WASTE TREATMENT

(No.)
Code 629

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

The mechanical, chemical, or biological treatment of agricultural waste.

II. Purpose

To use mechanical, chemical, or biological treatment facilities and/processes as part of an agricultural waste management system to:

- improve ground and surface water quality by reducing the nutrient content, organic strength, and/or pathogen levels of agricultural waste;
- improve air quality by reducing odors and gaseous emissions;
- produce value added byproducts;
- facilitate desirable waste handling, storage, or land application alternatives; and
- manage *leachate*[1] and *contaminated runoff* emanating from livestock *feed storage areas*.

III. Conditions Where Practice Applies

This practice applies where the form and characteristics of agricultural waste make it difficult to manage so as to prevent it from becoming a nuisance or hazard or where changing the form or composition provides additional utilization alternatives, and where conventional waste management alternatives are deemed ineffective.

This practice applies to:

- The treatment of *milking center wastewater* from *milking centers* producing up to 500 gallons of wastewater per day.
- Leachate and contaminated runoff generated by livestock feed and *waste feed* storage areas.
- Liquids and solids that need to be separated for further processing or for effective transport and subsequent utilization.
- Raw agricultural waste containing excess nutrient concentration too high for direct land application based on crop utilization requirements or nutrient ratios need to be modified to be more consistent with crop utilization requirements.
- Reducing the potential for leaching or runoff of nutrients and providing an appropriate location for discharge.
- The reduction of odors and/or gaseous emissions from livestock production facilities and waste storage/treatment system components.
- The production of value-added byproducts which can be produced to offset treatment costs.
- The reduction of pathogens.

IV. Federal, Tribal, State, and Local Laws

Users of this standard should be aware of potentially applicable federal, tribal, state and local laws, rules, regulations or permit requirements governing waste treatment. This standard does not contain the text of federal, tribal, state, or local laws.

Concentrated animal feeding operations will need to comply with the requirements of Wisconsin Administrative Code NR 243, Animal Feeding Operations.

V. Criteria

The following criteria establish minimum allowable limits for design parameters, acceptable installation processes, or performance requirements.

A. General Criteria

1. Management Assessment

   A management assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed with owner/operator to explore waste treatment options, available resources, and waste characteristics.

   The designer shall provide a narrative describing the agricultural waste management system, the waste treatment components objectives, and the anticipated outcomes of implementation. The narrative shall also include the waste management strategy for utilization, storage, or land spreading of the wastes following treatment.

[1]Words in the standard that are shown in italics are described in VII. Definitions. The words are italicized the first time they are used in the text.

The management assessment shall address the following:

- waste characterization – *consistency*, volume, nutrient content, sources, and degree of *source control*;
- current equipment, labor, and management capabilities;
- expected changes to current equipment, labor, management and equipment, including expansion needs.

2. Site Assessment

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste treatment system. The assessment shall include input from the owner and operator. The site assessment shall include the following:

a. Locations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, wells, *surface water features*, surface drains, drain tile, utilities, *cultural resources*, and wetlands.

b. Test pits or soil boring logs, soil test results, a soil survey photo and a narrative describing the design parameters that have been derived from the soils data. These test pit/soil borings shall extend to *bedrock*, a free water surface, or to a minimum depth to ensure the required separation distances for the proposed component are achieved. Test pit or soil boring criteria shall include the following.

1) The number, depth, and distribution needed to characterize the subsurface (soil layers, saturation, and bedrock). Test pits or borings shall be added if there is inconsistency within or between test pits or borings.

2) Based on the facility *footprint*, there shall be a minimum of one test pit or boring per 15,000 square feet of footprint, with a minimum of two per facility. Test pits and borings used to meet these criteria shall be located in the footprint or no more than 100 feet from the footprint.

A feed storage area and a *vegetated treatment area* (VTA) for runoff treatment are considered separate facilities.

3) Soil layers shall be described with respect to thickness, texture using the Unified Soil Classification System (USCS) as per ASTM D2488, Munsell color, presence and color of redoximorphic features (soil mottling), *gleyed soil* and moisture condition.

4) The elevation of bedrock and bedrock type encountered such as sandstone, limestone, dolomite, or granite.

5) The upper elevation of all saturated layers encountered.

c. Locations of *sinkholes* and other *karst* features within 1,000 feet of the facility.

d. Locations, dimensions, elevations, soil volumes, soil samples, and reclamation plans of any borrow areas. Characterize borrow areas according to Section V.A.2.b.1), 3), and 4).

e. Identification of potential impacts from failure of system components.

3. Separation From Subsurface Saturation or Bedrock

The separation is determined to be the closest distance from any point on the inside surface of the component to the feature from which separation is required.

The definition of subsurface saturation is not intended for application in any context other than to protect components installed from hydrostatic loadings.

a. For the purposes of this standard, factors used to identify subsurface saturation shall include observed saturation, gleyed soil, gray mottles, and soil color in conjunction with nearby surface water features. The highest subsurface saturation elevation in a test pit/soil boring will be identified by any of the following soil properties.

1) Free water or wet soil identified by glistening, due to the slow release of water.

2) Gleyed soil, that may extend uninterrupted from an observed free water surface.

3) The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.

4) Depleted matrices having a value of 4 or more and chroma 2 or less based on Munsell color charts. In some cases soil parent materials have a natural color of 2 chroma or less or gleyed color that is not due to saturation. In these cases other indicators may be used: landscape position, elevation or soils in relation to nearby water features.

b. In soils not conducive to mottling, such as sand, the subsurface saturation elevation shall be established by evaluating the soil morphology of the soil profile. Other indicators that may be considered in making the determination are the position of the soil in the landscape, topography, nearby wetlands and well construction logs.

c. Subsurface saturation, if encountered shall not be drained (or have water-bearing layers removed) except as described for *perched conditions*. Perched conditions may be drained or water-bearing materials removed to achieve separation distances in the tables and relieve hydrostatic loads. Documentation to demonstrate that subsurface saturation are perched and of drainable extent or its effects otherwise eliminated shall be included in the site assessment. All *drainage systems* shall drain by gravity. The effect of temporary tailwater on the structure or liner and the effects of outletting to perennial and intermittent waterways shall be evaluated. A drainage system shall be located around the outside perimeter of the component footprint and drain to a surface outlet.

d. If the site assessment indicates artesian features, a hydrogeologic and geotechnical evaluation of the site shall be completed to determine the site suitability for in-ground components.

e. Excavation of bedrock is permitted to achieve the required separation distance as specified in the tables. Bedrock shall not be removed by blasting. The exposed bedrock surface shall be evaluated to ensure a structurally sound base. Fractures or voids shall be treated to prevent migration of soil material. The surface of excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the storage facility, as to prevent any significant ponding on the rock surface. If bedrock is excavated, the material placed between the component and the bedrock shall have a minimum of 20% passing the #200 sieve.

4. Design

The waste treatment system provider shall complete and supply to the landowner/operator a detailed design of the facility/process clearly outlining the objectives and anticipated outcomes of implementation.

The 25-year, 24-hour storm design criteria shall be used to exclude clean water runoff from entering the proposed component areas.

The treatment system shall be located a minimum of 25 feet from a perforated subsurface clean water drainage tile, unless hydraulically separated to prevent leachate and contaminated runoff from entering drainage tile.

Facilities located in *flood prone areas* shall be protected from inundation, structural damage, and instability. These facilities shall be designed to accommodate any additional loading resulting from static water levels or saturated soil. The lowest point at which floodwater could enter the proposed component areas shall be 2 feet above the maximum elevation of flow resulting from a 100-year, 24-hour rainfall event.

5. Components

Waste treatment facilities and processes may consist of multiple components. Where

criteria for individual components are described in existing NRCS practice standards, those practice standards and their specific criteria shall be used for planning, designing, and installation of that component.

Where components of a facility or process are not described in a current NRCS practice standard, the system provider shall furnish a one-year warranty on all construction or applied processes. In addition, the manufacturer shall provide a warranty that describes the service life of each component and what the warranty covers.

The waste treatment facility or process shall have a minimum practice life of ten years. Where components have less than a ten-year service life, their planned replacement during the life of the practice shall be clearly identified in the operation and maintenance plan.

6. Safety

Design of the process or facility shall include safety features to minimize hazards. Guards and shields shall be provided for moving parts of the equipment used in the treatment process. Waste treatment facilities shall be fenced and warning signs shall be posted where needed to prevent children and others from entering a hazardous area.

All treatment processes shall be carried out in accordance with all safety regulations. Protective clothing shall be utilized when handling potentially harmful chemicals that may be used in the process.

If the facility includes a *confined space*, the confined space shall be configured in such a way that monitoring for hazardous gases, ventilation, observation of workers in the confined space, and extraction of workers from the confined space are all possible and practicable. Provisions of the American Society of Agricultural and Biological Engineers (ASABE) Standard EP 470, Manure Storage Safety, shall be followed.

7. Plans and Specifications

Plans shall include engineering drawings and supporting documentation as well as other plans required to manage the system.

Plans and specifications for waste treatment facilities shall be prepared in accordance with the criteria of this standard and good engineering practice.

As a minimum, the plans and specifications shall provide the following:

- layout and installation details of proposed facilities, waste collection points, waste transfer components, waste treatment and storage facilities;
- location and elevation of all inflow and discharge pipelines, pipeline materials, diameter and slope;
- details of support systems for all components of the treatment facility; and
- fencing and signage as appropriate for safety purposes.

8. Operation and Maintenance

An operation and maintenance (O&M) plan shall be developed and reviewed with the owner/operator prior to construction of a waste treatment facility or implementation of a waste treatment process. The O&M plan shall be consistent with the proper operation of all system components and shall contain requirements including but not limited to the following:

- recommended loading rates of the waste treatment facility or process for hydraulic and critical pollutant parameters;
- proper operating procedures for the waste treatment facility or process, including the amount and timing of any chemicals added;
- operation and maintenance manuals for control devices and other equipment used as components of the waste treatment facility or process;
- description of the planned startup procedures, normal operation, safety issues, and normal maintenance items. This includes procedures for the planned replacement of components;
- alternative operation procedures in the event of equipment failure;
- troubleshooting guide; and
- monitoring and reporting plan designed to demonstrate system performance on an ongoing basis, if required.

B. Specific Criteria for Milking Center Wastewater Treatment

This practice standard criterion does not apply to:

- the treatment of barn and holding area manure, waste milk, and sewage from restrooms and laundry facilities;
- those operations of a size to be regulated by a Wisconsin Pollutant Discharge Elimination System (WPDES) permit in accordance with NR 243 Animal Feeding Operations or NR 214 Land Treatment of Industrial Liquid Wastes, By-Product Solids and Sludges.

1. Criteria Applicable to All Treatment Methods.

   a. Design Criteria

      1) Exclude surface water runoff from entering the milking center wastewater treatment system.

      2) Pipelines shall be designed to avoid freezing.

      3) Design Flow Rate – Design flow shall be determined by measuring or estimating using the procedures in the companion documents located in the Wisconsin supplement to Chapter 10 of the NRCS Agriculture Waste Management Field Handbook (AWMFH).

   b. Operation and Maintenance

      An operation and maintenance plan shall be developed that is consistent with the purposes of the practice, its intended life, safety requirements, and the design criteria.

      The operation and maintenance plan shall include the following.

      - A management plan. The treatment system shall be operated in conformance with a management plan. The management plan shall specify information on pretreatment processes including source control, load and rest schedules, scheduled maintenance, vegetative cover management and removal, scheduling of soil nutrient testing, operational strategies for periods of adverse weather, monitoring procedures, and any other pertinent information. The management plan shall be updated to account for changes in an operation.
      - A contingency plan to address unexpected volumes of waste milk, wastewater, and runoff.
      - An emergency response plan to address the containment, clean-up, and reporting of spills.
      - Provisions to ensure that waste milk is never dumped into any treatment system requiring a pretreatment tank.
      - Maintenance and repair of fencing.
      - Annual pumping and solids removal from pretreatment tanks. Contents of the tank shall be land applied according to a *spreading plan*, stored in a waste storage facility meeting the criteria of Wisconsin NRCS Field Office Technical Guide, Section IV (WI FOTG), Conservation Practice Standard 313, Waste Storage Facility, or removed by a licensed hauler.

   c. Prefabricated Underground Pretreatment Tanks (Pretreatment Tank)

      Pretreatment can be accomplished using a prefabricated concrete, steel, or plastic sewage ("septic") tank. Requirements for using pretreatment tanks include the following.

      - Those currently listed on the Wisconsin Department of Safety and Professional Services , Safety and Building Division Plumbing Products Database.
      - Compliance with all stipulations listed in the Department of Safety and Professional Services approval that relate to liquid tightness and/or structural strength.
      - Appropriate baffling to function as grease traps.
      - A minimum of 15 feet separation from established or planned roadways.
      - Adequate ballast to prevent flotation.
      - A separation distance of at least 25 feet from any *channelized flow* path, surface water feature, well, and karst feature; greater than 10 feet from any water supply line; greater than 5 feet from any building; and greater than 2 feet from any property line.

d. Milkhouse Plumbing

1) A sanitary trap is required to prevent gasses from flowing into the milking center from the treatment system.

2) Materials must be provided to ensure all riser joints, access openings, and pipe connections are installed watertight.

3) For all treatment methods, except frequent haul, a flow diverter valve shall be installed at the discharge end of the wash water transfer line to divert waste milk from the treatment system.

e. Safety

Install a fence around the milking center treatment system where needed to exclude people, equipment and/or animals. Open storage containers or access openings shall be fenced, covered, or secured to prevent entry by people or animals. Warning signs shall be posted to alert people of the dangers of entering the storage container or pretreatment tank. Provisions of the ASABE Standard EP 470, Manure Storage Safety, shall be followed.

2. Specific Criteria for Frequent Haul

a. This system uses a storage container to receive and hold wastewater discharged from the milking center. The wastewater is removed from the storage container and land applied in accordance with a spreading plan. Hauling equipment shall be capable of transporting the liquid and solid waste without spillage. The application rate shall be limited to prevent runoff.

1) Design

a) The storage container capacity shall be a minimum of three days and no more than ten days of discharge from the milking center.

b) The storage container shall be water tight and designed to withstand all loads to which it will be exposed including but not limited to the spreader being filled. The container shall be equipped with a high water alarm to facilitate management.

Provide a vent to the atmosphere for covered storage containers.

Each storage container having a cover shall be provided with a minimum access opening of 23 inches that allows for storage container maintenance. The opening shall terminate above grade.

The options for storage containers include:

- Tanks meeting structural criteria contained in WI FOTG Standard 634, Waste Transfer,
- Department of Safety and Professional Services list as stated in the criteria in this section for all treatment methods; (baffling is not required),
- Above-ground storage containers installed and used in accordance with manufacturers' recommendations. In addition, above ground tanks shall be insulated or located within a heated structure.

c) All pumps installed in the tank shall be a two-inch minimum diameter discharge industrial grade trash or sewerage pump. When a submersible pump is installed, the pump intake shall be a minimum of 8 inches above the floor.

d) Install guard posts and other safety devices as necessary.

3. Specific Criteria for Ridge and Furrow

The ridge and furrow system includes a pretreatment tank from which the wastewater is delivered to a furrow infiltration area.

a. Siting Parameters

1) Soils – The in-situ soils shall at least have 50% of the particles passing a No. 200 sieve (P200 ≥ 50%), and a thickness of 3 feet below the furrow bottom. There shall be a 3-foot minimum separation distance from the

furrow bottom to bedrock and subsurface saturation.

2) The furrows shall be located a minimum of 50 feet from any private well and a minimum of 50 feet from channelized flow, surface water feature, or karst feature.

b. Design

1) Pretreatment – Pretreatment tanks shall be provided and shall be sized to provide a minimum three-day hydraulic retention time prior to discharge to the ridge and furrow system. The outlet from the pretreatment tank shall be gravity flow to a dosing tank or chamber which shall be separate from the pretreatment tank. A pump or siphon for pressure distribution of wastewater shall be located in the dosing tank or chamber.

2) *Load/Rest Cycle* – There shall be three days between dosing to any given furrow to allow sufficient resting for soil conditions to become unsaturated and aerobic prior to being loaded again.

3) System Size – The loading rate shall not exceed ½ gallon per square foot of the furrow bottom per day. This is equivalent to 1½ gallons per square foot of furrow bottom for a three-day cycle.

Furrow side slopes may not be steeper than 1:2 (1 horizontal: 2 vertical). The furrows shall be 1 foot deep and 1 foot wide at the bottom. Furrows shall be level and may be cut on the contour. Individual furrows shall not exceed 200 feet in length.

Ridgetops shall be a minimum of 6 feet wide to allow removal of vegetation by equipment.

4) Wastewater Distribution – The system shall be constructed in a manner which provides equal liquid distribution within the furrow. The header shall be designed to allow complete drainage after each wastewater loading.

When multiple furrows are employed, the wastewater distribution system shall be constructed so individual furrows within the system can be taken out of service for resting without interrupting the discharge to the remaining furrows.

c. Planting Medium

1) Compaction at the furrow bottom during construction shall be minimized.

2) Seedbed preparation, vegetation establishment and maintenance of vegetation on the ridges shall be in accordance with criteria specified in WI FOTG Standard 342, Critical Area Planting. Vegetation suited to wet conditions shall be used.

d. Specific Operation and Maintenance

1) Ensure the load/rest cycle is maintained.

2) At a minimum, twice per year mow the vegetation and remove the cut material from the site of ridge and furrow system.

3) Inspect the furrow bottoms annually and skim off accumulated solids. If infiltration decreases, rework the bottom of the furrow when dry.

4. Specific Criteria for Subsurface Absorption System – The subsurface absorption system includes a pretreatment tank followed by a subsurface absorption field using either a soil cover or an organic matter cover.

a. Siting Criteria

1) Soil Evaluation – Soil evaluations for subsurface absorption systems shall be conducted and reported by a Certified Soil Tester (CST) licensed through the Department of Safety and Professional Services.

The CST shall evaluate soils over a minimum area, calculated as follows:

$$\text{Area}\,(\text{ft}^2) = \frac{3 \times \text{wastewater production (gal/day)}}{0.2\ \text{gal/ft}^2/\text{day}}$$

A minimum of three test pits shall be completed. The CST shall provide a maximum soil application rate for all soil horizons, from the soil surface to either saturation, bedrock, or to a maximum depth of 8 feet. Soil application rates shall be based on soil texture and structure, shall be provided in units of gallons per square foot per day, and shall be currently published values from Department of Safety and Professional Services (SPS 383 Private Onsite Wastewater Treatment Systems, Table 383.44-2).

2) Separation Distance – The subsurface absorption system shall be located a minimum of 100 feet from any private water well and a minimum of 50 feet from channelized flow, a surface water feature, or karst feature.

b. Design Criteria

1) Pretreatment – Pretreatment tanks shall be provided and shall be sized to provide a minimum six-day hydraulic retention time prior to discharging to the subsurface absorption system.

2) Infiltrative Surface Design – The infiltrative surface shall be located at least 3 feet above subsurface saturation or bedrock. There shall be at least 2 feet of soil beneath the infiltrative surface that has a design soil application rate of greater than zero. The bottom of the infiltrative surface shall be level. Scarification of the infiltrative surface of the soil shall be done to reduce smear and shear.

The minimum size of the subsurface absorption system shall be 1.5 times the wastewater production rate, divided by the soil application rate at the infiltrative surface.

3) Distribution System – Gravity piping upstream of a soil absorption system shall be a minimum 4-inch diameter ASTM D1785 schedule 40 PVC pipe or equal, installed at a minimum grade of 1% or 1/8 inch per foot. It shall be buried to a depth sufficient to prevent damage from frost or traffic.

Pressure piping to a soil absorption system shall be a minimum 2-inch diameter ASTM D1785 schedule 40 PVC or equal, with a pump sized to produce a velocity in the pipe between two and five feet per second.

Distribution laterals shall be perforated with 1-inch diameter holes, spaced at a maximum of 3 feet, and installed such that the perforations are facing downward at the four and eight o'clock positions.

At least two 4-inch diameter perforated observation pipes shall be installed in each system at the upstream and downstream ends. The observation pipes shall be perforated within the clear washed stone zone and extend from the infiltrative surface to a minimum 1 foot above final grade and shall be capped.

Laterals shall be installed in either level trenches or in level beds.

a) Trenches shall be at least 6 feet wide and the distribution pipe shall be centered within the trench.

b) Beds shall be at least 6 feet wider and longer than the lateral distribution network, and the distribution network shall be centered in the bed. Distribution, laterals within a bed shall be spaced a maximum of 6 feet apart.

Laterals within a soil absorption system shall be 4-inch minimum diameter ASTM D1785 schedule 40 PVC; installed level or sloped in the direction of flow at a maximum of 2 inches per 100 feet. An air vent shall be connected to the upstream end of the subsurface absorption system piping.

4) Soil Covered Absorption System Bedding and Cover

a) Six inches of 1½- to 2½-inch washed stone shall be placed beneath the lateral piping for the entire width of the bed or trench. Pipes shall be stabilized by placing stone across the entire width of bed or trench to the top of the pipe.

b) A single layer of non-woven geotextile fabric shall be placed over the soil absorption system stone. Fabric shall meet the requirements of Wisconsin Construction Specification 13, Geotextiles, Class II fabric.

c) Backfill over the fabric shall consist of an 18-inch minimum thickness of topsoil, measured from the top of the lateral pipe.

d) The final finished grade of the subsurface absorption system shall be at least 1 foot above surrounding grade.

e) Immediately after completion of final grading, the surface topsoil material shall be stabilized by mulching and seeding.

5) Organic Matter Cover Absorption System Bedding and Cover

a) Six inches of 1½- to 2½-inch clear washed stone shall be placed beneath the lateral piping to a width of no less than 24 inches. Pipes shall be stabilized by encasing them in windrows of stone to a height 6 inches above the top of the pipe.

b) Backfill over the stone shall consist of either bark or woodchips a minimum thickness of 2 feet measured from the top of the stone above the lateral pipe.

c) The infiltrative surface shall be located a minimum of 30 inches below the ground surface or the top of a confining berm.

c. Specific Operation and Maintenance

1) Prevent traffic on the system.

2) Pump the pretreatment tank.

3) Maintain the thickness of the organic material cover.

5. Specific Criteria for Buffer Process

The buffer process includes a pretreatment tank from which wastewater is delivered to a sod area by an above-ground perforated distribution pipe located on the contour. Criteria is contained in WI FOTG Standard 635, Vegetated Treatment Area.

6. Milking Center Wastewater Treatment Considerations

Additional recommendations relating to design which may enhance the use of or avoid problems with this practice, but are not required to ensure its basic conservation function are as follows:

a. Consider using the companion documents located in Chapter 10 of the Agricultural Waste Management Field Handbook (AWMFH).

b. Dairy animals should not be in contact with the milking center wastewater to avoid disease transfer. Exclude dairy animals from the application site while liquid is present.

c. Utilize water, organic matter, and chemical conservation methods in the milking center.

d. Measures should be taken to control vectors (mosquitoes, flies, etc.) if they pose a problem.

e. Consideration should be given to storage of wastewater during winter months.

f. Settling basins may be installed prior to pretreatment tanks as a method to remove solids, such as lime, that may be difficult to remove from a tank.

7. Plans and Specifications

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Plans shall include construction sequence, vegetation establishment, and management and maintenance requirements.

C. Specific Criteria for Feed Storage Areas and Feed Storage Leachate and Contaminated Runoff Control

Criteria contained in this standard may not be adequate to comply with the requirements for concentrated animal feeding operations (CAFO) designs. Designers shall consult with the Wisconsin Department of Natural Resources (DNR) on feed storage, feed storage leachate

collection, and contaminated runoff control for a CAFO.

This practice standard criterion does not apply to:

- industrial inputs or waste stored at an industrial facility (i.e., cannery, distillery, brewery);
- commercial feed mills;
- feeds considered dry (typically 40% moisture or less) within storage areas protected from precipitation;
- feed bunk/equipment; and
- self-feeding structures (non-mobile).

1. Specific Criteria Applicable to all Feed Storage Areas excluding *Tower Silos*

   a. Site Assessment

   A site assessment shall be conducted in accordance with V.A.2. for the proposed and existing livestock feed storage area, feed leachate and contaminated runoff control system, and transfer components. In addition, existing feed storage areas shall be investigated and evaluated for subsurface leachate presence and deficiencies in comparison to this standard. A minimum of two test pits shall be located immediately adjacent to the existing feed storage area and intercept the subsurface material. Test pits shall be distributed around the perimeter of the existing feed storage area.

   b. Separation from Subsurface Saturation or Bedrock

   The separation is determined to be the closest distance from any point on the top surface of the feed storage area liner to the feature from which separation is required. Refer to Tables 1, 2, and 3 for separation distances.

   c. Leachate and Contaminated Runoff from *Permanent Feed Storage Areas*

   Horizontal feed storage can lose leachate through the floor (subsurface discharge) and around the perimeter (surface discharge). The proposed system shall include collection components that intercept and direct leachate to storage. The system shall also include a subsurface collection system to direct leachate to storage ~~u~~Unless a liquid-tight concrete or concrete-composite liner is used~~, the system shall also include a subsurface collection system to direct leachate to storage~~. A subsurface collection system shall consist of a suitable subgrade, liner, *leachate drainage layer*, and surfacing material. When a leachate drainage layer is required, it shall be placed above the liner and below the surfacing material of the feed storage area footprint and the apron. The profile and configuration of the collection system must allow gravitational flow to a low point (sump). Acceptable feed storage area liner systems are included in Tables 1, 2, and 3.

   If an existing feed storage area will be expanded as a part of the project, then a test pit or boring shall be performed. If leachate is found under the surface of existing feed storage area, a perimeter collection system shall be installed around the existing facility.

   1) All leachate shall be collected and conveyed to a transfer and/or storage system.

   2) The largest leachate volume is based on the harvest that will produce the largest silage weight. Estimate the leachate volume using ½ cubic foot leachate per ton of stored feed over a 30-day period. Unless determined otherwise, assume 60 pounds per cubic foot of stored feed (33.3 cu. ft./ton).

   3) Frequent Haul of Leachate– Storage or transfer systems that require manual pump out shall be sized to contain a minimum of 20% of the total leachate volume calculated in addition to any designed *first flush* collection.

   4) Contaminated runoff shall be delivered (via gravity or pump) to a vegetated treatment area meeting the criteria contained in WI FOTG Standard 635, Vegetated Treatment Area, or shall be collected and land applied according to a nutrient management plan.

   5) Transfer – All transfer components (pipes, reception structures, tanks, and channels) shall meet the criteria

contained in WI FOTG Standard 634, Waste Transfer. Materials shall be corrosion resistant.

All pumps shall be capable of transferring effluent with fibrous material and be able to withstand acidic corrosive environment. Pumps shall be installed and used in accordance with the manufacturer's recommendations.

6) Storage – Facilities for storage of leachate and contaminated runoff shall be designed in accordance with WI FOTG Standard 313, Waste Storage Facility. Leachate and/or contaminated runoff are considered to be less than 2% solids. Materials shall be corrosion resistant.

d. Safety Design

Safety design shall identify and minimize the hazards to animals and people. At a minimum, safety design shall include the following, where applicable.

1) Warning signs and fences to notify of potential hazards.

2) Minimize the accumulation of gasses; provide ventilation for covered waste-holding structures to reduce the risk of inhalation of poisonous gasses, asphyxiation, or explosion.

Note: Adding leachate to manure can produce poisonous gasses.

If the facility includes a confined space, the confined space shall be configured in such a way that monitoring for hazardous gases, ventilation, observation of workers in the confined space, and extraction of workers from the confined space are all possible and practicable. Provisions of ASABE Standard EP 470 shall be followed.

e. Seeding and Mulching

Disturbed areas shall be seeded and mulched in accordance with WI FOTG Standard 342, Critical Area Planting.

f. Plans and Specifications

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. A construction plan and quality assurance plan are required.

g. Operation and Maintenance

An operation and maintenance plan shall be developed that is consistent with the purposes of this practice, intended life of the components, safety requirements, and the criteria for the design. At a minimum, the plan shall include:

- handling and disposal practices for waste feed;
- handling and disposal practices for snow storage associated with the feed storage area;
- the frequency for cleaning the floor of accumulated feed;
- the interval for removing accumulated solids from the system components;
- proper treatment and disposal practices for leachate and contaminated runoff; and
- the schedule of inspection of system components to insure proper operation.

Table 1
Earthen Feed Storage Area Liner System

	Soil Liner	Clay Liner
1. Liner		
• %Fines passing the #200 sieve	≥50%	≥40%
• Thickness	≥2 feet	≥1 feet
• Plasticity Index (PI)[Note1]	---	≥12
• Compaction Specification[Note 2]	---	WI Spec. 204
2. Leachate Drainage Layer[Notes 3, 6]		
• %Fines passing the #200 sieve	≤5%	
• Compacted Thickness	≥6 inches	
• Side slopes	3H:1V or flatter	
3. Surfacing Material Options		
• Concrete	≥5 inches total thickness	
• Asphalt Pavement	≥4 inches Asphalt in ≥ 2 lifts over 13 inches *crushed stone* subbase[Note 8].	
• Crushed Stone	a. 4 inches of crushed stone over 18 inches base course of angular rock[Note4], or b. 4 inches of crushed stone over 18 inches base course of round graded rock, over an additional 6 inches pit run sand-gravel[Note 4], or c. 4 inches of crushed stone over 8 inches base course of graded rock[Note4], over nonwoven geotextile.[Note5]	
• Soil[Note 6]	Increase earthen liner thickness by ≥2 feet	
4. Separation Distances[Note7]		
• Well Distance	100 feet[Note 9]	
• Sinkholes	400 feet	
• Subsurface Saturation	2 feet	
• Bedrock	2 feet	

Note[1] PI shall be determined by ASTM D4318, Atterberg Limits.

Note[2] NRCS FOTG, Section IV, Wisconsin Construction Specification 204, Earthfill for Waste Storage Facilities.

Note[3] Other open cell material placed under the full footprint (i.e., geonet-type products) may be used in lieu of granular soils.

Note[4] The base course layer can also be considered the leachate drainage layer.

Note[5] The geotextile shall be Class I, nonwoven and meet the requirements of Table 2 in Wisconsin Construction Specification 13, Geotextiles.

Note[6] When using the soil surfacing material option, the leachate drainage layer is not required.

Note[7] The separation distance is measured from the top of the earthen liner, and does not include surfacing material or the leachate drainage layer.

Note[8] The crushed stone subbase can also be considered the leachate drainage layer.

Note[9] NR 243 permitted facilities require 250 feet separation from wells.

Table 2
Flexible Membrane Feed Storage Area Liner System

1. Liner Material	60 mil High Density Polyethylene (HDPE), 60 mil Very Flexible Polyethylene (VFPE), 60 mil Linear Low Density Polyethylene (LLDPE), or 45 mil Ethylene Propylene Diene Monomer (EPDM)[Note 1]
2. Leachate Drainage Layer[Note2]	Shall extend to the edge of the footprint of the feed storage area
• % Fines passing the #200 sieve	≤5%
• Particle Size and Shape	≤3/16 inch rounded
• Compacted Thickness	≥6 inches
3. Surfacing Material Options	
• Concrete	≥5 inches total thickness
• Asphalt Pavement	≥4 inches Asphalt in ≥2 lifts over 9 inches crushed stone subbase[Note 6] for subgrade soils[Note 7] classified as SP, GP, SW, and GW. ≥4 inches Asphalt in ≥ 2 lifts over 13 inches crushed stone subbase[Note 6] for all other subgrade soils[Note 7] except organic soils.
• Crushed Stone	4 inches of crushed stone over 8 inches base course of graded rock[Note3], over nonwoven geotextile[Note4].
4. Separation Distances[Note5]	
• Well Distance	100 feet[Note 8]
• Sinkholes	400 feet
• Subsurface Saturation	2 feet
• Bedrock	2 feet

Note[1] HDPE, VFPE, and LLDPE shall meet Wisconsin Construction Specification 202, Polyethylene Geomembrane Lining. EPDM shall meet Wisconsin Construction Specification 205, Ethyl Propylene Diene Monomer (EPDM) Geomembrane Lining. All liners shall be installed according to manufacturer's recommendations.

Note[2] The leachate drainage material must be stable to resist sliding on the side slopes. In addition to the granular soils, other open cell material placed under the full footprint (i.e., geonet-type products) may be used. Flexible membrane liners shall be protected from puncture by use of suitable materials in the leachate drainage layer preparation.

Note[3] If the base course layer contains aggregates larger than 4 inches, the drainage layer shall be twice the depth of the largest aggregate.

Note[4] The geotextile shall be a minimum 12-ounce per square yard nonwoven. Increasing the drainage layer to 12 inches can substitute for the geotextile.

Note[5] The separation distance is measured from the top of the liner, and does not include surfacing material or the leachate drainage layer.

Note[6] The leachate drainage layer is required under the crushed stone subbase to protect the liner.

Note[7] The subgrade consists of the first five feet of soil under the crushed stone subbase. If any of the subgrade consists of soil other than SP, GP, SW, or GW, then 13 inches of crushed stone subbase must be used.

Note[8] NR 243 permitted facilities require 250 feet separation from wells.

Table 3
Concrete Feed Storage Area Liner System Note 1

	Concrete Notes 2, 5	Concrete-Soil Composite Note 3	
1. Soils (Directly Below Liner)			
• % Fines Passing The #200 Sieve	---	≥20%	≥20%
• Plasticity Index	---	≥7	---
• Thickness	---	≥1.5 feet	≥3 feet
• Compaction of Placed Material Note 4	WI Spec. 204	WI Spec. 204	WI Spec. 204
2. Separation Distances Note 6			
• Well Distance Note 7	≥100 feet	≥100 feet	≥100 feet
• Sinkholes	≥400 feet	≥400 feet	≥400 feet
• Subsurface Saturation	≥2 feet	≥3 feet	≥4 feet
• Bedrock	≥2 feet	≥3 feet	≥3 feet

Note[1] The liner material is also the surfacing material. The leachate drainage layer is the concrete surface.

Note[2] The concrete liner thickness and reinforcement shall be designed for the anticipated equipment loadings and crack control. Slabs on ground subject to equipment loads shall be designed in accordance with American Concrete Institute, ACI 360, "Design of Slabs-on-Ground," and Portland Cement Association Concrete Floors on Ground, Chapter 5. The concrete liner thickness shall be a minimum of 5 inches, contain distributed reinforcing steel and all contraction or *expansion joints* shall have imbedded non-metallic water stops in accordance with WI FOTG Wisconsin Construction Specification 4, Concrete. Steel shall be continuous through all *construction joints*.

Note[3] The concrete is in intimate contact with the soil, and the two work together to reduce seepage losses. The concrete liner thickness shall be a minimum of 5 inches and continuous reinforcement of #3 steel bars spaced at 18 inches on center each way. No expansion or *contraction joints* are required. The concrete shall be placed in intimate contact with the foundation soils. If construction joints are required, steel shall be continuous through all construction joints and no waterstop is required. If the soil material below the floor meets Table ~~2~~ 1 criteria, then Table ~~2~~ 1 design criteria may be used.

Note[4] NRCS FOTG, Section IV, Wisconsin Construction Specification 204, Earthfill for Waste Storage Facilities.

Note[5] Joints having water stops shall be protected from differential movement by the use of dowels. Dowels shall be spaced no farther than the rebar oriented in the same direction. Thicken concrete an additional four inches at the joint and taper the concrete thickness back to the slab with a transition ratio of 1 inch of thickness change over 10 inches or longer run from the joint in each direction.

Note[6] The separation distance is measured from the top of the concrete.

Note[7] NR 243 permitted facilities require 250 feet separation from wells.

2. Specific Criteria, Tower Silos

   A collection system shall be installed to collect leachate from the tower silo when there is a risk of environmental impact to surface or groundwater.

   Floor drains shall be connected to the leachate collection or transfer system.

   If rainwater is collected, include this volume in the design. Rainwater may be diverted.

   All joints between the tower silo floor and foundation shall be sealed.

3. Specific Criteria – *Non-Permanent Feed Storage Areas*

   a. Feeds with over 75% moisture are not allowed on non-permanent areas.

   b. The storage site must be rotated annually, with a minimum of two consecutive years of non-use after a location is rotated out of use. The storage site must be moved a minimum of 50 feet from the previous location.

   c. The area where feed was stored must be re-vegetated after the feed is moved.

   d. The criteria in Table 4 shall be met.

Table 4
Non-Permanent Feed Storage Area Requirements

1. Hydrologic Soil Groups	**B, C, D**	**A**
2. Subsurface Separation Distance		
• Subsurface Saturation	≥ 3 feet	≥ 5 feet
• Bedrock	≥ 3 feet	≥ 5 feet
3. Surface Separation Distance		
• Wells	≥250 feet	≥250 feet
• Lakes	≥1,000 feet	≥1,000 feet
• Sinkholes, or other Karst Features	≥1,000 feet	≥1,000 feet
• Quarries	≥1,000 feet	≥1,000 feet
• Streams	≥300 feet	≥300 feet
• Wetlands and Surface Inlets	≥300 feet	≥300 feet
• *Open channel* flow	≥100 feet	≥100 feet
• Land Slope	≤ 6%	≤ 6%
• Floodplain (100 yr)	≥100 feet	≥100 feet

4. Considerations for Feed Storage Area Leachate and Runoff Control

   Additional recommendations relating to the design which may enhance the use of, or avoid problems with this practice, but are not required to ensure its basic conservation function, are as follows:

   a. A collection system to accept leachate may be installed around the perimeter of the feed storage area.

   b. Limit how much feed is exposed to precipitation while removing plastic and/or feed from storage. Cover waste feed with plastic or place under a roof to reduce leachate and contaminated runoff.

   c. Avoid locating feed storage areas and treatment systems in the 100-year floodplain without a flood analysis.

   d. When manual pump regulation is used, an alarm or indicator to mark the full level is suggested.

   e. A sediment basin should be considered to remove solids prior to entering a transfer system or vegetated treatment area. Design the sediment basin according to WI FOTG Standard 350, Sediment Basin.

   f. Line the top of the silage and the walls with plastic to exclude precipitation runoff from contacting the forage.

   g. Use dry feed ingredients on the floor and under the silage, or blend dry feed with wet silage, to absorb potential leachate.

   h. Use acid resistant materials (to pH 3.5) that will be in contact with feed leachate/seepage.

   i. Acid resistance measures should be taken for concrete and fiberglass tanks.

   j. Acid resistant reinforced concrete, with designed contraction joint spacing and a compacted subgrade, is recommended when surfacing a feed storage area with concrete.

k. Store plastic and weighting materials in a manner that avoids infestation by rodents and insects. Use cut tires or drill holes to reduce water accumulation. Mow weeds to discourage vermin colonization.

l. As generated, place waste plastic in a storage area where it will remain free of dirt and precipitation and be protected from transportation by the wind. Recycle or landfill the waste plastic on a regular basis.

m. When transferring leachate or contaminated runoff, consider installing a run time indicator on the pump.

n. Consider designing the feed storage area surface materials for expected equipment load or desired wear life.

o. Consider using the Wisconsin Asphalt Pavement Association (WAPA) 2001 Design Guide for designing the asphalt pavement.

p. Manage system for seasonal conditions. i.e. Collect more runoff in first month after feed is put up and/or during winter months when vegetated treatment area is dormant.

D. Specific Criteria for Alternative Waste Treatment Facilities not addressed in Sections B. or C.

1. Design

The waste treatment system provider shall complete and supply to the landowner/operator a detailed design of the facility/process clearly outlining the objectives and anticipated outcomes of implementation.

The design documentation shall include a process diagram containing, at a minimum, the following information:

- equipment, labor, and management capabilities;
- volumetric flow rates including influent, effluent, and recycle streams;
- waste load projections including volume, mass, and characteristics of the waste important to the waste treatment facility or process;
- unit process volumes and hydraulic retention times where appropriate;
- air emissions projections from the system;
- nutrient fate projections within the system;
- process monitoring and control system requirements as described below in the "Monitoring" section of the criteria; and
- an operation and maintenance plan that includes monitoring and reporting to demonstrate system performance over time.

Independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations shall be provided.

Where use of a waste treatment facility or process to improve one resource concern negatively impacts another, impacts and mitigation measures, if required by state or local agencies, are to be documented. The mitigation measures shall become a required component of this practice.

2. Expected System Performance

The expected system performance shall be clearly documented prior to system installation. At a minimum, the expected system volumetric flow rate, expected macro-nutrient reductions or change in form, expected pathogen reductions, gaseous ammonia and hydrogen sulfide emissions reductions (or increases) shall be documented.

3. Operating Costs

Where components of a facility or process are not described in a current NRCS practice standard, the system provider shall furnish an annual estimate of operating costs for the system. Operating costs not based on actual systems data shall be clearly identified as estimates.

4. Monitoring

Equipment needed to properly monitor and control the waste treatment facility or process shall be installed as part of the system. Process control parameters to be

monitored shall include those parameters identified in the design documentation. Parameters considered critical to proper system operation shall be identified in the Operation and Maintenance Plan. Run status of critical equipment and unit processes shall be monitored.

5. Byproducts

Implementation of a waste treatment process or operation of a waste treatment facility shall not result in discharge of byproducts harmful to the environment.

All byproducts shall be handled and stored in accordance with the criteria contained in WI FOTG Standards 634, Waste Transfer, and 313, Waste Storage Facility.

Byproducts land applied to supply plant nutrients shall meet the criteria in WI FOTG Standard 590, Nutrient Management.

Any unmarketable or unused byproducts shall be handled and disposed of in accordance with all applicable federal, state, and local laws and regulations. A plan for dealing with such byproducts shall be prepared and approved by NRCS prior to utilization of the process or installation of the waste treatment facility, and shall include a listing of any permits or permissions required for the execution of the plan.

Byproducts shall be recycled to the extent possible without causing a hazard to the environment.

VI. References

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section IV, Practice Standards and Specifications.

USDA, NRCS National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook and Companion Documents.

USDA, NRCS, National Engineering Handbook, Part 637, Environmental Engineering, Chapter 3, Constructed Wetlands.

USDA, NRCS, National Soil Survey Handbook, Title 430-VI.

Wisconsin Department of Safety and Professional Services, Safety and Building Division Plumbing Products Database: http://dsps.wi.gov.

ASTM D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).

ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

American Concrete Institute, ACI 360, Design of Slabs-on-Grade.

American Society of Agricultural and Biological Engineers (ASABE) Standard EP 470, Manure Storage Safety.

USGS, Regional Assessment of Groundwater Quality in the Glacial Aquifers System: http://water.usga.gov/nawqa/studies/praq/glacaq/indes.html.

2001 WAPA Design Guide, Wisconsin Asphalt Pavement Association Web Site: www.wispave.org.

VII. Definitions

Bedrock (V.A.2.b.) – The solid or consolidated rock formation typically underlying loose surficial material such as soil, alluvium or glacial drift. Bedrock includes but is not limited to limestone, dolomite, sandstone, shale and igneous and metamorphic rock.

Note: Although solid or consolidated bedrock can sometimes be removed with typical excavation equipment, these materials are included in the above definition.

Channelized Flow (V.B.1.c.) – Water movement in a surface drainage feature including, but not necessarily limited to: swales, draws, grassed waterways, ditches, gullies, creeks, or rivers.

Confined Space (V.A.6.) – Confined Space is a space that 1) contains or has the potential to contain a hazardous atmosphere; 2) is large enough and so configured that a person can bodily enter; 3) has limited or restricted means for entry or exit; and 4) is not designed for continuous human occupancy.

Consistency (V.A.1.) – Consistency of waste material may include % solids, viscosity, and general physical state of the material.

Construction Joint (Table 3, Note 2) – These joints are used where a fresh pour of concrete abuts an existing recent pour. Construction joints where the

steel is continuous through the joint are considered to be monolithic and liquid tight, if constructed properly.

Contaminated Runoff (II.) – Runoff that has come through or across a feed storage area. It generally includes the runoff and any sediment, feed, or other material carried in the runoff. It contains lower concentrations of contaminants than leachate from feed or manure.

Contraction Joints (Table 3, Note 3) – Contraction joints, often called control joints, are used to control the location of cracks caused by concrete shrinkage during setting and thermal changes.

Crushed Stone (Table 1) – 100% passing the ¾-inch sieve and 10% maximum passing the No. 200 sieve.

Cultural Resources (V.A.2.a.) – Cultural resources are the traces of any past activities and accomplishments of people. They include tangible traces such as historic districts, sites, buildings, structures, historical documents and cemeteries. They also include traces of less tangible objects such as dance forms, aspects of folk-life, cultural or religious practices, and some landscapes and vistas.

Drainage System (V.A.3.c.) – Water conveyance measures of specified capacity, location, and material that insure the removal of water to a free outlet.

Expansion Joints (Table 3, Note 2) – These joints are used to prevent crushing of abutting concrete or other structural units due to compressive forces developed during expansion caused by high temperature.

Feed Storage Area (II.) – An area used to store livestock feed. Livestock feed may include corn silage, haylage, and industrial by-products (i.e., distillers grain, brewers grain, candy, pizza crust, bakery waste, cotton seed, soy bean meal, animal fats, blood meal, fish meal, cannery waste, beet pulp, citrus pulp, soy hulls, corn midlings, whey, potatoes, grocery store vegetables). This is the area defined by the outside edge of the surface of where the feed is stored, including the apron. This area does not include feed stored in bags.

First Flush (V.C.1.c.3)) – The initial contaminated runoff volume, which typically contains higher concentrations of contaminants than runoff produced during the remainder of the storm event.

Flood Prone Areas (V.A.4.) – These include areas delineated as floodplains on Federal Emergency Management Agency (FEMA) maps, or local floodplain maps as well as areas along perennial streams (blue lines) shown on the United States Geologic Survey quadrangle sheets that may be subject to out of bank flows.

Footprint (*V.A.2.b.2)*) – This is the horizontal area within the perimeter of a facility liner, or the perimeter of a work surface that may cover a liner. For a liquid or solids containment facility, the footprint is the maximum horizontal extent of containment. For a liquid impoundment facility or pond, the footprint is normally defined by the inside top of the embankment. For a solids storage facility, the footprint is normally defined by the edge of the pad, the curb on a pad, or the inside surface of bunker walls.

Gleyed Soil (V.A.2.b.3)) – A soil condition resulting from prolonged soil saturation, which is manifested by the presence of bluish or greenish colors through the soil mass or in mottles (spots or streaks) among the colors. Gleying occurs under reducing conditions, by which iron is reduced predominantly to the ferrous state.

Karst (V.A.2.c.) – Areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features include sinkholes, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document to Standard 313, in Chapter 10 of the AWMFH for additional discussion of karst features.

Leachate (II.) – Concentrated liquid which has percolated through or drained from animal feed. It contains much higher concentrations of contaminants than Contaminated Runoff.

Leachate Drainage Layer (V.C.1.c.) – Material that allows leachate to flow to a collection point.

Load/Rest Cycle (V.B.3.b.2)) – A schedule of operation in which a certain volume of waste is loaded on a portion of the treatment system and then that portion is rested to allow the soil to re-aerate and the soil micro-organisms to break down the waste material.

Milking Center (III.) – Facility for harvesting cooling and storing milk from dairy cows, sheep, or goats. The facility can include animal holding area, milking parlor, milk house, milking equipment, and washing equipment. Excluded from the milking center is animal housing.

Milking Center Wastewater (III.) – Consists of wash water used to clean the milk harvesting and milk

cooling equipment. Other contaminated sources of wastewater (water softener) and wash water used to clean the floors and walls can be included in the combined flow of the milking center wastewater discharge. Wastewater from the floor of the holding area is excluded from treatment systems specified by this standard. Clean discharge water sources (plate cooler, roof water) and sanitary wastewater (toilets, sinks, clothes laundry) must be excluded from the treatment system.

Non-permanent feed storage area (V.C.3.) – An area used to store livestock feed for no more than 12 months at one location followed by a minimum of two consecutive years of non-use.

Open Channel (Table 4) – Open channels are assumed to begin where surveyed cross section information has been obtained, where channels are visible on aerial photographs, or where blue lines (indicating streams) appear on the United States Geological Survey (USGS) quadrangle sheets.

Perched Conditions (V.A.3.c.) – Perched conditions describe a soil moisture regime where saturated soil is located above unsaturated soil.

Permanent feed storage area (V.C.1.c.) – An area used to store livestock feed for more than 12 months at one location.

Sinkholes (V.A.2.c.) – Closed, usually circular depressions which form in karst areas. Sinkholes are formed by the downward migration of unconsolidated deposits into solutionally enlarged openings in the top of bedrock.

Source Control (V.A.1.) – Management practices and/or equipment that reduce the volume and strength of the generated milking center waste stream to facilitate its treatment. Further explanation of source control measures to reduce volume, strength and reduce contaminant levels are found in the companion documents in the WI supplement to Chapter 10 of the NRCS AWMFH.

Spreading Plan (V.B.1.b.) – A plan that prevents runoff, excessive accumulation of nutrients in the soil, and spreading of wastes in karst areas and areas of concentrated flow.

Surface Water Feature (V.A.2.a.) – Lakes, ponds, wetlands, open channel flow, grassed waterways, streams, sinkholes and karst features.

Tower Silo (V.C.1.) – Vertical high moisture feed storage structure confined on the sides and bottom.

Vegetated Treatment Area (V.A.2.b.2)) – A vegetated area designed to treat contaminated runoff from feed storage areas by physical, chemical and biological means.

Waste Feed (III.) – Spilled, spoiled or unused feed not suitable for livestock consumption. Includes feed mixed with snow and other contaminants.