SECTION 8: Tank Management and Septage

TANK MANAGEMENT AND SEPTAGE

All systems need to be managed to operate properly. It is critical that all system owners understand that all properly operating systems will have a management aspect in order to serve as a long term solution. These activities are straight forward but necessary and time sensitive for systems to operate properly. See Section 1 for more information about communicating with the homeowner about monitoring and maintenance tanks. The UMN Septic System Management Plans also clearly identify homeowner vs. professional responsibilities in the management of a septic system.

Tank Maintenance

Cleaning

How frequently a septic tank should be cleaned depends upon the tank capacity, the number of people using the system, and appliances that send waste to the tank, such as a garbage disposal. The solids from one person will, on the average, occupy about 50 gallons of tank capacity per year.

MN Rules Chapter 7080.2450, Subp. 2 requires an assessment of every tank every three years, at minimum. This assessment includes the measurement or removal of scum and sludge accumulations as well as a determination of whether the sewage tank leaks below the designed operating depth or at penetrations such as tank tops, riser joints or riser connections. The tank should be cleaned when:

- 1/4 of the initial liquid capacity is occupied by floating and settled solids (for example, 250 gallons in a 1,000-gallon tank),
- when the top of the sludge layer reaches twelve inches below the outlet baffle, or
- when the bottom of the scum layer reaches three inches above the outlet baffle.

Some tanks may need cleaning within two years or even sooner, while others may go longer before they need cleaning.

Tanks with a shorter distance between the inlet and outlet baffles will need more frequent cleaning in order to protect the soil treatment unit. Once sludge scours through the tank outlet, it can quickly plug a soil treatment unit to the point where a new one is required.

Scum and Sludge Accumulations

Scum and sludge accumulations should be periodically evaluated. At least once every three years, the owner of the tank or a septic system professional must inspect the tank and measure the accumulation of sludge and scum. In addition, the tank must be checked to assure that it is not leaking below the operating depth or at any joints or connections. Equipment is commercially available to measure scum and sludge accumulations.

According to **MN Rules Chapter 7080.2450, Subp. 3 (A and B)**, the septic tank must be cleaned through the maintenance hole:

- whenever the sludge and scum depths are greater than **25%** of the tank depth measured at the front of the tank, or

- the top of the sludge layer is closer than 12 inches to the bottom of the outlet baffle, or
- whenever the bottom of the scum layer is closer than three inches to the bottom of the outlet baffle.

Tank capacity and, consequently, detention time, is reduced as solids build up. A tank detention time of much less than 24 hours may result in some solids being discharged with the effluent and carried to the soil treatment unit. To protect the soil treatment unit, periodic removal of accumulated solids in the septic tank is necessary.

It is a good idea to check the accumulated solids in a new septic tank one to two months after the tank is put into operation. The measurement of the accumulated solids will help to predict the frequency of solids removal.

Septic Tank Cleaning Procedure

How to Clean a Tank

1. Locate Maintenance Hole

The first step in pumping a septic tank is to locate the maintenance hole for servicing. **MN Rules Chapter 7080.2450, Subp. 3 (B)** requires that the tank be pumped through the maintenance hole. The use of any other opening like the 4" inspection pipes, is not considered maintenance, and the owner must approve these improper activities (see #11). The use of any other opening besides the maintenance hole is only permissible in emergency situations such as winter freeze-ups or early spring plugging, or in the case of a deep install with an older tank with out risers or no maintenance hole available. In both of these situations, deep tanks or emergency service, the pumping frequency should be shortened due to the inability to clean the tank thoroughly.

Experience is helpful in finding the maintenance hole. If you are new to onsite system maintenance, ask the county what the older tanks in the area look like and the typical location for the maintenance hole. New tanks will have risers to the surface and manholes at both ends. In older tanks, the maintenance hole may be in the center of the tank. You will learn the actual design in your area once you have experienced digging up a number of the lids.

Deep digging should be a one-time happening. The addition of a riser to the maintenance hole for any tank deeper than 12 inches should be a local requirement or at least well marketed by the maintainer. The connection of the riser to the tank is critical to maintaining a water-tight tank. The deeper the system, the more critical is the connection to the tank, and time should be invested in the connection on the tank. More information about this critical connection is found in Section 7.

2. Open Maintenance Hole

Opening the 20 inch maintenance cover is critical for proper maintenance. **MN Rules Chapter 7080.2450, Subp. 3 (C)** also requires the professional to assess the cover and its level of secureness. A plastic cover must be properly secured with bolts or screws. A concrete lid is considered secure by **MN Rules Chapter 7080.1970 C** if it weighs at least 95 lbs. Older covers that are in sound physical condition can be considered secure by the local unit of government. Both of these conditions require proper tools for the

professional to access the septic tank. Do not arrive at a site to find that you can't properly open the tank!

3. Inspect Contents

Checking the three layers in the tank is an important step for the tank's long-term operation. The scum, sludge and clear zones should be measured and verified at the time of maintenance. The depth of the sludge and scum determines the need for their removal, and the appearance of the clear zone can tell much about the performance of the system.

The scum layer should be present. A missing scum layer can be the result of a loss of the outlet baffle or the chemicals that are being added to the tank. The chemical addition can be assessed using your nose and testing the pH level. The pH level may be between 6- 7.7, but should be similar to the pH of the tap water. If the pH level is a point above or below the tap water, the tank will be struggling to support active bacterial activity. Low pH values are caused by acids (cleaners or dairy) being added to the system. High pH values are caused by basic cleaners or other chemicals.

Another possible cause of a missing scum layer is the addition of water softener recharge water. This product can reduce the tank's ability to release and hold the soap scum in the tank, causing them to flow through the system. Routing the recharge around the tank can be helpful.

The clear zone should be at least 75 percent of the tank depth. The appearance of flocculent (small floating solids) will also speak to tank operation. A clear zone with little flocculent means the tank is working well. A cloudy clear zone usually identifies high BOD content, the BOD typically related to a soluble source, soda, dairy or alcohol. An absent clear zone is the result of an anti-bacterial addition that has significantly impacted bacterial action.

If the sludge and the scum are greater than 25 percent of the operating tank depth the contents of the tank should be removed. A sticky dark sludge may be related to the use of an iron filter. These water conditioners may discharge a solid {iron precipitate} into the tank as part of typical operation. This water using component will increase the maintenance frequency.

4. Remove All Tank Contents

All solids and scum in the tank should be removed. Chapter 7080 requires that the solids should be removed to within 1 inch of the bottom of the tank. This means that seeing the bottom is critical for a successful cleaning. A number of choices for cleaning are available. Mechanical mixing, air mixing or back flushing are all methods to deal with the solids.

Cleaning Procedure

Removing all of the septic tank solids involves more than just pumping the tank. When the septic tank is cleaned, the cleaning access cover or the tank cover must be removed to facilitate cleaning and to ensure that all solids have been pumped out. A septic tank cannot be cleaned adequately by pumping out liquids through a four or six inch inspection pipe. This improper practice often results in the scum layer plugging the outlet baffle when liquid again fills the tank. Removal of all sludge, scum, and liquid must be done through the maintenance hole. If no maintenance hole exists, this typically indicates a non-watertight tank.

The tank cleaning job must be performed by a professional having adequate equipment.

When all of the solids have been broken up and are suspended in the liquid, the mixture is pumped out of the septic tank into the truck. Unless the cleaning access is open, it will be virtually impossible to tell if all of the solids have been removed from the tank.

Mechanical Mixing

Mechanical mixing of the tank contents can make the removal of solids an easier job. A crust buster is a device designed to agitate and mix the scum and solids, even stirring the corners of the tank. It can shorten the time necessary to clean the tank. Be sure the effluent level in the tank is below the outlet piping so no solids are pushed out of the tank. Recognize that the vacuum will remove the water first and the important solids second. If the scum layer is hard, it may be necessary to agitate the tank with air, a mixer, or a long-handled shovel through the cleaning access in order to break up the scum layer.

This device can make the cleaning job easier quicker and reduce the time at the site as well as the time your pump needs to operate.

Back Flush

Another method for removing and mixing the solids is back flushing. In this method, the tank is partially emptied and the septage is pushed back into the tank for further mixing and cleaning of the tank. This is a good way to allow for the removal of the solids. Be careful that the back flush volume being put back into the tank is not more than the tank capacity; overfilling the tank puts solids in bad locations like the basement or the soil treatment area. If someone has attempted to service a septic tank through the inspection pipes over the inlet and outlet baffles, those baffles may be broken or dislodged. When the septic tank cleaning access is open, check the condition, length, and submergence of the inlet and outlet baffles. Septic tank service personnel should replace the baffles if they are the wrong length or in poor condition. It is not necessary to leave solids in the septic tank to "start" it again. Sufficient bacteria remain in the tank on the walls and bottom.

5. Inspect Tank

Once the tank is empty, it should be inspected to ensure it meets minimum requirements of tank performance. By checking for baffles, water tightness and inflow, you can offer the owner the ability to deal with small problems before they become large.

When the tank is empty there is also an opportunity to certify the tank as watertight or non-watertight under 7082.0700, Subp B (1). This should be done through a maintenance hole whenever available.

Baffles

Identifying the inlet and outlet baffles is critical for the tank's good performance. The loss of a baffle can reduce system life and performance. The requirement of effluent screens in the tanks will increase the need to check the outlet end of the tank. Be sure that at least a four-inch gap between the piping and each baffle exists in the tank. Excessive corrosion or breakdown of the baffles may be a result of hydrogen sulfide buildup in the tank. This is a naturally created gas that needs to be vented from the septic tank. The breakdown is caused by a lack of venting, so verify that the tank is properly venting through the plumbing stack on the structure.

Water tightness

Verifying that the tank is water tight starts when the tank is opened. The effluent level in the tank should be at the outlet piping. If the effluent is lower, the tank is not water tight. After pumping, the submerged portion of the tank is checked for visible cracks or roots. In many cases these will be identified by water leaking into the tank. A tank is noncompliant if it is not water tight below the operating depth and is not working correctly if it is not water tight above the operating depth. The lid and walls are another more critical point of hydrogen sulfide corrosion. If the walls are impacted or corroded to the rebar the tank is structurally unsound and needs replacement.

Inflow from System

Effluent running back into the tank from the outlet shows that the system is not accepting the effluent as designed, so the soil treatment area should be further explored. Sewage running in from the structure shows that there is a leaky fixture, and this also should be addressed with the owner.

6. Replace Maintenance Hole Cover

Be sure the cover is in good shape and properly secured. This can mean that all the screws are replaced for a plastic lid or that the cement lid meets the weight requirements in Chapter 7080. **Maintainers are required under MN Rules Chapter 7080.2450, Subp. 3 (C) to bring the tank access into compliance with MN Rules 7080.1970 (D):**

Covers for maintenance holes must:

1. **be secured by being locked, being bolted or screwed, having a weight of at least 95 pounds, or other methods approved by the local unit of government. Covers shall also be leak resistant; and be designed so the cover cannot be slid or flipped, which could allow unauthorized access to the tank;**
2. **have a written and graphic label warning of the hazardous conditions inside the tank;**
3. **be capable of withstanding a load that the cover is anticipated to receive; and**
4. **be made of a material suitable for outdoor use and resistant to ultraviolet degradation.**

Be sure the cover is in good shape; if there are odors, a little weather stripping can seal the cover. Do not use caulk or expandable foam since these products are not designed for removal. Be careful to not strip the plastic threading when returning screws - stripped screws pose an imminent public health threat (7080.1500 Subp. 4 (A))!

7. Restore Yard

Leaving the property as you found it is a small but important step to minimize problems at the site. Making sure the power is on and the lids are all secure is a must. This is also a great time to check and pick up all the tools used at the job.

8. Get Paid

This step can be the hardest and one that each business deals with differently. Be certain that it is being addressed.

9. Proper Land Application of the Septage

Septage must be land applied or taken to a treatment facility following all applicable rules and regulations. This is discussed in detail later in this section.

10. Receipt

According to MN Rules Chapter 7083.0770, Subp. 2 (A), a record of the pump out must be provided to the homeowner. It is good practice to make this a part of the receipt for services provided to the homeowner upon payment. This record must include:

- **The pump-out date**
- **Gallons removed**
- **Any tank leakage below or above the operating depth**
- **Access point used to remove septage**
- **Method of disposal**
- **The reason for pumping**
- **Any safety concerns with the maintenance hole cover**
- **Any troubleshooting or repairs needed or conducted**

A receipt should identify the method of recycling that is applied to the waste as well as the treatment method. A tank maintenance reporting form can be found online at septic.umn.edu/ssts-professionals/forms-worksheets, and includes additional information recommended for the owner. A clear picture of the system is valuable to the owner. In some counties, septic tank report may be required to be submitted by the Maintaine**r.**

11. Improper Maintenance Notice

Chapter 7080 only allows the removal of solids through a maintenance hole. If the owner will not allow solids to be removed in this way, it must be noted in your records. The note should include a statement from the owner identifying that it was their choice and the reason for the decision. MN Rules Chapter 7083.0770, Subp 2 (C) states that a signed statement by the owner is required if they refuse to allow removal of solids and liquids through the maintenance hole.

Effluent screens

Effluent screens should be removed and cleaned upon service. Screens can either be replaced with new ones or they can be rinsed off with a hose stream over the inlet opening of the tank so all material removed in cleaning goes back into the tank. Safety dictates always wearing gloves when performing this task. Never allow the screen cleanings to be left on the ground surface. Observations should be made regarding past or present elevated liquid level in the tank caused by a screen clogging or other downstream conditions. If the liquid level is elevated, the tank must be pumped down before removing the screen to avoid passing the solids out into the soil treatment system as the screen is removed. Some screens have a secondary device to prevent solids bypass.

In most cases, the effluent screen is cleaned when the tank is pumped, but it should be inspected at a frequency of at least every one to two years. Observations show that frequency of cleaning the screen is less when the screen is placed in the second compartment of a two-compartment tank than if placed in a single compartment tank. Other factors that can increase the frequency of maintenance include:

- High content of fats, greases, and oils
- Presence of hair or laundry lint
- Presence of excessive solids through use of garbage disposal or excessive toilet tissue
- High water usage and peak flows

There is some evidence that when backwash from water softening units is plumbed into the septic system, increased effluent screen maintenance may be required. More research is needed in this area. Clogging of screens should not be considered an indication of a problem with the screen unit since the purpose of a screen is to catch suspended solids. Rather, *premature* clogging may be an indicator of problems such as:

- Reduced detention time due to excessive flows
- Neglecting to pump out the septic tank as needed
- Excessive flushing of grease or oil down the kitchen drain
- Use of a garbage grinder
- Excessive toilet paper use

If a screen requires servicing more frequently than anticipated by design, either the effluent screen or the wastewater characteristics should be evaluated to find the cause for premature clogging. This may indicate leaks in the fixtures, excess water use, poor wastewater quality, or that the screen is not adequately sized for that application.

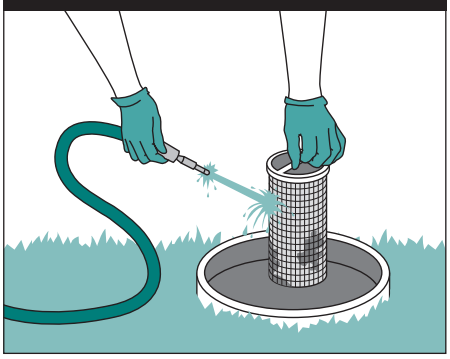
Cleaning an effluent screen

1. DO NOT ENTER the septic tank for any reason!

   Noxious gasses exist in septic tanks and can result in serious injury or death. You do not need to enter the tank in order to clean the screen.

2. Put on waterproof, disposable gloves and safety glasses. Remove the maintenance hole cover of the septic tank and note the liquid level in the tank. The liquid level should be at the bottom of the outlet pipe. If it is below the outlet pipe this is a sign that the tank is not water tight and you should call a septic professional to help troubleshoot the problem. If the liquid level is above the outlet pipe or the effluent screen do not remove the screen. This is a sign of problems somewhere in the system; a plugged screen, pump failure, plugged soil treatment area, etc. Pump the tank before removing the screen. This will prevent a surge of excess effluent, containing unwanted solids, from moving into the next component of the treatment system.

FIGURE 8.1 Cleaning An Effluent Screen



3. If the liquid level is at the bottom of the outlet pipe, remove the screen from its casing. Note the condition of the screen and the extent of build-up. Using a garden hose, spray off the screen over the first septic tank maintenance hole (as shown in Figure 8.1) or place the screen in a 5-gallon bucket and spray off all material into the bucket. Be careful to prevent splashing onto your body or clothes or into the yard. Do not clean the effluent screen in the grass next to the septic tank; raw sewage in the yard is a public health hazard.

4. Return the screen to its casing once it has been cleaned. Dump the contents of the bucket into the septic tank and add a small amount of bleach and rinse the bucket several times (emptying the rinse water into the septic tank

each time.) Secure the maintenance hole cover once you are finished. The solids from the screen cleaning will settle and get removed the next time the tank is pumped during routine maintenance.

Make sure the screen is reinstalled properly to ensure proper operation.

5. Once the job is complete, dispose of the gloves and wash your hands thoroughly with soap and hot water. If your clothes were contaminated, remove them immediately and launder in hot water.

Troubleshooting an Effluent Screen

If an effluent screen seems to need excessive cleaning, it may be that the homeowner has too many solids, chemicals or too much water going down the drains.

- Large volumes of wastewater generated in a short period of time can result in turbulence in the septic tank and reduced retention time, which can lead to solids plugging the effluent screen. To avoid this situation:
  - > Do not do all the laundry in one day. Spread wash loads throughout the week and wash at times when there is not a lot of water being used in the home.
  - > Do not run multiple water-using devices at the same time, such as showering or running the dishwasher while doing the laundry.
  - > Disconnect water treatment devices such as iron removers and water conditioners from the septic system. The discharge water from these devices is considered clean and does not need further treatment.
- Garbage disposals and dishwashers with food grinders are notorious for adding solids to a septic tank. Minimize the use of the garbage disposal, or eliminate its use altogether by placing food scraps into a compost bin or trash can. Most new dishwashers are equipped with food grinders which act as garbage disposals. To keep solids out of your system, scrape all dishes well before placing them in the dishwasher.
- Washing machines can add a significant amount of lint to your septic tank. Avoid this by placing a simple lint filter on the end of the outlet hose.
- Do not use the toilet as a trash can. Nothing other than human waste and toilet paper should be flushed. Do not flush tissues, hygiene products, cigarette butts, etc.
- Reduce the amount of strong cleaning chemicals and antibacterial soaps used in the home. Bleach and other antibacterials can kill the beneficial bacteria in the septic tank, reducing the rate of solids decomposition.
- Do not flush unused or expired medications. These products can kill the beneficial bacteria in your septic tank.
- Do not use products advertised as septic additives or septic cleaners. These products are not necessary and may kill the beneficial bacteria in your septic tank.

Problems: Professional Cleaning, Not Additives

A 1,000 gallon septic tank serving a three-bedroom home with four or five occupants should be cleaned every one to three years. To estimate the proper cleaning frequency, it is recommended that the septic tank be assessed three to six months after it is first placed into service by a new owner. This will allow the Maintainer to determine the rate at which solids accumulate according to current use. This also allows for removal of any chemicals from the new construction or significant cleaning/painting associated with new tenants and will identify typical use. It's particularly important that all three layers (sludge, clear zone, and floating scum) are developing.

Septic tank solids should be removed from the tank and hauled away periodically by licensed maintainers. Additives are not recommended because their use may flush the solids into the soil treatment area, plugging the soil pores.

A septic tank has three layers: a floating scum layer, a sludge layer at the bottom and a clear layer in between. When the septic tank accumulates too much scum and sludge, flow through the clear layer is too fast and solids are flushed out into the soil treatment area. A good cleaning service will agitate the scum and sludge layers into suspension, remove the entire contents of the tank, and haul them away.

Additives may chemically agitate the tank, flushing the contents into the soil treatment area. This harms the soil by plugging its pores.

Three types of additives are marketed. One type adds bacteria and enzymes. Plenty of these are already present in the septic tank. Another type of additive lightens the bottom sludge layer so that it is washed out into the soil treatment area. A third type breaks down the scum layer, again washing this into the soil treatment area. The last two can cause permanent damage to the soil treatment area.

Proper cleaning of the septic tank by a licensed Maintainer will prevent most tank problems. **MN Rules Chapter 7080.2450, Subp. 5** strictly prohibits the use of additives as a means to reduce the frequency of proper maintenance.

Effect of Using Hydrogen Peroxide

The use of hydrogen peroxide as an additive to reduce the biomat in the soil treatment area was researched in the early 1980's and was found to aggressively impact the organic material, but only with sand columns. Additional research on various soil textures found that the use of hydrogen peroxide as an additive would be detrimental to most soil treatment systems.

The following are excerpts from a report entitled "Chemical Rehabilitation of Soil Wastewater Absorption Systems Using Hydrogen Peroxide: Effects on Soil Permeability," by David L. Hargett, E. Jerry Tyler, and James C. Converse, 1983.

Experiments on wastewater-clogged columns of four soil types demonstrated that H_2O_2 application may further reduce infiltration rate, beyond the clogged state, in medium and fine textured soils. High H_2O_2 loading rates produced some degree of reclamation of infiltrative capacity in clogged sandy loam columns, but none of the H_2O_2 treatments resulted in infiltration rated greater than 35 percent of initial values.

These research results definitively show that H_2O_2 can do serious, and possibly irreversible, damage to the physical integrity and infiltrative capacity of most soils. This data, in combination with a rigorous review of the previous research, do not substantiate the use of H_2O_2 for wastewater soil absorption systems, even those in sands.

Safety Keys for Maintainers

Safety gear for Maintainers

1. Safety goggles
2. Emergency eyewash station
3. First aid kit
4. Half-mask respirator with appropriate cartridge
5. Gloves
6. Shoulder-length fully coated neoprene gloves
7. Carbon dioxide fire extinguisher

Onsite wastewater systems for domestic wastes pose a number of potentially life-threatening situations. The greatest hazards are:

- Enclosed spaces
- Electrical shock
- Explosion
- The presence of pathogens
- Collapse of structures due to corrosion

Safety for Confined Spaces

A septic tank is considered a confined space. All OSHA requirements must be met before entering a septic tank for any period of time for any reason. This manual discusses how to conduct most management activities without ever needing to enter a tank.

Of the enclosed spaces associated with onsite systems, septic tanks are the most likely to be hazardous, but any enclosed space should be considered dangerous. The gas space must be adequately ventilated using blowers and a large diameter, flexible hose. Be sure to test the gas space frequently for:

- Sufficient oxygen. Use an oxygen deficiency meter. Sufficient oxygen generally ensures that carbon dioxide will also be in a safe range.
- Hydrogen sulfide. Use lead acetate paper or a hydrogen sulfide detector.
- Explosive conditions. Use a combustible gas indicator.

A person entering the confined space must be secured with a lifeline, preferably attached to a safety harness. Appropriate lifelines are 3/4-inch manila, 1/2-inch nylon, or 1/2-inch polypropylene. The free end of the line should be tied to an appropriate object so that it does not fall into the tank.

Two physically able people must remain on the surface when someone enters a tank. Rescue of a person who has collapsed in a confined space without a lifeline should be undertaken only by someone wearing a self-contained breathing apparatus and a lifeline, or after adequate ventilation and testing as previously described. The entry of a

second person without adequate protection will only result in two casualties.

Remember, no flames, sparks, or electrical tools are allowable until the atmosphere of a confined space is proven non-explosive. Do not smoke.

Suffocation due to oxygen deficiency is one hazard of enclosed spaces. Chemical and biological activities present in onsite sewage systems consume oxygen. Also, the proportion of atmospheric oxygen to other gases can be substantially decreased because of the production of such gases as carbon dioxide and methane. These can seep through joints, cracks, and even soil into confined spaces.

Be aware of the danger levels of oxygen depletion. Normal air **contains 21 percent oxygen**. At 14 to 16 percent, the minimum safe exposure is eight hours. For a short time, humans can tolerate levels as low as 12 percent, but levels below ten percent are potentially fatal. At seven percent or below, conditions are considered fatal.

Toxic gases, which are common at onsite waste water systems, are another hazard. The following are some of the attributes of toxic gases that may be present in an onsite system:

Hydrogen Sulfide (H_2S)

- Forms during anaerobic decomposition
- Has a rotten egg odor in small concentrations: sense of smell is rapidly impaired as concentrations increase; loss of smell occurs in two to 15 minutes at 0.01%, faster at higher levels
- Causes death in a few minutes at 0.2%; acute poisoning is rapid at 0.07 to 0.1%
- Maximum safe 60-minute exposure level is 0.02%
- Maximum safe eight-hour exposure level is 0.001%

Carbon Dioxide (CO_2)

- Forms during aerobic or anaerobic decomposition
- Appears colorless, odorless, and may have acid taste at high concentrations
- Is heavier than air, so found near bottom
- Cannot be endured at 10% or higher for more than a few minutes, even if sufficient oxygen is present
- Maximum safe 60-minute exposure level is 4%
- Maximum safe eight-hour exposure level is 0.5%

Gasoline Fumes

- Result from spills or improper disposal
- Rapidly fatal at 2.4%
- Maximum safe six-minute exposure level is 0.4%

Electricity Hazards

Electricity and water are a lethal combination. Safety precautions include:

- All equipment must be properly grounded with a third wire.
- All hand tools must be double insulated or properly grounded.
- Ground fault interrupters should be used on circuits with potential exposure to water.

- Be aware of the location of lines, cards, etc. to prevent cutting through the insulation.
- Unless a wire is absolutely known to be dead and it is impossible for it to accidentally become live again, handle it as though it were a live wire.
- One person should never work alone on energized equipment that operates at 440 volts.
- All equipment that is installed in a confined/enclosed space (such as sump or dry well) should be of explosion-proof design.
- All lights and switches should be of explosion-proof design.

Explosion Hazards

Explosions are another hazard. The most common explosive agent found in onsite systems is methane. Methane is colorless and odorless. It is not in itself toxic, but it may cause oxygen depletion. The explosive limits are atmospheric concentrations of five to 15 percent.

The septic tank head space may contain as much as **60 percent** methane. Even though there may be little or no oxygen to support combustion, an explosion may nonetheless occur. As a tank is pumped, the inrushing air can create an explosive condition when none had previously existed. Be aware that methane, which is less dense than air, may seep into areas containing electrical equipment.

Another explosive agent you may encounter is gasoline. The explosive limits for gasoline fumes are atmospheric concentrations of 1.3 to six percent. These fumes are denser than air, so they are more likely to be near the bottom of the gas space.

Infectious Disease Hazards

Wastewater should be assumed to be infectious. All workers should keep their hands and fingers from their noses, mouths, and eyes while working with wastewater. A good rule is to keep your hands below your collar while you work. Before eating, drinking, or smoking, be sure to wash up thoroughly, and, preferably, change your clothes. You should provide yourself with a way to change out of your work clothes and wash up before entering a food store, restaurant, or even your car or home.

Maintain current vaccinations against typhoid, paratyphoid, tetanus, hepatitis A and B, and polio.

Structural Collapse Hazards

Metal parts may fail due to corrosion. Most metals, when exposed to high humidity and particularly to condensed moisture, will corrode rapidly, thus losing their structural integrity. Anaerobic decomposition produces gases which can dramatically increase corrosion rates.

For the above reasons, always test structural components such as ladders, brackets, or railings before relying on them for support. To avoid the hazards of collapsing materials, structural components that are installed in confined or enclosed spaces should be of corrosion-resistant materials.

Septage Management

These guidelines provide maintainers with information on how to manage septage and restaurant grease trap wastes. Because land application is a common and sometimes complex management option, these guidelines focus on requirements for land application. These guidelines combine the federal rule requirements and the Minnesota Pollution Control Agency (MPCA) management guidelines for land application of septage into one document. If these guidelines are followed, maintainers will be in compliance with 40 CFR, part 503, and the MPCA septage management guidelines. These guidelines also include requirements for land application of restaurant grease trap waste. If these guidelines are followed, maintainers will also be in compliance with MPCA requirements for land application of restaurant grease trap waste. Requirements for land application of commercial wastes, other than restaurant grease trap waste, are not included in these guidelines.

Definitions

"Agronomic rate for nitrogen" is the amount of septage that will provide the nitrogen required for crops or other vegetation grown on the land.

"Cover crop" is a small grain or other close-growing vegetation not grown for harvest (e.g. vegetation growing on the land set aside for conservation purposes).

"Cropping year" means a year beginning on September 1 of the year prior to the growing season and ending August 31 the year the crop is harvested. For example, the 1994 cropping year began September 1, 1993 and ended August 31, 1994.

"Domestic septage" *(federal definition) means either liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that receives only domestic sewage. Domestic septage does not include liquid or solid material removed from a septic tank, cesspool, or similar treatment works that receives either commercial wastewater or industrial wastewater and does not include grease removed from a grease trap at a restaurant.*

"Fallow land" is land that is not cropped and kept cultivated throughout a growing season and has a vegetative cover of less than 25 percent. Any land that is not cropped and cultivated during the months of September through May where a crop will be grown the following growing season is not considered fallow land.

"Feed Crops" are crops produced primarily for consumption by animals.

"Fiber Crops" are crops such as flax and cotton.

"Food Crops" are crops consumed by humans. These include but are not limited to fruits, vegetables, and tobacco.

"Highly permeable soil" means soil whose soil leaching potentials are rated as severe, poor filter for soil pesticide loss, by the Natural Resource Conservation Service using the procedure found in part 620, Soil Interpretation Rating Guides of the United States Department of Agriculture-Natural Resources Conservation Service National Soil Survey Handbook.

"Pathogens" are organisms that can cause an infection or disease in a susceptible host.

"pH" is the degree of acidity or alkalinity of a solution and is a measure of the strength

of an acid or a base. It is expressed as the logarithm of the reciprocal of the hydrogen ion concentration measured at 25 degrees Celsius (77 degrees Fahrenheit) or measured at another temperature and then converted to an equivalent value at 25 degrees Celsius.

"Maintainer" is an individual or business holding a Maintainer license issued by the Minnesota Pollution Control Agency in accordance with MN rule chap. 7080.

"Residential development" means ten or more places of habitation concentrated within ten acres of land. The term also includes schools, churches, hospitals, nursing homes, businesses, offices, and apartment buildings or complexes having ten or more living units.

"Septage" (State Definition) means solids and liquids removed from an SSTS and includes solids and liquids from cesspools, seepage pits, other pits, or similar systems or devices that receive sewage. Septage also includes solids and liquids that are removed from portable, incinerating, composting, holding, or other toilets. Waste from Type III marine sanitation devices, as defined in Code of Federal Regulations, title 33, section 159.3, and material that has come into contact with untreated sewage within the past 12 months is also considered septage.

"Winter" is the time that soils are frozen or snow covered, so that incorporation or injection are not possible. This time period varies from year to year.

At the federal level, land application of domestic septage is regulated by 40 CFR, part 503. At the state level, MN Rule Chapter 7080 requires anyone that pumps individual sewage treatment systems to be licensed by the MPCA. A table of differences between Minnesota's Guidelines and EPA's 40 CFR, part 503 can be found in Table 8.1

TABLE 8.1 Comparison of Federal EPA Requirements and the Minnesota (MPCA) Guidelines for the Land Application of Domestic Septage to Non-Public Contact Sites

	Federal 503 Rules	Minnesota [1] Guidelines
PERMITS REQUIRED	No	No
APPLICATION RATE		
Based on:	Crop Nitrogen Requirement	Crop Nitrogen Requirement and Other Nitrogen Impacts
Maximum Annual Rate (gal/ac/year)	No	Yes
Hydraulic Loading Limits	No	Yes
Maximum Daily Rate	No	15,000 gal/ac (total for winter) [2] 10,000 gal/ac (surface applied) [3]
RECORD KEEPING	Yes	Yes
Reporting Required	None	None
Years to be retained	Five years	Five years
Required Information		
Site location	Yes	Yes
Date of application	Yes	Yes
Time of application	Yes	No
Number of acres	Yes	No
Amount of septage applied	Yes	Yes
Crop grown	Yes	Yes
Weather conditions	No	No
Certification	Yes	Yes
Depth to water table	No	Yes
Percent vegetative cover	No	No

TABLE 8.1 Comparison of Federal EPA Requirements and the Minnesota (MPCA) Guidelines for the Land Application of Domestic Septage to Non-Public Contact Sites

	Federal 503 Rules	Minnesota [1] Guidelines
PATHOGEN REDUCTION	pH of 12 for 30 minutes (temp adjusted) and harvesting restrictions OR Site and harvesting restrictions	pH of 12 for 30 minutes (temp adjusted) and harvesting restrictions OR Site and harvesting restrictions
VECTOR ATTRACTION REDUCTION	Three Options: pH of 12 for 30 minutes (temp adjusted) OR Injection OR Incorporation	Three Options: pH of 12 for 30 minutes (temp adjusted) OR Injection OR Incorporation
CROP HARVESTING RESTRICTIONS		
Human Food Crops With Harvestable Portions That Touch the Soil Surface But Are Totally Above Ground	14 Months	14 Months [4]
Root Crops	20 Months [6] 38 Months [7]	20 Months [6] 38 Months [7]
Other Food, Fibers or Feed	30 Days	30 Days
Grazing	30 Days [4]	30 Days [4]
Turf	1 Year [4]	1 Year [4]
ACCESS RESTRICTION		
(Fencing, posting, remoteness, etc.)	Required for Non-Stabilized	Required
SET BACK REQUIREMENTS		
Surface Waters	None	Varies with site slope [8]
Public Water Supply Well	None	1000 ft [8]
Private Drinking Water Well	None	200 ft [8]
Residence	None	200 ft [8]
Property Boundary	None	10 ft [8]
Recreational Area	None	600 ft (200 ft trails) [8]
Intermittent Streams	None	100 ft [8]
Road Right-of-Ways	None	10 ft [8]
Holes and Channels	None	Varies with site slope [8]
SOIL REQUIREMENTS		
Slope	None	0-6% (if surface spread) 0-12% (injected)
Minimum Depth to Seasonally Saturated Soil or Bedrock	None	3 ft
Permeability	None	If 0.2 inches/hour or less, this soil is suitable only for surface application with incorporation within 48 hours or injection.
Flooding	None	Free from flooding hazard

TABLE 8.1 Comparison of Federal EPA Requirements and the Minnesota (MPCA) Guidelines for the Land Application of Domestic Septage to Non-Public Contact Sites

	Federal 503 Rules	Minnesota [1] Guidelines

Notes: 1 = Minnesota's entered information is guidelines, not regulation.
2 = Medium-textured soils.
3 = Fine-texture soils.
4 = Non-treated septage.
5 = Use of septage not allowed on leafy vegetables or tobacco.
6 = If septage remains on the sol surface for four months or longer.
7 = If septage remains on the soil surface for less than four months.
8 = Non-stabilized, surface spread septage.

Commercial wastes are any liquid or solid materials removed from septic tanks, holding tanks, or similar treatment works that receive either commercial or industrial wastewater. A waste is not considered commercial if the wastewater is only from the sanitary facilities from the business. Examples of commercial wastes include waste pumped from small animal slaughtering operations, pre-treatment wastes from a food processing facility, or waste from a flammable trap at a car wash. Land application of non-hazardous commercial waste is regulated at the federal level by 40 CFR, part 257, and at the state level by MN Rules Chapters 7001 and 7035.

It is important for maintainers to be aware that not all commercial wastes can be legally land applied safely. Before land applying commercial wastes other than restaurant grease trap waste, the MPCA district office should be contacted to determine if the waste can be land applied. In most cases, testing of the waste is needed before land application can take place, and in some cases an MPCA permit is required.

Land applying septage is becoming more and more visible to the public. Because of this, maintainers may find themselves having to communicate more with the public and local government officials than in the past. Public relations has become part of the job and are not something that everyone finds enjoyable. However, ignoring concerns of the public and other groups can cause time consuming controversies and leave you without a land application site to use. Following the recommendations from the MPCA will not always mean that the public or other organized groups will support what you are doing. You have to find the best way that you can to work with the people in your community to show them land application is an acceptable option for managing septage.

Septage Treatment

Septage and Its Characteristics

Septage is managed in a variety of ways throughout the country and in Minnesota. Common methods of management include transferring septage to a Publicly Operated Treatment Works (POTWs), land application, and land filling.

In Minnesota, the options for management are determined by where you are located in the state. In the larger metropolitan areas, it is common for septage to be discharged into a POTW where it is treated and managed as biosolids. The septage becomes the

POTW's responsibility and is subject to the requirements of MN Rule Chap. 7041 (Sewage Sludge Management Rules) and 40 CFR, part 503. In smaller communities or areas that are not close to a POTW, transfers are not practical and septage is typically land applied. **Land filling of septage is not allowed** in Minnesota because it is in liquid form, and landfills cannot accept materials containing free liquids.

Some wastewater treatment plant managers will not accept septage because they are concerned that it will overload their system. Septage is a waste that has a very high Biochemical Oxygen Demand (about 6480 mg/L) and can shock a wastewater treatment plant and reduce treatment. At most plants, changing the way septage is added to the system can lessen the impact to the plant. You may receive instructions on where and when septage should be discharged into the system to prevent problems from occurring. You need approval from the operator of the wastewater treatment plant to discharge septage into their facility.

The quantity of septage removed from septic tanks each year is not tracked by the state or the federal government at this time; however, estimates have been made by using the following assumptions: approximately 500,000 homes in Minnesota have individual sewage treatment systems; these systems should be pumped every three years if maintained properly; and the average septic tank capacity is 1500 gallons. Using these assumptions, about 250,000,000 gallons of septage are pumped each year. Of this total, about 173,000,000 gallons of septage are land applied, and the remaining 77,000,000 gallons are transferred to POTWs. This makes land application the most common method for managing septage in Minnesota.

Federal requirements for land application provide limited information on how to prevent runoff or contamination of groundwater. The federal 503 rule simply states that these must not occur. The state guidelines provide maintainers with detailed information on site suitability, separation distances to features such as surface waters and wells, and detailed site management requirements. These are practices commonly used for land application of other by-products and wastes in Minnesota. They have proven to be effective for preventing the problems from runoff of wastes and contaminants from application sites and preventing contamination of groundwater.

Maintainers are not required to analyze septage before it is land applied, though they should observe the waste in the tank to determine if it may be industrial or hazardous waste as shown in Figure 8.2. Both state and federal requirements use average septage analysis results to calculate allowable application rates. Table 8.2 contains concentrations for specific parameters in septage that have been determined by testing. Septage supplies about five pounds of nitrogen, and two pounds of phosphorus per 1000 gallons.

FIGURE 8.2 Observe Waste in Tank

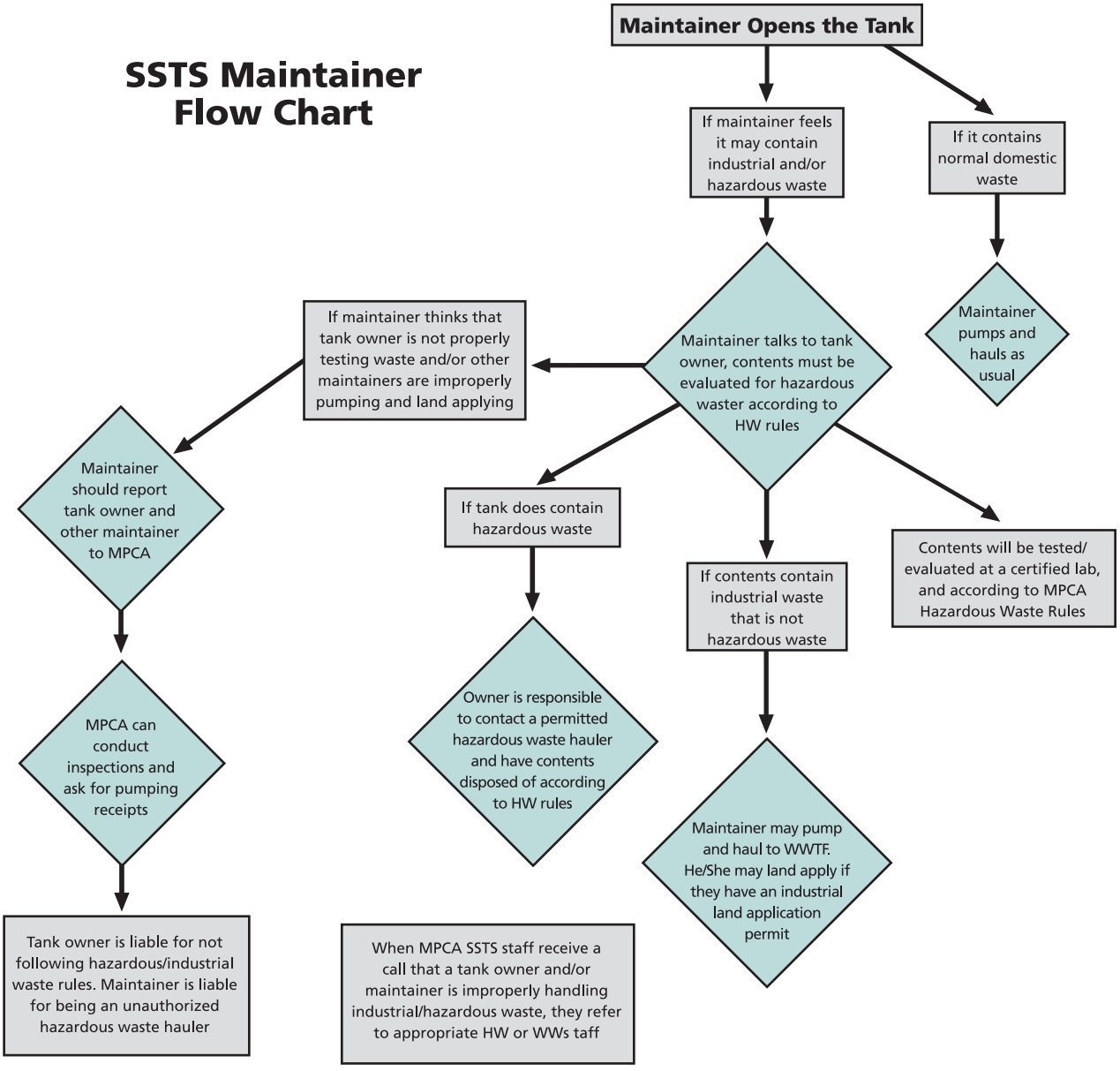


TABLE 8.2 Characteristics of Septage[1]

	Concentration (mg/L)		
Parameter	**Average**	**Minimum**	**Maximum**
Conventional Parameters			
Total Solids	34,106	1,132	130,475
Total Volatile Solids	23,100	353	71,402
Total Suspended Solids	12,862	310	93,378
Volatile Suspended Solids	9,027	95	51,500
Biochemical Oxygen Demand	6,480	440	78,600
Chemical Oxygen Demand	31,900	1,500	703,000
Total Kjeldahl Nitrogen	588	66	1,060
Ammonia Nitrogen	97	3	116
Total Phosphorus	210	20	760
Alkalinity	970	522	4,190
Grease	5,600	208	23,368
pH	—	1.5	12.6
Metals			
Arsenic	0.141	0	3.5
Barium	5.76	0.002	202
Cadmium	0.097	0.005	8.1
Chromium (total)	0.49	0.01	34
Cobalt	0.406	<0.003	3.45
Copper	4.84	0.01	261
Cyanide	0.469	0.001	1.53
Iron	39.3	0.2	2,740
Lead	1.21	<0.025	118
Manganese	6.09	0.55	17.1
Mercury	0.005	0.0001	0.742
Nickel	0.526	0.01	37
Silver	0.099	<0.003	5
Tin	0.076	<0.015	1
Zinc	9.97	<0.001	444
Organics			
Methyl Alcohol	15.8	1	396
Isopropyl Alcohol	14.1	1	391
Acetone	10.6	0	21
Methyl Ethyl Ketone	3.65	1	240
Toluene	0.17	0.005	1.95
Methylene Chloride	0.101	0.005	2.2
Ethylbenzene	0.067	0.005	1.7
Benzene	0.062	0.005	3.1
Xylene	0.051	0.005	0.72

[1] Taken from "EPA Guide to Septage Treatment and Disposal", EPA/625/R-94/002, September 1994.

Variability of Septage

The rate at which solids accumulate in a septic tank depends upon the nature of the raw sewage and the use of the septic system.

For example, the use of a garbage disposal will approximately double the rate of solids accumulation. Although a septic tank should be maintained on a regular basis, many homeowners wait until problems arise with the treatment system. Other homeowners will have the solids removed from their septic tank each year regardless of the amount of accumulation.

Consequently, the nature of septage is highly variable from one load to the next and also varies by geographic areas in the state. Some average values for the characteristics of septage were measured by the Department of Agricultural Engineering at the University of Minnesota and are presented in Table 8.3. Values for nitrogen are presented in milligrams per liter and in pounds per 1,000-gallon truckload.

The three-year study on the characteristics of septage and the pollution potential of land-spread septage on groundwater quality was made possible through the financial support of the Minnesota Water Resources Research Center. Landspreading sites were selected in Crow Wing County, and instrumentation was installed to evaluate the movement of nitrates and coliform bacteria.

TABLE 8.3 Characteristics of Septage in Minnesota

Characteristic	Mean Values	
	Brainerd Area	White Bear Lake Area
chemical oxygen demand*	16,100 mg/L	13,600 mg/L
total solids	1.9%	4.3%
volitile solids	1.0%	2.4%
total Kjeldahl nitrogen	486 mg/L (4.05lbs/1,000gal)	983 mg/L (8.2lbs/1,000gal)
nitrogen as nitrate	115 mg/L (0.96lbs/1,000gal)	133 mg/L (1.11lbs/1,000gal)

* Chemical Oxygen Demand (COD) is a measure of the amount of oxygen necessary to decompose all organic matter. COD is usually higher than BOD because more compounds can be oxidized chemically than biologically.

Restaurant Grease Trap Wastes

Grease traps are used by restaurants to prevent fats, oils, and greases from entering the soil treatment area of an individual sewage treatment system or the collection system of a centralized sewage treatment system. Wastes that are pumped from these traps are very high in fats and oils and should not contain sanitary wastes.

Grease traps are set up in two main configurations. One configuration is a separate tank that receives only wastewater from the kitchen that is high in fats, oils, and greases. The effluent from the tank is then discharged to a centralized sewage treatment system or an individual sewage treatment system septic tank. Restaurants that have individual sewage treatment systems generally install several septic tanks in series to provide a cleaner effluent before discharging it to the soil treatment area. In this system design, the first septic tank in the series acts as a grease trap, but is regulated as a septic tank. In these guidelines, the first septic tank in the series will be recommended to be considered the same as a grease trap, and the remaining tanks in series regular septic tanks.

Grease trap wastes may be transferred to a POTW; however, the same issues exist as those for septage transfers. It is not likely that smaller POTWs will accept this waste because of the high biochemical oxygen demand of fats and oils. Landfills cannot accept this waste because of the liquid content; therefore, land application is a common form of management, though issues exist with this method, as shown in Table 8.4.

TABLE 8.4 The Problems with FOG (Fats, Oils, and Grease)

Soil Systems	Septage Application
Clogging of soil pores	Clogging of soil pores
Slow breakdown	Clinging to and killing vegetation
Plugging of distribution	Low nitrogen

Table 8.5 provides an analysis from a composite of four restaurant grease traps. This data shows that, unlike septage, grease trap wastes are low in nitrogen.

TABLE 8.5 Grease Trap Waste Characterization[1]

Parameter	Results on Wet Weight Basis
Total Solids (%)	6.0
Total Volatile Solids (%)	88.0
Fats, Oils & Grease (%)	1.1
pH (SU)	4.4
Total Nitrogen (%)	0.0056
Total Phosphorus (%)	0.0029
Potassium (%)	0.0036

1Taken from: Rohm, S.P., "Land Treatment of Grease Trap Wastes - A Beneficial Use. Approach", Pumper. March 2000.

Limited research has been conducted on the effects of land applied grease trap wastes on the soil or plants. Some studies suggest that the soil can break down this waste and that the waste may even be beneficial to the soil. The National Association of Waste Haulers conducted a demonstration project and documented observations made on areas receiving grease trap wastes. It was concluded that restaurant grease trap wastes can be land applied safely if rates are limited to four dry tons/acre/year (Rohm, 2000). This is approximately 16,000 gallons/acre using a total solids content of 6 percent.

Wastes similar to those from grease traps are permitted for land application in Minnesota. Sludges produced by treating wastewaters from meat and poultry processing industries can also contain high percentages of fats, oils, and greases. These wastes have been land applied for many years without causing any known problems. Some farmers believe that application of these sludges has actually improved their soil by making it more permeable and better aerated (though these are not measured observations).

Potential Complications

One of the problems that occurs when grease traps wastes are applied to forage or cover crops is that the above-ground portions of the plant are coated with the fats, oils, and greases. This kills the above-ground portion of the plant temporarily. Plants do recover since the roots are not damaged; however, yields are likely affected.

Excessive application rates of FOG can cause clogging of soil pores. This could lead to problems with soil aeration or runoff, since the soil's infiltration capacity and rate may be reduced. To avoid this problem, application rates must be limited, especially when surface applied. The application rate that causes problems like this to occur has not been established, so these guidelines use conservative application rate limits (see section on requirements for land application of restaurant grease trap wastes).

Another concern with land application of grease trap wastes is that they can be very odorous. Odor is not only a nuisance condition but can attract vectors such as flies and rodents to application sites. To reduce the odor problem, it is recommended that incorporation or injection be used as an application method whenever possible and that care be taken when locating sites that will be used for land application of grease trap wastes. If these wastes are applied to the surface, they must be mixed with septage and lime stabilized.

Some maintainers have noted that restaurant grease traps can contain a lot of floating

oils. These oils should be collected in the restaurant and recycled. If there are a lot of oils in the grease trap, the management of the restaurant should be informed and their workers trained on how to collect and manage this oil. Restaurant managers should be encouraged to train their workers to catch as much of the fats, greases, and oils as possible before they go down the drain. This will not only reduce problems with their effluent, it will also limit the amount of this waste that is land applied.

Septage Storage

MPCA SSTS Maintenance businesses are allowed to store up to 50,000 gallons of septage in registered underground sewage tanks without a state disposal system permit (SDS permit) as long as a local SSTS permit is issued for the practice. The following conditions must be met before septage storage up to 50,000 gallons is conducted under a local SSTS permit in lieu of an MPCA permit.

- Limit of 50,000 gallons of septage storage
- Local construction permits issued, may include operating permits at local discretion
- Land application by MPCA-licensed SSTS Maintenance businesses
- Underground storage in sewage tanks that are verified and listed by the MPCA
- Tanks and facility must meet requirements for holding tanks contained in Chapter 7080.2290
- If a Maintenance business seeks storage on more than one site, the MPCA permit threshold will be evaluated based on the provision of Chapter 7081.0040, Subp. 1(B)
- All other local requirements must be met (setbacks, zoning considerations, etc.)

Transferring Septage and Restaurant Grease Trap Waste to a Publicly Owned Treatment Works (POTW)

Septage and restaurant grease trap waste can be transferred to a POTW with their permission. Because these two waste types have high biochemical oxygen demands, not all POTWs are willing or able to accept them. POTWs may be more willing to accept domestic holding tank waste because the biochemical oxygen demand averages about 500 mg/L .

Each POTW has the authority to refuse or accept these wastes. This decision is based on how the transfers could affect their system's operation. Information is available to assist POTWs in determining whether they can accept septage or holding tank wastes at their facility. The following documents contain useful information for POTWs trying to decide whether they should accept septage at their facility:

> "Accepting Septage at a Wastewater Treatment Plant" (available from MPCA, Resource Management and Assistance, Certification and Training).
>
> "Septage Handling", (1997). Water Environment Federation Manual of Practice, No. 24. Water Environment Federation, 601 Wythe Street, Alexandria, VA 22314-1994, (703) 684-2400.
>
> "Handbook Septage Disposal Guide", (1984). EPA-625/6-84-009, U.S. Environmental Protection Agency Publication.

If septage or restaurant grease trap waste is transferred to a POTW, this information

must be indicated on the hauler's daily record log. This also will apply to the other septage wastes like marine toilets and/or portable toilets. This type of record is needed to show the final destination of the waste to prove it has been properly managed.

Septage Storage Requirements

A structure used to store or treat septage pumped from multiple sources when the structure is not located at a permitted wastewater treatment facility requires a MPCA permit. Requirements for permitting are covered by MN Rules Chapter 7041. Mobile storage units used for the transport of septage do not require an MPCA permit.

To determine if your septage storage structure requires an MPCA permit, contact (800) 657-3864. If a permit is required you will be requested to submit a permit application.

Land Application Requirements for Septage

These requirements are only for land application of septage on areas referred to as non-public contact sites. These are agricultural, forest, and mine lands. Areas that are frequented by the public such as ball fields, golf courses, cemeteries, etc. must meet the more detailed requirements of 40 CFR, part 503, (503 regulations) for sewage sludge.

It is important for maintainers to check with local units of government to find out if they have land application requirements or ordinances that must be followed. It is the maintainer's responsibility to be up to date on all rules and ordinances related to land application.

Requirements for Pathogen Control and Vector Attraction Reduction

All septage that is land applied must meet the 503 requirements for pathogen control and vector attraction reduction. These requirements are intended to provide protection against transfer of diseases from the application area. This is done by limiting the crops that receive septage, reducing the number of pathogens present, preventing vectors such as flies and rodents from being attracted to the application site, and by following restrictions on site use. Maintainers must select from the options described in this section to ensure that pathogen control and vector attraction reduction requirements are met.

Pathogen Control Requirements

One of the following options for pathogen control must be met when septage is land applied:

Option 1 - Site Restrictions: The site restrictions A through F in Table 8.6 must be maintained. Table 8.7 provides examples of crops' relationship to the ground surface.

Option 2 – Lime Stabilization with Site Restrictions: The pH of the septage must be raised to 12.0 or greater by alkali addition and without the addition of more alkali, must remain at 12.0 or higher for 30 minutes, and the site restrictions A through C in Table 8.6 must be maintained.

Maintainers are responsible for ensuring that farmers or other end users are informed

of site use restrictions and that appropriate precautions are taken to prevent access to sites. This may require that some sites be posted with signs informing the public to stay off the site. No hunting or trespassing signs meet this requirement.

TABLE 8.6 Land Application Site Restrictions

Restriction Reference	Restricted Activity	Waiting Period
A	Food crops whose harvested part may touch the soil/septage mixture	14 months
B	Food crops with harvested parts below the surface	38 months[1]
C	Feed, food, or fiber crops that do not touch the soil surface	30 days
D[2]	Turf harvest	12 months
E[2]	Grazing of animals	30 days
F[2,3]	Public access to land High potential for exposure Low potential for exposure	12 months 30 days

[1]This can be reduced to a 20 month duration between application and harvest when the septage is surface applied and stays on the soil surface four months or longer prior to incorporation into the soil.
[2]Not required if lime stabilization used for pathogen control.
[3]Lands with high potential for exposure are public contact sites, reclamation sites located in populated areas, turf farms, or plant nurseries.
Lands with low potential for exposure are lands with infrequent public use and include areas such as agricultural land, forests, or reclamation sites located in an unpopulated area.

TABLE 8.7 Examples of Crops Impacted by Domestic Septage Site Use Restrictions

These crops have harvested parts that...		
Usually do not touch the ground	**Usually touch the ground**	**Are below the ground**
Peaches	Melons	Potatoes
Apples	Eggplants	Yams
Corn	Squash	Sweet Potatoes
Wheat	Tomatoes	Rutabagas
Oats	Cucumbers	Peanuts
Barley	Celery	Onions
Oranges	Strawberries	Leeks
Grapefruits	Cabbage	Radishes
Cotton	Hay	Turnips
Soybeans	Lettuce	Beets

Pathogen Reduction Alternative #1 for Domestic Septage with pH Treatment Applied to Non-Public Contact Sites

The domestic septage pumped from the septic tank or holding tank has had its pH raised to 12 or higher by the addition of material such as hydrated lime or quicklime and, without adding more alkaline material, the domestic septage remains at a pH of 12 or higher for at least 30 minutes prior to being land applied, AND

Crop Restrictions

1. Food crops with harvested parts that touch the septage/soil mixture and are totally above ground shall not be harvested for 14 months after application of domestic septage. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after application of domestic septage when the domestic septage remains on the land surface for four months or longer prior to incorporation into the soil.
2. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after application of domestic septage when the domestic septage remains on the land surface for less than four months prior to incorporation into the soil.
3. Animal feed, fiber, and those food crops whose harvested parts do not touch the soil surface shall not be harvested for 30 days after application of domestic septage. Domestic septage may only be applied to hay land within 7 days after cutting and removal of the hay
4. Turf grown on land where domestic septage is applied shall not be harvested for one year after application of the domestic septage when the harvested turf is placed on either a lawn or land with a high potential for public exposure, unless otherwise permitted by the permitting authority.

Grazing Restrictions

NONE

Site Restrictions

NONE

You must meet either of the two pathogen-reduction alternatives.

Note: if you meet this pathogen reduction alternative, you also meet Vector Attraction Reduction alternative # 3.

Pathogen Reduction Alternative #2 for Domestic Septage without Additional Treatment Applied to Non-Public Contact Sites

Domestic septage is pumped from the septic tank or holding tank and land applied without treatment, incorporated within six hours, AND

Crop Restrictions

1. Food crops with harvested parts that touch the septage/soil mixture and are totally above ground shall not be harvested for 14 months after application of domestic septage.
2. Food crops with harvested parts below the surface of the land shall not be harvested for 38 months after the application of the domestic septage.
3. Animal feed, fiber, and those food crops that do not touch the soil surface shall not be harvested for 30 days after application of the domestic septage. Domestic septage may only be applied to hay land within 7 days after cutting and removal of the hay
4. Turf grown on land where domestic septage is applied shall not be harvested for one year after application of the domestic septage when the harvested turf is placed on either a lawn or land with a high potential for public exposure, unless otherwise specified by the permitting authority.

Grazing Restrictions

Animals shall not be allowed to graze on the land for 30 days after the application of domestic septage.

Site Restrictions

Public access to land with a low potential for public exposure shall be restricted for 30 days after application of domestic septage. Examples of restricted access include the remoteness of site, posting with no trespassing signs, and/or simple fencing.

You must meet either of the two pathogen reduction alternatives (not both).

Vector Attraction Reduction Requirements

One of the following options for vector attraction reduction must be met when septage is land applied:

Option 1 - Injection: Septage must be injected into the soil. No significant amount of septage can be present on the soil surface within one hour after injection has taken place.

Option 2 - Immediate Incorporation: Septage must be incorporated by tillage with-

in 6 hours after surface application.

Option 3 - Lime stabilization: The pH of the septage must be raised to 12.0 or greater by alkali addition and without the addition of more alkali must remain at 12.0 or higher for 30 minutes.

NOTE: When lime stabilization is used for either pathogen control or vector attraction reduction, the temperature of the septage must be taken into account when measuring pH. The reading must be taken at the standard temperature of 25° C (77° F), or corrected to 25° C (see Table 8.8, page 8-28).

Vector Attraction Reduction Alternatives for Domestic Septage Applied to Non-Public Contact Land

Alternative 1: Injection

Domestic septage shall be injected below the surface of the land, AND no significant amount of the domestic septage shall be present on the land surface within one hour after the domestic septage is injected.

Alternative 2: Incorporation

Domestic septage applied to the land surface shall be incorporated into the soil surface plow layer within six hours after application.

Alternative 3: pH Adjustment

The pH of domestic septage shall be raised to 12 or higher by addition of alkaline material and, without the addition of more alkaline material, shall remain at 12 or higher for 30 minutes.

You must meet vector attraction reduction alternative 1, 2, or 3 (not all three).

Lime Stabilization Treatment

The purpose of adding lime to septage is to treat and reduce the number of pathogens present in the septage and to reduce odors. The high pH kills bacteria, viruses, and parasites. Odor reduction occurs because the high pH slows the biological activity and break down of the septage taking place. The reduction in odor is a benefit because it improves public acceptance of septage and also reduces its attractiveness to vectors. It is important to remember that lime treatment does not kill all of the pathogens present; therefore, site use restrictions are still required.

A side benefit of adding lime to septage is that, in some soils, it can change the soil pH. This is a benefit for farmers that have low pH soils. Farmers prefer soils that are near

neutral in pH because it makes nutrients more available to their crops. The pH adjustment is dependent on many factors including soil texture, initial soil pH, etc. Monitoring the soil pH is a standard farming practice, so you can work with the farmer to see if and how much the soil pH is changing after septage is applied.

Lime must be added to septage properly. The goal is to achieve a pH of 12.0 and hold it at 12.0 for 30 minutes. **To get to this pH, approximately 25 pounds of lime per 1,000 gallons of septage is needed.** This can change with the solids content of the septage; therefore, you must measure the pH to ensure that it is 12.0 for 30 minutes. **The pH of the septage must remain at 12 or higher for at least 30 minutes after the lime is added.** This >12 pH is after the use of temperature correction in Table 8.8.

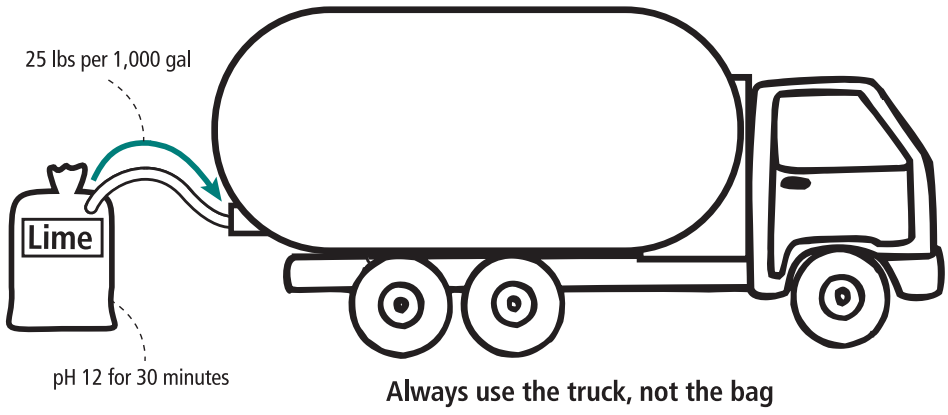
TABLE 8.8 Temperature/pH Correction Table

Temperature °F	Temperature °C	Required Minimum pH Reading	Actual pH
35	1.7	12.7	12.0
36	2.2	12.7	12.0
37	2.8	12.7	12.0
38	3.3	12.7	12.0
39	3.9	12.6	12.0
40	4.4	12.6	12.0
41	5.0	12.6	12.0
42	5.6	12.6	12.0
43	6.1	12.6	12.0
44	6.7	12.6	12.0
45	7.2	12.5	12.0
46	7.8	12.5	12.0
47	8.3	12.5	12.0
48	8.9	12.5	12.0
49	9.4	12.5	12.0
50	10.0	12.5	12.0
51	10.6	12.4	12.0
52	11.1	12.4	12.0
53	11.7	12.4	12.0
54	12.2	12.4	12.0
55	12.8	12.4	12.0
56	13.3	12.4	12.0
57	13.9	12.3	12.0
58	14.4	12.3	12.0
59	15.0	12.3	12.0
60	15.6	12.3	12.0
61	16.1	12.3	12.0
62	16.7	12.3	12.0
63	17.2	12.2	12.0
64	17.8	12.2	12.0
65	18.3	12.2	12.0
66	18.9	12.2	12.0
67	19.4	12.2	12.0
68	20.0	12.2	12.0
69	20.6	12.1	12.0
70	21.1	12.1	12.0
71	21.7	12.1	12.0
72	22.2	12.1	12.0
73	22.8	12.1	12.0
74	23.3	12.1	12.0
75	23.9	12.0	12.0
76	24.4	12.0	12.0
77	25.0	12.0	12.0
78	25.6	12.0	12.0
79	26.1	12.0	12.0
80	26.7	12.0	12.0

Actual pH = Measured pH + [0.0167 x (Temp °F - 77)]

There are a number of ways to add the lime. One is to draw powdered lime as a solid into your truck tank. Care must be taken to avoid bringing it into the pumps since lime dust can cause damage to your equipment. Another way is to add the lime as a slurry, as shown in Figure 8.3 (next page). This is done by mixing lime with water before adding it to the truck tank. There are many methods for adding and mixing lime with septage. Experiment, talk with others, and find a method that works for you. The important thing is to get good mixing of the lime and septage, so that the pH change happens.

FIGURE 8.3 Draw Lime as Slurry into Truck Tank



Hydrated lime is the most common type of lime used for lime treatment. Quicklime can also be used, but takes special precautions to be followed because of its reactive nature. Agricultural lime **cannot** be used because it will not increase the pH of the septage sufficiently to work. Follow safety precautions when working with lime. Protection of the eyes and lungs is very important, so wear goggles and a dust mask.

CAUTION: Quicklime is more reactive than hydrated lime and it releases a lot of heat. **If quicklime is used, you must take safety precautions!** Quicklime can cause bad burns if it gets onto moist skin or into your eyes. Appropriate safety precautions include the use of rubberized gloves, a respirator to exclude dust, protective eyewear and clothing to keep moist skin from contacting the quicklime. In addition, a fire could start if a bag of quicklime gets wet and sits around. Any fire involving quicklime must be put out using a chemical fire extinguisher.

Measuring pH: The pH of the septage can be measured using a pH meter. When a meter is used, follow the manufacturer's directions for calibration and use. Sources for pH meters are included in this manual. Using litmus paper is another way to measure pH, but the litmus paper must be sensitive enough to work. You must measure total pH accurately and if you are using litmus paper you should be calibrating the colors with your meter regularly. You should use litmus paper with a pH range between 10 and 14 that has a sensitivity that can measure changes in pH at 0.1 increments. For example, the litmus paper must be sensitive enough to be able to show the difference between a pH of 11.9 and 12.0 or it should not be used. You must request this sensitivity when ordering the paper.

Another important measurement when taking the pH is the temperature of the septage. Because the solubility of lime changes with temperature, the pH that you measure will not be accurate unless you make a temperature correction. There is approximately a 0.03 change in pH for each degree change in temperature above or below 25° Celsius (77° Fahrenheit).

Actual pH = Measured pH + [0.0167 x (Temp °F - 77)]

For example, using Table 8.8: You measure the temperature of the septage on a cold winter day. The septage temperature is 45° F. This means you must add enough lime to increase the pH of the septage measured to 12.5. When you do this, the actual pH of the septage mixture is 12.0 and meets the requirements of the rule.

The pH of the septage must be measured and recorded **after** lime has been added and measured and recorded again at least 30 minutes later. The purpose of these measurements is to show that the pH of the septage was kept at 12.0 or greater for a minimum of 30 minutes. Your records must show that this requirement has been met.

Benefits

The first "benefit" of lime is a public perception benefit. People like the idea that the septage is treated.

The second benefit is odor reduction.

The third benefit is the removal of pathogens. Even though removal is not complete, the addition of lime makes a difference and allows for the use of septage on more sites.

The fourth is soil modification. Many farmers add lime to their soil to allow better transfer of nutrients, so by using lime you actually open places up that were not usable for land application of septage in the past.

pH Indicator Paper and Meter Sources

Hach Company
P.O. Box 389
Loveland, Colorado 80539-0389
Phone: 800-227-4224
www.hach.com

Fischer Scientific
2000 Park Lane Drive
Pittsburgh, PA 15275
Phone: 800-766-7000
www.fishersci.com

Lab Safety Supply
PO Box 1368
Janesville, WI 53547-1368
Phone: 800-356-0783
www.labsafety.com

Thomas Scientific
PO Box 99
Swedesboro, NJ 08085
Phone: 800-345-2100
www.thomassci.com

Brands of pH meters include Oakton, Fischer and Corning. Suitable meters cost between $50 - $150 depending on features.

Site Suitability Requirements for Septage Application

Soil Terminology: Definitions for Septage Application

Slope is the change in elevation with distance. This is calculated as the "rise" divided by the horizontal distance, and expressed as a percent.

Bedrock is hard or weathered rock material that underlies the soil and may also be exposed at the surface.

"Highly permeable soil" means soils whose soil leaching potentials are rated as severe, poor filter for soil pesticide loss, by the Natural Resources Conservation Service using the procedure found in part 620, Soil Interpretation Rating Guides of the United States

Department of Agriculture-Natural Resources Conservation Service National Soil Survey Handbook.

Saturated Soil is the upper surface of the zone of soil (or underlying material) that is saturated by water.

Soil texture refers to the relative mixture of sand, silt, and clay in a soil.

Permeability is the maximum rate of water movement through the soil, usually expressed in inches per hour.

Note: A soil is made up of layers called horizons. A vertical section of a soil made up of all its horizons is called a soil profile.

The maintainer must determine whether land application sites are suitable. Sites are considered suitable if the suitable soil conditions in Table 8.9, slope restrictions in Table 8.10, and separation distances in Table 8.11 are met.

TABLE 8.9 Suitable Soil Conditions[1]

Site Characteristic	Minimum Requirement
Soil Texture	At the zone of application the soil texture must be listed below*
Surface horizon permeability	If 0.2 inches or less, this soil is suitable for surface application with incorporation within 6 hours or injection
Depth to bedrock[2]	3 feet
Depth to saturated soil[2,3]	3 feet
Frequency of Flooding	Must not be frequent

* Fine sand, loamy fine sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, silty clay, clay

TABLE 8.10 Slope Restrictions for Application Sites Where Septage Is Land Applied

Slope (percent)[1]	Surface Application	Injection or Immediate Incorporation[2]
Summer: 0–6 >6–12 >12	 Allowed Not Allowed Not Allowed	 Allowed Allowed Not Allowed
Winter: 0–2	Only areas with slopes from 0 to 2% can be used for winter applications of septage	

[1] This information can be obtained from the soil surveys published by the Natural Resources Conservation Service or by characterization of the site by a state of Minnesota licensed soil scientist or other qualified person.
[2] Immediate incorporation is mixing of septage into the soil with some form of tillage within 46 hours of application.

Site Selection

To select a site for soil treatment of septage, the following factors should be considered:

- soil texture;
- topography (slope and surface drainage patterns);
- separation distances from:
  - > groundwater,
  - > surface waters, lakes or streams,
  - > roads,

> occupied structures,
> residential or commercial developments,
> water supply wells, and
> public road rights-of-way;

- vegetative cover; and
- access by the tank truck hauling septage.

Some odors may be associated with the land spreading of septage. While sunlight acts as an affective bactericide and the odor soon dissipates from the area, common sense should be used when spreading septage on the soil surface. Usually several sites are available in a general area. The prevailing wind direction during the day should be noted when selecting the site upon which to spread the septage.

If land spreading is not an option, the septage must be delivered to a POTW treatment facility.

TABLE 8.11 Minimum Separation Distances From the Land Application Site

Feature		Separation Distances in Feet		
		Surface Applied	Incorp. w/in 6 hours	Injected
Private drinking water supply wells		200	200	200
Public drinking water supply wells[1]		1000	1000	1000
Irrigation wells		50	25	25
Residences[2]		200	200	100
Residential developments		600	600	300
Public contact sites		600	600	300
Property boundaries and Public roads		10	10	10
Down gradient lakes, rivers, streams,wetlands, intermittent streams, or tile inlets connected to these surface water features[2], and sinkholes	Slope 0% to 6%	200	50	50
	Slope 6% to 12%	Not Allowed	100	100
	Winter (0% to 2%)	600	N/A	N/A
Grassed Water Ways[3]				
Slope 0 % to 6%		100	33	33
Slope 6 % to 12%		Not Allowed	33	33

[1] There may be special requirements if the land application site is within the boundaries of a wellhead protection area. Check with the Minnesota Department of Health or local unit of government.
[2] Intermittent streams means a drainage channel with definable banks that provides for runoff flow to any of the surface waters listed in the above table during snow melt or rainfall events.
[3] Separation distances are measured from the centerline of grassed waterways. For grassed waterways that are wider than these separation distances, application is allowed to the edge of the grass strip. Grassed waterways are natural or constructed, typically broad and shallow, and seeded to grass as protection against erosion.

Using the Soil Survey

Soil surveys have entered a new era across Minnesota and the United States. The official soil survey information and documentation now resides online at:

websoilsurvey.nrcs.usda.gov (verified 8/8/17).

Those that seek to land apply septage should use this tool to help determine if a site is suitable for land application. While users may choose to print off information, this information is subject to change and should be checked online frequently for updates.

Online soil surveys still present soil lines on a photographic background indicating the boundaries between different soil types. These maps show the occurrence and distribution of each kind of soil.

For counties that do not have published soil surveys, the county Soil and Water Conservation District office can often provide soils information.

In order to use the Web Soil Survey to assist in identifying site suitability, locate the site on the survey (GPS coordinates, county, address, township, range, section, or simply zoom) and determine what soil map units exist on the parcel:

1. Outline the desired parcel/area using the Define AOI (Area of Interest) tool.
2. Once the AOI has been defined, select the tab for "Soil Map" near the top of the browser window.
3. You will now see a display of the aerial photograph with soil lines over the top. On the left of the map (legend), you will see a summary of map units, map unit names, acres in the AOI and percent composition of the AOI. Map units are denoted by symbols such as 401C.
4. List the map unit symbols found at your location.
5. Selecting the third tab entitled "Soil Data Explorer" allows the mapping of selected soil properties over the AOI.
6. Now select the "Suitabilities and Limitations for Use" tab.
7. Under this tab, there is a suitabilities rating for "Sanitary Facilities." Select this rating.
8. Under this rating, there are numerous interpretations. The five interpretations we are interested in include:
   - Septage Application - Incorporation or Injection (MN)
   - Septage Application - Surface (MN)

These interpretations were developed based on Septage and Restaurant Grease Trap Waste Management Guidelines (MPCA, 2002) and are accurate on a regional scale.

9. Select the "View Ratings" button to view map of ratings with tables of soil map units and their individual suitabilities.

If you do not have access to the Web Soil Survey, use of the hard copy Soil Surveys can also provide valuable information:

Soil Survey Tables: Useful Information for Determining Suitability of Soils for Septage Application

The Web Soil Survey's "Soil Data Explorer" has a section for "Suitabilities and Limitations for Use" that includes a tool for rating Septage Application.

I. Engineering Properties and Classifications

> These give the **soil texture** for each horizon. Make sure the surface texture is **not** sand, loamy sand, peaty, or mucky.

II. Soil and Water Features:

Use this table to make sure:

1. There is **no flooding hazard,** and

2. depths to bedrock and the high water table are **3 feet or more.**

Take note of these two depths!! You will need them later.

III. Physical and Chemical Properties of Soils

This table gives the permeability and available water holding capacity of each soil horizon. Use it to make sure:

1. One (or more) horizons have a permeability of fewer than six inches/hour
2. If septage will be surface applied, the permeability of the surface layer is greater than 0.2 inches/hour
3. "High permeable soil" increases up to five feet

General Site Management

The following general site management practices must be followed:

1. Application of septage is not allowed on areas of a site ponded with water or septage.
2. Septage cannot be applied by spraying from public roads or across road right of ways.
3. The application area must be clearly identified with flags, stakes, or other easily seen markers at the time of application to identify the site boundaries, separation distances, and unsuitable application areas within the site. Where site boundaries can be identified by field roads, fences, etc., identification is not necessary.
4. All septage that is land applied must be uniformly distributed over the area of the site used during application.
5. A distribution device (splash plate or spreader) is required on the application vehicle so that even application of septage is possible and application rate limits can be met.
6. Measures must be taken to ensure that septage remains where it was applied and does not run off and concentrate in low areas of the field or run off the site.
7. The application vehicle must be moving at all times during application.
8. Winter applications cannot occur unless measures are taken that allow septage to be applied evenly over the application area. This generally means that fields must be plowed or cleared of snow in some way.

Allowable Application Rates

Typically, nitrogen is the nutrient used to determine how much septage can be applied to an application site. Septage must be applied at a rate that supplies no more nitrogen than a crop needs. This is referred to as the agronomic application rate. In this guide, the Maximum Allowable Nitrogen Application (MANA) rate is used to calculate the gallons of septage that can be applied to a site over an entire cropping year. Maintainers can choose one of the following options for determining their maximum annual septage application rate:

Land Spreading

Spreading septage on the surface of the soil is an effective method of treatment, particularly for the removal of pathogenic bacteria. After the organic material begins to decompose, there will be some downward movement of nitrates through the soil profile. Thus, it appears that the application rate of the septage should be based on nutrient removal by a crop in the succeeding year.

In general, septage cannot be applied during the growing season of a crop. A practical method of application is to apply septage based on crop nitrogen requirements and plan to harvest a crop the following year. Since the nitrogen in septage is mostly in the organic form, it will be stored in the soil and utilized by the crop the following year if other plant nutrients are balanced. It is advisable to utilize the nutrients in septage for crops that are consumed as livestock feed, such as small grains or forage.

When septage is applied to a soil, a portion of the nitrogen as nitrate will volatilize or be lost to the atmosphere rather than be incorporated into the soil and become available to plants. The amount of volatilization depends upon a number of factors such as temperature, wind, and pH. Thus, the actual nitrogen loading rate will be somewhat less than that indicated by the total Kjeldahl nitrogen (TKN) concentration.

Septage Application Rate Limits

There are several rate limits for land applied septage. They are:

- **daily hydraulic loading limit of 10,000 gallons/acre/day when surface applied;**
- **winter hydraulic limit of 15,000 gallons/acre/winter; and**
- **nitrogen application rate limits equal to the agronomic rate for the crop or vegetation grown on the site (limit varies depending on the crop grown).**

The **daily** hydraulic limit of 10,000 gallons/acre/day is set for surface applications of septage. This limit is set to prevent ponding of septage and runoff.

A **winter** hydraulic limit of 15,000 gallons/acre/winter cannot be exceeded for the time period that begins when the ground is frozen or snow covered and ends when the ground is no longer frozen or snow covered in the spring. Winter is defined as "the time period that the ground is frozen and snow covered, so that injection or incorporation are not possible". The time period when this occurs varies from year to year; therefore, no dates are set for winter. In general, this time period begins sometime in November and ends sometime in early April.

The **nitrogen** application rate limit is based on how much nitrogen the plants growing on the site can use over a cropping year. Septage must be applied at a rate that supplies no more nitrogen than a crop needs. This is referred to as the agronomic rate for nitrogen. The agronomic rate varies depending on the type of crop grown, the yield that can realistically be expected, soil type it is grown on, and other factors.

Annual application rate limits use what is termed a **cropping year.** The cropping year goes from September 1st through August 31st each year. For example, the 1999 cropping year went from September 1, 1998 to August 31, 1999. The cropping year corresponds to the growing season that the plant will actually use the nitrogen applied. The

cropping year starts September 1 because nitrogen and other nutrients applied in the late fall will be used by the crop the next spring and summer.

Maximum Allowable Nitrogen Application (MANA) rate is used to calculate the gallons of septage that can be applied to a site over an entire cropping year. Maintainers can choose one of the following options for determining their maximum annual septage application rate:

Apply septage at rates that supply the MANA rates in the MPCA's Septage and Restaurant Grease Trap Waste Management Guidelines, and calculate loadings using the following equation:

$$\text{Maximum Allowable Septage Application Rate (gal/ac/yr)} = \frac{\text{MANA rate lbs/acre/yr}}{\text{0.0026 lbs N/gal}}$$

For both options, the MANA rate must be adjusted by subtracting out other nitrogen applied to the site from fertilizers, manure, or other by-products. These are called nitrogen credits and are subtracted from the MANA rate to determine the amount of nitrogen that can be supplied by the septage.

Realistic yield goals are needed to determine MANA rates when using option 2 and can be determined by one of the following methods:

- Use the most recent five-year average crop yield, excluding the worst year.
- Use the most recent three to five-year average crop yield increased by 10 percent.
- Use information from the Natural Resource Conservation Service, county extension office, or a crop consultant on typical yields for the soil type and management being used in the area.

Additional Nitrogen Management Requirements

- After the last cutting of a hay crop for each year the septage application rate must be reduced so that no more than half of the MANA rate for the cropping year is applied. For example, if the MANA rate for the hay crop is 100 lb/acre, no more than 50 lb/acre can be applied after the second cutting.
- Septage cannot be applied on land that remains fallow for the entire cropping year. Fallow land is kept bare for the entire summer. A crop must be grown at some time during the year if septage is to be applied on the site.
- If septage is applied on a site that has no crop growing during the months of July 1 through August 31, the following requirements must be met (this may happen after harvest of small grains or other early season crops):
  - > Application rates are limited to 20,000 gallons/acre (50 lb N/acre).
  - > All nitrogen applied must be used as a nitrogen credit the following cropping year.
  - > A crop must be grown the following cropping year.

EXAMPLE 1: MANA rate determined using option 1

Crop grown: oats
MANA Rate: 50 lb N/acre
Nitrogen Credits: Farmer did not apply any other nitrogen to the site.

Maximum Allowable Septage Application Rate: 20,000 gal/acre

EXAMPLE 2: MANA rate determined using option 1

Crop grown: oats
MANA Rate: 50 lb N/acre
Nitrogen Credits: Farmer applied 20 lb/acre of fertilizer nitrogen.
MANA Rate Adjusted for N Credits: 30 lb N/acre

Maximum Allowable Septage	30 lb N/acre
Application Rate (gal/ac/yr)	0.0026
=	**11,539 gal/acre**

EXAMPLE 3: MANA rate determined using option 2

Crop Grown: Oats
Realistic Yield Goal: 70 bu/acre
Previously Grown Crop: corn
Soil Organic Matter Content: low
MANA Rate: 80 lb/acre
Nitrogen Credits: Farmer did not apply any other nitrogen to the site.

Maximum Allowable Septage	80 lb N/acre
Application Rate (gal/ac/yr)	0.0026
=	**30,769 gal/acre**

EXAMPLE 4: MANA rate determined using option 2

Crop Grown: Oats
Realistic Yield Goal: 70 bu/acre
Previously Grown Crop: corn
Soil Organic Matter Content: low
MANA Rate: 80 lb/acre
Nitrogen Credits: Farmer applied 20 lb/acre of nitrogen fertilizer.
MANA Rate Adjusted for N Credits: 60 lb N/acre

Maximum Allowable Septage	60 lb N/acre
Application Rate (gal/ac/yr)	0.0026
=	**23,076 gal/acre**

Truck Calibration

Application rates need to be accurate. This means that the area of the site where septage is applied needs to be known, and the amount of septage applied on any given area needs to be known. Without this information, application rates will only be a guess.

To find out the rate of septage application, the equipment must be calibrated. There are several ways to calibrate your equipment. One of the simplest methods is to fill the tank with a known amount of septage or water. Go to the field and spread the liquid at the speed that you normally drive at. When done, measure the area the liquid covered in square feet. Then convert this to a rate per acre. If you drive at different speeds, you need to adjust the rate accordingly (twice the speed would be half the application rate, etc.).

Another way is to figure out the pumping rate from your truck in gallons/minute. If your tank is emptied by gravity and not a pump, you will need to figure out what your

pumping rate is. Then you can use a chart with different speeds and spread widths to determine your rate of application.

To figure out how much liquid you have in the tank, you can weigh the truck empty and full. Assume that the septage weighs the same as water (8.35 pounds per gallon). If you always fill the tank to the same level, you will know the quantity of septage you are spreading in each load. If not, you can weigh the truck at several levels so that you can estimate fairly accurately how much septage is in your truck at different levels. Another way you can know how much septage is in your truck is to put a flow meter on the truck so you know how much you are spreading.

To get a more even application and a lower application rate, some type of spreader or splash plate is needed. This also helps to reduce soil erosion as the septage falls on the ground from the application truck and reduces damage to the crop if spreading on hay or other forage type crops.

Some people find it difficult to apply septage at low rates because of their equipment. There are a few things you can do to lower the gallon/acre rate applied such as:

- Drive at a higher speed if this is possible.
- Use a splash plate that spreads the septage out over more surface area.
- Reduce the size of the valve opening that septage is being spread out of by using o-rings or other devices to make the opening smaller.

EXAMPLE CALIBRATION:

Weight of liquid in the truck tank: 20,850 pounds
Weight of liquid per gallon: 8.35 lb/gal
Quantity of septage in the truck tank: $\frac{20{,}850 \text{ lb}}{8.35 \text{ lb/gal}}$ = 2,500 gallons
Area Covered: 15 feet
Distance Traveled: 750 feet

1 acre = 43,560 ft^2

$$\text{Rate} = \frac{20{,}850 \text{ lb}}{15 \text{ ft} \times 750 \text{ ft}} = \frac{2{,}500 \text{ gal}}{11{,}250 \text{ ft}^2} = 0.22 \text{ gal/ft}^2$$

0.22 gal/ft^2 X 43,560 ft^2/acre = 9,680 gal/acre

With this information, you can determine your rate at different speeds. For example, if you are traveling at two mph, then your application rate would be doubled, so it would be 19,360 gal/acre (this would exceed the 10,000 gal/acre/day limit).

Specific Nitrogen Management Requirements:

The nitrogen management requirements in this section were developed to prevent nitrogen from being lost by leaching into groundwater. All of the requirements in this section must be followed.

a. After the second cutting of a hay crop, the septage application rate must be reduced to supply no more than half of the MANA rate for the cropping year.
b. Septage cannot be applied on land that remains fallow for the entire cropping year.
c. When no crop is grown on the application site during the time period July 1 through August 31 (this generally occurs on sites where early maturing

crops such as oats, sweet corn, or peas have been harvested), the following requirements apply:

> applications of septage are limited to rates that supply no more than 50 pounds of nitrogen per acre (20,000 gallons/acre);

> all nitrogen applied must be credited to the following cropping year; and

> a crop must be grown the following cropping year.

Hydraulic Loading Rate Limits

Hydraulic loading rate limits are set to prevent ponding of septage on the soil surface and runoff of septage from where it was applied. The following requirements must be met:

a. Daily application rates for surface applied septage are limited to 10,000 gallons/acre/day.
b. Field conditions must be taken into account to ensure that the following requirements are met:
   > No runoff of septage from the application site is allowed.
   > No surface ponding of septage is allowed after six hours from the time of application.
   > Minimal movement of septage from where it was applied occurs.
c. Application rates are limited to a total of 15,000 gallons/acre over the entire winter period.

Maintainer Qualifications

All septage must be land applied by a state of Minnesota licensed maintainer.

Record Keeping

You must keep records that show you are meeting land application requirements. Records must be kept for a minimum of five years. These records are the first thing requested during any complaint investigation. Records for sites should be kept on a cropping year basis. Example record keeping forms are included in this manual. You can set up your own record keeping forms and system as long as your records include the information described below.

For each land application site, the following information must be kept:

- Location of each land application site used. This can be recorded as the street address, latitude and longitude of the site, or legal description indicating the quarter section, township coordinate, range coordinate, township name, and county name
- A map of the land application site with the site boundaries identified. The map must be from a soil survey when available. If not available, another map with comparable information can be used. Any areas of the site which are not used because they are unsuitable should be indicated on the map by coloring or crosshatching
- Total usable acreage of the site (unsuitable areas should not be included in the

site acreage, because application rates are based on the actual area septage is applied)

- Crop grown on the site
- Maximum allowable nitrogen application rate for the cropping year in pounds/acre
- Maximum allowable septage application rate for the cropping year in gal/acre
- Running total of gallons of septage applied on the site
- A written description of how the pathogen reduction requirements have been met

Example Statement:

"Each load of septage that was applied on this site was lime stabilized for 30 minutes. This was done by adding hydrated lime at a rate of about 25 pounds per 1000 gallons. The pH was measured using litmus paper after lime addition and again after 30 minutes to make sure a pH of 12.0 or greater was met for 30 minutes. In addition, site restrictions were used."

- A written description of how the vector attraction reduction requirements have been met

Example Statement:

"Each load of septage that was applied on this site was lime stabilized for 30 minutes. This was done by adding hydrated lime at a rate of about 25 pounds per 1000 gallons. The pH was measured using litmus paper after lime addition and again after 30 minutes to make sure a pH of 12.0 or greater was met for 30 minutes."

- The following signed certification statement:

"I certify under penalty of law, that the information that will be used to determine compliance with the pathogen requirements [insert either 503.32(c)(1) or 503.32(c)(2)] and the vector attraction reduction requirement [insert either 503.33(b)(9), 503.33(b)(10) or 503.33(b)(12)] was prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

For each load of septage applied to a site, the following detailed information must be kept:

- Source(s) of septage in the load. This means the home or facility the material was removed from and can be indicated by property owner name, or invoice number. The type of material pumped should be identified (septage, grease trap waste, etc.)
- The date each load of septage is applied on the site
- Total gallons land applied
- Total acres covered
- Rate applied in gallons/acre
- If surface applied, specific pH, temperature and time information

Requirements for Land Application of Restaurant Grease Trap Waste

Restaurant grease traps are designed to remove greases, fats, and oils before they enter a centralized sewage treatment system or the soil treatment area of an individual sewage treatment system. The waste that is removed from the tank described in Example 1 and the first septic tank described in Example 2 are restaurant grease trap wastes and must be managed by following the special management requirements of this section.

Example 1 – Tanks designed for the purpose of removing fats, oils, and greases from effluent before discharge to a centralized sewage treatment system or to an individual sewage treatment system septic tank.

Example 2 – When there is no tank specifically dedicated to the collection of greases, fats, and oils, the first septic tank that receives effluent from a restaurant is considered the grease trap.

Restaurant grease trap waste can be land applied if **all** of the previously discussed requirements for the land application of septage are followed. **In addition,** one of the following four options for management must be met:

Option 1: Restaurant grease trap waste must be *incorporated* into the soil within *six hours of surface* application and is limited to an application rate of *15,000 gallons/acre/year.*

Option 2: Restaurant grease trap waste must be *injected* into the soil and is limited to an application rate of *15,000 gallons/acre/year.*

Option 3: Restaurant grease trap waste from a tank, as described by Example 1, must be mixed with domestic septage prior to *land application.* The quantity of restaurant grease trap waste mixed with septage cannot exceed *25% of the mixture by volume.* Maximum application rates of this mixture are limited to *60,000 gallons/acre/year.*

Option 4: Restaurant grease trap waste from the first septic tank, as described by Example 2, must be combined with domestic septage and mixed prior to *land application.* The quantity of restaurant grease trap waste mixed with septage cannot exceed *50% of the mixture by volume.* The source of the septage used for diluting the grease trap waste can be from the other tanks in series with the first or from another ISTS system. Maximum application rates of this mixture are limited to *30,000 gallons/acre/year.*

In addition to the application rate limits specified for each option, the application rate limits used for septage also apply. This means that the maximum application rate for restaurant grease trap waste cannot cause the annual application rate limit specified for septage to be exceeded.

Additional septage may also be applied to sites receiving restaurant grease trap waste or mixtures of restaurant grease trap waste and septage as long as the sum of all these wastes are counted as part of the year's maximum allowable application rate for septage.

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