Recirculating sand filters were developed in the early 1970's in Illinois as a modification to the established technology of intermittent (single pass) sand filters. They are a simple, compact method of providing a higher level of treatment of septic tank effluent as compared to conventional soil absorption systems. RSFs are especially attractive for systems with higher flows or high strength wastes since high rates of failure have been associated with large conventional soil absorption systems nationwide and the higher degree of treatment afforded by RSFs can help insure better treatment, reliability and longevity of these systems. In addition, properly designed RSFs offer nitrogen removal that is important in nitrogen sensitive areas.

A typical RSF system consists of a septic tank, a recirculating tank and a sand filter. Operation of the system begins with primary treatment in the septic tank. The treated septic tank effluent then flows to the recirculating tank. In doses controlled by both a timer and a high level float switch, a mixture of fresh influent and recirculated, partially treated filtrate is applied to a sand filter bed of specified media. The wastewater is dispersed over the media bed through a pressure distribution network, and as the wastewater trickles downward through the sand/gravel media, pollutant reduction occurs through biological treatment on the surface of the media particles.

The treated wastewater (filtrate) is collected at the bottom of the filter, and discharges, either by gravity or by pressure, to the recirculation tank. There it mixes with fresh influent, a portion is discharged, and the cycle begins again. Customarily, a float-activated valve is used to control recirculation and discharge. Treated wastewater is discharged to an approved soil absorption system.

An important design factor in the sand filter dosing is the recirculation ratio (RR). The RR is defined as the ratio of the total flow through the sand filter to the forward (or average design) wastewater flow. Typical RR values for an RSF system range between 3:1 to 5:1. Besides determining the amount of wastewater to be pumped, the RR helps avoid odors by ensuring that the majority of wastewater applied to the sand filter is previously treated wastewater.

Typical effluent values for conventional systems for BOD_5 range from 28-84 mg/L and for TSS range from 18-53 mg/L. RSFs, properly operated and maintained can consistently achieve BOD_5 and TSS values under 10 mg/L. Depending upon design, nitrogen removal in RSFs can range from 40%-80% resulting in concentrations ranging from 10-30 mg/L.

310 CMR 15.202(4)*(h)* requires that RSFs be inspected annually by a Massachusetts certified wastewater operator. In addition, the Board of Registration of Operators of Wastewater Treatment Facilities will require that the owner/operator of RSFs execute a contract or maintenance agreement with a certified operator of appropriate grade. As such, RSFs will be subject to a higher level of oversight than conventional onsite sewage disposal systems. Appendix A provides much more detailed information on the design, operation and maintenance of RSFs and provides information on operation, maintenance and inspection parameters.

Pressure Distribution

Uniform application of septic tank effluent throughout the leaching system is an important factor in the proper operation of an onsite subsurface sewage disposal system. Gravity application does not provide uniform distribution and can create localized ponding within the leaching system. This can inhibit proper treatment and is of special concern in larger systems where failure rates have been documented to be higher than in smaller, residential systems. Pressure distribution networks can be employed as a means of achieving uniform application and can overcome the limitations of gravity distribution systems. Pressure distribution is required for systems with a design flow in excess of 2,000 gpd.

The pressure distribution network usually consists of 1 to 3 inch perforated laterals connected by a central or end manifold of larger diameter. Pumps pressurize the network and are sized to provide relatively uniform distribution. Because the perforations of the distribution laterals are loaded at approximately the same pressure they will discharge at approximately the same rate. Systems serving a facility of less than 2000 gpd are to be inspected annually and systems over 2000 gpd are to be inspected quarterly.

- **In-line Pressure:** The pressure network should be designed to provide a minimum of 2 to 3 feet of head at the distal ends of the laterals. The variation in flow rate between two orifices in the same lateral should not exceed 10% and the variation in flow between any two orifices in the network should not exceed 15%.

- **Perforation Spacing:** Uniform distribution can best be achieved by providing as many uniformly spaced perforations as is practical. Minimum perforation size should be ¼ in. since smaller perforations will tend to clog. It is recommended that the spacing between perforations should not exceed five (5) feet; however, shorter spacings are more desirable. In bed systems, the perforations between any two laterals should be staggered so that they lie on the vertices of equilateral triangles.

- **Manifolds:** In order to minimize flow variation, the manifold should have as small a volume as possible. Also, in order to minimize leakage as the network is pressurized, the manifold should be installed below the distribution laterals so that it fills and pressurizes before discharge from the perforations occurs.

Appendix B provides detailed design procedures for pressure distribution systems. Generally, inspections of these systems will be limited to checking that the pumps are operating as required unless there are other indications of gross failure of the soil absorption system.

Grey Water Systems
Greywater from facilities may be discharged or reused in accordance with the provisions set forth in 310 CMR 15.262. The discharge from an on site systems consists of grey water as defined in 310 CMR 15.002 (Greywater) may be reduced by no more than 50%. The depth of the soil over the system shall be at least 9 inches with backfill clean and free of stones greater than 2 inches in size. Greywater can be discharged using an alternative to a soil absorption system that is approved by the Department. These systems are to be operated, maintained, and inspected according to 310 CMR 15.300.

Composting Toilets
Composting toilets accept toilet waste only in a waterless or semi-waterless unit. Human waste is decomposed in a composting vessel and the final compost is removed periodically. A disposal system (comprised of a septic tank and soil absorption system) is required for graywater.

Amphidrome Process
The Amphidrome Process makes use of an innovative configuration of Tetra Technology's Colox and Denite (denitrification) processes. Colox is an upflow, packed bed aerobic biological treatment process. It utilizes fixed-film granular media that has a high specific surface area for the attachment of bacteria. This allows the development of a high density biomass in a very small space. As a result the hydraulic detention time is quite long. The Denite filter system is a columnar biological denitrification process that employs microorganisms growing on the fixed surfaces of the filter media to convert oxidized nitrogen in the wastewater to gaseous nitrogen under anoxic conditions. In order to accelerate the denitrification reaction, a carbon source is added to the nitrified wastewater to supply the energy and carbon required by the denitrifiers.

AWT Bioclere System
The Bioclere units utilize a trickling filter concept for wastewater treatment. The unit is added to a conventional system between the septic tank and the soil absorption system. The filter consists of a bed of highly permeable plastic media to which microorganisms are attached and through which septic tank effluent is trickled. The base of the unit serves as a final settling basin which discharges to a traditional leaching area. Nitrified effluent from the settling basin can be returned (pumped) to the septic tank for passive denitrification.

Cromaglass
The Cromaglass System is a Sequencing Batch Reactor (SBR). The unit is a fiberglass tank separated into three chambers. The raw wastewater enters the first chamber. The large particles are retained while the liquid and small particles flow through the retention screens to the second chamber that serves as the primary aeration chamber and provides biological treatment. Agitation and mixing are provided by an aeration process. At preset intervals a batch of processed wastewater is transferred to the third chamber that acts as a settling basin. After approximately one hour of quiescent settling, a portion of the treated effluent is discharged to the soil absorption system.

Eljen In-Drain System
The Eljen In-Drain leaching system provides an alternative leaching system that does not require stone. The In-Drains are constructed of recycled cuspated plastic core and a high grade non-woven biofabric. The biofabric is continuous and wrapped over and under each piece of plastic core. Each In-Drain unit is banded using high strength plastic strapping to provide a final dimension of 3 feet wide by 4 feet long by 7 inches high (3' W x 4' L x 7" H). The In-Drain units are placed on top of 6 inches of concrete sand end to end and the distribution pipe is placed directly on top of the units. The system is then covered with a geotextile fabric. It is intended to be used as a leaching system without stone. When used in a trench

configuration, the Model B provides an effective leaching area of 6.2 square feet per linear foot.

Envirochamber

The Envirochamber is an open bottom leaching chamber molded from high density polyethylene. It is intended to be used as a leaching system without stone. In a trench configuration, the standard Envirochamber provides an effective leaching area of 26.04 square feet and each high capacity Envirochamber provides an effective leaching area of 32.29 square feet.

Infiltrator

The Infiltrator is an open bottom leaching chamber molded from high density polyethylene. It is intended to be used as a leaching system without stone. When used in a trench configuration, each Infiltrator provides an effective leaching area of 28.12 square feet.

KROFTA Compact Clarifier

The KCC 5-2.25 Compact water clarification system is a wastewater clarifier capable of handling flows up to 5 gallons per minute. The KCC clarifier combines the technology of flotation with sand filtration in a compact package in order to provide additional removal of wastewater contaminants such as BOD_5, TSS, phosphorus and nitrogen. The system contains a self-automated control panel that operates both the filtration process and a periodic backwash allowing the system to clean itself.

RUCK System

The RUCK system is a passive denitrifying system designed to treat domestic sewage by means of a parallel septic tanks (receiving graywater and blackwater, respectively), a nitrifying (RUCK) filter and a conventional subsurface leaching system. By mixing the nitrified effluent from the RUCK filter with graywater, enhance nitrogen removal occurs.

SANECO Intermittent Sand Filter

Intermittent sand filters are beds of medium to coarse sands, usually 24 to 36 inches deep and underlain with gravel containing underdrains. Effluent from the septic tank is intermittently applied to the surface and purification of the effluent occurs as it infiltrates and percolates through the sand bed. Underdrains collect the filtrate and convey it to the leaching field.

Smith and Loveless Single Home and Modular FAST Systems

The FAST (Fixed Activated Sludge Treatment) process consists of primary settling zone and an aerobic biological zone. Solids are trapped in the primary zone where they settle. In the aerobic zone, the bacteria attach themselves to the surface of a submerged media bed and feeds on the sewage as it circulates throughout the system. Final discharge is to a conventional leaching system.

Shared Systems

Title 5 allows the use of shared systems for repairs, upgrades and new construction. The implication for System Inspectors is that such systems are required to be inspected once every three (3) years and that, as larger systems, the inspector may come into contact with a variety of systems ranging from conventional to RSFs to innovative or alternative systems. The System Inspector again should be cautioned to limit inspections to those types of systems with which he or she is familiar. This is an issue that not only relates to ethical practice, but also to the question of inspector's liability.

CHAPTER 4
REGULATIONS

Regulations governing system inspections and system inspectors are found in Title 5 at 310 CMR 15.300 through 15.354. These regulations describe the purpose and intent of the inspection process and the responsibilities of the Department, system inspectors and owners. This subpart of the regulations contains inspection and maintenance requirements for all systems, both those already constructed and those that will be built under the rules. Among the most significant provisions are:

Inspection at time of transfer and other circumstances
Inspections of septic systems are required within 2 years prior to the transfer of property, unless weather conditions preclude such inspection in which case the inspection may be completed as soon as weather permits but no longer than 6 months after the transfer, provided the seller notifies the buyer; when there is a change in use, increase in use for which a building permit is required, or a variety of other circumstances (see sections 15.301 and 15.302). Inspections must be conducted by approved system inspectors, who are either designated in the code as being qualified by rule or have passed an examination given by the DEP or their representative.

Definition of failed systems
The rules contain specific definitions of systems failing to protect public health and the environment that must be upgraded. These include: obvious hydraulic failures (breakout or backup); systems located within Zone I of public water supply wells, within 100 feet of public water supply reservoirs or their tributaries, or within 50 feet of surface water bodies; or systems found to be a specific health or environmental threat. See section 15.303. These systems must be upgraded within two years of discovery of the problem. The upgrade standard is maximum feasible compliance. The Board of Health may require an earlier upgrade if there is an imminent health hazard, or may allow a longer time, under an enforceable agreement, if a longer time is needed to achieve an environmentally superior solution. See section 15.305.

Large systems
Existing systems over 10,000 gpd must be inspected once every three years. In addition, the rules classify as significant threats all systems serving facilities with design flows of 10,000 gpd or more which are located within zones of contribution of public water supply wells, within 400 feet of water supply reservoirs, or within 200 feet of their tributaries. These systems must be replaced by treatment plants within five years of discovery, unless the owner demonstrates that the water quality standards are being met at the property boundary or in the receiving waters. The Department may allow a longer time, under an enforceable agreement, if needed to achieve an environmentally superior solution. See section 15.304.

Pumping
The rules establish a performance standard for when pumping septic tanks is required, but also recommend pumping at least once every three years, and at least once every year for homes with garbage grinders. See section 15.351.

The remainder of this section is presented in outline form to facilitate an understanding of the regulations.

I. Purpose and General Provisions

   A. To identify systems which are failing to operate properly;

   B. To educate homeowners about the importance of proper maintenance of system;

   C. To provide an objective basis for requiring upgrades;

   D. Regulations specify owner/operator responsibilities for inspection, maintenance, and upgrade of systems;

   E. Instruct the Department to produce educational materials.

II. System Inspection (15.301):

   A. Required at or within two years prior to transfer of title:

      1. May be extended for three years if system has been pumped annually;

      2. If weather precludes inspection, up to six months after sale to complete inspection if seller notifies buyer in writing of inspection requirements.

   B. Transactions not requiring an inspection:

      1. Taking a security interest in a property (e.g., issuing a mortgage);

      2. Refinancing;

      3. Change in the form of ownership among the same owners (e.g., forming a family trust);

      4. Adding or deleting a spouse to the deed;

      5. Appointment or change of guardian, conservator or trustee;

      6. Transfers between parents and children, full siblings, or when one of the trust beneficiaries has a first degree relationship with the grantor.

   C. Applicability to Specific Transfers:

      1. <u>Condominiums:</u> Condo association is responsible for inspection, maintenance and upgrades.

         a. If the facility has 5 or more units, each system must be inspected at least once every three years.

         b. If the facility has less than 5 units:

            1. Each system is to be inspected at least once every three years; or

2. At the time of transfer of title of any unit, the system serving that unit shall be inspected in accordance with the time of transfer regulations.

2. <u>Foreclosure:</u> Inspection must be within two years prior or six months after execution of memorandum of sale. Can be extended to three years prior if system has been pumped at least once a year.

3. <u>Inheritance (with or without a will):</u> Unless inherited by a spouse or a family relation defined as exempt under Title 5 at 310 CMR 15.301(4)(d), the inspection must be within two years prior or one year after the will being allowed or appointment of an administrator. Can be extended to three years prior if system has been pumped at least once a year.

4. <u>Legal life estate or life (or term of years) interest in trust:</u> Inspection must be within two years prior or six months after death of tenant or expiration of interest in trust for a term of years unless the interest passes to a spouse. Can be extended to three years prior if system has been pumped at least once a year.

5. <u>Inter-family transfers with new parties (e.g. parents' deed property to children):</u> Inspection must be within two years prior to transfer or six months after if weather conditions preclude an inspection at transfer. Can be extended to three years prior if system has been pumped at least once a year.

6. <u>Tax taking by federal, state, or municipal government:</u> Inspection must be within two years prior to transfer by governmental entity to buyer or within six months after right of redemption provided that the governmental entity notifies the buyer in writing of the inspection requirements. Can be extended to three years prior if system has been pumped at least once a year.

7. <u>Levy of execution that results in a conveyance of property:</u> Inspection must be within two years prior to officer's deed of debtor's interest or within six months after the expiration of the right of redemption provided that the officer notifies the buyer in writing of the inspection requirements. Can be extended to three years prior if system has been pumped at least once a year.

8. <u>Bankruptcy:</u> Inspection must be within two years prior to transfer by bankruptcy trustee to buyer or within six months after the transfer provided that the debtor notifies the buyer in writing of the inspection requirements. Can be extended to three years prior if system has been pumped at least once a year.

9. <u>Change in ownership or form of ownership where new parties are introduced:</u> Inspection must be within two years prior to transfer or six months after if weather conditions preclude an inspection at transfer provided that the new party is notified in writing of the inspection requirements. Can be extended to three years prior if system has been pumped at least once a year.

D. Inspections <u>not</u> required at time of transfer if:

1. Certificate of compliance for the system has been issued within past three years and system was

pumped at least once during the third year;

2. Owner of the system or buyer has enforceable agreement with the approving authority to upgrade, connect to sewer or connect to shared system within two years; or

3. The town has a DEP approved inspection program.

E. Required for change in use or expansion of use of facility served by the system if building or occupancy permit is required.

   1. Upgrade required if:
      a. System is a cesspool;
      b. Meets failure criteria;
      c. Is a significant threat to public health safety, environment;
      d. Subject to enforcement order or court order requiring upgrade.

   2. Upgrade not required if system is designed to handle the design flows resulting from the proposed change in use or expansion, unless triggered as described above.

   3. For a proposed addition or footprint change to an existing structure with no increase to design flow, the inspection shall be an assessment of the location of existing components to insure that proposed construction will not be placed over components.

   4. If official records are available for locations, inspection not required for foot print changes.

F. Systems with flow of 10,000 gpd or greater at full build out:

   1. Inspected by the last day of the calendar year pursuant to provisions of 310 CMR 15.006.

   2. Shall be re-inspected at least once during the fifth calendar year following the applicable year of initial inspection.

G. Shared systems shall be inspected every three years.

H. If a facility is divided or ownership of two or more facilities is combined all systems serving the facility or facilities shall be inspected as specified in 310 CMR 15.010(2) or (3).

I. All systems shall be inspected when owner/operator is required to do so by the local approving authority-the Department, or the court.

J. Inspection results:

   1. Required submittals:

      a. To the approving authority on a form approved by the Department within 30 days of the field inspection;
      b. To the Department for systems with flows over 10,000 gpd;

c. To the Department for shared systems;
d. Voluntary assessments are allowed and do not have to be reported to the approving authority if the assessment was not triggered by an inspection requirement;
e. All inspections required shall be conducted by a currently approved System Inspector;
f. The Inspection Form must be filled out in its entirety.

K. Failure to have a system inspected or using a system requiring an inspection according to the regulations (15.301(1) through (7)) constitutes a violation.

L. Failure to submit the required inspection form in accordance with 310 CMR 15.301 shall create a presumption that the required inspection has not been performed.

III. Criteria for Inspection (15.302)

A. Intent is to provide reasonable guidelines for inspections in as non-intrusive a manner as possible.

B. Obtain the following information:

1. General description of components and layout;

2. Source/type and design flow of sewage;

3. Analysis of failure criteria;

4. Water use records for previous two years if a public water supply and records are available;

5. Description of the septic tank;
   a. Approximate age, size, condition;
   b. Distance between bottom of the scum/grease layer and bottom of outlet tee;
   c. Distance between top of grease/scum layer and top of outlet tee;
   d. Thickness of grease/scum layer;
   e. Depth of sludge layer and distance from sludge to outlet tee;
   f. Condition of inlet and outlet tees;
   g. Evidence of leakage into or out of tank;
   h. Evidence of effluent backup;
   i. A copy of pump out records on file with local Approving Authority.

6. Description of distribution box;
   a. Evidence of solids carryover;
   b. Leakage into or out of the box;
   c. Flow equally divided;
   e. Evidence of backup.

7. Description of soil absorption system
   a. Signs of hydraulic failure;
   b. Condition of surface vegetation;
   c. Ponding within disposal area;

d. Encroachments into disposal area;
e. Other sources of hydraulic loading;
f. Location of private water supply well (if any).

C. Minimum requirements:

1. "At a minimum, the septic tank and distribution box if present, or cesspool, if present, shall be located and inspected, and reasonable professional efforts made to locate and identify other components and features, as described in 310 CMR 15.302(2)."

2. Reasonable efforts must be made to complete the information on the inspection form:
   a. Groundwater determination;
   b. Location of components.

IV. Systems Failing to Protect Public Health Safety and the Environment (15.303):

A. Failure criteria applicable to all systems:

1. Backup of sewage into the facility;

2. Discharge to ground or surface water;

3. Static level in d-box above outlet invert;

4. Liquid depth in a cesspool is less than 6 inches from pipe invert or available volume is less than 1/2 day's design flow;

5. Septic tank or cesspool pumped more than 4 times a year;

6. Metal septic tank and/or tight tank if structurally unsound;

7. Cesspool, privy or SAS extends below high groundwater elevation.

B. Failure criteria applicable to cesspools and privies:

1. Cesspool or privy is within 100 feet of a surface water supply or tributary;

2. Cesspool or privy is within Zone I of a public well;

3. Cesspool or privy is within 50 of a private water supply well;

4. Cesspool or privy is less than 100 feet but greater than 50 feet from a private well unless analysis meets Title 5 criteria (15.303);

5. Cesspool has a design flow of 2000 gpd or greater but less than 10,000.

C. Further evaluation required for cesspools and privies near water resources:

1. Within 50 feet of a surface water;

2. Within 50 feet of a bordering vegetated wetland or a salt marsh;

3. Systems are assumed to PASS unless approving authority determines that the system is not functioning properly.

D. Further evaluation required for systems with septic tanks and soil absorption systems near drinking water supplies:

1. If the soil absorption system is within 100 feet of a surface water supply or tributary to a surface water supply;

2. If the soil absorption system is within a Zone I of a public well;

3. If the soil absorption system is within 50 feet of a private well;

4. If the soil absorption system is less than 100 feet but greater than 50 feet from a private well unless analysis shows potability;

5. Systems are assumed to FAIL unless approving authority determines that the system is functioning properly.

E. System shall be upgraded upon order of Department or local approving authority if specific circumstances exist that indicate a threat to the public health or environment.

V. Large Systems which Fail to Protect or which Threaten Public Health and Safety and the Environment (15.304):

A. Systems serving a facility with a design of 10,000 gpd or greater and less than 15,000 gpd are subject to the failure criteria described above.

B. Considered a significant threat if:

1. System located within 400 feet of surface water supply;

2. System located within 200 feet of tributary to surface water supply;

3. System located in a nitrogen sensitive area.

C. Upgrade requirements

1. Owner/operator to bring system into compliance with Groundwater discharge Permit Program unless:
   a. Department can determine if this is manifestly unjust; and
   b. Department can determine if there are other means to provide the same degree of

environmental protection.

2. Application for above determination must be made two years prior to date on which the owner needs to file for a discharge permit.

3. In making upgrade determinations the Department can impose appropriate conditions.

VI. Deadlines for Completion of Upgrades (15.305):

A. Upgrade within two years of discovery:

1. Shorter time may be set by approving authority;

2. Continued use may be allowed if there is an enforceable schedule for upgrade, connection to sewer or connection to a shared system.

B. Upgrades for systems with flows of 10,000 gpd or greater but less than 15,000 gpd within five years based on enforceable schedule:

1. Shorter time may be set by Department if imminent hazard exists.

2. Continued use allowed if necessary to implement an environmentally superior solution:
   a. Requires enforceable commitment to perform interim measures;
   b. Expires within seven years or failure to meet interim deadlines.

C. Owner to insure no backup or discharges.

D. Systems to be abandoned in accordance with the regulations.

VII. Approval of System Inspectors (15.340):

A. Massachusetts Professional Engineers with a concentration in civil, sanitary, or environmental engineering, Massachusetts Registered Sanitarians and Massachusetts Certified Health Officers must apply to DEP for approval.

B. Board of Health members and agents with at least one year experience, EITs with a concentration in civil, sanitary, or environmental engineering, licensed septage haulers, Massachusetts licensed home inspectors and associate home inspectors, licensed system installers and others with demonstrated one year of demonstrated experience in septic system design or inspection are approvable after taking the course and passing the examination.

C. The Department is to maintain a list of all approved inspectors.

D. The Department may revoke or suspend an approval if a hearing determines falsification or fraudulence in preparing a report.

E. Violation for a person to falsify, misrepresent or fraudulently alter a report.

F. Inspectors must submit to the approving authority the results of the inspection on a Department approved form.

G. Inspectors may act as an agent of the approving authority or as an agent of the owner.

H. Qualifying individuals per 310 CMR 15.340(1) shall apply to the Department for Approval to perform inspections.

I. System Inspectors approved by the Department prior to January 1, 2005, shall apply to the Department to renew their approval by January 1, 2007. System Inspectors approved by the Department after January 1, 2005, shall apply to the Department to renew their approval at least 90 days prior to the expiration of three years following their approval date. The Department's approval of a renewal application shall expire three years from the date of issuance.

J. Beginning in 2010, the second filing for renewal the System Inspector shall demonstrate that they have earned 10 TCH in the previous three years.

VIII. System Pumping and Routine Maintenance (15.351):

A. Septic or cesspool pumped when necessary:

1. Sludge layer within 12 inches of outlet tee;

2. Top of scum layer within two inches of top of outlet tee;

3. Bottom of scum layer within two inches of bottom of outlet tee;

4. Generally necessary once every three years;

5. When pumped condition noted on a pumping form and submitted by pumper to approving authority;

6. Results of the pumping shall be submitted to the Approving Authority within 14 days from the pumping date.

B. Grease traps:

1. Must be inspected monthly by the owner/operator;

2. Cleaned by a licensed hauler at least every three months or when grease level is 25% of volume, whichever is sooner.

IX. Emergency Repair (15.353):

A. Limited to:

1. Pumping to prevent backup or breakout;

2. Repair or replace one or more structural components within 30 days.

B. Imminent danger exists after pumping, Disposal System Installer may repair or replace component provided;

1. System is within compliance otherwise with 310 CMR 15.000;

2. Component repaired or replaced shall be in compliance with or upgraded to requirements of 310 CMR 15.000;

3. Installer has determined cause of condition creating imminent danger;

4. No modification or alteration of the system design is required.

C. Emergency pumping must be reported to the approving authority by the pumper.

D. Only Disposal System Installer may conduct emergency repair with 24 hour notice to the Approving Authority and apply for DSCP within 14 days.

X. Abandonment of Systems (15.354):

A. When use is discontinued, considered abandoned and further use is prohibited.

B. Use of septic system as part of sewer tie-in requires prior written approval of the Department.

C. Procedure for abandonment:

1. Apply to approving authority within 14 days prior to discontinuance;

2. Upon approval septic tank to be pumped by licensed hauler;

3. Tank excavated and removed or the bottom ruptured and the tank filled with clean sand.

CHAPTER 5
INSPECTION PROCEDURE

Now is the time to put all the knowledge and expertise you have gained so far into practice. This section describes proper inspection procedures, provides some helpful hints and expands upon the inspection guidance and inspection form that is provided in Appendix C of this manual.

From the outset, it is important to remember that a System Inspector is essentially an information gatherer. Inspectors record the condition of the sewage disposal system at the time they are performing the inspection. Inspectors are not expected to offer warranties as to the future performance of the system. Their job, based on the results of the inspection, is to determine whether the system passes, conditionally passes, requires further evaluation or fails based on the specific criteria in Title 5 and outlined on the inspection form. Once the inspection is complete and the inspection form has been submitted to the approving authority, the inspector has met the responsibilities assigned to him or her by Title 5. If conditions exist which show the system is failing to protect public health, safety or the environment then the approving authority will require that the system be repaired, replaced, or upgraded. **The System Inspector has no enforcement authority and cannot require the system owner to perform upgrades or repairs.**

In addition to the above, please note the following law regarding System Inspectors and System Installers:

> *M.G.L. c21A §13A, Section 13A:*
> A system inspector of on-site sewage disposal systems, approved by the department of environmental protection, who performs an on-site inspection sewage disposal system under the provisions of the state environmental code, shall not recommend a specific disposal system installer, including himself, to perform any work related to the replacement, repair, alteration or design of said system; provided, however, that all system inspectors shall, at the time of inspection, provide to the property owner a list prepared by the local board of health of local disposal system installers who are approved to perform such work. Each board of health shall prepare and make available a list containing the name, address, and phone number for at least five such installers who request to be included on such list. Nothing contained herein shall be construed to prohibit a system inspector from distributing such list on which his own name shall appear; provided, however, that such inspector shall in no way distinguish his name from others on such list.
>
> A violation of this section shall be punished by a fine of not more than $1,000.

The inspection must not result in disruption of the functioning of the system and should be conducted to minimize disruption of the site in general. However, at a minimum, all manholes, covers, and cleanouts must be exposed in order to achieve the goal of this inspection. Pumping of system components, when required, shall be done after an initial inspection of the entire disposal system to observe normal operating conditions. Each component requiring pumping can then be re-inspected after pumping has been completed.

Minimum Requirements

The following are the minimum requirements necessary to complete an inspection. Meeting these minimum criteria, however, should not be construed as completion of an acceptable inspection if, through reasonable effort, a complete inspection of all components of the system is feasible. Furthermore, if a complete inspection cannot be performed, the inspector must provide adequate documentation of the specific conditions that prevented a complete inspection.

1. The inspector must note the general conditions of the property to identify any obvious signs of failure. These would include backup of sewage to the facility, effluent ponding, breakout to the surface of the ground or to surface waters, and other indications of failure as they are listed in the failure criteria in Title 5.

2. All components prior to the leaching facility must be located and inspected. In a conventional component system, this would generally require inspection of the septic tank and distribution box. If a cesspool system, the single cesspool or, if an overflow cesspool system, all cesspools prior to the final leaching system must be exposed for inspection.

3. Determine high groundwater elevation at the site through non-intrusive means unless the system owner grants permission to initiate more extensive investigation.

Ideally, an inspection will be performed on a system that is receiving normal flow. Thus, the inspection gives a representative view of the system under normal operating conditions. However, if the system is serving a facility that is unoccupied or the system is dry or not receiving normal flow, then the inspection becomes more problematic. Once again, the inspectors must keep in mind that their job is to record conditions at the time of inspection and not to predict future performance. Accordingly, under these circumstances, there may be certain information that is impossible to obtain, such as depth of sludge and scum layers if inspecting a dry septic tank or determining static water levels in the distribution box if there is no standing water.

A more complicated example involves the inspection of a dry cesspool that has not received flow for an extended period. Sometimes staining along the walls of the cesspool will indicate that at some point during the active life of the cesspool the liquid level was high enough to have violated the failure criteria. While this should be noted on the report, it cannot constitute grounds for failure since it was not directly observed. Essentially, the same rationale should be followed for all other failure criteria: if failure conditions are not observed directly, then the system cannot fail. The only exception to this general rule relates to the separation of groundwater and the bottom of the soil absorption system. The regulations are specific that the historical high groundwater level, obtained by acceptable methods (but not necessarily by direct observation), be used for determining if the system violates the requirement that the bottom of the soil absorption system be above high groundwater.

Preliminary Activities

Inspections of onsite systems should begin with a records search at the local board of health or other appropriate sources to obtain design plans and as-built drawings, if available. This information will facilitate locating the system components in the field. If these records are not available, then the components will have to be located by other means. Non-invasive techniques for locating system components are preferred options. However, as a last resort, it may be necessary to expose piping at intervals in order to trace out the layout of the system.

It is also necessary to obtain information on system pumping records. These may be obtained from the owner, operator or board of health; however, official records from the board of health are preferable if for no other reason than to protect the inspector from any liability claims in the event that system owner records are incomplete. The inspector should determine if the system has required pumping more than four times in the past year to determine if that failure criterion has been triggered. Also, the System Inspector should insure that the system or any component thereof has not been pumped within two weeks prior to the inspection. If pumping has occurred within that period, the system will not have had enough time to equilibrate. Thus, circumstances at the time of inspection may not accurately reflect the condition of the system under normal operation.

If there is any indication that the system may need to be pumped during the course of the inspection, it is *extremely* important that the system be evaluated initially before any pumping is done. This will give the System Inspector the opportunity to examine the system in its existing condition that, in turn, will provide valuable information on its condition and function that would otherwise be lost.

Inspection Procedure

The System Inspector should be equipped with a basic toolkit comprised of the following:

Cloth Measuring Tape – 100 feet	Crowbar	First Aid Kit
Flashlight	Line Level	Masking Tape
Metal Detector	Mirror	Plumber's Snake
Rubber Boots	Rubber Gloves	Scum Measuring Device
Shovel	Sludge Measuring Device	Steel Measuring Tape – 25 feet

These items will be valuable in carrying out the inspection and protecting the inspector from some of the health hazards likely to be encountered at the job site.

The inspection should begin with an observation of the entire site to note general conditions and check for obvious signs of failure such as surface breakout or ponding. Look for signs of sewage, stains on the ground or saturated, spongy soils. The presence of sewage odors should be determined when first arriving at the site so as not to rely on desensitized olfactory senses later on during the inspection.

The inspector should always try to observe the interior of the facility. This allows the inspector to check such things as the interior sewer piping for defects, cracks, leaks or evidence of blockage, to verify the presence of garbage grinders, to see where the plumbing exits the building and gather other pertinent information. Laundry connections are important items to check to see if they are connected to the main system or if they are on a separate system. Often the only way to determine this is to trace the piping in the building. Walking through the building is also helpful in obtaining accurate flow estimates based on applicable criteria (e.g., number of bedrooms as defined in Title 5, retail floor space, etc.) If available, water meter records should be provided to determine actual flows. It is important to remember that many water meters read in cubic feet of water, so it will be necessary to convert to gallons per day from that data. In addition, the inspector should note the number of current occupants.

While inside the building, the inspector should also flush the toilet or run a small volume of water to see how well the plumbing drains. Slow draining may indicate problems with the system; however, the inspector <u>should not</u> introduce large volumes of water as part of the inspection as this generally does not reflect normal flow. It may be appropriate to run a faucet for 10 or 15 minutes in order to monitor water levels and response times in the septic tank and distribution box, but running water for longer periods of time is not good practice.

The System Inspector should interview occupants concerning back-up or break-out of sewage or evidence of high groundwater on the site.

Components of the system should be located next. Non-invasive search techniques to be employed if as-built plans are not available could include metal detectors to locate steel reinforced tanks or metal pipes. Another method is to insert a plumber's snake at the building sewer to estimate pipe length and to note the direction from which the pipe exits the building. The use of a metal detector may aid in locating the metal snake thereby tracing the pipe location. Other methods such as video cameras or radio/electronic tracking devices may be useful. However, the regulations do require that the septic tank and distribution box be inspected. Accordingly, these components must be located and if non-invasive techniques do not work, then these components must be located by other means. Thus, it may be necessary to expose distribution piping at intervals until the components in question are found. If this is not sufficient, then the search should progress to more extensive excavation until the septic tank and/or distribution box are found.

Septic Tank:

Inspecting the septic tank must accomplish specific goals:

1. To insure that it is watertight
2. To determine that it is made of suitable materials
3. To determine that the inlet and outlet tees are intact
4. To determine that sludge and scum depths are not excessive.

The inspector, in accordance with the regulations, must expose and remove the septic tank covers. If they are more than a foot deep, recommend that extensions be provided to at least that elevation, or within six inches of final grade if possible.

Once the covers are off, the inlet and outlet tees should be inspected for damage. If damage is evident, then they should be replaced. Some tanks may have concrete cross-sectional flow baffles in lieu of PVC or concrete tees. These are not allowable substitutes for tees under 15.227(1) and were not allowable under the 1978 code. If they are present, the System Inspector should note this on the report and recommend that conforming tees be installed. In addition, the inspector should measure the depths of the inlet and outlet tees below the flow line. Many methods can be employed, but the most useful is to use a stick with a white rag wrapped at the bottom of the stick, set the bottom of the stick level with the bottom of the tee and then measure from the mark on the rag showing the flow line to the bottom of the stick. This is the depth of the tee below the flow line. Another method requires a stick with a hinged "flapper" on the bottom. Insert the stick down through the tee and let the flapper fall open. Pull it snug against the bottom of the tee and mark the stick at a reference point at the top of the tank. Next, set the stick even with the flow line and mark at the same reference point. The distance between the two marks is the depth of the tee below the flow line. It is a good idea to use masking tape on the side of the sticks for marking the distances for each individual inspection. In that way, the masking tape can be removed after the inspection that allows the stick itself to remain "clean" and unmarked for the next inspection.

As the septic tank is now semi-exposed, the inspector should determine material of construction. Reasonable attempts should also be made to measure tank dimensions (length, width and depth). If the dimensions cannot be measured, then they should be estimated as accurately as possible. From these measurements, an approximation of the tank volume can be made.

Check liquid levels for evidence of leakage. If the tank is discharging when there is no flow from the facility there may be infiltration to the tank indicating that it may be in high groundwater. If the liquid level is below the outlet invert then the tank is probably leaking to surrounding soils. Leaking tanks must be pumped and inspected further. When the tank is empty, one thing the inspector should look for is whether the weephole in the bottom of the tank has been plugged. If it has not, then this could be a possible cause of leakage. Other causes may be improperly sealed tank halves, cracks or faulty grout at pipe junctions. Watertight septic tanks are essential to the proper function of the system so it is important to recommend repair or replacement of all leaking tanks.

Measure scum depth and thickness and report. The regulations require that the system owner pump the tank if the bottom of the scum layer is within two inches of the bottom of the outlet tee or if the top of the scum layer is within two inches of the top of the outlet tee; if these conditions exist, during the inspection is probably a good time to pump. Otherwise, it must be noted on the inspection form that conditions exist which trigger the regulatory requirement for pumping. The use of the hinged stick is appropriate here also. Lower the stick gently through the scum layer. When the flapper opens, pull it up slowly until you feel resistance against the scum layer. Mark the stick at the reference point used previously. Measure the distance between this mark and the bottom of the outlet tee as determined before. This is the distance between the bottom of the scum layer and the bottom of the tee. The distance between the top of the scum layer and the top of the tee can be measured directly.

Measure sludge depth and thickness with a stick wrapped at the bottom with a white rag. Mark the stick at the reference point. With this reference mark lined up with the mark on the hinged stick, measure the distance from the top of the sludge layer to the bottom of the outlet tee. Require pumping as part of the inspection if indicated by being within 12" of the outlet tee or baffle. Also, the use of a "sludge judge" may be appropriate.

Check for evidence of backup (i.e. liquid level significantly higher than invert of outlet pipe). If such backup is evident, the outlet pipe will need to be examined as it enters the distribution box to determine the cause of backup. Recommend clean out or repair of outlet pipe as necessary or, alternatively, determine if the system may be in failure due to high groundwater.

<u>Distribution Box:</u>

The distribution box should be exposed and its cover removed. The first order of business is to determine the static water level in the distribution box. If it is higher than the outlet invert(s), this may be an indication of backup or clogging in the soil absorption system. The inspector should also note if there are solids carrying over into the distribution box. This may be an indication of septic tank malfunction.

The System Inspector must also evaluate the function of the distribution box by determining if it is level and if flow is equal. This can be accomplished by adding water to the box and observing the distribution of liquid to the outlet pipes. If the liquid appears to be distributed in equal portions, then the distribution box is functioning properly. Levelness of the box can be determined using an ordinary carpenter's level laid crosswise at opposite corners. It must be kept in mind that equal distribution of flow is most important and takes precedence over whether the distribution box is absolutely level. If the inspector finds that the distribution box is not allowing equal flow, then corrective measures should be recommended. These may include the installation of plastic weirs on the outlet pipes to adjust flow (commonly known as "speed levellers") or resetting the box itself.

If the distribution system is a pump system, refer to the section on <u>Pump inspection</u>. In either case, the inspector should look for appropriate indications of groundwater elevation as described in the section on <u>Groundwater Determination.</u>

Soil Absorption System:

The soil absorption system is the critical component where the majority of treatment takes place and, at a minimum, must be located by non-intrusive means. Excavation of the entire soil absorption system is not required in the regulations as part of the inspection. However, it may be appropriate to expose a portion of the soil absorption system to determine its condition if other indications of failure (e.g., evidence of breakout, ponding, sewage backup, condition of the distribution box, etc.) suggest that the soil absorption system is not functioning properly or that failure of the soil absorption system is likely.

The soil absorption system should be located by means of record plans, as-built drawings or other documentation. If this is not possible, approximate the location and lay out by examining topography, noting the drain arrangement from the outlet of the distribution box or any other means available.

Once the location of the soil absorption system is established, note the area for obvious signs of failure. If the inspection of other components indicates that the soil absorption system is stressed, then the inspector may wish to encourage the system owner or operator to authorize more extensive investigation, particularly if the soil absorption system is close to the surface and can be examined with soil cores taken by hand augers or opening inspection holes hand dug with a shovel or a post hole digger. The inspector would then be able to determine the condition of the surrounding soil and check for clogging, hydrogen sulfide crust, excessive ponding, or other indications of failure. The inspector should also determine if there are encroachments to the soil absorption system. Examples of this would include structures located on the soil absorption system or inside required setbacks, evidence of roots invading the system, and any other occurrence that may interfere with the function of or access to the absorption system. The inspector should also note whether roof leaders, drains or other sources of non-sewage hydraulic loading are being fed to the soil absorption area.

The System Inspector is also required to determine if the bottom of the soil absorption system is at or below the high groundwater elevation. Various methods for this determination are explained in the section on Groundwater Determination.

Pump Inspection:

Certain system designs employ the use of pumps and pump chambers. While there are no specific failure criteria for pumps or pump chambers listed in Title 5, the criteria for inspection listed in 310 CMR 15.302 do require that the System Inspector evaluate the pump system. In addition, some pump chambers act as dosing chambers in lieu of the distribution box, and in these cases would need to be inspected under the minimum inspection requirements.

The pump chambers that a System Inspector is likely to encounter will be simplex (single pump) or duplex (two pumps). Simplex systems will generally be restricted to single or two family residences while duplex systems are required for multi-family and commercial systems.

The level of detail required for inspecting pump chambers under these regulations is fairly minimal for the specific reason that the inspector will be dealing with live electricity and therefore be subject to potential electrical hazards. Unless the System Inspector is thoroughly trained in electrical safety procedures and lockout/tagout protocol and follows these procedures, he or she should take all necessary precautions to minimize exposure to electrical components. Also, pump chambers qualify as confined spaces. As such, there are specific safety guidelines for entry. More information on safety topics is presented in Chapter 6.

The System Inspector should note the condition of the pump chamber itself in terms of structural integrity, watertight integrity, and evidence of corrosion of concrete, other metal components (hatches, ladders, access rungs, etc.) and any of the electrical components. The presence of excess grease and/or solids should be noted. Appurtenances such as slide rails (for pump removal), inlet piping, discharge piping, valves and miscellaneous fittings should be observed to insure that they are intact and functional.

The pump chamber is required to have level controls that regulate pump operation. A typical duplex system will have controls for pumps off, lead pump on, lag pump and alarm on. The circuitry must also be set up so the pumps will alternate in their operation. Simplex systems will have a similar arrangement except that there is no need for a lag pump. The inspector should check the level controls for proper operation. In most instances, the level controls will be mercury float switches that should be activated manually. Level controls and pumps should be installed so they are not subject to hang-ups from any obstructions. The inspector should also note if there is any grease or scum buildup on the floats or switches. If switches are of a type that depend on electrical contact directly with the effluent, excess grease may interfere with their function. The alarm should also be checked to insure that it is in proper working order.

When checking the level switches, the pump function should be observed. The inspector should note if there are any leaks at fittings and fixtures, note if check valves or relief valves operate properly and that the pumps are operating as designed without excessive vibration. Obviously, the switches will be activating the pumps and if they are not, then either the switch or the pump is faulty. Submersible pumps will usually be encountered and if mounted on slide rails (as they usually are), the pump(s) should be raised out of the chamber and inspected for obvious signs of wear and/or failure. It is advisable to consult the operations manual of the pump, if available, before or during the inspection to help determine the type of operation and condition of the pump.

The inspector should also note the available emergency storage capacity above the working level in the pump chamber. Under the regulations, the capacity should be equal to the daily design flow. If emergency power is provided at the site, the inspector should advise the owner/operator that system controls should be operated and tested on a regular schedule.

<u>Single Cesspools:</u>

If the establishment or a section of the establishment being inspected is served by a single cesspool, that cesspool must be exposed and inspected. Inspection of a single cesspool must provide sufficient information to determine if any of the failure criteria are triggered.

The System Inspector can inspect the cesspool using techniques described previously. Essentially, the inspection of the cesspool is comprised of the following:

1. Determine dimensions and materials of construction.

2. Measure liquid level distance to invert and evaluate compared to failure criteria.

3. Determine the distance below the bottom of the cesspool to high groundwater.

4. Note depth of sludge and scum.
5. Require pumping upon completion of initial inspection. Observe infiltration of groundwater, if any.

<u>Overflow Cesspools:</u>

Overflow cesspool systems consist of an initial cesspool that overflows to some type of leaching facility, either pits, fields or trenches. Generally, these systems are found in older facilities and have been installed bit by bit over the years, usually to "repair" failed cesspools. These are hybrid systems and do not fall under the definition of "cesspool" as found in Title 5, nor are they conforming Title 5 systems. As a result, these systems have to be inspected using criteria for both cesspools and conventional systems.

When inspecting an overflow cesspool system, the inspector should recognize that the first cesspool is nominally functioning as a septic tank. This means that this unit is likely to be fitted with inlet and outlet pipes and will not have the requisite free space of six inches or half a day's storage volume that is required for a single cesspool. Accordingly, in order to assess its suitability to function as a septic tank, the first cesspool should be evaluated based on septic tank criteria, except for water tightness. Thus the inspector must check for sludge and scum levels and depths, condition of inlet and outlet tees, and other septic tank criteria. The leaching system(s) or additional cesspool should then be evaluated based on criteria for soil absorption systems.

Because the first cesspool is not watertight, it will leach some effluent and therefore must also be evaluated for setback distances for cesspools as defined in the failure criteria and held to these setbacks for determining failure. In addition, it must also be pumped after the evaluation of its function in order to determine if it is below the maximum groundwater elevation, as is required for single cesspool systems.

In some instances, there may be more than two cesspools in series. Each cesspool that has an inlet and outlet pipe and overflows to another type of soil absorption system is to be evaluated as a septic tank as outlined above. Furthermore, they must be evaluated for cesspool setback criteria and pumped to determine if they are below the maximum groundwater elevation. The terminal leaching facility, whether a pit, trench field or additional cesspool (i.e. no outlet and/or connection to any other leaching facility or cesspool) would be subject to the soil absorption system criteria only.

<u>Groundwater Determination:</u>
An adequate separation from groundwater is one of the most important factors governing proper treatment of wastewater in the soil absorption system. As such, determining that the soil absorption system is above the high groundwater elevation is an essential part of the inspection.

In accordance with the regulations, high groundwater elevation should be determined by the least invasive method possible. The following list describes a variety of methods that may be employed to determine high groundwater elevation:

a. if a sewage disposal plan is on record for the site, it should include groundwater elevations from the original deep observation hole. If not available, determine if such information is available from adjacent lots. Make appropriate adjustments to determine high groundwater elevation.

b. regional planning agencies may have records indicating high groundwater elevation in the particular city or town. If so, it can be determined if the bottom of the leaching facility is above the high groundwater elevation.

c. USDA Soil Conservation Service soil surveys and maps may provide indications of high groundwater.

d. observation of infiltration into the septic tank or distribution box. If infiltration is evident, the surrounding soil shall be examined to determine groundwater elevation.

e. pumping a cesspool to monitor groundwater rise, as required by 310 CMR 15.302(3)(a)(2). This approach may also be appropriate for other leaching facilities, particularly pit, gallery or chamber systems that have access and inspection ports.

f. use a hand auger if groundwater is suspected to be near the surface. Various standard measuring techniques can be used to determine groundwater depth. Use appropriate adjustments to estimate high groundwater elevation.

g. note the position of the system if in proximity to a water body or wetland.

h. note if there is a cellar sump pump in the building being served or if there are foundation drains around the building.

Methods (i) through (l) below constitute more invasive means of determining high groundwater elevation. It is not suggested that these methods are required in all cases; however, in instances where methods (a) through (h) above have failed to provide adequate information for determining high groundwater elevation, it may be necessary to employ these methods as described below.

i. small diameter wellpoints can be driven to monitor groundwater elevation. Use appropriate adjustments to determine high groundwater elevation. This method may be suited to soils that are easier to penetrate with smaller equipment and may limit applications in tighter soils. However, a drilling contractor should be consulted about the application of this method in any given soil condition.

j. after observing effluent water levels, pump the leaching facility and monitor to see if groundwater rises to the bottom (may be more applicable to pits, chambers and galleries than trenches and fields). In general, if the groundwater can be observed after pumping, regardless of the type of system, this method should yield reliable results. This approach should be taken with caution. If done during the dry season, the results do not guarantee that subsequent groundwater level rise will not inundate the leaching system. Best professional judgment must be used in order to determine at what point backflow into the system is due to groundwater infiltration or other factors. Also, in some soils, groundwater may take some time to stabilize. In these instances proper precautions must be taken to insure that the open area around the leaching facility is properly secured to prevent injury.

The system owner may choose to have the high groundwater elevation determined by the methods described in k. and l. below to confirm or disprove the results obtained by other methods, or in place of the minimum requirements.

k. drive an observation well with a well drilling rig or powered auger, observe the groundwater elevation and make appropriate adjustments to determine high groundwater elevation. The maximum depth of the observation well should be twelve feet below grade at the lowest natural elevation on the site or six feet below the bottom of the leaching facility.

l. dig a deep observation hole (generally the last resort) and use appropriate adjustments to determine maximum high groundwater elevation. The maximum depth of the hole should be twelve feet below grade at the lowest natural elevation on the site or six feet below the bottom of the leaching facility.

If groundwater levels are observed through the more intrusive methods described above, appropriate adjustments may have to be made to determine high groundwater elevations since it is not guaranteed that the inspection will be conducted when the groundwater is at its highest elevation.

Soils can be used to determine the presence and approximate elevation of a seasonal high water table, even during dry periods when the water table may be much lower. When a water table fluctuates within a soil it causes alternating saturated (reduced) and unsaturated (oxidized) conditions. The chemical reactions caused by these different conditions result in color changes within the soil profile.

The coloration caused by a fluctuating water table within a soil is referred to as redoximorphic features. Soil redoximorphic features are variegated or irregular spots of orange, yellow and gray colors within the soil profile. The highest point that gray color mottles are observed in the soil is a clue for estimating the average seasonal high water table level. It is important to keep in mind that the highest point of distinct mottle occurrence relates to the estimated average seasonal high water table. For any given year, the actual high water table may be higher than or lower than the average.

The amount of gray colors within an area indicates the duration of saturation. The more gray present, the longer the soil is saturated. A gleyed soil condition is one that results from prolonged periods of wetness, and the soil material is gray throughout with possibly only a few orange or yellow mottles. Increasing amounts of orange and/or yellow mottles indicate areas of soil that are saturated just during the very wet periods of the year.

"Rust line" is a term often used by health agents to describe a dark red layer or band in the soil that is often interpreted as being the maximum height of the water table. Bright red and yellow streaks can form within the soil through two contrasting processes that may or may not be the result of a high water table.

Those not associated with a water table may develop when percolating water is momentarily interrupted as it passes through different soil strata. This brief pause may cause dissolved iron within the water to precipitate out and over many years develop a bright red or yellow streak. This soil feature is common within some stratified sand and gravel deposits, and can often be observed on the sides of gravel pits high above any water table.

Only in a few unique situations do soils develop a rust line resulting from a fluctuating water table and they are the exception rather than the general rule. Rust lines associated with a water table are the result of a fluctuating water table and dissolved iron in the groundwater. As the water table fluctuates, iron precipitates out forming a coating on the surface of soil particles and with time develops a bright red and yellow line in the soil. For a rust line to be interpreted as an indicator of the maximum high water table elevation it should meet some or all of the following criteria: the rust line should appear as a nearly continuous band on all sides of the deep observation hole; it should be on a nearly level plane within the hole; soil mottling should be observed below the rust line; and in some situations dark nodules of hardened or cemented soil material are present within the rust line. In situations where gray color mottles occur above a rust line, the height of the gray mottles should be interpreted as the height of the average seasonal high water table and not the underlying rust line.

A soil condition that exists in some wet areas is locally referred to as bog iron. Bog iron is a cemented layer within the subsoil that is dark red and in some instances almost black. This layer is difficult to penetrate and is generally only a few inches thick. Bog iron is formed by a fluctuating water table and indicates a wet soil. Gray mottles are not present within the bog iron layer but are generally observed either above or below it.

Another method for estimating high groundwater elevation was developed by the U.S. Geological Survey and is explained in detail in Probable High Groundwater Levels in Massachusetts (USGS Water Resources Investigations, Open File Report 80-1205) commonly referred to as the Frimpter method. By using the historical record of a network of groundwater observation wells, this method correlates observed water elevations at the site and at a reference well in proximity to the site and in a similar geologic setting to a probable groundwater rise. This method involves the use of a specific mathematical equation and an understanding of geological formations.

Both these methods require specialized training that is beyond the scope of this manual. Soil scientists or Approved Soil Evaluators can be of assistance in the use and application of these methods and should be consulted.

Setbacks:

The failure criteria listed in 310 CMR 15.303 include certain setback requirements for cesspools, privies and soil absorption systems. The System Inspector must determine compliance with these setbacks as part of the inspection. In some instances, particularly with respect to setbacks to wetland resource areas, the inspector must either be competent in wetlands delineations or rely on the services of someone who is.

For determinations relative to setbacks from surface water supplies, tributaries from water supplies and Zone I's of public water supply wells, and private water supply wells, the inspector should consult with the local water department, board of health, system owner, or the Division of Water Supply in the Department's regional office. Maps indicating locations of public drinking water supply resources should be on file with the board of health.

In the case of tributaries to those public water supplies (Ware, Quabbin and Wachusett) to which the provisions of 350 CMR 11.00 (MDC Watershed Protection regulations) apply, such tributaries shall be identified solely by reference to the maps identified in 350 CMR 11.07(3) (most recent edition of Massachusetts GIS maps unless MDC submits more detailed maps to the legislature in accordance with 350 CMR 11.07(3)). To aid in identifying the location of all other tributaries to a public water supply, reference may be made to a Department publication titled "Designated Outstanding Resource Waters of Massachusetts 1990", dated July, 1993, as amended. This publication is intended solely as an informational aid. In the event of conflicting information, the surface water quality standards found in 314 CMR 4.00 shall prevail.

If a cesspool, privy or soil absorption system is less than 100' but greater than 50' from a private well, the system must be failed unless acceptable water quality data from the well, as referenced in 310 CMR 15.303 (l) and (m) is provided. The analyses required are for fecal coliform bacteria, volatile organic compounds (VOCs) and ammonia nitrogen and nitrate nitrogen. Coliform bacteria, ammonia and nitrate shall be analyzed by a Massachusetts certified laboratory according to Standard Methods for the Examination of Water and Wastewater. VOCs shall be analyzed by a Massachusetts certified laboratory according to the EPA 500 series. In all instances, proper sampling procedures must be followed.

Difficulty in Locating Components:

If the inspector has difficulty locating components of the disposal system, the following steps should be followed:

1. Pursuant to 310 CMR 15.302 all components prior to the leaching facility must be located.

2. If the high groundwater elevation is 12 feet below or lower than the lowest elevation on the lot, and there is no evidence of backup in the system, the leaching facility most likely is not below the high groundwater elevation. This condition, however, should not relieve the inspector from exercising due diligence in locating the leaching facility and inspecting its condition.

Keep in mind that the approving authority may determine that reasons for entering information as "Not Determined" on the inspection form are inadequate and may require that the inspector provide that information. When in doubt, try to be as complete as possible in conducting the inspection.

CHAPTER 6
SAFETY

System Inspectors will encounter a variety of situations that can constitute safety and health hazards. Understanding these potential hazards and having a good plan of action in dealing with them will help prevent personal injury and illness. Common safety hazards include pathogenic (disease-causing) organisms, poisonous or explosive gases, electrical hazards, falling into open tanks or excavations, and other dangerous situations.

Safety Hazards

System Inspectors will undoubtedly come into contact with pathogenic organisms present in raw sewage or sewage effluent. These organisms can be disease-causing bacteria, viruses, protozoa, or parasites and are responsible for such diseases as salmonella, typhoid, hepatitis, polio, dysentery, and many others.

Poisonous or explosive gases are another potential hazard when inspecting subsurface sewage disposal systems. There normally should not be a need to enter a septic tank or other confined spaces such as manholes or pump chambers; however, if it is necessary, the System Inspector should be aware of the dangers posed by the accumulation of gases. Before entering any confined space, the System Inspector should check for oxygen levels and toxic gases with an explosive meter. Appropriate levels of personal protection such as gas masks, self-contained breathing apparatus (SCBA), and/or protective outerware should be worn. Inspectors should not enter into a septic or pump tank or other confined space unless they are certified in confined space entry by OSHA.

Gases which can accumulate in the septic tank or any other anaerobic environment include; hydrogen sulfide (H_2S), chlorine (Cl_2), carbon monoxide (CO), carbon dioxide (CO_2) and methane (CH_3). Hydrogen sulfide has a characteristic odor of rotten eggs and can form sulfuric acid that can corrode metal and concrete and remove paint. As a gas, it can paralyze the human respiratory system. Chlorine gas can accumulate in the septic tank. It is heavier than air and can cause respiratory distress and suffocation. Since gas masks do not offer protection against chlorine, SCBA equipment is required. Carbon dioxide and carbon monoxide are both colorless, odorless and can cause asphyxiation. Methane, an explosive gas, is given off by the anaerobic bacteria and can cause suffocation.

Electrical shock is another hazard that can be encountered during inspections of pumps and other mechanical equipment. Electrical shock can cause severe injury or death. System Inspectors should use caution in dealing with electrical systems and should not try to repair or troubleshoot such systems. The following basic safety rules should be kept in mind at all times:

- Keep your mind on potential hazards at all times
- Do not use metal ladders
- Never override any electrical safety device
- Inspect extension cords for abrasion and insulation failure
- Use only grounded or insulated [Underwriter Laboratory (UL) approved] electrical equipment
- Take care not to inadvertently ground yourself when in contact with electrical equipment or wiring
- Remember that outdoor activity with electricity poses greater potential for hazard.
- Call Dig Safe before any excavation.

Generally, an inspection will only require checking the operation of electrical equipment. The System Inspector, however, should be aware of safe work practices if any servicing is required. This includes following proper lockout and tagout procedures in accordance with paragraph (b) of General Industry Standards 1910.353.

Other miscellaneous hazards and nuisances that may be encountered include stinging or biting insects or spiders, snakes, dogs, poisonous vegetation and open excavations.

Good Personal Hygiene

Wastewater contains pathogenic organisms and should be considered infectious. Accordingly, good personal hygiene practices are important to avoid illness. The following precautions should be followed:

- Keep hands and fingers away from the eyes, ears, nose and mouth
- Wear rubber gloves
- Wash hands before eating or smoking
- Do not store personal clothes with work clothes
- Give cuts and scratches first aid immediately
- Take a shower after work with a disinfectant soap
- Receive inoculations for typhoid fever, tetanus, paratyphoid and polio
- Provide waterless hand cleaners

Physical Injury Prevention

System Inspectors will necessarily have to engage in physical exertion such as removing manhole covers, some digging and other activities. Heavy lifting may be the most common activity and has the potential to result in strains, sprains and back injury. The following precautions should be considered:

- Do not lift more than can be handled comfortably
- Establish solid footing and good balance before lifting
- Get as close to the load as possible when lifting or carrying
- Keep the back straight, gripping the object firmly and using the legs, not the back, to lift
- Never carry a load that is too large to see over or around

When lifting manhole covers, always be wary of fingers and toes getting caught in or under the lip or edges. Manhole covers are heavy and can wreak serious havoc on various parts of the anatomy.

First Aid

A well supplied first aid kit is an essential part of the System Inspector's toolkit. Knowledge of CPR is highly recommended and certification can be obtained through the local chapter of the Red Cross. Additionally, the System Inspector should know the location of the nearest telephone in the event that emergency services need to be contacted.

Confined Space Entry

Confined spaces are those which have limited entry and exit, contain known or potential hazards, have poor ventilation, and are not designed for continuous occupancy. The two classes of confined spaces are open top enclosures with depths that restrict the flow of air and enclosures with small openings for entry and exit. Typical confined spaces that a System Inspector may encounter are septic tanks, manholes, and pump chambers. It generally will be unnecessary for an inspector to enter a confined space and this should be avoided as routine practice. However, if circumstances dictate entry, the System Inspector should be trained in proper safety and rescue procedures for confined space entry.

Many fatalities that occur as a result of confined space entry result from rescue attempts by people not properly trained. Thus, it is imperative that System Inspectors seek appropriate training that, at a minimum, conforms to the Occupational Safety and Health Administration (OSHA) regulations for confined space entry. Training should include:

- Safe entry and exit procedures
- Use of respiratory equipment
- Knowledge of first aid techniques
- Isolation techniques: blanking and blocking
- Lockout/tagout
- Safe practices
- Confined space rescue

Ventilation is a problem when dealing with confined spaces. A clean air supply should be provided and the space should be ventilated if there are sources of combustible vapors or gases (and in dealing with septage and sewage you should always assume that a combustion hazard is present), if toxins or other contaminants are above permissible levels and if the atmosphere has too little or too much oxygen. Normal oxygen levels are 20.9%, oxygen deficient levels are 19.5% and excess levels which can lead to an explosion are greater than 23%.

Conclusion

Safety must be your primary concern, not only for yourself but also for your client and others who may be affected by your activity. Observing proper safety practices and being well-trained in emergency procedures will help insure your protection and the protection of those around you.

CHAPTER 7
SAMPLING

The System Inspector may be required to collect potable water samples for analysis, particularly if the separation between a private water supply well and cesspool, privy or soil absorption system is between 50 and 100 feet. Analyses required would be for coliform bacteria, volatile organic compounds, ammonia nitrogen and nitrate nitrogen. This section provides information on sampling techniques. However, the inspector should always consult with the Massachusetts certified laboratory that will conduct the analyses to review sampling procedures and to obtain proper sample containers. The laboratory sampling protocol must be followed and its chain of custody forms signed and completed. A copy of the results and chain of custody forms should be attached to the inspection form.

This is a brief synopsis of sampling procedures for the analyses required under Title 5 and is not intended to be all inclusive. Further information can be obtained from the latest edition of Standard Methods for the Examination of Water and Wastewater, published jointly by the American Public Health Association, the American Water Works Association and the Water Environment Federation (formerly the Water Pollution Control Federation).

Fecal Coliform Bacteria

Samples for microbiological examination should be collected in bottles that have been thoroughly cleansed and rinsed, given a final rinse with distilled water and sterilized. For samples expected to have any residual chlorine (unlikely in a private well), the sample bottles should be treated with a dechlorinating agent such as sodium thiosulfate.

The water sample should be taken at a tap that is fed from the well. The line should be flushed for approximately 2 or 3 minutes prior to sampling. In all cases, proper aseptic techniques should be observed in order to avoid sample contamination. Aseptic techniques are those procedures that prevent biological contamination of the sample itself or of the sampling apparatus that could contaminate the sample. Such procedures include:

- Keeping sterilized sample bottles closed until just before the sample is to be collected.
- Do not touch the lip of the bottle or any other surface that will come into contact with the sample.
- Wear rubber gloves, if possible.
- Do not contaminate the surface of the cap or inner neck of the bottle
- Fill the container without rinsing.
- Immediately replace the cap.

After the tap has been flushed, reduce water flow to permit filling the bottle without splashing. When the sample is collected (approximately 250 mL), make sure to leave an air space of at least an inch to permit mixing by shaking prior to examination. Samples must be analyzed within 24 hours of collection and must be kept in an iced cooler if they cannot be analyzed within one hour of collection. Upon receipt at the laboratory, the samples should be refrigerated immediately.

Ammonia Nitrogen and Nitrate Nitrogen

Both these constituents can be sampled in either plastic or glass containers. Minimum sample size for ammonia is 500 mL and for nitrate, 100 mL. There are no specialized procedures for collecting samples to analyze for these constituents; however, ammonia does require preservation in sulfuric acid (H_2SO_4) to a pH less than 2. The sample should be refrigerated if not analyzed immediately. Nitrate does not require preservation other than refrigeration if it is not analyzed immediately.

CHAPTER 8
MATHEMATICS REVIEW

This section provides a quick review of pertinent mathematical definitions, formulas and units of measurement that are valuable to the System Inspector.

Definitions	Common Units of Measurement:
Area: The measurement of a surface in square units such as square feet, square inches, etc.	Area: Square inches, square feet, square yards, acres
Circumference of a Circle: The length of the external boundary of a circle such as the rim on a basketball hoop which is 62" around.	Length: Inches, feet, yards, miles, meters
Diameter of a Circle: Distance from one side of a circle to the other through the center point, such as a three inch inside diameter of a pipe.	Volume: Cubic inches, cubic feet, cubic yards, gallons, liters
Hydraulic Soil Loading Rate: The number of gallons of wastewater applied to an area of soil in a day, such as 0.6 gallons/day/ft^2.	Pressure: Pounds per square inch (psi), pounds per square foot
Pi (π): A known ratio that is a constant in the geometry of circles (3.1416).	Concentration: Milligrams/liter, pounds/gallon
Pressure: The force applied to a unit area, usually given in pounds per square inch.	Flow rate: Gallons per minute (gpm), gallons per day (gpd), millions of gallons per day (MGD), cubic feet per second (cfs)
Radius: One half the diameter of a circle.	Time: Seconds, minutes, hours, days
Volume: The capacity of a container such as a cubic yard of loam or a 55 gallon drum.	

Abbreviations	
% = percent	h= height
< = less than	in = inches
> = greater than	l = length
1 gallon of water weighs 8.34 pounds	l = liter
A = area	m^3 = cubic meters
ac = acre	min = minute
cfs = cubic feet per second	ml = milliliter
cm = centimeters	ppm = parts per million
d = diameter	psi = pounds per square inch
ft^2 = square feet	Q = flow rate
ft^3 = cubic feet	r = radius
gpd = gallons per day	V = velocity
gpd/ft^2 = gallons per day per square feet	w = width
gpm = gallons per minute	π (pi) = 3.14

Important conversion factors:

Multiply	By	To Obtain
acre	43,560	square feet
cubic feet	7.5	gallons
cubic feet per second	0.646	million gallons per day (MGD)
diameter (d)	0.5	radius (r)
inches of mercury	1.133	feet of water
million gallons per day (MGD)	1.55	cubic feet per second (cfs)
pounds per square inch (psi)	2.31	feet of water
feet of water	0.434	Pounds per square inch (psi)
gallons per minute	1440	gallons per day (gpd)

Important equations:

- Circumference of a Circle = $2(\pi)(r)$
- Area of a Circle = $\pi(r^2)$
- Area of a rectangle or square = (l)(w)
- Volume of a Cylinder = $\pi(r^2)h$, where h = height
- Volume of a rectangular tank = (l)(w)(h)
- 1 Cubic foot = 7.5 gallons
- Detention time (hrs) = (tank volume)/(flow rate) - units must be consistent
- Hydraulic soil loading rate = gallons applied per day (gpd)/(area applied (ft^2)
- Radius (r) = ½ diameter (d)

Practice Math Problems

These math problems are designed to allow you to practice your skill using the information provided in the definitions, common units of measure, abbreviations, important conversion factors and important equations sections of this chapter. The problems are purposely kept uncomplicated so that you can practice using the individual definitions and formulas. The answers to each question are included on the pages following the questions.

Since real life situations will often involve a series of mathematical calculations rather than the simple forms given here, you must go one step further: learn to take a complex problem, write it down, separate it into simpler parts and then do the calculations presented here, no matter how complex the actual problem.

1. What is the volume of a septic tank with the following dimensions: l = 5', h = 10', w = 12'?
   a. 540 cubic feet
   b. 600 cubic feet
   c. 5400 cubic feet
   d. 300 cubic feet

2. What is the maximum number of gallons of water which the septic tank in question 1 could hold?
   a. 3500 gallons
   b. 4500 gallons
   c. 5500 gallons
   d. 4425 gallons

3. What is the volume of a cylindrical septic tank if the diameter of the tank is 12 feet and the height of the tank is 8 feet?
   a. 905 cubic feet
   b. 175 cubic feet
   c. 102 cubic feet
   d. 1750 cubic feet

4. If the water in a cylindrical tank, which is 12 feet in diameter and 8 feet deep, drops 5 feet in 5 hours, how many gallons per minute are being lost?
   a. 11 gpm
   b. 14 gpm
   c. 848 gpm
   d. 120 gpm

5. You know that a household is using 345 gallons per day of water and you want to know how much space that takes up in a septic tank.
   a. 46 cubic feet
   b. 109 cubic feet
   c. 481 cubic feet
   d. 19 cubic feet

6. You know a household used 23,450 cubic feet of water last year. Calculate how much water they used per day in gallons.
   a. 64 gpd
   b. 482 gpd
   c. 621 gpd
   d. 23 gpd

7. Add 225 gallons of water to 309 gallons of water and convert this to cubic feet.
   a. 4005
   b. 534
   c. 423
   d. 71

8. If a rectangular septic tank has a horizontal surface area of 120 square feet and is 8 feet wide, how long is it?
   a. 10 feet
   b. 15 feet
   c. 25 feet
   d. 12 feet

9. What is the area of a circle with a radius of twelve feet?
   a. 657 square feet
   b. 235 square feet
   c. 821 square feet
   d. 452 square feet

10. If a circular septic tank has a horizontal surface area of 285 square feet, what is its diameter?
   a. 41.5 feet
   b. 9.5 feet
   c. 19 feet
   d. 81 feet

Answers

1. *600 cubic feet. Note that the units of measure are feet X feet X feet that yield the answer in cubic feet.*
2. *Using the conversion factor for cubic feet to gallons, we multiply the volume (600 cubic feet) times 7.5 and get 4500 gallons. Note that since we are using a conversion factor, the units of measure changes from cubic feet to gallons.*
3. *905 cubic feet. Using the formula for the volume of a cylinder ($v = \pi r^2 h$) where $v = 3.1416 X 6^2 X 8$. Keep in mind the fact that the diameter is twice the radius, therefore, the value of r is 6 feet.*
4. *The solution to this problem must be taken in steps: first, figure the volume of water lost in 5 hours by doing a simple cylinder volume calculation ($v = \pi r^2 h$) where $v = 3.1416 X 6^2 X 5 = 566$ cubic feet of water lost. Second, we account for the time by dividing the number of cubic feet of water lost by 5 hours = 113 cubic feet per hour and then dividing that by 60 minutes = 1.9 cubic feet per minute. Finally, we convert that to gallons by using the conversion factor, 7.5, and getting a product of 14 gallons per minute.*
5. *This is a conversion of gallons of water to cubic feet of water. Divide the number of gallons by 7.5 to get 46 cubic feet of water.*
6. *This is a conversion of cubic feet of water to gallons of water. You multiply the cubic feet by the conversion factor (7.5). Now divide that by 365 days and get 482 gallons per day.*
7. *Take the problem in two steps: first, add the gallons to get 534 gallons of water, now divide the total gallons by the conversion factor (7.5) to get the 71 cubic feet of water.*
8. *Since a surface area is the product of the width X length of an object, we can divide the surface area by the width (8 feet) and get the length (15 feet).*
9. *We use the formula for the area for a circle ($a = \pi r^2$) to solve this problem. We know that r is the radius and equals 12 feet. Square that by multiplying 12 X 12 = 144. Next, we multiply 144 X π or 3.1417 for an answer of 452 square feet.*
10. *The solution involves using the formula for the area of a circle and calculating backwards. The formula is $a = \pi r^2$. We know that a = 285 square feet; π (pi) is a constant and equals 3.1416. The only part of the problem we don't know is the r^2. In order to find r^2 we are going to modify the basic formulas ($a = \pi r^2$) by dividing both sides of the formula by π or 3.1416 with a result of 91. Since this is r^2 we must find the square root of 91which is 9.5 feet or the radius of the circle. The diameter is twice the radius or 19 feet.*

CHAPTER 9
ETHICAL RESPONSIBILITIES

The primary responsibility of the System Inspector is not to the system owner or prospective buyer, but to the public that has entrusted him or her with fairly and objectively evaluating the condition of onsite sewage disposal systems. The inspector should always bear in mind that this is a responsibility that transcends regulations and defines the moral standards under which ethical practice is performed. It is in this frame of mind that the System Inspector should approach system inspections.

The regulations require that an inspection report be prepared on a form approved by the Department. The contents of this form have already been discussed in the Inspection Process section of this manual. It is the inspector's responsibility to fill out the form as completely as possible so that anyone reviewing the report can determine the compliance status of the system in question. While much of the information required on this form can be determined in the field, the inspector will have to spend some office time both before and after the inspection to produce an accurate evaluation of the system.

For any inspection required under the regulations, the System Inspector is required to submit a copy of the inspection report to the approving authority within thirty (30) days of the inspection. Failure to submit the required inspection form shall create a presumption that the required inspection has not been performed. The report must be on a Department approved System Inspection Form and completed in its entirety. For systems with design flows greater than 10,000 gpd and for all shared systems, the inspection report must be submitted to the Department. Inspection reports for title transfers must also be submitted to the buyer or other person acquiring title to the facility served by the system.

A proper inspection requires that the System Inspector exercise best professional effort and due diligence in conducting a complete inspection. As mentioned previously, the inspector should be cognizant of the intent of the inspection regulations as opposed to merely meeting the requirements of the regulations. Essentially, the System Inspector should keep in mind the following:

1. Determine if the sewage disposal system triggers any of the failure criteria;
2. Alert the owner of potential problems; and
3. Attempt to evaluate if the system is functioning properly.

The regulations specifically address item 1 above; however, experience and professional judgment should guide the System Inspector in observing and noting any warning signs of future problems that could be alleviated by preventive action.

Additionally, please note the following law regarding System Inspectors and System Installers:

> *M.G.L. c21A §13A, Section 13A:*
> A system inspector of on-site sewage disposal systems, approved by the department of environmental protection, who performs an on-site inspection sewage disposal system under the provisions of the state environmental code, shall not recommend a specific disposal system installer, including himself, to perform any work related to the replacement, repair, alteration or design of said system; provided, however, that all system inspectors shall, at the time of inspection, provide to the property owner a list prepared by the local board of health of local disposal system installers who are approved to perform such work. Each board of health shall prepare and make available a list containing the name, address, and

phone number for at least five such installers who request to be included on such list. Nothing contained herein shall be construed to prohibit a system inspector from distributing such list on which his own name shall appear; provided, however, that such inspector shall in no way distinguish his name from others on such list.

A violation of this section shall be punished by a fine of not more than $1,000.

System Inspectors must be honest in their approach to their work. Ethics should dictate that inspectors limit their practice to the type of systems they know and with which they are familiar. If inspectors wish to broaden their knowledge of different systems for the purposes of inspection, then they should seek appropriate training that would qualify them to conduct inspections of the system of interest.

Infractions such as fraudulently or falsely filling out inspection reports or conducting fraudulent inspections will result in the System Inspector's approval being revoked. Such inappropriate behavior may also expose the System Inspector to personal liability to those who relied on the inspection report, or perhaps even to civil or criminal penalties. However, in the broader sense, all inspections should be conducted in a professional and respectful manner. The System Inspector is the frontline exposure that most people will have with the inspection process. If the experience is as trouble-free as possible, then a big battle for public acceptance of the necessity for inspections will have been won. Your positive performance is essential for the future of not only the inspection process but for your profession as well.

CHAPTER 10
GUIDANCE FOR THE INSPECTION OF ON-SITE SEWAGE DISPOSAL SYSTEMS

On-site sewage disposal systems are governed by Title 5 of the State Environmental Code 310 CMR 15.000. When properly designed and sited, these systems provide an acceptable level of wastewater treatment and are a legitimate treatment and disposal option in areas where centralized sewers are not available. Given the traditional view that these systems are temporary solutions until sewers are provided, they are often neglected and this can result in harm to the environment and threats to the public health. With the increased demand on our water resources we are developing a greater appreciation for the importance of groundwater recharge and improvement of stressed basins. Title 5 requires that systems be inspected under certain circumstances. At the time of the Title 5 system inspection, system owners can be educated about the importance of properly maintaining their systems, and those systems that are an environmental or public health threat can be identified and upgraded.

This document is intended to provide guidance to both the septic system owner and septic system inspector for evaluating the adequacy of existing on-site sewage disposal system. Approved System Inspectors are charged with theresponsibility for inspecting systems in accordance with 310 CMR 15.000 and this guidance, and for reporting their findings to the approving authority. System Inspectors are not required to submit the results of a Voluntary Inspection to the approving authority. A voluntary assessment must be requested by the system owner prior to the System Inspector conducting an inspection of the system, and does not comply with the requirements of 310 CMR 15.000.

It should be noted that the duty of the inspector is to give a fair and impartial inspection of the system. The inspector should never take steps to try to make the system pass.

All inspectors are required to inspect the on-site sewage disposal system in accordance with Title 5 Regulations and MassDEP guidance documents. Failure of any inspector to follow these requirements may subject the inspector to potential enforcement by the MassDEP. MassDEP has the authority to levy fines, penalties, suspension or revocation of the inspector's approval status for any inspector who does not comply with the Regulations or guidance documents.

The goal of the inspection is to provide sufficient information to make a determination as to whether the system complies with the inspection requirements contained within Title 5. If conditions exist that show the system is failing to protect public health or the environment, the system must be repaired, replaced or upgraded. The only grounds for failing a system or conditionally passing a system are if any of the criteria listed on the inspection form and specified in 310 CMR 15.303 are met.

The inspection must avoid disruption of the functioning of the system and should be conducted to minimize disruption of the site in general. However, at a minimum, all manholes, covers, and cleanouts must be exposed in order to achieve the goal of this inspection. Pumping of system components, when required, shall be done after an initial inspection of the entire disposal system to observe normal operating conditions. Each component requiring pumping can then be re-inspected after pumping has been completed.

The Department has developed an approved System Inspection Form that is to be completed by the Inspector when doing an evaluation. Reference materials are available on the DEP website and the inspector should review these materials on a regular basis for updates. The inspection form consists of:

Part A – General Information
Part B – Certification
Part C – Checklist
Part D – System Information

The form can be downloaded at:
http://www.state.ma.us/dep/brp/wwm/t5forms.htm

Part A General Information

The General Information Section provides identification information on the property being inspected and the inspector.

Part B Certification

The Certification Section presents the results of the inspection relative to the failure criteria outlined in 310 CMR 15.303. In the certification statement, the inspector is certifying that the conditions existing at the time of inspection are accurately presented in the inspection report. The inspector is not certifying that the system is adequate for the current use of the system nor for the future use of the system.

In the Inspection Summary portion, the inspector indicates whether the system passed inspection, conditionally passed inspection, failed inspection, or needs further evaluation by the Local Approving Authority. Usually the local Board of Health is the Local Approving Authority. For systems with a design flow of 10,000 gallons per day or greater or for state-owned and federal facilities, the Department of Environmental Protection (MassDEP), is the Approving Authority.

Please note that only an individual currently approved as a System Inspector may certify the results of an inspection. Each inspector shall ensure that he/she has a current approval prior to performing an inspection. Failure to have a current approval while performing an inspection is a violation of the Regulations and may subject the individual to potential enforcement action by MassDEP.

System Passes

None of the failure criteria listed in 310 CMR 15.303 are violated.

System Conditionally Passes

The system violates one of the failure criteria in 310 CMR 15.303, or a specific condition under "B) System Conditionally Passes" on the Title 5 Official Inspection Form, but the nature of the violation is such that it can be easily corrected by making a simple repair or replacement to the broken component. In many cases this can be done without a Disposal System Construction Permit from the Board of Health. However, the Board of Health or agent should be consulted before any corrections are made, even if a permit will not be required.

Further Evaluation is Required by the Board of Health

There are a number of situations where the inspector will not be able to determine if the system passes or fails. They are listed on the form under the section, "Further Evaluation is required by the Board of Health." The first two situations involve cesspools or privies located within 50 feet of a surface water body (not a drinking water supply or its tributaries) or a bordering vegetated wetland or salt marsh. These systems will pass inspection unless the Board of Health determines that a cesspool or privy is functioning in a manner that does not protect the public health and safety and the environment. This determination must be made by the Board of Health. System inspectors can NOT make this evaluation. The system inspector should merely identify that the cesspool or privy is located within the setback. Boards of Health will use other information collected by the inspector, such as depth to groundwater, system design and flow characteristics, along with specific guidance prepared by MassDEP to help determination if a system passes or fails.

A second set of situations involves septic tank and soil absorption systems that are too close to drinking water supplies, drinking water supply tributaries, or public and private water supply wells. In these situations, the systems are deemed to be failed unless the Board of Health (in conjunction with the public water supplier in the case of public surface water supplies and their tributaries) determines that the systems are functioning in a manner that protects the public health and safety and the environment. Again, the system inspector can NOT make this evaluation. The information collected during the inspection and the guidance provided by MassDEP will be used by the Board of Health to make the determination. The system inspector can assist the Board of Health in the case of septic tanks and soil absorption systems located less than 100 feet from a private drinking water well by arranging to have the well tested for fecal coliform bacteria, and ammonia and nitrate nitrogen.

If the inspector has determined that there is a well between 50 and 100 feet on an abutting property, the inspector must make an effort to obtain a sample from that well. If the property owner does not allow access to the property, the inspector should notify the approving authority and allow them to make an evaluation.

In the event that the Board of Health does not make a determination under the Further Evaluation is Required by the Board of Health, then the inspection will stand as determined by the inspector.

System Fails

The system fails if any of the criteria listed in 310 CMR 15.303 (1) (a) through (c) are violated. If the system fails, the owner or operator of the system should contact the Board of Health before any attempt is made to upgrade or repair the system or otherwise attempt to bring the system into compliance. In virtually every situation, a permit will be needed from the Board of Health. It only makes sense, therefore, to contact the Board of Health to determine what the Board will require before arranging to have plans drawn.

Large Systems

In addition to the criteria that apply to all Title 5 regulated systems, there are several criteria that apply to systems with a design flow of 10,000 gallons per day or greater. Please note that all design flow on the property is added together when determining if a system is a Large System. If the large system is located within 400 feet of a surface drinking water supply; 200 feet of a tributary to a surface drinking water supply; or within a nitrogen sensitive area, Interim Wellhead Protection Area (IWPA) or a mapped Zone II of a public water supply well, the system is failed. The inspector must ensure that he/she is knowledgeable about the proximity of the system to these sensitive areas. If the large system is in failure, the owner/operator of the system could be required to obtain a groundwater discharge permit from MassDEP. The owner/operator should contact the local regional office of MassDEP to determine the necessary steps.

Inspection Form Submittal

An approved System Inspector must submit a completed System Inspection Form to the approving authority within 30 days of a field inspection. The approving authority for systems under 10,000 gpd is the Board of Health and for large systems over 10,000 the approving authority is MassDEP. Failure to do so is a violation of 310 CMR 15.000.

Voluntary Assessments

The regulations 310 CMR 15.301(10) provide the owner of a system the ability to have their system assessed without having a complete inspection. Such an assessment need not be done by an approved inspector. However, the Official Inspection Form cannot be used for a voluntary assessment. It can NOT be used to satisfy the requirements to have a system inspected as required in 310 CMR 15.301. Finally, the results of a voluntary assessment not performed to comply with the requirements of section 310 CMR 15.301 need not be submitted to the Local Approving Authority.

If an individual proposes to perform a voluntary assessment on the system, it should be discussed in advance of performing any inspection and prior to arriving on site. It is not appropriate for an inspector to start a formal system inspection and then change to a voluntary assessment when the results would not be favorable to the system owner.

Minimum Requirements for an Inspection
The following are the minimum requirements necessary to complete an inspection. Meeting these minimum criteria, however, should not be construed as completion of an acceptable inspection if through reasonable effort, a complete inspection of all components of the system is feasible. Furthermore, if a complete inspection cannot be performed, the inspector must provide adequate documentation of the specific conditions that prevented a complete inspection and should indicate on the inspection form what was done to try to locate components, determine high groundwater, etc.

1. The inspector must note the general conditions of the property to identify any obvious signs of failure. These would include but not be limited to backup of sewage to the facility, effluent ponding, breakout to the surface of the ground or to surface waters, and other occurrences which professional judgment would deem indications of failure.

2. All components prior to the leaching facility must be located and inspected. In a conventional component system, this would generally require inspection of the septic tank and distribution box. If a cesspool system, all cesspools in the system must be exposed for inspection.

3. Determine high groundwater elevation at the site.

4. Identify the location of system components in relation to sensitive areas such as private water supply wells, surface water supplies and tributaries, interim well head protection area (IWPA) and delineated Zone II of a public water supply.

Preliminary Activities
Information on system pumping must be requested of the owner, occupant, Board of Health or septage receiving facility.

Inspections of on-site systems should begin with a records search at the local Board of Health or other appropriate sources to obtain design plans and as-built drawings, if available. This information will facilitate locating the system components in the field. If these records are not available, then the components will have to be located by other means. Non-invasive techniques for locating system components such as the use of metal detectors or estimating length and direction of pipes are preferred options. However, as a last resort, it may be necessary to expose piping at intervals in order to trace out the layout of the system.

Inspection Procedure: General
Walk around the entire site to note general conditions and check for obvious signs of failure such as surface breakout or ponding. Look for signs of sewage, stains on the ground or saturated, spongy soils. The presence of sewage odors must be determined when first arriving at the site.

Check pumping records for frequency of system pumping and verify that the system has not been pumped within two weeks prior to inspection.

Interview occupants concerning back-up or break-out or high groundwater. Sewage backup into the house can be caused by:

1. Clogged pipes
2. Surcharged septic tank
3. Failed leaching area

It is extremely important that the inspector determine the cause of the backup or breakout. For example, if the problem is due solely to broken or obstructed pipes, this would be considered a Conditional Pass situation; however, if the cause of the backup or breakout can be attributed to a general clogging of the leaching system by solids, then this could be grounds for failing the system.

Locate and inspect all pipes exiting the building. Locate all systems on the property.

Check water meter readings, if receiving city/town water, and attach a copy of water meter readings for 2 years to the inspection report.

Inspection Procedure: Septic Tank
Expose and remove manhole covers. If septic covers are more than a foot deep, recommend that extensions be provided to within six (6) inches of finished grade.

Determine material of construction. If the tank is a metal tank, this is grounds for a Conditional Pass, providing that no other conditions exist that would trigger a system failure. Unless the owner or operator has provided the system inspector with a copy of a Certificate of Compliance indicating that the tank was installed within the 20-year period prior to the date of inspection, the tank must be replaced. A copy of the Certificate of Compliance must be attached to the Inspection form.

Check inlet and outlet tees or baffles for damage. Recommend repair necessary based on the requirements of 310 CMR 15.227. Check outlet tee for gas baffle and/or effluent filter.

Check liquid levels for evidence of leakage. If tank is discharging when there is no flow from facility, there may be infiltration to the tank, which would indicate that the tank may be in high groundwater and is not watertight. If the liquid level is below the outlet invert, then the tank is probably leaking to surrounding soils. Leaking tanks must be pumped in order to inspect them further. If further inspection shows that the tank is cracked, structurally unsound, is leaking, or if groundwater is infiltrating the system through a crack or seam, this condition should warrant a Conditional Pass that would require replacement or sealing of the tank if no other failure criteria are triggered. If the liquid level is above the outlet pipe and there is no outflow, then the outlet pipe may be clogged or the distribution box may be surcharged. The inspector should try to determine the cause. If a surcharge in the tank is due to a broken or cracked pipe or other easily correctable circumstance, the system should merit a Conditional Pass if no other failure criteria are triggered.

Measure sludge depth and thickness, and record on the inspection form. Recommend pumping as part of the inspection if the sludge depth is within 12 inches of the outlet tee.

Check for evidence of backup (i.e., liquid level significantly higher than invert of outlet pipe). Outlet pipe will need to be examined as it enters distribution box to determine cause of backup. If backup is due to broken or obstructed pipe and no other failure criteria are triggered, the system may conditionally pass inspection.

Inspection Procedure: Distribution Box
Expose and remove cover. Determine if d-box is level and if flow is equal. Check for is evidence of solids carryover.

Check if static water level is at or higher than invert of outlet pipe. If the liquid level is above the outlet and there is no outflow, either the outlet pipes are clogged or the leaching area is surcharged and in failure. The inspector must determine the cause. The system may qualify for a conditional pass if the high liquid level is due to broken or obstructed pipes, a broken distribution box, or if the distribution box is uneven or settled.

It should be noted that if the hydraulic backup is due to a soil absorption system which is clogged, the system CANNOT be made to pass by application to the soil absorption system of physical, chemical or biological agents or treatments. Such failures can generally only be corrected by upgrading or replacing the system. The Local Approving Authority should be consulted before any effort is made to repair or upgrade a failed soil absorption system.

Check the pump function if there is a dosing/pump chamber instead of a distribution box. Check that alarms and pumps are functioning correctly. Similarly, if the system includes a siphon, its condition and functionality should be determined. If the pump is not functioning properly, the system may receive a conditional pass provided that the pump is repaired or replaced. If the siphon is not functioning and cleaning the siphon cannot correct the problem, the siphon should be replaced with a pump system (unless it is part of a recirculating sand filter system or other approved alternative technology). In either case, the entire system does NOT need to be upgraded unless other conditions exist which would warrant a complete upgrade.

Inspection Procedure: Soil Absorption System
It is extremely important that the inspector locate the leaching system. However, excavation of the soil absorption system, once it is located, is typically NOT required. It may be appropriate to expose a portion of the soil absorption system (especially if the leaching system is a pit) to determine its condition if indications of failure exist, such as evidence of breakout, ponding, sewage backup, condition of the distribution box, etc., which suggest that a failure of the soil absorption system may have occurred. If the system is a leaching pit, it will generally make sense to open the pit and pump the liquid out of the pit to determine if groundwater infiltrates back into the pit. It should be noted that a leaching pit is not a cesspool and is not inspected under cesspool criteria. A leaching pit is inspected under the SAS criteria.

Approximate layout should be determined by examining the topography and noting drain arrangement from access at the distribution box. Location of the leaching system can often be accomplished by running a snake down the line(s) coming from the distribution box.

1. Determine condition of soil (e.g., clogged, hydrogen sulfide crust, etc.).

2. Determine level of ponding within disposal area (visual inspection).

3. Determine if leaching system is below the high groundwater elevation.

It should be noted that a soil absorption system that fails because it is clogged CANNOT be made to pass by application to the soil absorption system of physical, chemical or biological agents or treatments. Generally, these kinds of failures can only be corrected by upgrading or replacing the system. The Local

Approving Authority should be consulted before any effort is made to repair or upgrade a failed soil absorption system.

The inspector must locate all systems on the property, including laundry dry wells. If the facility has a laundry dry well, it must be inspected and a separate inspection report submitted. A separate inspection form must be completed for each system in use for that property.

If the system has not been in use (the facility is vacant or a seasonal use), the inspector should carefully inspect all components for any signs of failure. The report should clearly indicate the last date of occupancy and report this to the approving authority.

Inspection Procedure: Groundwater Determination
Location of the bottom of the leaching facility compared to the HIGH groundwater elevation is the most common reason for the failure of systems inspected. It is also the most important reason that sewage is not adequately treated before it enters the groundwater table. For these reasons it is most important that the HIGH groundwater elevation be properly determined.

The phrase "high groundwater elevation" is used throughout this section because groundwater elevation can vary significantly throughout the year, from year to year, and in different types of soil. High groundwater is determined in accordance with 310 CMR 15.101, 15.102, and 15.103.

At the present time the most reliable method for determining high groundwater elevation is to excavate a deep test hole and have it evaluated by a Massachusetts approved soil evaluator. This method is probably beyond a routine system inspection and should be used only in cases where, after consultation with all parties, there is disagreement among the inspector, the homeowner and the Board of Health.

Acceptable methods of estimating high groundwater elevation are as follows:

a. **Utilize Existing Plans:** If plans of the disposal system are available, they should show the groundwater elevation on which the plan was based if they are dated between 1995 and present. Unfortunately, many older systems have no plans available and some have plans that merely recorded the groundwater elevation at the time of testing. This may or may not be the HIGH groundwater elevation. Be aware of the date the groundwater tests were performed, and how the results correspond to existing groundwater levels..

b. **Observation on Site:** Look for infiltration into the septic tank, cesspool or distribution box...even leaching pits, galley, or chambers if appropriate. Investigate the surrounding soil by the use of hand augers to determine groundwater elevation. Check the basement for a sump pump.

c. **Assess Local Conditions:** Observe the elevation of nearby wetlands; check for groundwater elevations on plans for systems located nearby; see if there is a sump pump in the building associated with the system under inspection; look for water marks on cellar walls. NEARBY is of course a subjective word. Be prepared to justify this use.

d. **Check with the Local Board of Health:** Many towns maintain a network of groundwater monitoring wells that show relative groundwater elevations.

e. **Check with USDA:** The United States Department of Agriculture, Natural Resources Conservation Service often has maps, records and soil surveys, along with knowledgeable staff, which may be helpful in determining high groundwater elevation.

f. **Check FEMA Maps:** Flood plain maps from the Federal Emergency Management Agency can be useful. They are often available from the local Conservation Commission.

g. **Check Pumping Records:** If the system under inspection is pumped each spring, it is possible this is needed due to high groundwater.

h. **Check with Local Diggers:** Talk with the local water department and sewer department to learn if they have any first hand knowledge of water depths. Do the same with local excavators and installers, also, gas, telephone and electronic companies.

i. **Subscribe to USGS:** Subscribe to USGS groundwater records available at their website below.

j. **Know the Current State of Groundwater:** Groundwater elevations are recorded monthly by the USGS throughout New England, including over 100 wells within Massachusetts. Examination of the records from these wells shows water elevation changes varying from less than a few feet to more than seventeen feet in a given well. These records are available from: http://ma.water.usgs.gov/water.

Methods k through n below constitute more invasive means of determining high groundwater elevation. This guidance does not suggest that these methods are required in all cases. However, in instances where methods a through j have failed to provide adequate information for determining high groundwater elevation, it may be necessary to employ these methods as described below.

k. Small diameter wellpoints can be driven to monitor groundwater elevation. Use appropriate adjustments to determine high groundwater elevation. This method may not be suitable for all soil conditions.

l. After observing effluent water levels, pump the leaching facility and monitor to see if groundwater rises to the bottom (may be more applicable to pits, chambers and galleries than trenches and fields).This approach should be taken with caution. If done during the dry season, the results do not guarantee that subsequent groundwater level rise will not inundate the leaching system. Best professional judgment must be used to determine at what point backflow into the system is due to groundwater infiltration or other factors. Also, in some soils, groundwater may take some time to stabilize. In these instances, proper precautions must be taken to insure that the open area around the leaching facility is properly secured to prevent injury.

The system owner may choose to have the high groundwater elevation determined by the methods described in m and n below to confirm or disprove the results obtained by other methods or in place of the minimum requirements.

m. Drive an observation well with a powered auger, observe the groundwater elevation, and make appropriate adjustments to determine high groundwater elevation. The maximum depth of the well should be twelve feet below grade at the lowest natural elevation on the site or six feet below the bottom of the leaching facility.

n. Dig a deep observation hole and use appropriate adjustments to determine maximum high groundwater elevation. The maximum depth of the hole should be twelve feet below grade at the lowest natural elevation on the site or six feet below the bottom of the leaching facility. The determination of high groundwater through a deep hole must be evaluated by a Massachusetts Soil Evaluator. This approach is generally a last resort, and pursued only when all other approaches have failed.

Inspection Procedure: Single Cesspools
Inspection of a single cesspool must provide sufficient information to determine if any of the failure criteria are triggered.

Minimum requirements are:

- Determine dimensions and materials of construction.
- Measure liquid level distance to invert and evaluate compared to failure criteria.
- Determine the distance below the bottom of the cesspool to high groundwater.
- Note depth of sludge and scum, require pumping upon completion of initial inspection, and observe infiltration of groundwater, if any.

A cesspool that is serving a facility that has a design flow of 2,000 gpd or more but is less than 10,000 gpd is considered a failed system. The owner is required to notify DEP and the local Approving Authority 30 days prior to upgrading.

Inspection Procedure: Overflow of Cesspool Systems
Overflow cesspool systems consist of an initial cesspool that overflows to some type of leaching facility, either another cesspool, pits, fields or trenches. Generally, these systems are found in older facilities and have been installed incrementally over the years, usually to "repair" failed cesspools. These are hybrid systems and do not fall under the definition of "cesspool" as found in Title 5, nor are they conforming Title 5 systems. As a result, these systems have to be inspected using criteria for both cesspools and conventional systems.

When inspecting an overflow cesspool system, the inspector should recognize that the first cesspool is nominally functioning as a septic tank. This means that this unit is likely to be fitted with inlet and outlet pipes and will not have the requisite free space of six inches or half a day’s storage volume that is required for a single cesspool. Accordingly, in order to assess its suitability to function as a septic tank, the first cesspool should be evaluated based on septic tank criteria, except for water tightness. Thus the inspector must check for sludge and scum levels and depths, condition of inlet and outlet tees, and other septic tank criteria. The leaching system(s) or additional cesspool(s) should then be evaluated based on criteria for soil absorption systems.

Because the first cesspool is not watertight, it will leach some effluent and therefore must also be evaluated for setback distances for cesspools as defined in the failure criteria and held to these setbacks for determining failure. In addition, it must also be pumped after the evaluation of its function in order to determine if the bottom of the tank is above or below the maximum groundwater elevation, as is required for single cesspool systems.

In some instances, there may be more than two cesspools in a series.
Each cesspool that has an inlet and outlet pipe and overflows to another type of soil absorption system is to be evaluated as a septic tank as outlined above. Furthermore, they must be evaluated for cesspool setback criteria and pumped to determine if they are below the maximum groundwater elevation. The terminal leaching facility, whether a pit, trench field or additional cesspool (i. e., no outlet and/or connection to any other leaching facility or cesspool), would be subject to the soil absorption system criteria only.

Inspection Procedure: Setbacks
For soil absorption systems, cesspools and privies, measure setbacks from drinking water supplies For cesspools and privies only measure setbacks from surface waters and bordering vegetated wetlands or salt marshes If after measurement it is determined that a cesspool or privy is less than 100 feet but more than 50 feet from a private water supply well, a water analysis is required. The water analysis must be performed at a DEP-certified laboratory and indicate if there is evidence of fecal coliform and less than 5 ppm of ammonia nitrogen and nitrate nitrogen. The inspector must attach a copy of the lab analysis to the inspection report.

As previously indicated, encroachment on these setbacks may trigger failure or require further evaluation of the system by the Local Approving Authority. The System Inspector's job is only to gather information. It is the responsibility of the Local Approving Authority to determine an appropriate course of action in regard to upgrade requirements.

IT IS NOT THE SYSTEM INSPECTOR'S RESPONSIBILITY TO ENFORCE UPGRADE REQUIREMENTS OR TO MAKE ANY RECOMMENDATION OR DETERMINATION OF UPGRADE REQUIREMENTS.

Inspection Procedure: Difficulty in Locating Components
If the inspector is unable to locate components of the disposal system, the following steps should be followed:

1. Pursuant to 310 CMR 15.302, all components prior to the leaching facility must be located.

2. If the system does not have a distribution box, it is important to try to locate the leaching facility and inspect it directly to determine its condition.

3. If the high groundwater elevation is12 feet or more below than the lowest surface elevation on the lot, and there is no evidence of backup in the system, the leaching facility most likely is not below the high groundwater elevation. This condition, however, should NOT relieve the inspector from exercising due diligence in locating the leaching facility and inspecting its condition.

4. The Local Approving Authority should evaluate all “Not Determined” entries on the inspection form and have the final decision as to whether further investigation is required to adequately evaluate the system.

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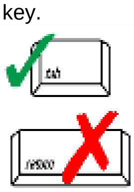
Inspection results must be submitted on this form. Inspection forms may not be altered in any way. Please see completeness checklist at the end of the form.

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



A. Inspector Information

Name of Inspector

Company Name

Company Address

City/Town	State	Zip Code

Telephone Number	License Number

B. Certification

I certify that: **I am a DEP approved system inspector in full compliance with Section 15.340 of Title 5 (310 CMR 15.000);** I have personally inspected the sewage disposal system at the property address listed above; the information reported below is true, accurate and complete as of the time of my inspection; and the inspection was performed based on my training and experience in the proper function and maintenance of on-site sewage disposal systems. After conducting this inspection I have determined that the system:

1. ☐ Passes
2. ☐ Conditionally Passes
3. ☐ Needs Further Evaluation by the Local Approving Authority
4. ☐ Fails

Inspector's Signature	Date

The system inspector shall submit a copy of this inspection report to the Approving Authority (Board of Health or DEP) within 30 days of completing this inspection. If the system has a design flow of 10,000 gpd or greater, the inspector and the system owner shall submit the report to the appropriate regional office of the DEP. The original form should be sent to the system owner and copies sent to the buyer, if applicable, and the approving authority.

Please note: This report only describes conditions at the time of inspection and under the conditions of use at that time. This inspection does not address how the system will perform in the future under the same or different conditions of use.

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C. Inspection Summary

Inspection Summary: Complete 1, 2, 3, or 5 and all of 4 and 6.

1) System Passes:

☐ I have not found any information which indicates that any of the failure criteria described in 310 CMR 15.303 or in 310 CMR 15.304 exist. Any failure criteria not evaluated are indicated below.

Comments:

2) System Conditionally Passes:

☐ One or more system components as described in the "Conditional Pass" section need to be replaced or repaired. The system, upon completion of the replacement or repair, as approved by the Board of Health, will pass.

Check the box for "yes", "no" or "not determined" (Y, N, ND) for the following statements. If "not determined," please explain.

The septic tank is metal and over 20 years old*** or** the septic tank (whether metal or not) is structurally unsound, exhibits substantial infiltration or exfiltration or tank failure is imminent. System will pass inspection if the existing tank is replaced with a complying septic tank as approved by the Board of Health.

***** A metal septic tank will pass inspection if it is structurally sound, not leaking and if a Certificate of Compliance indicating that the tank is less than 20 years old is available.

☐ Y ☐ N ☐ ND (Explain below):

C. Inspection Summary (cont.)

2) System Conditionally Passes (cont.)**:**

☐ Pump Chamber pumps/alarms not operational. System will pass with Board of Health approval if pumps/alarms are repaired.

☐ Observation of sewage backup or break out or high static water level in the distribution box due to broken or obstructed pipe(s) or due to a broken, settled or uneven distribution box. System will pass inspection if (with approval of Board of Health):

☐	broken pipe(s) are replaced	☐ Y	☐ N	☐ ND (Explain below):
☐	obstruction is removed	☐ Y	☐ N	☐ ND (Explain below):
☐	distribution box is leveled or replaced	☐ Y	☐ N	☐ ND (Explain below):

☐ The system required pumping more than 4 times a year due to broken or obstructed pipe(s). The system will pass inspection if (with approval of the Board of Health):

☐	broken pipe(s) are replaced	☐ Y	☐ N	☐ ND (Explain below):
☐	obstruction is removed	☐ Y	☐ N	☐ ND (Explain below):

3) Further Evaluation is Required by the Board of Health:

☐ Conditions exist which require further evaluation by the Board of Health in order to determine if the system is failing to protect public health, safety or the environment.

a. System will pass unless Board of Health determines in accordance with 310 CMR 15.303(1)(b) that the system is not functioning in a manner which will protect public health, safety and the environment:

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C. Inspection Summary (cont.)

☐ Cesspool or privy is within 50 feet of a surface water

☐ Cesspool or privy is within 50 feet of a bordering vegetated wetland or a salt marsh

b. System will fail unless the Board of Health (and Public Water Supplier, if any) determines that the system is functioning in a manner that protects the public health, safety and environment:

☐ The system has a septic tank and soil absorption system (SAS) and the SAS is within 100 feet of a surface water supply or tributary to a surface water supply.

☐ The system has a septic tank and SAS and the SAS is within a Zone 1 of a public water supply.

☐ The system has a septic tank and SAS and the SAS is within 50 feet of a private water supply well.

☐ The system has a septic tank and SAS and the SAS is less than 100 feet but 50 feet or more from a private water supply well**.

Method used to determine distance: ____________________

** This system passes if the well water analysis, performed at a DEP certified laboratory, for fecal coliform bacteria indicates absent and the presence of ammonia nitrogen and nitrate nitrogen is equal to or less than 5 ppm, provided that no other failure criteria are triggered. A copy of the analysis must be attached to this form.

c. Other:

____

____

____

____

4) System Failure Criteria Applicable to All Systems:

You <u>must</u> indicate "Yes" or "No" to each of the following for <u>all</u> inspections:

Yes	No	
☐	☐	Backup of sewage into facility or system component due to overloaded or clogged SAS or cesspool
☐	☐	Discharge or ponding of effluent to the surface of the ground or surface waters due to an overloaded or clogged SAS or cesspool

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C. Inspection Summary (cont.)

4) System Failure Criteria Applicable to All Systems: (cont.)

Yes	No	
☐	☐	Static liquid level in the distribution box above outlet invert due to an overloaded or clogged SAS or cesspool
☐	☐	Liquid depth in cesspool is less than 6" below invert or available volume is less than ½ day flow
☐	☐	Required pumping more than 4 times in the last year ***NOT*** due to clogged or obstructed pipe(s). Number of times pumped: _____.
☐	☐	Any portion of the SAS, cesspool or privy is below high ground water elevation.
☐	☐	Any portion of cesspool or privy is within 100 feet of a surface water supply or tributary to a surface water supply.
☐	☐	Any portion of a cesspool or privy is within a Zone 1 of a public water supply well.
☐	☐	Any portion of a cesspool or privy is within 50 feet of a private water supply well.
☐	☐	Any portion of a cesspool or privy is less than 100 feet but greater than 50 feet from a private water supply well with no acceptable water quality analysis. **[This system passes if the well water analysis, performed at a DEP certified laboratory, for fecal coliform bacteria indicates absent and the presence of ammonia nitrogen and nitrate nitrogen is equal to or less than 5 ppm, provided that no other failure criteria are triggered. A copy of the analysis and chain of custody must be attached to this form.]**
☐	☐	The system is a cesspool serving a facility with a design flow of 2000 gpd-10,000 gpd.
☐	☐	**The system fails.** I have determined that one or more of the above failure criteria exist as described in 310 CMR 15.303, therefore the system fails. The system owner should contact the Board of Health to determine what will be necessary to correct the failure.

5) Large Systems: To be considered a large system the system must serve a facility with a design flow of 10,000 gpd to 15,000 gpd.

For large systems, you must indicate either "yes" or "no" to each of the following, in addition to the questions in Section C.4.

Yes	No	
☐	☐	the system is within 400 feet of a surface drinking water supply
☐	☐	the system is within 200 feet of a tributary to a surface drinking water supply
☐	☐	the system is located in a nitrogen sensitive area (Interim Wellhead Protection Area – IWPA) or a mapped Zone II of a public water supply well

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C. Inspection Summary (cont.)

If you have answered "yes" to any question in Section C.5 the system is considered a significant threat, or answered "yes" to any question in Section C.4 above the large system has failed. The owner or operator of any large system considered a significant threat under Section C.5 or failed under Section C.4 shall upgrade the system in accordance with 310 CMR 15.304. The system owner should contact the appropriate regional office of the Department.

6. **You must indicate "yes" or "no" for each of the following for *all* inspections:**

Yes	No	
☐	☐	Pumping information was provided by the owner, occupant, or Board of Health
☐	☐	Were any of the system components pumped out in the previous two weeks?
☐	☐	Has the system received normal flows in the previous two week period?
☐	☐	Have large volumes of water been introduced to the system recently or as part of this inspection?
☐	☐	Were as built plans of the system obtained and examined? (If they were not available note as N/A)
☐	☐	Was the facility or dwelling inspected for signs of sewage back up?
☐	☐	Was the site inspected for signs of break out?
☐	☐	Were all system components, excluding the SAS, located on site?
☐	☐	Were the septic tank manholes uncovered, opened, and the interior of the tank inspected for the condition of the baffles or tees, material of construction, dimensions, depth of liquid, depth of sludge and depth of scum?
☐	☐	Was the facility owner (and occupants if different from owner) provided with information on the proper maintenance of subsurface sewage disposal systems?

The **size and location of the Soil Absorption System (SAS)** on the site has been determined based on:

Yes	No	
☐	☐	Existing information. For example, a plan at the Board of Health.
☐	☐	Determined in the field (if any of the failure criteria related to Part C is at issue approximation of distance is unacceptable) [310 CMR 15.302(5)]

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D. System Information

1. **Residential Flow Conditions:**

Number of bedrooms (design): ______ Number of bedrooms (actual): ______

DESIGN flow based on 310 CMR 15.203 (for example: 110 gpd x # of bedrooms): ______

Description:

Number of current residents: ______

Does residence have a garbage grinder? ☐ Yes ☐ No

Does residence have a water treatment unit? ☐ Yes ☐ No

If yes, discharges to: ______

Is laundry on a separate sewage system? (Include laundry system inspection information in this report.) ☐ Yes ☐ No

Laundry system inspected? ☐ Yes ☐ No

Seasonal use? ☐ Yes ☐ No

Water meter readings, if available (last 2 years usage (gpd)): ______

Detail:

Sump pump? ☐ Yes ☐ No

Last date of occupancy: ______
Date

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D. System Information (cont.)

2. **Commercial/Industrial Flow Conditions:**

Type of Establishment: ______

Design flow (based on 310 CMR 15.203): ______ Gallons per day (gpd)

Basis of design flow (seats/persons/sq.ft., etc.): ______

Grease trap present? ☐ Yes ☐ No

Water treatment unit present? ☐ Yes ☐ No

If yes, discharges to: ______

Industrial waste holding tank present? ☐ Yes ☐ No

Non-sanitary waste discharged to the Title 5 system? ☐ Yes ☐ No

Water meter readings, if available: ______

Last date of occupancy/use: ______ Date

Other (describe below):

______

3. **Pumping Records:**

Source of information: ______

Was system pumped as part of the inspection? ☐ Yes ☐ No

If yes, volume pumped: ______ gallons

How was quantity pumped determined? ______

Reason for pumping: ______

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D. System Information (cont.)

4. **Type of System:**

☐ Septic tank, distribution box, soil absorption system

☐ Single cesspool

☐ Overflow cesspool

☐ Privy

☐ Shared system (yes or no) (if yes, attach previous inspection records, if any)

☐ Innovative/Alternative technology. Attach a copy of the current operation and maintenance contract (to be obtained from system owner) and a copy of latest inspection of the I/A system by system operator under contract

☐ Tight tank. Attach a copy of the DEP approval.

☐ Other (describe):

Approximate age of all components, date installed (if known) and source of information:

Were sewage odors detected when arriving at the site? ☐ Yes ☐ No

5. **Building Sewer** (locate on site plan):

Depth below grade: ______ feet

Material of construction:

☐ cast iron ☐ 40 PVC ☐ other (explain):

Distance from private water supply well or suction line: ______ feet

Comments (on condition of joints, venting, evidence of leakage, etc.):

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D. System Information (cont.)

6. **Septic Tank** (locate on site plan):

Depth below grade: ____________ feet

Material of construction:

☐ concrete ☐ metal ☐ fiberglass ☐ polyethylene ☐ other (explain)

If tank is metal, list age: ____________ years

Is age confirmed by a Certificate of Compliance? (attach a copy of certificate) ☐ Yes ☐ No

Dimensions: ____________

Sludge depth: ____________

Distance from top of sludge to bottom of outlet tee or baffle ____________

Scum thickness ____________

Distance from top of scum to top of outlet tee or baffle ____________

Distance from bottom of scum to bottom of outlet tee or baffle ____________

How were dimensions determined? ____________

Comments (on pumping recommendations, inlet and outlet tee or baffle condition, structural integrity, liquid levels as related to outlet invert, evidence of leakage, etc.):

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D. System Information (cont.)

7. **Grease Trap** (locate on site plan):

Depth below grade: ________ feet

Material of construction:

☐ concrete ☐ metal ☐ fiberglass ☐ polyethylene ☐ other (explain):

Dimensions: ________

Scum thickness ________

Distance from top of scum to top of outlet tee or baffle ________

Distance from bottom of scum to bottom of outlet tee or baffle ________

Date of last pumping: ________ Date

Comments (on pumping recommendations, inlet and outlet tee or baffle condition, structural integrity, liquid levels as related to outlet invert, evidence of leakage, etc.):

8. **Tight or Holding Tank** (tank must be pumped at time of inspection) (locate on site plan):

Depth below grade: ________

Material of construction:

☐ concrete ☐ metal ☐ fiberglass ☐ polyethylene ☐ other (explain):

Dimensions: ________

Capacity: ________ gallons

Design Flow: ________ gallons per day

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D. System Information (cont.)

8. **Tight or Holding Tank** (cont.)

Alarm present: ☐ Yes ☐ No

Alarm level: ______ Alarm in working order: ☐ Yes ☐ No

Date of last pumping: ______ Date

Comments (condition of alarm and float switches, etc.):

____

____

____

____

* Attach copy of current pumping contract (required). Is copy attached? ☐ Yes ☐ No

9. **Distribution Box** (if present must be opened) (locate on site plan):

Depth of liquid level above outlet invert ______

Comments (note if box is level and distribution to outlets equal, any evidence of solids carryover, any evidence of leakage into or out of box, etc.):

____

____

____

____

____

____

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D. System Information (cont.)

10. **Pump Chamber** (locate on site plan):

Pumps in working order: ☐ Yes ☐ No*

Alarms in working order: ☐ Yes ☐ No*

Comments (note condition of pump chamber, condition of pumps and appurtenances, etc.):

* If pumps or alarms are not in working order, system is a conditional pass.

11. **Soil Absorption System** (SAS) (locate on site plan, excavation not required):

If SAS not located, explain why:

Type:

☐	leaching pits	number:	
☐	leaching chambers	number:	
☐	leaching galleries	number:	
☐	leaching trenches	number, length:	
☐	leaching fields	number, dimensions:	
☐	overflow cesspool	number:	
☐	innovative/alternative system		

Type/name of technology:

Commonwealth of Massachusetts

Title 5 Official Inspection Form

Subsurface Sewage Disposal System Form - Not for Voluntary Assessments

Property Address

Owner information is required for every page.

Owner's Name

City/Town | State | Zip Code | Date of Inspection

D. System Information (cont.)

11. **Soil Absorption System** (SAS) (cont.)

Comments (note condition of soil, signs of hydraulic failure, level of ponding, damp soil, condition of vegetation, etc.):

12. **Cesspools** (cesspool must be pumped as part of inspection) (locate on site plan):

Number and configuration

Depth – top of liquid to inlet invert

Depth of solids layer

Depth of scum layer

Dimensions of cesspool

Materials of construction

Indication of groundwater inflow ☐ Yes ☐ No

Comments (note condition of soil, signs of hydraulic failure, level of ponding, condition of vegetation, etc.):

Property Address

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D. System Information (cont.)

13. **Privy** (locate on site plan):

Materials of construction: ____________________

Dimensions ____________________

Depth of solids ____________________

Comments (note condition of soil, signs of hydraulic failure, level of ponding, condition of vegetation, etc.):

Property Address

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D. System Information (cont.)

14. **Sketch Of Sewage Disposal System:**
Provide a view of the sewage disposal system, including ties to at least two permanent reference landmarks or benchmarks. Locate all wells within 100 feet. Locate where public water supply enters the building. Check one of the boxes below:

☐ hand-sketch in the area below
☐ drawing attached separately

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D. System Information (cont.)

15. **Site Exam**:

- ☐ Check Slope
- ☐ Surface water
- ☐ Check cellar
- ☐ Shallow wells

Estimated depth to high ground water: ______ feet

Please indicate all methods used to determine the high ground water elevation:

☐ Obtained from system design plans on record

If checked, date of design plan reviewed: ______ Date

☐ Observed site (abutting property/observation hole within 150 feet of SAS)

☐ Checked with local Board of Health - explain:

______

☐ Checked with local excavators, installers - (attach documentation)

☐ Accessed USGS database - explain:

______

You **must** describe how you established the high ground water elevation:

______

______

______

______

______

______

Before filing this Inspection Report, please see Report Completeness Checklist on next page.

Commonwealth of Massachusetts

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Subsurface Sewage Disposal System Form - Not for Voluntary Assessments

Property Address

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Owner's Name

City/Town | State | Zip Code | Date of Inspection

E. Report Completeness Checklist

Complete all applicable sections of this form inclusive of:

- ☐ A. Inspector Information: Complete all fields in this section.
- ☐ B. Certification: Signed & Dated and 1, 2, 3, or 4 checked
- ☐ C. Inspection Summary:

  1, 2, 3, or 5 completed as appropriate

  4 (Failure Criteria) and 6 (Checklist) completed

- ☐ D. System Information:

  For 8: Tight/Holding Tank – Pumping contract attached

  For 14: Sketch of Sewage Disposal System drawn on pg. 16 or attached

  For 15: Explanation of estimated depth to high groundwater included

Massachusetts's Main Title 5 Page: https://www.mass.gov/septic-systems-title-5

Massachusetts's Title 5 Septic System Forms: https://www.mass.gov/septic-systems-title-5

Listing of I/A (Innovative and Alternative) technologies approved for use (or under review) in Massachusetts. For the most current listing, please visit the MassDEP web site at the following page: https://www.mass.gov/doc/summary-table-of-innovativealternative-technologies-approved-for-use-in-massachusetts/download

310 CMR 15.000: Septic Systems Regulations: https://www.mass.gov/regulations/310-CMR-15000-septic-systems-title-5

- Download Code: https://www.mass.gov/doc/310-cmr-15000-title-5-of-the-state-environmental-code/download
- Download Changes eff. 1/3/2014: https://www.mass.gov/doc/title-5-changes-effective-january-3-2014/download

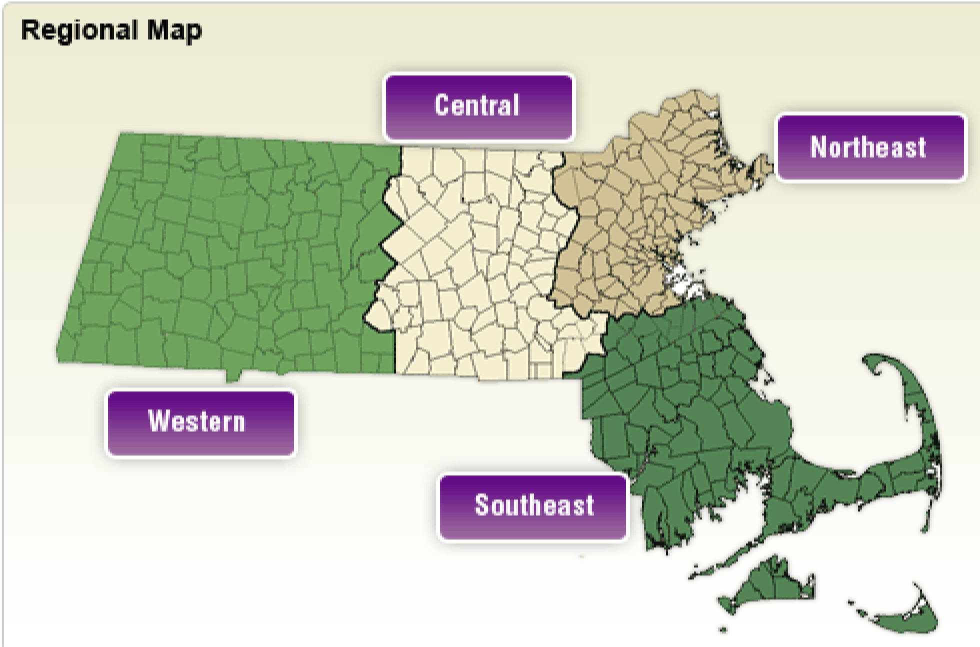
Massachusetts Title 5
System Inspector Manual

CHAPTER 12
MASSDEP REGIONS

Locations and Info
(All locations open 8:45 am – 5:00 pm
Monday through Friday, except state holidays)

Contact Info

MassDEP Northeast Region 205B Lowell Street Wilmington, Massachusetts 01887 Main Phone: 978-694-3200 Fax: 978-694-3499 Service Center: 978-694-3200
MassDEP Southeast Region - Main Office 20 Riverside Drive Lakeville, Massachusetts 02347 Main telephone: 508-946-2700 Fax: 508-947-6557 Service Center: 508-946-2714
MassDEP Central Region 8 New Bond Street Worcester, Massachusetts 01606 Main Phone: 508-792-7650 Fax: 508-792-7621 Service Center: 508-792-7683
MassDEP Western Region 436 Dwight Street Springfield, Massachusetts 01103 Main Phone: 413-784-1100 Fax: 413-784-1149 Service Center: 413-755-2214



Abington - Southeast Region
Acton - Central Region
Acushnet - Southeast Region
Adams - Western Region
Agawam - Western Region
Alford - Western Region
Amesbury - Northeast Region
Amherst - Western Region
Andover - Northeast Region
Aquinnah (Gay Head) - Southeast Region
Arlington - Northeast Region
Ashburnham - Central Region
Ashby - Central Region
Ashfield - Western Region
Ashland - Northeast Region
Athol -Western Region
Attleboro - Southeast Region
Auburn - Central Region
Avon - Southeast Region
Ayer - Central Region

Barnstable - Southeast Region
Barre - Central Region
Becket - Western Region
Bedford - Northeast Region
Belchertown - Western Region
Bellingham - Central Region
Belmont - Northeast Region
Berkley - Southeast Region
Berlin - Central Region
Bernardston - Western Region
Beverly - Northeast Region
Billerica - Northeast Region
Blackstone - Central Region
Blandford - Western Region
Bolton - Central Region
Boston - Northeast Region
Bourne - Southeast Region
Boxborough - Central Region
Boxford - Northeast Region
Boylston - Central Region
Braintree - Southeast Region
Brewster - Southeast Region
Bridgewater - Southeast Region
Brimfield - Western Region
Brockton - Southeast Region
Brookfield - Central Region
Brookline - Northeast Region
Buckland - Western Region
Burlington - Northeast Region

Cambridge - Northeast Region
Canton - Southeast Region
Carlisle - Northeast Region
Carver - Southeast Region
Charlemont - Western Region
Charlton - Central Region

Chatham - Southeast Region
Chelmsford - Northeast Region
Chelsea - Northeast Region
Cheshire - Western Region
Chester - Western Region
Chesterfield - Western Region
Chicopee - Western Region
Chilmark - Southeast Region
Clarksburg - Western Region
Clinton - Central Region
Cohasset - Southeast Region
Colrain - Western Region
Concord - Northeast Region
Conway - Western Region
Cummington - Western Region

Dalton - Western Region
Danvers - Northeast Region
Dartmouth - Southeast Region
Dedham - Northeast Region
Deerfield - Western Region
Dennis - Southeast Region
Dighton - Southeast Region
Douglas - Central Region
Dover - Northeast Region
Dracut - Northeast Region
Dudley - Central Region
Dunstable - Central Region
Duxbury - Southeast Region

East Bridgewater - Southeast Region
East Brookfield - Central Region
Eastham - Southeast Region
Easthampton - Western Region
East Longmeadow - Western Region
Easton - Southeast Region
Edgartown - Southeast Region
Egremont - Western Region
Erving - Western Region
Essex - Northeast Region
Everett - Northeast Region

Fairhaven - Southeast Region
Fall River - Southeast Region
Falmouth - Southeast Region
Fitchburg - Central Region
Florida - Western Region
Foxborough - Southeast Region
Framingham - Northeast Region
Franklin - Central Region
Freetown - Southeast Region

Gardner - Central Region
Gay Head (Aquinnah) - Southeast Region
Georgetown - Northeast Region
Gill - Western Region
Gloucester - Northeast Region
Goshen - Western Region
Gosnold - Southeast Region
Grafton - Central Region
Granby - Western Region
Granville - Western Region
Great Barrington - Western Region
Greenfield - Western Region
Groton - Central Region
Groveland - Northeast Region

Hadley - Western Region
Halifax - Southeast Region
Hamilton - Northeast Region
Hampden - Western Region
Hancock - Western Region
Hanover - Southeast Region
Hanson - Southeast Region
Hardwick - Western Region
Harvard - Central Region
Harwich - Southeast Region
Hatfield - Western Region
Haverhill - Northeast Region
Hawley - Western Region
Heath - Western Region
Hingham - Southeast Region
Hinsdale - Western Region
Holbrook - Southeast Region
Holden - Central Region
Holland - Western Region
Holliston - Central Region
Holyoke - Western Region
Hopedale - Central Region
Hopkinton - Central Region
Hubbardson - Central Region
Hudson - Central Region
Hull - Southeast Region
Huntington - Western Region
Hyannis - Southeast Region

Ipswich - Northeast Region

Kingston - Southeast Region

Lakeville - Southeast Region
Lancaster - Central Region
Lanesborough - Western Region
Lawrence - Northeast Region
Lee - Western Region
Leicester - Central Region
Lenox - Western Region
Leominster - Central Region
Leverett - Western Region
Lexington - Northeast Region
Leyden - Western Region
Lincoln - Northeast Region
Littleton - Central Region
Longmeadow - Western Region
Lowell - Northeast Region
Ludlow - Western Region
Lunenburg - Central Region
Lynn - Northeast Region
Lynnfield - Northeast Region

Malden - Northeast Region
Manchester-by-the-Sea - Northeast Region
Mansfield - Southeast Region
Marblehead - Northeast Region
Marion - Southeast Region
Marlborough - Central Region
Marshfield - Southeast Region
Mashpee - Southeast Region
Mattapoisett - Southeast Region
Maynard - Central Region
Medfield - Central Region
Medford - Northeast Region
Medway - Central Region
Melrose - Northeast Region
Mendon - Central Region
Merrimac - Northeast Region
Methuen - Northeast Region
Middleborough - Southeast Region
Middlefield - Western Region
Middleton - Northeast Region
Milford - Central Region
Millbury - Central Region
Millis - Central Region
Milton - Northeast Region
Millville - Central Region
Monroe - Western Region
Monson - Western Region
Montague - Western Region
Monterey - Western Region
Montgomery - Western Region
Mount Washington - Western Region

Nahant - Northeast Region
Nantucket - Southeast Region
Natick - Northeast Region
Needham - Northeast Region
New Ashford - Western Region
New Bedford - Southeast Region
New Braintree - Central Region
Newbury - Northeast Region
Newburyport - Northeast Region
New Marlborough - Western Region
New Salem - Western Region
Newton - Northeast Region
Norfolk - Central Region
North Adams - Western Region
North Andover - Northeast Region
North Attleborough - Southeast Region
Northborough - Central Region
Northbridge - Central Region
North Brookfield - Central Region
Northfield - Western Region
Northhampton - Western Region
North Reading - Northeast Region
Norton - Southeast Region
Norwell - Southeast Region
Norwood - Southeast Region

Oak Bluffs - Southeast Region
Oakham - Central Region
Orange - Western Region
Orleans - Southeast Region
Otis - Western Region
Oxford - Central Region

Palmer - Western Region
Paxton - Central Region
Peabody - Northeast Region
Pelham - Western Region
Pembroke - Southeast Region
Pepperell - Central Region
Peru - Western Region
Petersham - Western Region
Phillipston - Central Region
Pittsfield - Western Region
Plainfield - Western Region

Plainville - Southeast Region
Plymouth - Southeast Region
Plympton - Southeast Region
Princeton - Central Region
Provincetown - Southeast Region

Quincy - Northeast Region

Randolph - Southeast Region
Raynham - Southeast Region
Reading - Northeast Region
Rehoboth - Southeast Region
Revere - Northeast Region
Richmond - Western Region
Rochester - Southeast Region
Rockland - Southeast Region
Rockport - Northeast Region
Rowe - Western Region
Rowley - Northeast Region
Royalston - Western Region
Russell - Western Region
Rutland - Central Region

Salem - Northeast Region
Salisbury - Northeast Region
Sandisfield - Western Region
Sandwich - Southeast Region
Saugus - Northeast Region
Savoy - Western Region
Scituate - Southeast Region
Seekonk - Southeast Region
Sharon - Southeast Region
Sheffield - Western Region
Shelburne - Western Region
Sherborn - Northeast Region
Shirley - Central Region
Shrewsbury - Central Region
Shutesbury - Western Region
Somerset - Southeast Region
Somerville - Northeast Region
Southborough - Central Region
Southbridge - Central Region
South Hadley - Western Region
Southampton - Western Region
Southwick - Western Region
Spencer - Central Region
Springfield - Western Region
Sterling - Central Region
Stockbridge - Western Region
Stoneham - Northeast Region
Stoughton - Southeast Region
Stow - Central Region
Sturbridge - Central Region
Sudbury - Northeast Region
Sunderland - Western Region
Sutton - Central Region
Swampscott - Northeast Region
Swansea - Southeast Region

Taunton - Southeast Region
Templeton - Central Region
Tewksbury - Northeast Region
Tisbury - Southeast Region
Tolland - Western Region
Topsfield - Northeast Region
Townsend - Central Region
Truro - Southeast Region
Tyngsboro - Northeast Region
Tyringham - Western Region

Upton - Central Region
Uxbridge - Central Region

Wakefield - Northeast Region
Wales - Western Region
Walpole - Southeast Region
Waltham - Northeast Region
Ware - Western Region
Wareham - Southeast Region
Warren - Western Region
Warwick - Western Region
Washington - Western Region
Watertown - Northeast Region
Wayland - Northeast Region
Webster - Central Region
Wellesley - Northeast Region
Wellfleet - Southeast Region
Wendell - Western Region
Wenham - Northeast Region
Westborough - Central Region
West Boylston - Central Region
West Bridgewater - Southeast Region
West Brookfield - Central Region
Westfield - Western Region
Westford - Northeast Region
Westhampton - Western Region
Westminster - Central Region
West Newbury - Northeast Region

Weston - Northeast Region
Westport - Southeast Region
West Springfield - Western Region
West Stockbridge - Western Region
West Tisbury - Southeast Region
Westwood - Northeast Region
Weymouth -Southeast Region
Whately - Western Region
Whitman - Southeast Region
Wilbraham - Western Region
Williamsburg - Western Region
Williamstown - Western Region
Wilmington - Northeast Region
Winchendon - Central Region
Winchester - Northeast Region
Windsor - Western Region
Winthrop - Northeast Region
Woburn - Northeast Region
Worcester - Central Region
Worthington - Western Region
Wrentham - Southeast Region

Yarmouth - Southeast Region