Barnyard, Manure and Waste Management

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Livestock Waste Management Plan
A livestock waste management plan specifies how, when and where animal waste will be handled. It is used for systems that store, stabilize, transport or apply animal waste to land. In Ohio for instance, the EPA uses a livestock waste management plan for controlling land applied wastes in two situations: if animal operations or facilities have a controlled direct discharge to waters of the state; or if an animal operation has 1,000 or more animal units. This plan also may be part of an installation permit if a permit is needed for new or expanded animal waste treatment, storage or disposal facilities.

The plan describes:

- Systems to store, treat and transport manure;
- Characteristics of the manure and/or wastewater;
- Amount and topography of land available for application;
- Methods and times of land application;
- Crop rotations
- The condition and nutrient status of the soil

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The livestock waste management plan provides a documented method of operation that will prevent land-applied waste from impacting water quality.

The information necessary to process a waste management plan includes:

- Description of waste collection, treatment and disposal
- Volume of waste produced (manure analysis results -application rate calculations)
- Site maps and soil descriptions (for land application)
- Description of land application management
- Sample sales contract (if applicable)
- Manure and soil sampling schedule
- Recordkeeping and reporting requirements

Contact the NRCS office for assistance in completing this plan.

Manure Management
A manure storage structure is a facility that stores manure until conditions are appropriate for application or disposal. Farmers must regard manure as a cost saving resource that can contribute to soil fertility when used as a soil amendment.

Areas of concern are those which can be easily subject to groundwater and surface water contamination such as, structures where animals are held and maintained, grazing areas, and riparian areas. Pollutants form livestock waste include slats, nutrients and pathogens, and organic solids. These pollutants can cause severe environmental problems such as water supply contamination, eutrophication of nearby lakes and streams, fish kill caused by eutrophication and anaerobic conditions which will harm plant and aquatic life.

There are several types of manure handling methods and facilities:

1. Vegetative filter strips which are areas of vegetation used to buffer and filter out various pollutants in manure runoff that could be subject to water contamination. Vegetative strips remove sediment which carries pollutants and organic matter. They are grown in areas located near the closest water source, surrounding the perimeter of the farm or areas of highly concentrated livestock grazing and activity. In addition to supplying a way to buffer the runoff, filter strips also provide a habitat for wildlife.
2. Manure Composting is a process to treat organic wastes in ordered to prevent water contamination and to prepare the manure for use as a soil amendment. Composting is a process that accelerates aerobic degradation. Manure composting must be done in an aerated pile or special composting structure. Composting must be monitored in order to prevent leaching of nutrients and to prevent nitrogen rich manure form leaching nitrates into groundwater. Successful composting requires careful attention and monitoring.
3. Providing alternative water supplies for grazing animals that will lead them away from stream banks and riparian zones will greatly reduce the amount of runoff form manure and it will also protect wetlands and riparian zones from livestock trampling. A pipeline can be installed to carry water from a nearby water source to an upland area away from stream banks and riparian zones.

When planning a manure storage facility, consider the following:

- The facility must be located in consideration with landscape, potential odor problems, visibility and compatibility with existing farm buildings.
- Farm equipment must be suitable to safely store the manure.
- Buffer strips should be placed around facility to filter runoff and should also be placed around nearby streams and riparian zones.
- Manure structures should be fenced safety.

When using manure as a soil amendment and fertilizer, consider the following:

- Application rates are low enough to avoid runoff
- Avoid applications on steep slopes
- Environmental factors such as weather forecasts to avoid runoff.
- Monitoring all water supplies and outlets subject to contamination from runoff.

Agronomic Plan

Manure Characterization:

Summaries and estimates of manure quantities and nutrient content are available from the Cooperative Extension Service, US Department of Agriculture and USDA-Soil Conservation Service. When planning a new operation, these averages provide “ball park” figures and should be utilized. Existing operations are encouraged to develop individual estimates of the volume of manure, litter, feedlot runoff or lagoon liquid to be land applied. Representative samples of the material to be land applied should be analyzed biannually for nutrient and mineral content.

Crop / Soil Selection:

Soil types should be mapped for each field on the farm to receive manure. Soil infiltration rates will often determine maximum irrigation rates or how much lagoon liquid can be applied before runoff occurs. Soil types also determine the fate of unused nutrients. Well- drained sandy soils provide more potential for unused nitrogen to convert to nitrates and leach downward. Heavy soils or poorly-drained soils reduce infiltration rates and water-holding capacity but provide more potential for unused nitrogen to denitrify harmlessly. Clay soils have more capacity to tie-up and hold phosphorus in place than do coarse soils.

Soil types also influence the yield potential of selected crops. For example, if a corn crop only has a yield potential of 100 bu/A on a given soil type, then it should only be fertilized for 100 bu/A, since any more nutrients would be wasted and become potential pollutants. Crop types should be selected for their nutrient requirements.

Application Rates:
Application rates of manure, litter or wastewater should only supply the fertilizer needs of the crops. Since the manure nutrients are not a balanced blend for most crops, some nutrients will either be under- or over-applied. Some over application of phosphorus and potassium may be tolerated, however significant and prolonged over application of phosphorus and potassium should be avoided. Supplemental fertilizer may be needed. Under no circumstances should available nitrogen be over applied. Plant available nitrogen is currently estimated to be half of the total nitrogen in irrigated lagoon liquid and 70 percent of the total nitrogen in manure slurries that are soil incorporated.

NRCS can help to calculate available nutrients and application rates.

Scheduling of Manure Application
Manure nutrients should be applied as near to the period of plant uptake as possible. Nutrients that are readily available, such as lagoon liquid are more efficiently utilized by the crop in several small applications throughout the growing season. Nutrients should only be applied to crops during their normal growing season. For example, Bermuda grass normally thrives from May to September and should not receive manure at other times of year unless when over-seeded with a cool season grass such as rye. Cool season crops are necessary to allow application to proceed during the cool season, or enough storage is necessary to avoid having to spread. Land application of manure nutrients on fallow soil or onto dormant crops will only lead to nitrate leaching downward toward ground water.

Manure Application Equipment
Most manures will either be hauled with farm liquid manure spreaders, spread with irrigation systems or applied by a custom applicator. Costs and time required for hauling, additional acreages required for concentrated slurries, soil compaction, odor considerations and availability of custom applicators need to be considered for slurry management. It is not cost effective to haul wastewater. Most farms with lagoons will use simple farm irrigation systems, use portable company irrigation equipment or hire custom irrigators. Those farms with field crops, tree stands and large acreage will probably find portable systems such as travelers or center pivots most advantageous. All manure equipment should be calibrated periodically for application rate and uniformity. Appropriate equipment or contractual arrangements must be available whenever manure or lagoon liquid needs to be land applied.

Crop Management Utilization
It is important to remember that regardless of what crops are grown on land application sites, they all must be regularly harvested and removed from the site. Otherwise, nutrients will simply recycle back into the soil system and eventually become pollutants. For most field crops, readily established markets are available for the products. For grass crops, markets for hay may not be readily available and may need to be developed. Consideration should be given to marketing a particular crop before selecting that crop for land application.

Avoiding Runoff of Surface Applied Manure
Contaminated runoff can occur rapidly if excessive amounts of manure are applied to the ground surface. An excessive rate can be as low as 2,000 gallons per acre if the soil is in a crusted, compacted or saturated condition (especially in sloping situations). Runoff can start very quickly therefore, constant supervision during application is necessary.

The best solution is immediate incorporation. Even delaying the incorporation for a period of time becomes risky if a large rainfall occurs before the manure is incorporated. Cultivation of the soil prior to manure application will also greatly increase the soil's ability to absorb applied manure and resist immediate runoff. Several custom operators have made it a practice not to apply manure until the farmer has first cultivated the land. **This practice serves several purposes**:

- It lowers the possibility of surface runoff and tile drainage contamination.
- It ensures the soil is dry enough to allow uncomplicated access to the land and is in a

proper condition to resist soil compaction.

Situations with no till management or continuous sod create manure application difficulties. Full cultivation will destroy either cropping system**. If manure is to be applied to the surface without incorporation, the following steps should be taken:**

- Ensure application rates are low enough to avoid any immediate runoff
- Avoid application on steep slopes
- Consider weather conditions. It is best to have a 24 to 48 hour dry period following application.
- Apply manure at least 1000 feet away from any conflicting use (i.e. neighbor's residence).
- Monitor tile drain outlets to ensure manure is not flowing into the tile drains.

Lagoons

Lagoons became popular for livestock manure treatment as an historic interest to utilize fertilizer nutrients by direct land application was replaced by desires to have more convenient systems for manure management. Originally viewed as a total disposal system; it is now recognized that in moisture excess regions, lagoons are one pretreatment process in an overall manure management plan. Within two to three years lagoons will usually fill to capacity with wastewater and rainfall surplus, once the interior surfaces of the lagoon have biologically sealed. When the filling process is complete, overflow will occur unless the operator is equipped to apply the excess liquid back to field crops, grassland or woodlots. Lagoons act as digesters in which two major types of bacteria decompose organic matter into gases, liquids and sludge. Anaerobic bacteria, present in the intestinal tract of warm-blooded animals, do not survive in the presence of free oxygen. Aerobic bacteria require free elemental (dissolved) oxygen.

Advantages of using lagoon systems for treatment of livestock waste are:

- Storage and disposal flexibility.
- Less land required for a total treatment system.
- A liquid recycling pit for waste removal.
- Land application by means of simple irrigation.
- Lower labor needs and operating costs.

Disadvantages of lagoon systems:

- An appreciable loss of nutrient value.
- If improperly designed and managed lagoons lead to offensive odors.
- If undersized, frequent sludge removal is necessary.
- Groundwater protection considerations.
- High mechanical aeration costs.

Anaerobic lagoons are most commonly used for livestock waste treatment. Anaerobic bacteria can decompose more organic matter per unit lagoon volume than aerobic bacteria and are predominantly used for treatment of concentrated organic wastes. Since the anaerobic process is not dependent on maintaining dissolved oxygen, lagoons can be much deeper and require less surface area. Anaerobic decomposition of livestock waste can result in the production and emission of odorous gases, primarily hydrogen sulfide, ammonia and intermediate organic acids. An anaerobic lagoon can be properly sized and managed to operate with minimal odor.

Design Capacity

Liquid volume, rather than surface area, is the basis for anaerobic lagoon design. Sizing criteria should emphasize major operational needs to control odor, minimize sludge buildup and manage nitrogen. As lagoon capacity increases, odor potential, rate of sludge buildup and pathogenic organisms decrease while nitrogen losses increase. Because bacterial activity increases at higher temperatures, lagoons work best in areas without cold winters. Lagoons in colder areas require more design treatment volume.

The **liquid capacity** of an anaerobic lagoon should include the appropriate design treatment capacity, storage for accumulated sludge and temporary storage for rainfall and wastewater inputs. In addition to this liquid capacity, surface storage for a 25-year, 24-hour rainfall (5 to 8.75 inches) and an additional foot of freeboard to prevent embankment overtopping should be provided. Wastewater storage capacity should be figured for 180 days.

Anaerobic lagoons are not used for treatment of cattle wastes without prior manure solids settling, separation or removal. Cattle wastes have a higher percentage of relatively non-degradable fibrous material which significantly increases the solids buildup rate in a lagoon.

Shape

Lagoons may be round, square, rectangular or irregularly shaped to fit existing terrain provided the perimeter does not contain unusually deep bays or pockets. Length-to-width ratios for rectangular lagoons should not exceed 4:1 to encourage even distribution of waste. Side slopes generally vary from 1:1 in clay soils to 3:1 in sandy soils. A minimum liquid depth of six feet should always be maintained in an anaerobic lagoon. Maximum depths are dictated by soil and groundwater site constraints but may range up to 20 feet to minimize the surface area and to encourage dissolution of anaerobic gases. A level lagoon bottom is desirable but not necessary.

Site Investigation

A site investigation by an agency with expertise similar to the Soil Conservation Service should be made to determine the soil characteristics and suitability for lagoon construction. A location on highly permeable soils which will not seal, shallow soils over high water tables or fractured or cavernous rock may cause groundwater contamination. Most properly planned livestock lagoons receiving raw manure eventually seal, limiting soil permeability to rates as low as 10-6 cm/sec. The sealing mechanism is mainly physical as organic solids are trapped within soil pores at the soil surface. Biological mechanisms also help bind manure solids to soil particles thus strengthening the seal. Chemical constituents of manure such as sodium also tend to disperse soil particles.

Management

New lagoons should be filled half-way with water before waste loading begins. Start-up during warm weather and seeding with bottom sludge from a working lagoon will speed establishment of a stable bacterial population. Manure should be added to anaerobic lagoons daily. Infrequent shock loadings can cause sharp increases in odor production and wide fluctuations in nutrient content. Lagoon liquid drawdown by irrigation should begin when the liquid reaches the maximum normal wastewater storage level. Liquid should not be pumped below the design treatment level to ensure adequate volume is available for optimum bacterial digestion.

An anaerobic lagoon in proper balance will have a pH ranging from 7 - 8 (slightly basic). The pH in new lagoons without adequate dilution water or in overloaded lagoons can be reduced to 6.5 or less (acidic), thereby creating odor problems. This condition can be temporarily corrected by evenly distributing agricultural lime (preferably hydrated) to the liquid surface at the rate of one pound per 1000 cubic feet of lagoon volume.

Land Application

Lagoon liquid should be land applied through irrigation equipment when it reaches the maximum normal wastewater storage level. Substantial amounts of nutrients can be provided to grassland, cropland or woodlots, with application rates based on matching the available nitrogen content of the lagoon liquid to the fertilizer requirement of the crop. Nutrient concentrations vary widely among different lagoons and within individual lagoons seasonally. Applicators are strongly encouraged to periodically have lagoon samples analyzed to more accurately determine the amount of nutrients being applied.

Irrigation Equipment

Liquid from lightly-loaded anaerobic lagoons can be applied through sprinkler nozzles ¼-inch or larger. Single-nozzle, straight-bore sprinklers are recommended. Pump suction intakes should be floated approximately 18 inches underneath the lagoon liquid surface. Liquid from moderate to heavily loaded lagoons can be applied through ½- to ¾- inch nozzles. Larger gun-type sprinklers with ¾- to 2-inch nozzle diameters should be used for lagoons with high concentrations of solids or liquid sludge irrigation. Low-pressure systems in the 20 psi range with either high-rate or rotary impact nozzles less than ¼-inch diameter are not recommended.

For solid contents under four percent, standard centrifugal irrigation pumps are recommended over specialized chopper pumps or cutter attachments. If a lagoon contains an appreciable amount of long-stemmed vegetation or large debris, this material should be removed and efforts should be made to prevent its recurrence.

Sludge Removal

Even with good bacterial digestion, significant amounts of sludge accumulate in an anaerobic lagoon. The rate of sludge buildup can be reduced by mechanical solids separation or gravity settling the waste prior to lagoon input. This practice is particularly recommended for cattle wastes containing a high percentage of relatively non-degradable lignin and cellulosic fiber.

At some point the treatment capacity of most lagoons will be severely diminished by sludge accumulation. Organic nitrogen compounds and phosphorus tend to accumulate in the sludge causing nitrogen levels up to 13 times higher than lagoon liquid levels and phosphorus up to 55 times higher. In addition to higher nutrient levels, the bottom sludge may also contain significant concentrations of heavy metals, salts and other trace elements. These factors dictate the need to have the sludge analyzed and expert agronomic advice sought prior to land application.

The most frequently used method to remove sludge consists of vigorous mixing of the sludge and lagoon liquid using a chopper-agitator impeller pump or pto propeller agitator. The sludge mixture is pumped through a large bore gun-sprinkler slurry irrigation system onto cropland followed by soil incorporation. One alternative is partial lagoon dewatering followed by sludge agitation, and then pumping the slurry mixture into a liquid manure spreader for field spreading. Another alternative is lagoon dewatering followed by dragline dredging. The sludge may be hauled and applied directly to cropland by spreaders equipped to handle slurries, or stockpiled near the lagoon and allowed to further drain before spreading.

Solids Separation

Lagoon management is eased by separating solids from raw or flushed manure prior to lagoon input. Removing fiber from cattle wastes and grit from poultry manure significantly reduces the lagoon solids buildup rate and associated pumping problems. Removal of oxygen-demanding solids in swine and poultry manure reduces the lagoon organic loading and lessens its odor potential. Beneficial uses of the recovered solids include bedding materials, supplements to animal feed rations, composting and soil amendments.

To recover a relatively dry by-product, vibrating-screen, sloping stationary screen or pressure-roller mechanical separators are the most advantageous. Waste is collected in a sump sized to store three to four days accumulation of manure plus dilution and flush water. A submersible or stationary bottom-impeller agitator-lift pump mixes the waste into slurry and pumps it across the separator where the liquid drains into the lagoon. Solids are dry enough to be handled by conventional materials handling equipment. Up to 30 percent of the total solids and 25 percent of the oxygen-demanding materials are removed.

A gravity settling basin may be less costly while removing 50 percent or more of the solids from liquid manure. Solids can be settled and filtered by a shallow basin (two to three feet deep) with a concrete floor and walls and a porous dam or perforated pipe outlet. It should allow access by a front-end loader to remove solids every one to two months. An alternative is an earthen settling basin for six to twelve months storage of solids. For flushed swine manure at least 0.55 gallon

capacity per 135 pounds animal live weight per day of storage should be provided. The basin top width should be no more than 100 feet with a length-to-width ratio near 3:1 and a liquid depth of eight to ten feet. The basin contents should be thoroughly agitated and removed for land spreading either by a liquid manure spreader or slurry irrigation. A third alternative consists of a large rectangular metallic or concrete settling tank with a 3:1 length-to-width ratio and liquid depth of eight feet. Tank volume depends on a peak-flow wastewater detention time of 10 to 30 minutes. Most solids in livestock manure settle in about 10 minutes, although some additional settling occurs for hours. Tank inlets and outlets are baffled and solids are removed by automated skimmers and scrapers.

Naturally Aerobic (Oxidation Ponds)

The main advantages of aerobic lagoons are that bacterial digestion tends to be more complete than anaerobic digestion with relatively odor-free end products. In naturally aerobic lagoons, oxygen diffusion occurs across the water surface. Algae also generate oxygen through photosynthesis which takes place when sunlight can penetrate the water depths. Water depths are rather shallow ranging from three to five feet. Because of the need for oxygen transfer, naturally aerobic lagoons are designed on the basis of surface area rather than volume. The USDA Soil Conservation Service recommends a maximum daily loading rate of 50 pounds of biochemical oxygen demand (BOD5) per acre of lagoon surface. Vast amounts of land are required for naturally aerobic lagoons - as much as 25 times more surface area and 10 times more volume than an anaerobic lagoon 10 feet deep. Thus, naturally aerobic lagoons are impractical for primary oxidation and are generally not recommended for treatment of livestock production wastes.

Mechanically Aerated

Mechanically aerated lagoons combine the odor control advantages of aerobic digestion with relatively small surface requirements. Aerators are used mainly to control odors in sensitive areas and for nitrogen removal at limited land disposal sites. Aerated lagoons have successfully met these objectives by providing enough oxygen to satisfy 50 percent of the waste chemical oxygen demand (COD) assuming an aerator oxygen transfer rate of three pounds per horsepower-hour. The lagoon liquid surface should not exceed 1000 square feet per horsepower of aeration for floating surface aerators to ensure complete surface influence. Liquid depths should be at least 10 feet.

A major disadvantage of mechanically- aerated lagoons is the expense of continually operating electrically-powered aerators. Larger anaerobic lagoons may provide similar performance with less expense. Aerated lagoons also yield more sludge than anaerobic units because more input organics are converted to biomass. Suspension of bottom sludge by the aerators can cause increased lagoon liquid concentrations and stimulate foaming. Solid traps such as a septic tank type settling chamber between primary aerated and secondary lagoons can provide a convenient mechanism for solids collection and removal. Mechanically-aerated lagoon liquid nitrogen levels are significantly reduced.

Two-stage lagoons provide certain advantages over single, primary lagoons. More than two lagoons in a series are rarely beneficial. Secondary lagoons provide temporary storage prior to land application. Aerobic systems need a second lagoon to provide storage and allow the primary lagoon to function solely for biological treatment. A second stage also allows a maximum liquid volume to be maintained in primary anaerobic lagoons for stabilizing incoming wastes. For livestock operations which recycle lagoon liquid for open-gutter flushing where animals have direct access to flush water, a second lagoon provides some insurance against disease organisms being returned from the primary lagoon before a reasonable die-off period. Pumping from a secondary lagoon reduces the solids pickup common in primary lagoons due to seasonal water turnovers and biological mixing.

Sizing of secondary lagoons is not clearly defined or critical but should have 180 days of wastewater storage generated plus enough volume for the combined 25-year, 24-hour rainfall storage from both lagoons.

When planning a lagoon system, consider the following:

- New lagoons should be filled half-way with water prior to waste input, and the liquid be maintained at or above the design treatment level.
- When possible, manure loading of a new lagoon should begin in the spring to permit a good bacterial population to develop during the warm season.
- Lagoons should be loaded on a frequent basis avoiding large shock loadings which cause excessive odors and nutrient level fluctuations.
- Apply one pound of agricultural lime per 1000 cubic feet of lagoon volume when the lagoon liquid pH falls below 7 to optimize bacterial digestion.
- Mechanical aeration can be used to control odors, reduce nitrogen content and reduce surface area but at high operating costs.
- Solids separation and removal from raw wastes either mechanically or by gravity settling can reduce the sludge buildup and organic loading rate
- Prevent additions of bedding materials, long- stemmed forage or vegetation, molded feed, plastic gloves, egg flats or other foreign material.
- Remove sludge when 75 percent of the lagoon design treatment volume has filled.
- Plan lagoon liquid draw-downs such that adequate storage is available during wet seasons.
- Do not lower the lagoon liquid level below the seasonal groundwater table.
- Locate pump intakes approximately 18 inches underneath the liquid surface and as far from the waste inlet to the lagoon as possible.
- Electric pump housings should be adequately grounded to prevent stray voltage from contributing to salt deposits on internal surfaces.
- Irrigate lagoon liquid on field crops, grassland or woodlots at agronomic rates with equipment selected to handle the particular waste characteristics, when the lagoon reaches the normal wastewater storage level.
- Irrigate when odors are apt to be least offensive, on days with low humidity, or when breezes are blowing away from neighboring residences.
- Maintain strict vegetation, rodent and varmint control near lagoon edges.

Wash-water Management

To select and design the best system for your farm, you need to know your approximate daily wash-water production. It is important to accurately measure your specific water use to properly select and size the system that is best for you.

Measure your actual water use by installing a water flow meter, or estimate it using a calibrated pail, or the sink (if you know its capacity) and a stopwatch to time the water flow. If an excessive amount of wash-water is being used, it is wise to reduce this amount to make the disposal system work properly and reduce the amount of storage and handling required. Steps which reduce water use include proper calibration and adjustment of pipeline and bulk tank wash cycles, the use of recaptured wash-water for cleaning floors and directing clean waste water, such as the overflow from heat reclaimers away from the floor drains. Ensure that any steps taken to reduce wash-water do not adversely affect the cleaning of the milking system.

Disposal Systems

Disposal systems must be properly designed, installed and operated to be economical, compatible with current wash-water and manure handling systems on the farm, and effective in preventing pollution of surface or groundwater.

Three methods have proven to be the most acceptable for handling milking center washwater:

1. Add the milking center wash-water to a liquid manure storage or runoff storage
2. Collect and store wash-water in separate storage
3. Dispose of wash-water through a sediment tank and treatment trench system

Adding to Liquid Manure or Runoff Storage
A proven means of storing and disposing of milking center wash-water is to add it to a liquid manure or manure runoff storage. The milking center wash-water can then be applied to the land along with the liquid manure. **Consider this system if**:

- You already have a liquid manure or runoff storage with adequate additional capacity for the milk house wash-water; or are planning to add one in the future
- You have a large herd or produce a large amount of wash-water (>80 cows or >250 imperial gallons/day)
- There are lots of solids in the wash-water
- Additional liquid is required in your manure storage for agitation and pumping

Manure and runoff storages should be sized to contain at least 200 days production of manure, wash-water, runoff and precipitation falling on the storage. Concrete and glass-lined steel storages are commonly used. If the clay content of the soil is high enough and proper construction techniques are used, earthen storages are also a viable alternative.

The addition of the milking center wash-water will add very little fertility value to the manure, but dilution of manure solids makes agitation and pumping easier. When disposing of the manure and wash-water be sure to follow procedures and practices that prevent ground and surface water pollution.

Consult NRCS for further information on the sizing and design of manure and runoff storages.

Separate Storage
Milking center wash-water may also be collected and stored in a separate storage. This storage should have capacity for a minimum of 200 days of wash-water production. **Consider this system if:**

- Your liquid manure storage cannot hold additional liquid
- A treatment trench system is not feasible due to heavy clay soil, a high water table or shallow soil
- You can locate a separate storage such that odors will not be a problem

Milking center wash-water can give off offensive odors during warm summer weather. It is wise to locate open storages at considerable distances from neighbors' dwellings and from the farm family's living area. Any concrete or steel storage that is adequate for liquid manure will also be adequate for storing milking center wash-water. Earthen storages may require a greater clay content to store milk house wash-water as opposed to liquid manure, because the wash-water may not have the amount of solids to promote sealing of the clay as manure does.

Sediment Tank and Treatment Trench System
A sediment tank and stone-filled treatment trench system is a third method of handling and disposing of milking center wash-water. With proper design, management and soil conditions, these systems can work quite well. However, systems will fail with the disposal of excess milk and water.

In addition, treatment trench systems fail to address other farmstead environmental problems such as runoff from the manure storage and from paved livestock yards. If a runoff storage is added in the future, the treatment trench system may become redundant. However, if working properly it can be used to reduce the size of the runoff storage. **Consider this system if:**

- You do not have or are not planning to build a liquid manure or runoff storage
- The soil around the farm is deep and has good drainage characteristics
- Your wash-water is relatively free from solids
- You are willing to restrict the water that enters the system to a minimum

- You are willing to collect the first rinse from the milking equipment
- You are willing to prevent milk from going down the floor drain.

A treatment trench system consists of a sediment tank and several stone-filled treatment trenches. The purpose of the sediment tank is to collect manure, dirt or other solids that are washed down drains, and to prevent floating material from blocking the treatment trench lines. The treatment trenches distribute the liquid from the sediment tank over a large area to allow it to percolate into the soil. Bacteria attached to the stone in the treatment trench help to remove contaminants in the milking center wash-water; additional contaminants like phosphates are trapped and degraded by the soil.

The success of the treatment trench system depends on treated water draining away from the septic pipes. Therefore, this system works best in well-drained soil types which have internal drainage characteristics equivalent to a Guelph loam soil or better. Where finer soils exist, it may be better to use one of the first two options. **You should not consider this system if bedrock is located within two meters (six feet) of the surface or if the soil is saturated for long periods of time within this two meter zone.** It is extremely important that the design details for this system be followed closely if it is to work satisfactorily.

The tank and disposal unit should be located at least 50 feet from a drilled well and at least 100 feet from a dug or bored well. These are the minimum distances; it is preferable that it be located more than 200 feet away from all wells. It should also be located so that it doesn't pollute surface water sources. The treatment trench area should be seeded to grass and fenced to keep heavy traffic and livestock from damaging the system.

The sediment tank must be large enough to retain the wastes until the solid particles can separate out. A minimum retention time of four days is recommended but six days is preferred. The retention time is the time in days that the wash-water remains in the sediment tank. It is equal to the capacity of the sediment tank divided by the daily wash-water use. The tank must also provide space for six months or more of accumulated solids. An approved two compartment septic tank with a minimum capacity of 800 imperial gallons will be satisfactory for operations producing up to 150 gallons of wash-water per day.

The disposal field includes septic tile and treatment trenches. If the septic tile must go under a roadway, replace it with galvanized steel pipe to prevent damage due to heavy vehicles or frost. The treatment trenches should be excavated with a backhoe in parallel lines at least eight feet on center. The trenches should be approximately 60 to 100 feet long. Excavate trenches 40 inches wide and at least 36 inches deep. Partially fill trenches to a depth of 24 inches with septic stone 3/4 inch to 1 inch clear, crushed or round, washed stone to make an aerated treatment bed. Lay the septic pipe at a uniform slope of one to two percent away from the tank, with the holes in both sides of the pipe at the four and eight o'clock position. Straight up and down will cause plugging or uneven loading of the trench with wash-water. Add more septic stone to provide two inches of cover on the pipe and a layer of filter cloth to keep soil out of the stone bed. Lastly, back fill to the top of the trench with the excavated topsoil. **Do not use plastic drainage tile, as the perforations are not large enough and will quickly become plugged.**

The treatment trench lines should be long enough to provide at least 10 to 20 feet of line for every 1 ft^3 or 6 imperial gallons of wash-water produced. A minimum of two treatment trench lines should be installed per system. An operation producing 150 imperial gallons per day would require approximately 375 ft of treatment trench. A system of six runs, 60 feet each would be satisfactory.

Make your sediment tank and treatment bed large enough to accommodate any foreseeable future herd expansion. Waste milk, milk from treated cows or waste colostrum **should never be disposed of through the sediment tank and treatment trench system.** This system is not designed to "treat" milk. Large quantities of waste milk should be disposed of by spreading on the

surface of the land where runoff will not occur. In the event of a milk spill, the sediment tank should be pumped out and properly disposed of immediately.
Do not wash manure from the parlor into the sediment tank, as this could completely fill the system with solids in a week or less. Shovel all manure solids into manure alleys or gutters of adjoining barns before washing walls and floors into the waste system. If you want to wash wastes from the milking parlor through the floor drain system, connect the system to a liquid manure storage tank and not to the treatment trench system.
If this method is to work, wash-water must be reduced to the minimum needed to assure proper cleaning of the milking equipment. This system is practical on farms with no milk pipeline or automatic bulk tank washing equipment, as these are the main contributors to milking center wash-water volume.

Raised Bed Systems
In areas with bedrock close to the surface or where the soil is saturated close to the surface, it may still be possible to use a treatment trench system installed in a raised bed or a mound. These systems are working, but the design and installation of the system is critical. Consult someone with knowledge of the design and construction of these systems before proceeding.

Contact NRCS for further information and for the best system for you r operation or future plans.

Roof Runoff Management
Roof runoff management involves a facility for collecting, controlling and disposing of runoff water from the roof. This will prevent runoff water from flowing into or across concentrated waste areas, barnyards, livestock or equipment laneways or other areas where clean roof runoff could wash contaminants into surface or groundwater.

Types of facilities include erosion resistant channels or subsurface drains installed along building foundations, below eaves, roof gutters and down spouts. You must determine what and where the areas of potential contamination are such as barnyard, waste storage, treatment areas and tilled fields.

Consider diverting runoff to permanent pasture, a grassed waterway or a vegetated recharge basin. Roof runoff water may be used for livestock watering as well as discharge to a dry well via groundwater provided the ground can assimilate the quantity of recharge and contaminated water cannot reach the dry well.

To maintain runoff management facilities, the following items should be part of a maintenance program:

- Clean leaves and debris from gutters in fall and spring.
- Keep downspouts clear.
- Paint steel gutter and downspouts.
- Repair or replace damaged gutters or downspouts as needed.
- Clear any surface blockage to allow free outlet flow of downspouts into channels, storm drains, etc.
- Properly maintain associated facilities (e.g. grassed waterway, vegetated recharge basin).