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WISCONSIN FIELD OFFICE TECHNICAL GUIDE
450-11-TECHNICAL GUIDE
FOTG NOTICE WI-86

SUBJECT: WISCONSIN FIELD OFFICE TECHNICAL GUIDE

Purpose. Revisions to Wisconsin Conservation Practice Standards and Specifications.

Explanation of Changes.

Section IV: Conservation Practice Standards and Specifications:

Composting Facility (CPS 317) - The newly issued National Standard revised language as needed to improve readability and clarify intent of criteria. Criteria was revised to include facility siting and design language. Two sections, "Criteria for Mechanically Assisted Composting" and "Power Supply," were added.

Drainage Water Management (CPS 554) - The newly issued National Standard was revised for clarity. Two purposes were removed: reduce wind erosion or particulate matter (dust) emissions and provide seasonal wildlife habitat. Significant additions and clarifications were made to most of the "General Criteria," particularly instructions under "Control Elevation" and "Control Zone." Similarly, changes were made to sections "Additional Criteria to Reduce Nutrient, Pathogen, and Pesticide Loading" and "Additional Criteria to Improve Productivity, Health, and Vigor of Plants." The "Considerations," and "Plans and Specifications" sections were rewritten.

Field Border (CPS 386) - Clarified the "Purpose" statements to be in alignment with NRCS resource concerns. Minor edits were made throughout the document for clarification purposes. Added the purpose "reduce excessive sediment to surface waters."

Filter Strip (CPS 393) - Practice purposes were revised. Minor editing was made throughout the document to clarify criteria. Noxious or invasive plants language removed since this is NRCS policy for all matters. Added criteria to remove phosphorus by harvesting above-ground biomass at least once each year.

Residue and Tillage Management, No Till (CPS 329) - Practice purposes edited to align with NRCS resource concerns. Added the purpose to reduce excessive sediment in surface waters. Made minor edits throughout the document to improve clarity. Removed the 2,000 pounds per acre of residue to increase plant available moisture as this is no longer needed for the erosion prediction tools in use at this time. The needed amount of residue now states 60 percent.

Residue and Tillage Management, Reduced Till (CPS 345) - Added to the purpose to reduce sheet, rill and wind erosion, and excessive sediment in surface waters. Made minor edits to improve clarity throughout the document. Added the criteria to document/determine the purpose to reduce sheet, rill and wind erosion, and excessive sediment in surface waters.

Waste Treatment (CPS 629) - The specific criteria for ridge and furrow milkhouse treatment was removed. The criteria for leachate and contaminated runoff from permanent feed storage areas was edited for clarity. The term "First Flush" was removed and replaced with "Initial Runoff" to be compatible with the VTA Standard.

Remove the following outdated Standards and Specifications from any printed copies of the WI FOTG:

- Index
- Composting Facility (CPS 317)
- Drainage Water Management (CPS 554)
- Field Border (CPS 386)
- Filter Strip (CPS 393)

Natural Resources Conservation Service
8030 Excelsior Drive, Suite 200, Madison, WI 53717
www.wi.nrcs.usda.gov Phone: (608) 662-4422 Fax: (855) 819-6165

- Residue and Tillage Management, No Till (CPS 329)
- Residue and Tillage Management, Reduced Till (CPS 345)
- Waste Treatment (CPS 629)

Add the following Standards and Specifications from any printed copies of the WI FOTG:

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- Residue and Tillage Management, No Till (CPS 329)
- Residue and Tillage Management, Reduced Till (CPS 345)
- Waste Treatment (CPS 629)

A link to the Wisconsin FOTG is located on the Wisconsin NRCS website at:
http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/

MARGARET RHODES
Acting State Conservationist

Natural Resources Conservation Service
8030 Excelsior Drive, Suite 200, Madison, WI 53717
www.wi.nrcs.usda.gov Phone: (608) 662-4422 Fax: (855) 819-6165
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INDEX
Wisconsin Field Office Technical Guide, Section IV
Conservation Practice Standards

Practice Name	Code	Discipline	Date
Access Control	472	Resources	4/2016
Access Road	560	Engineering	10/2014
Agrichemical Handling Facility	309	Engineering	10/2014
Alley Cropping	311	Resources	1/2012
Amending Soil Properties with Gypsum Products	333	Resources	3/2016
Amendments for Treatment of Agricultural Waste	591	Engineering	3/2014
Anaerobic Digester	366	Engineering	8/2011
Animal Mortality Facility	316	Engineering	3/2016
Anionic Polyacrylamide (PAM) Application	450	Engineering	12/2016
Aquaculture Ponds	397	Engineering / Resources	8/2013
Aquatic Organism Passage	396	Resources / Engineering	7/2016
Brush Management	314	Resources	8/2015
Building Envelope Improvement	672	Engineering	1/2014
Channel Bed Stabilization	584	Engineering	3/2016
Clearing and Snagging	326	Engineering	6/2016
Composting Facility	317	Engineering / Resources	1/2017
Conservation Cover	327	Resources	1/2013
Conservation Crop Rotation	328	Resources	9/2015
Constructed Wetland	656	Engineering	12/2016
Contour Buffer Strips	332	Resources	7/2016
Contour Farming	330	Resources	3/2016
Contour Orchard and Other Perennial Crops	331	Resources	6/2016
Controlled Traffic Farming	334	Resources	8/2016
Cover Crop	340	Resources	8/2015
Critical Area Planting	342	Resources / Engineering	8/2016
Cross Wind Ridges	588	Resources	6/2016
Cross Wind Trap Strips	589C	Resources	6/2016
Denitrifying Bioreactor	605	Engineering	12/2016
Dike	356	Engineering	9/2016
Diversion	362	Engineering	8/2016
Drainage Water Management	554	Engineering	1/2017
Dust Control on Unpaved Roads and Surfaces	373	Engineering / Resources	10/2014
Early Successional Habitat Development/Mgt.	647	Resources	5/2014
Emergency Animal Mortality Management	368	Resources	3/2016
Farmstead Energy Improvement	374	Engineering	10/2016

Practice Name	Code	Discipline	Date
Feed Management	592	Resources	7/2016
Fence	382	Resources	1/2014
Field Border	386	Resources	1/2017
Field Operation Emissions Reduction	376	Resources	8/2016
Filter Strip	393	Resources	1/2017
Firebreak	394	Resources	8/2016
Fish Raceway or Tank	398	Resources / Engineering	6/2016
Forage and Biomass Planting	512	Resources	1/2013
Forage Harvest Management	511	Resources	8/2016
Forest Stand Improvement	666	Resources	10/2015
Forest Trails and Landings	655	Resources / Engineering	9/2015
Fuel Break	383	Resources	4/2014
Grade Stabilization Structure	410	Engineering	8/2016
Grassed Waterway	412	Engineering / Resources	7/2016
Groundwater Testing	355	Engineering	10/2014
Heavy Use Area Protection	561	Engineering	8/2015
Herbaceous Weed Control	315	Resources	6/2016
Herbaceous Wind Barriers	603	Resources	8/2016
High Tunnel System	325	Resources	9/2015
Integrated Pest Management (IPM)	595	Resources	1/2013
Irrigation Pipeline	430	Engineering	10/2016
Irrigation Reservoir	436	Engineering	7/2016
Irrigation System, Microirrigation	441	Engineering	4/2016
Irrigation System, Tailwater Recovery	447	Engineering	10/2014
Irrigation Water Management	449	Engineering / Resources	10/2014
Karst Sinkhole Treatment	527	Engineering	3/2016
Lighting System Improvement	670	Engineering	4/2016
Lined Waterway or Outlet	468	Engineering	3/2013
Livestock Pipeline	516	Engineering	12/2016
Livestock Shelter Structure	576	Resources	3/2014
Mine Shaft and Adit Closing	457	Engineering	7/2016
Monitoring Well	353	Engineering	10/2014
Mulching	484	Resources	6/2016
Multi-Story Cropping	379	Resources	8/2016
Nutrient Management	590	Resources / Engineering	12/2015
Obstruction Removal	500	Engineering	7/2016
On-Farm Secondary Containment Facility	319	Engineering	10/2014
Open Channel	582	Engineering	3/2016

Practice Name	Code	Discipline	Date
Phosphorous Removal System	782	Engineering	9/2015
Pond	378	Engineering	8/2016
Pond Sealing or Lining , Flexible Membrane	521A	Engineering	9/2012
Pond Sealing or Lining, Compacted Soil Treatment	520	Engineering	8/2016
Prescribed Burning	338	Resources	3/2016
Prescribed Grazing	528	Resources	12/2008
Pumping Plant	533	Engineering	7/2016
Residue and Tillage Management, No Till	329	Resources	1/2017
Residue and Tillage Management, Reduced Till	345	Resources	1/2017
Restoration and Management of Rare or Declining Habitats	643	Resources	5/2014
Riparian Forest Buffer	391	Resources / Engineering	1/2013
Road/Trail/Landing Closure and Treatment	654	Resources / Engineering	1/2014
Roof Runoff Structure	558	Engineering	9/2015
Roofs and Covers	367	Engineering	4/2016
Saturated Buffer	604	Engineering	6/2016
Sediment Basin	350	Engineering	8/2016
Shallow Water Management for Wildlife	646	Resources	4/2016
Spoil Spreading	572	Engineering	7/2016
Spring Development	574	Engineering	3/2014
Sprinkler System	442	Engineering	4/2016
Stormwater Runoff Control	570	Engineering	10/2014
Stream Crossing	578	Engineering	3/2015
Stream Habitat Improvement and Management	395	Resources	8/2016
Streambank and Shoreline Protection	580	Engineering	8/2013
Stripcropping	585	Resources	6/2016
Structure for Water Control	587	Engineering	1/2011
Structures for Wildlife	649	Resources	12/2014
Subsurface Drain	606	Engineering	3/2014
Surface Drain, Field Ditch	607	Engineering	4/2016
Surface Drain, Main or Lateral	608	Engineering	4/2016
Terrace	600	Engineering	3/2015
Trails and Walkways	575	Engineering / Resources	4/2016
Tree/Shrub Establishment	612	Resources / Engineering	7/2011
Tree/Shrub Pruning	660	Resources	3/2016
Tree/Shrub Site Preparation	490	Resources	1/2013
Underground Outlet	620	Engineering	3/2014
Upland Wildlife Habitat Management	645	Resources	1/2013
Vegetated Treatment Area	635	Engineering	9/2016

Practice Name	Code	Discipline	Date
Vegetative Barrier	601	Resources	8/2016
Waste Facility Closure	360	Engineering / Resources	3/2013
Waste Separation Facility	632	Engineering	4/2014
Waste Storage Facility	313	Engineering	1/2014
Waste Transfer	634	Engineering	1/2014
Waste Treatment	629	Engineering	1/2017
Water and Sediment Control Basin	638	Engineering	8/2016
Water Well	642	Engineering	10/2014
Watering Facility	614	Engineering / Resources	10/2014
Well Decommissioning	351	Engineering	10/2014
Wetland Creation	658	Resources / Engineering	10/2016
Wetland Enhancement	659	Resources / Engineering	9/2015
Wetland Restoration	657	Resources / Engineering	9/2016
Wetland Wildlife Habitat Management	644	Resources	1/2013
Windbreak/Shelterbelt Establishment	380	Resources	10/2016
Windbreak/Shelterbelt Renovation	650	Resources	1/2013
Woody Residue Treatment	384	Resources	9/2016

Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD

COMPOSTING FACILITY

Code 317
(No)

DEFINITION

A structure or device to contain and facilitate an aerobic microbial ecosystem for the decomposition of manure and/or other organic material into a final product sufficiently stable for storage, on farm use and application to land as a soil amendment.

PURPOSE

To reduce water pollution potential and improve handling characteristics of organic waste solids, reuse organic waste as animal bedding, or use as a soil amendment that provides soil conditioning, slow-release plant-available nutrients and plant disease suppression.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where at least one of the following conditions occur:

- Organic solid wastes to be composted derive primarily from agricultural production or processing.
- The compost can be reused in the operation, utilized for crop production, soil improvement and/or marketed to the public.

This practice does not apply to the routine handling of livestock and poultry carcasses. Use Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS) Animal Mortality Facility (Code 316) for carcass composting facility design.

This practice does not apply to routine storage and handling of animal manure solids. Use WI NRCS CPS Waste Storage Facility (Code 313) for animal manure solids dry stack facilities.

CRITERIA

General Criteria Applicable To All Purposes

Design and install measures according to a site-specific plan in accordance with all local, State, Tribal, and Federal laws and regulations. Apply measures that are compatible with improvements planned or being carried out by others.

Siting. Locate and design the compost facility such that it is outside the 100-year floodplain unless site restrictions require locating it within the floodplain. If located within the floodplain, protect the facility from inundation or damage from a 25-year flood event. Additionally, follow the policy found in the NRCS General Manual (GM) 190, Part 410.25, “Flood Plain Management,” which may require providing additional protection for storage structures located within the floodplain. Redirect upslope surface runoff away from the composting site.

The facility (except in-vessel composters) shall meet the separation criteria in WI NRCS CPS Waste Storage Facility (Code 313), “Specific Criteria for Permanent Stacking Facilities at the Animal Production Area.”

Type. Select the type of composting facility and composting method based on the landowner’s goals, kind of organic waste solids, planned quality of finished compost, operator’s equipment, labor, time, land available for the facility footprint, and resource concerns.

Capacity. Size the composting facility in accordance NRCS National Engineering Handbook, (NEH) Part 637, Chapter 2, “Composting.” Design the composting facility to accommodate the amount of organic waste feedstock generated for active composting and compost curing, along with the needed volume of additional bulking material or carbon source to achieve the composting action. Active composting includes both the primary and secondary stages of composting. Space for both the active composting and compost curing are required for making a stable finished compost product. Select facility dimensions to accommodate all stages of composting with space for turning, handling and processing.

Moisture. Orient and design the facility to enable the management of the compost moisture content. A water source is needed for adding moisture in dry conditions. If considerable precipitation is likely, design a cover. Minimize blown-in precipitation on covered facilities by providing a roof overhang or orient the open side of the facility away from the prevailing wind direction.

Roofs and Roof Runoff. Design the roof using WI NRCS CPS Roofs and Covers (Code 367). Use WI NRCS CPS Roof Runoff Structure (Code 558) when designing the collection, control and conveyance of runoff from a roof. Use WI NRCS CPS Underground Outlet (Code 620) when designing pipe outlets where erosion may be a concern.

Foundation. Design the facility to prevent the contamination of groundwater resources. Evaluate site soils for depth to subsurface saturation, permeability, texture, and bearing strength based on the design load and frequency of use. For the design of a stable surface treatment, where appropriate, use criteria in WI NRCS CPS Heavy Use Area Protection (Code 561). Guidance on restricting seepage through foundation and subgrade material can be found in NEH-651, Agricultural Waste Management Field Handbook (AWMFH), Appendix 10D.

Structures. Use the criteria in WI NRCS CPS Waste Storage Facility (Code 313) when designing composting facility slabs, walls, floors and contaminated runoff water pond liner.

Wastewater. Use WI NRCS CPS Waste Transfer (Code 634) for collection and conveyance of any leachate or contaminated runoff from the composting facility to a wastewater storage or treatment facility for further management or reuse.

Safety. Incorporate safety and personnel protection features and practices into the facility and its operation to ensure biosecurity and minimize the occurrence of equipment and fire hazards associated with the composting process as appropriate.

Additional Criteria For Electric Powered Mechanically Assisted Composting

Power Supply. All power supply and electrical components, including wiring, boxes, and connectors, shall meet the requirements of the National Electric Code. If the power supply is located in an area that is reasonably accessible by machinery, protect it with strategically placed bollards or other appropriate safety measures.

CONSIDERATIONS

Consider the landscape elements when locating the facility. Landscape features can buffer prevailing winds which will minimize odors and protect visual resources.

Consider all-weather access roads to the composting facility site.

When locating the facility, consider a location away from produce crops typically consumed raw, food contact surfaces, water distribution systems, and other soil amendment sources where it could become a potential source of contamination.

If site is located where fields have been drained consider water quality. Locate or remove field tiles where seepage from the composting facility is a resource concern to groundwater or surface waters.

Consider equipment access to the facility location and determine if a heavy use area apron is needed to properly manage the compost.

If compost facility is in a higher precipitation area or site will have heavy vehicle traffic, consider using a concrete base for the facility.

When designing for windrows, consider the compost site grade and pile alignment. Grade site to prevent ponding from occurring. Align windrows north to south to maximize solar warming.

Consider protecting compost facilities from wind in cold or dry climates. Wind in cold climates can cause heat loss thru convection, limiting microbial metabolism. In low humidity climates wind can cause drying, limiting water availability for microbial metabolism.

Consider the options for finished compost storage.

Consider the impact of using treated lumber for the construction of composting facilities on the quality and or acceptability of the compost. For production of certified organic compost have the producer consult with an organic certifier as to the use and acceptability of treated lumber for bins and compost storage.

PLANS AND SPECIFICATIONS

The landowner is required to obtain all necessary permits for project installation prior to construction.

The landowner and/or contractor are responsible for having all buried utilities located in the project area, including identifying the location of drainage tile and other structural measures.

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use, including, but not limited to:

- Plan view showing layout and location of composting facility, if applicable, access road to facility, setback distances from water bodies, streams, sensitive areas, property line, etc.
- Drainage and grading plan showing excavation, fill, and drainage containment, as appropriate.
- Pertinent elevations of the facility.
- Utilities located and source of water supply.
- Structural details of all components.
- Material quantities and specifications.
- Safety features, i.e., fire suppression.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of this practice and the design life of the composting facility. Outline periodic inspections and maintenance of equipment and facilities. Include structural elements of the facility to be inspected or maintained, an inspection interval time frame, and recommendations for preventive maintenance.

Describe essential safety features of the facility to provide protection from or prevention of a compost fire.

Include a statement that explains composting as a microbiological process that needs monitoring and management. Monitoring the temperature of composting material reflects the phases of successive populations of microorganisms and their metabolism as they decompose the organic matter. The operation may need to undergo some trial and error in the start-up of a new composting facility while the operator determines an efficient operating process. The operator must keep accurate records to aid in learning how to operate the facility efficiently.

List the type(s) and volume(s) of animal waste and/or other sources of organic feedstock planned to be composted. Provide information on planned compost recipe ingredients and the sequence for mixing and building the compost piles. Direct the operator to land-grant universities and other recognized entities that provide compost mixture calculators to balance feedstocks in order to meet a target carbon-to-nitrogen (C:N) ratio and moisture content.

Manage the compost for temperature, moisture, oxygen, and pH as appropriate. Test the finished compost as appropriate to assure that the product is stable and no longer heating from biological decomposition. Guidance for composting management, monitoring and the testing of compost stability is in NEH, Part 637, Chapter 2, Section 637.0209(h), “Determination of compost stability.”

Monitoring Documentation

Provide a record-keeping form for the operator to use listing at a minimum, the date, amounts and types of material added, compost temperature, weather conditions, and actions taken to manage the compost. Monitoring may include but not be limited to:

- **Compost Mix**. Build a compost mix that encourages aerobic microbial decomposition and avoids nuisance odors. Blend feedstock, build compost pile, and handle the compost mix to develop a porous structure for uniform aeration during composting.
- **Carbon-Nitrogen Ratio**. The recommended C:N ratio of the initial compost mix is between 25:1 and 40:1. Compost with a lesser C:N ratio can be used if nitrogen mobilization and odors are not a concern. If the C:N ratio is above optimal, the composting process will be slower.
- **Carbon**. If needed, store a dependable source of carbonaceous material with a high C:N ratio for mixing with nitrogen rich waste materials. Minimize odors and ammonia volatilization by blending sufficient carbonaceous material with the nitrogenous material (C:N ratio).
- **Bulking Materials**. Add bulking materials to the mix as necessary to enhance aeration. The bulking material may be the carbonaceous material used in the mix or slowly-degradable natural organic material or a nonbiodegradable or slowly-degradable material that is salvaged at the end of the compost period for reuse in additional composting cycles. Make provision for the salvage of any nonbiodegradable or slowly-decomposing material used in the composting process.
- **Moisture Level**. Maintain adequate moisture in the compost mix throughout the compost period within the range of 40 to 60 percent (wet basis). Prevent excess moisture from accumulating in the compost. This may require the pile be covered.
- **Temperature of Compost Mix**. Manage the compost to attain and then maintain the target internal temperature for the duration required to meet the desired compost product. It may be necessary for the compost to reach 145°F to adequately kill weed seeds. Closely monitor

temperatures above 165°F as that will inhibit the composting process by destroying the thermophilic bacteria. Take action immediately to cool piles that have reached temperatures above 185°F to prevent combustion.

- **Turning/Aeration**. Schedule the turning/aeration frequency to attain the desired amount of moisture removal and temperature control appropriate for the composting method used while maintaining aerobic degradation.
- **Odors**. If initial compost mixing and compost pile structure do not provide adequate odor reduction, strategies may include altering the recipe to add more carbon, modify the moisture content, modify the pH by applying a material compatible with compost quality and with any specifications for its end use (e.g,. certified organic), or use a biological inoculant.

Compost

- **Compost Products**. Time, temperature and turning of composted products can limit uses.

General compost material, to be used in the same way as manure solids, must store safely without undesirable odors. Typically this requires a temperature phase to be maintained above 104°F for 5 days with at least 4 hours above 131°F or higher during that time period.

Organic compliant compost for organic vegetable crops and off farm use or sale, which meets the USDA National Organic Program, requires a stable finished compost that has further pathogen reduction. This includes compost that can be used on farm for crops subject to the Food Safety Modernization Act (FSMA) Standards for the Growing, Harvesting, Packing and Holding of Produce for Human Consumption (Produce Safety Rule).

- For processing organic compliant compost in either a static aerated pile or in-vessel compost system, the temperature of the compost is required to be maintained between 131°F and 170°F for 3 days.
- For a windrow system the temperature of the organic compliant compost is required to be between 131°F and 170°F for 15 days with a minimum of five turnings of the compost to ensure the windrow is mixed and evenly composted.

For crops subject to the Produce Safety Rule, direct growers to the rule for additional criteria that may be applicable. See http://www.fda.gov/food/guidanceregulation/fsma/ucm334114.htm

Use of Finished Compost. Compost can be reused in the operation, utilized for crop production, soil improvement and/or marketed to the public.

Use the WI NRCS CPS Nutrient Management (Code 590) for producer land application of finished compost to provide nutrients and/or as a soil amendment where the finished compost is stable decomposed material that will not reheat, is reduced in pathogenic organisms and most weed seed are no longer viable.

When applying a general compost material that is not a stable pathogen reduced compost product, follow WI NRCS CPS Nutrient Management (Code 590) criteria for manure solids application, and any state or local rules that may detail crop type, location and timing restrictions for manure application.

REFERENCES

Northeast Regional Agricultural Engineering Service (NRAES). 1992. On-Farm Composting Handbook, NRAEAS-54.

United States Food and Drug Administration. 2015. Food Safety Modernization Act (FSMA): Final rule. Standards for the Growing, Harvesting, Packing, and Holding of Produce for Human Consumption. 21 CFR.

USDA, NRCS. 2000. National Engineering Handbook, Part 637, Chapter 2, Composting. Washington, D.C.

USDA. 2000. National Organic Program (NOP): Final rule. Codified at 7 CFR Ch. 1 (1-1-11 Edition), part 205.203, (c) (2).

Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD

DRAINAGE WATER MANAGEMENT

Code 554
(Acre)

Definition

The process of managing the drainage volume and water table elevation by regulating the flow from a surface or subsurface agricultural drainage system.

Purpose

The purpose of this practice is to:

- Reduce nutrient, pathogen, and pesticide loading from drainage systems into downstream receiving waters.
- Improve productivity, health, and vigor of plants.
- Reduce oxidation of organic matter in soils.

Conditions Where Practice Applies

This practice is applicable to agricultural lands with surface or subsurface agricultural drainage systems that can be adapted, or are partially adapted, to allow management of drainage volume and water table by changing the elevation of water level at the outlet(s).

This practice applies where a high natural water table exists or has existed, and the topography is relatively smooth, uniform, and flat to very gently sloping.

This practice does not apply to the management of irrigation water supplied through a subsurface drainage system. For that purpose use Wisconsin NRCS Conservation Practice Standards (WI NRCS CPS), Irrigation System, Surface and Subsurface (Code 443) and Irrigation Water Management (Code 449).

The practice does not apply to the seasonal inundation of fields from overland surface runoff.

Criteria

General Criteria Applicable to all Purposes

Manage the drainage discharges and water levels in a manner that does not cause adverse impacts to other properties or drainage systems. Water control structures used in the management system must not cause water to back up into a main or lateral beyond a property line unless the upstream landowner has given written permission.

Manage gravity drainage systems by adjusting the outlet elevations of the water control structure(s) located within the drainage system. Refer to WI NRCS CPS, Water Control Structure (Code 587) for design criteria. Managed drainage mode is raising the elevation of the control structure outlet above the normal drain elevation to store water in the soil, as opposed to free drainage mode.

Manage pumped drainage outlets by adjusting the on-off elevations for pump cycling throughout the year to provide the required outlet elevation for the drainage system.

Raising the outlet elevation of a water control structure in a flowing drain must result in an elevated free water surface within the soil profile.

Locate structures and pumps where they are convenient to operate and maintain. When operated in free drainage mode, water control structure(s), including any buried in-line control valve(s), must require no more than 0.2 feet of head to maintain the unrestricted flow rate of the drainage system.

Ensure the flow velocity in the drainage system does not exceed acceptable velocities prescribed by WI NRCS CPSs, Surface Drain, Main or Lateral (Code 608) and Subsurface Drain (Code 606), as applicable. Controlling drain velocities is typically necessary only during the release of drainage water from control structures.

Lower the outlet elevation during winter after drain flow has stopped. This will avoid freezing damage to the water control structures. Raise the water to the planned elevation when flow resumes.

Control Elevation. Reference the outlet elevation of each water control structure to a “control elevation” which is defined as the lowest elevation of the soil surface in the area of the field (control zone) impacted by the operation of the water control structure.

To determine the area drained by a single drain, use the lateral spacing in the drained field, or if the spacing is unknown, determine the lateral drain spacing using the van Schilfgaarde equation. The outer boundary of the drained area is a distance of one-half the lateral spacing away from the drain(s).

Control Zone. The control zone (or impacted area) for each water control structure is defined as the drained area upstream of the given control structure. The control zone is bounded on the lower end by the planned control elevation of the given water control structure and on the upper end by the control elevation of the structure immediately upstream or a defined elevation above the given control structure, whichever is less. The defined elevation is a maximum of 2 feet.

Develop a management calendar which specifies the target water control structure outlet elevation throughout the year to meet the intended purpose. Adjust the water levels throughout the year to allow for proper root zone development. Specify conditions where adjusting the outlet elevations may be required, such as significant rainfall events. Describe what those adjustments might be. Provide means for the operator to monitor and record the water levels in the water control structure(s) and the water table within the control zone(s). This information will enable the operator to adapt management to changing weather conditions and minimize adverse effects on crops and soils.

Additional Criteria to Reduce Nutrient, Pathogen, and Pesticide Loading

Drainage Water Management is an ongoing practice implemented throughout all days of the year.

Minimize drainage below that necessary to provide an adequate root zone for the crop.

Maintain each water control structure outlet in managed drainage mode except when the water table must be lowered for trafficability for field work, adverse weather conditions, or system maintenance.

Raise the outlet elevation of the water control structure to within 12 inches or less of the ground surface during noncropped (fallow) periods. Raise the outlet within 2 weeks after final field operations following harvest. Change to free drainage mode no more than 2 weeks before the planned commencement of the next season’s field operations, except during system maintenance periods or to provide trafficability when field operations are necessary.

Lower the outlet elevation during winter after drain flow has stopped. This will avoid freezing damage to the water control structures. Raise the water to the planned elevation when flow resumes. In fields with winter cover crops, lower the outlet elevation during winter to within 0.5 feet of the expected cover crop rooting depth.

Raise the outlet elevation of the water control structure to within 0.5 feet below the control elevation or just below the root zone of an actively growing crop prior to and during liquid manure applications in order to prevent direct leakage of manure into drainage pipes through soil macro pores (cracks, wormholes, root channels). Maintain the raised outlet elevation for at least 15 days following manure application or until the next precipitation event that produces drain flow. Monitor the control structure(s) for trapped manure. Remove liquid manure trapped in the structure(s) and dispose of it in an appropriate manner.

Additional Criteria to Improve Productivity, Health, and Vigor of Plants

When managing drainage outflow to maintain water in the soil profile for use by crops or other vegetation, specify the water elevation based on root depth and soil type to maintain proper root development and soil aeration.

Raise the outlet elevation after planting to allow the retention and movement of water in the crop root zone.

Additional Criteria to Reduce Oxidation of Organic Matter in Soils

Minimize drainage beyond that necessary to provide an adequate root zone for the crop.

To reduce oxidation of organic matter, set the outlet elevation to enable the water table to rise to the ground surface, or to a designated maximum elevation, for sufficient time to create anaerobic soil conditions. The implementation of this practice must result in a reduced average annual thickness of the aerated layer of the soil.

Considerations

Generally, the same drainage intensity is not required at all times during the year. Consider a management strategy that enhances crop yield while minimizes negative water quality impacts.

For the practice to be economical and practical, each control structure needs to influence a significant amount of the field; therefore, drainage water management is generally limited to nearly flat fields with slopes typically less than 1.0 percent. On moderate slopes design drainage laterals on the contour to maximize the control zone of each structure. Raising the water table during the growing season will generally increase evapotranspiration and may increase crop yield. Take care to maintain a sufficiently aerated crop root zone so as not to damage the crop.

Monitoring of root zone development may be necessary if the free water surface in the soil profile rises close to the soil surface during the growing season.

Because of the increase in water volume stored in the soil profile, drainage water management may affect the water budget, especially volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation and ground water recharge.

Drainage water management may increase base flow in streams and ditches because of a higher gradient from the fields. A higher field water table may increase lateral and vertical seepage losses. Since this water will likely pass through reduced (low) oxygen zones, seepage water may be denitrified before reaching surface water conduits.

Installing inexpensive water table observation wells can improve management.

Avoid traffic on fine-textured, wet soils to minimize soil compaction.

Reducing mineralization of organic soils may decrease the release of soluble phosphorus, but water table management may increase the release of soluble phosphorus from mineral soils.

Elevated water tables may increase the runoff portion of outflow from fields. Consider conservation measures that control sediment loss and associated agrichemical discharge to waterways.

When using this practice for reduction of pesticide loading or rodent control, apply pesticide in accordance with WI NRCS CPS Integrated Pest Management (IPM) (Code 595).

If wildlife habitat is a resource concern, design the system so that during the noncropped season, the managed elevation of the drainage outlet is consistent with the habitat management plan for the targeted species.

Plans And Specifications

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended purpose(s).

At a minimum, include:

- Farm and field information with a location map.
- The objectives of the landowner.
- A map (or maps) that includes:
    - » Field boundaries.
    - » Drainage water management project area (drained area) boundaries.
    - » A soils map showing the drainage class.
    - » A map of the drainage system, including the location of water control structure(s) and the size and location of all mains and laterals.
    - » A topographic map with one foot contours or less.
    - » A map that shows the location, size, and impacted area (i.e., control zone) of each existing and planned control structure.
- A management plan as described in the Operation and Maintenance section of this standard.

Operation And Maintenance

Prepare an operation and maintenance (O&M) plan and review with the landowner or operator responsible for the application of this practice.

- Identify the intended purpose of the practice, safety requirements, and critical dates and target elevations of the water table necessary to meet the intended purpose(s).
- Include instructions for operation and maintenance of critical components of the drainage management system, including instructions necessary to maintain flow velocities within allowable limits when lowering water tables. Address the following management objectives as applicable:
    - » Prior to tillage, harvest, and other field operations, set the outlet elevation at a depth to provide trafficability throughout the field (typically the bottom of the drainage outlet).

    - » After planting and other necessary field operations, raise the outlet elevation to the planned level. Monitor water elevations to allow capacity to store infiltration from rainfall, as well as subsurface water from up gradient, depending on the soil texture, significant allowance may be required to allow for capillary rise. This will vary, depending on crop, stage of growth, and soil.
    - » Operate the outlet elevation in the control structure during the crop season so that prolonged saturation of the root zone does not occur (i.e., as observed in the water table observation wells, if any).
    - » During the fallow period, set the outlet elevation in the control structure to allow local groundwater and infiltrated precipitation to elevate the water table to potentially rise to near the soil surface or to an elevation specified by the planner.
    - » To prevent leakage of liquid manure applications into drain pipes, specify the elevation of the raised drainage outlet and the number of days prior to and after the application that a raised outlet elevation is to be maintained.
- Replace warped flashboards and damaged seals that cause structure leakage.

References

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Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD

Field Border

Code 386
(Acre)

Definition

A strip of permanent vegetation established at the edge or around the perimeter of a field.

Purpose (resource concern)

- Reduce erosion from wind and water and reduce excessive sediment to surface waters (soil erosion).
- Reduce sedimentation off-site and protect water quality and nutrients in surface and ground waters (water quality degradation).
- Provide food and cover for wildlife and pollinators or other beneficial organisms (inadequate habitat for fish and wildlife).
- Reduce greenhouse gases and increase carbon storage (air quality impact).
- Reduce emissions of particulate matter (air quality impact).

Conditions Where Practice Applies

This practice applies to cropland and grazing lands located around the inside perimeter of fields to support or connect other buffer practices within and between fields.

Criteria

General Criteria Applicable to All Purposes

Establish field borders at field edges to the extent needed to meet the resource needs and producer objectives. Minimum field border widths shall be based on local design criteria specific to the purpose or purposes for installing the practice.

Establish field borders to adapted species of permanent grass, forbs and/or shrubs that accomplish the design objective.

Plants selected for field borders will have the physical characteristics necessary to control wind and water erosion to tolerable levels on the field border area. For portions of the border that will be subject to equipment traffic, establish species tolerant to equipment such traffic.

Seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with approved local criteria and site conditions.

Ephemeral gullies and rills present in the planned border area will be eliminated as part of seedbed preparation. If present, ephemeral gullies and rills located immediately upslope from the planned border area need to be treated to ensure more sheet flow and less concentrated flow enters the field border area.

Break up or redirect concentrated water flow within the field borders to prevent gully erosion.

Additional Criteria to Reduce Erosion from Wind and Water and Reduce Excessive Sediment to Surface Waters

Field border establishment will be timed so that the soil will be adequately protected during the critical erosion period(s).

Establish permanent species that create a dense cover.

Establish stiff-stemmed, upright grasses, grass/legumes or forbs to trap wind or waterborne soil particles.

The amount of surface and/or canopy cover needed from the field border shall be determined using current approved water and wind erosion prediction technology. Soil erosion estimates shall account for the effects of other practices in the management system.

Wind Erosion Reduction. Locate borders to provide a stable area on the windward edge of the field as determined by prevailing wind direction data during the critical erosion period(s).

Minimum height of grass or forbs shall be one foot during the critical wind erosion period.

Water Erosion Reduction. Locate borders to eliminate sloping end rows, headlands, and other areas where concentrated water flows will enter or exit the field.

Orient plant rows as closely as possible to be perpendicular to sheet flow direction.

Additional Criteria to Reduce Sedimentation Off-site and Protect Water Quality and Excess Nutrients in Surface and Ground Waters

Do not burn the field border.

As a minimum, locate field borders along the edge(s) of the field where runoff enters or leaves the field. The minimum width for this purpose shall be 30 feet and have a dense vegetative stand (similar to a dense sod).

Design border widths to comply with all applicable State and local regulations regarding manure and chemical application setbacks.

Establish stiff-stemmed, upright grasses, grass/legumes or forbs to trap wind or waterborne soil particles.

Additional Criteria to Provide Wildlife Food and Cover and Pollinator or Other Beneficial Organisms

Use an approved habitat evaluation procedure to determine the appropriate amount, arrangement and composition of habitat resources needed to provide adequate food and cover for target wildlife species.

Select species that provide adequate habitat, food source and/or cover for the wildlife species of interest.

The minimum width for this purpose shall be 30 feet.

Schedule mowing, harvest, weed control, and other management activities within the field border to accommodate reproduction and other life-cycle requirements of target wildlife species.

When possible, disturb no more than 1/3 of the field border at any given time. Avoid vehicle traffic in the field border area.

For beneficial organisms (e.g., predatory and parasitic insects, spiders, insectivorous birds and bats, raptors, and terrestrial rodent predators) that prey on target pests, select diverse plant species that meet dietary, nesting and cover requirements for the intended species, at least during the critical period for

control of target pests, and ideally year-round. Avoid exposure of the field border to pesticides and other chemicals that are potentially harmful to wildlife, pollinators, and other beneficial organisms.

When wildlife and/or pollinators are a concern, a lower percent groundcover than would be needed if protecting soil and water quality is acceptable as long as the soil resource concern is also adequately addressed (i.e., no excessive soil loss). This may be achieved by simply increasing the field border width.

Additional Criteria to Reduce Greenhouse Gases and Increase Carbon Storage

Establish plant species that will produce adequate above- and below-ground biomass for the site (i.e., a positive soil conditioning index will be achieved).

Maximize the width and length of the field border to fit the site and increase total biomass production.

Do not burn the field border.

Do not disturb the roots of the established vegetation with tillage.

Additional Criteria to Reduce Emissions of Particulate Matter

Establish plant species with morphological characteristics that optimize interception and adhesion of airborne particulates. Select plants with persistent roots and residue that stabilize soil aggregates and mitigate the generation of airborne particulates.

Do not burn the field border.

Establish species resistant to damage from equipment traffic.

Considerations

Applicable to All Purposes

Design border widths to comply with all applicable State and local regulations regarding manure and chemical application setbacks.

Plant field borders around the entire field, not just on the field edges where water enters or leaves the field, to maximize resource conservation benefits.

Establishing a narrow strip of stiff-stemmed upright grass at the crop/field border interface can increase soil particle and other airborne particulate trapping efficiency of the field border.

Considerations to Enhance Wildlife and/or Pollinator Value

Native plants are best suited for wildlife and pollinator habitat enhancement, and provide other ecological benefits where adapted to site conditions and when consistent with producer objectives.

When enhancement of wildlife habitat is a purpose, plant species diversity should be encouraged. Plantings that result in multiple structural levels of vegetation will maximize wildlife use.

Include native plants that provide diverse pollen and nectar sources to encourage local pollinator populations. Where possible, re-establish the native plant community for the site.

Overseed the field border with forbs for increased plant diversity, soil quality, pollinators, and wildlife benefits.

To minimize wildlife mortality and habitat degradation, turn or drive machinery on field borders only when necessary, at low speed, and with implements fully raised. If extensive turning/traffic will be necessary

on the field border during the nesting season, mortality may be reduced by mowing it early to reduce its attractiveness as a nesting site, if alternative nesting cover is available.

Considerations for Design Criteria

In selecting plant species consider the plant's tolerance to:

- Sediment deposition and chemicals planned for application.
- Drought in arid areas or where evapotranspiration can potentially exceed precipitation during the field border's active growing period(s).
- Equipment traffic.

Establish plant species that will have the desired visual effects and that will not interfere with field operations or field border maintenance.

Establish plant species taking into account shading from adjacent vegetation.

The use of native perennial plant species as opposed to introduced species provides a longer period of resource protection.

Conservation Practice Standards Prescribed Burning (Code 338), Prescribed Grazing (Code 528), and Early Successional Habitat Development and Management (Code 647) are management practices that can be used to maintain suitable habitat for specifically desired wildlife species, provided those practices are applied following specifications that do not compromise the purpose(s) of the practice.

Design border widths to match the required field application setback widths for easier management (i.e., land-use and management changes occur in the same location).

Consider installing a contour buffer system, no till practice, or other conservation practices on adjacent upland areas to reduce surface runoff and excessive sedimentation of field borders.

Where genetic drift is a concern, use buffer vegetation to create a barrier between the pollen-producing crop and the crop that must be protected, or increase the distance between them so that cross-pollination is less likely.

Border widths can be designed to accommodate equipment turning, parking, loading/unloading equipment, grain harvest operations, etc. to minimize soil compaction on the high-traffic field edges.

Berms may be needed to breakup or redirect concentrated water flow within the field borders.

Considerations for Organic Production

Organic producers may have to submit plans and specifications to their certifying agent for approval prior to installation, as part of the organic producer's organic system plan.

Plans and Specifications

Specifications shall be prepared for each site and purpose and recorded in the approved implementation requirements document.

- Practice purpose(s).
- Field border widths and lengths based on local design criteria.
- Field border location(s) within the field(s) or farm boundary.
- Species to be used and the location and planting density of the species used.

- Site preparation requirements.
- Timing of planting and planting method.
- Liming or fertilizer requirements.
- Operation and maintenance requirements.

Operation and Maintenance

Field borders require careful management and maintenance for performance and longevity. The following O&M activities will be planned and applied as needed:

- Repair storm damage.
- Remove sediment from above, within, and along the leading edge of the field border when accumulated sediment either alters the function of the field border or threatens the degradation of the planted species.
- Shut off pesticide sprayers and raise tillage equipment to avoid damage to field borders.
- Shape and reseed border areas damaged by animals, chemicals, tillage, or equipment traffic.
- Do not use the field border as a hay yard or machinery parking lot for any extended period of time, especially if doing so will damage or impair the function of the field border.
- Maintain desired vegetative communities and plant vigor by liming, fertilizing, mowing, disking, or burning and controlling noxious and invasive weeds to sustain effectiveness of the border.
- Repair and reseed ephemeral gullies and rills that develop in the border.
- Minimally invasive vertical tillage (e.g., paraplowing) may be performed in rare cases where compaction and vehicle traffic have degraded the field border function. The purpose of the tillage is strictly to relieve soil compaction and increase infiltration rates so as to provide a better media for reestablishment of vegetation and field border function.
- When managing for wildlife, maintenance activities that result in disturbance of vegetation should not be conducted during the primary nesting, fawning and calving seasons. In addition, when managing for wildlife, pollinator, and beneficial habitat, conduct any pesticide spray operations in the production area in a manner that prevents exposure of the field border to the pesticides, taking into account toxicity of the materials used to non-pest organisms, and weather conditions. Activities should be timed to allow for regrowth before the growing season ends whenever possible. The optimal vegetative successional state shall be maintained to accommodate target wildlife species' requirements.
- Periodic removal of some products such as medicinal herbs, nuts, and fruits is permitted provided the conservation purpose is not compromised by the loss of vegetation or harvesting disturbance.
- Avoid vehicle traffic when soil moisture conditions are saturated.
- Maintain records of the field border maintenance as needed by the land user.

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 field borders. This standard does not contain the text of federal, tribal, state, or local laws.

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USDA, NRCS, Conservation Practice Job Sheet 386, Field Border.

USDA, NRCS Wisconsin Agronomy Technical Note 5, Establishing and Maintaining Native Grasses, Forbs and Legumes.

USDA, NRCS Wisconsin Agronomy Technical Note 6, Establishing and Maintaining Introduced Grasses and Legumes.

USDA, NRCS Wisconsin Biology Technical Note 8, Pollinator Biology and Habitat.

Natural Resources Conservation Service
CONSERVATION PRACTICE STANDARD

FILTER STRIP

Code 393
(Acre)

Definition

A strip or area of herbaceous vegetation that removes contaminants from overland flow.

Purpose

- Reduce suspended solids and associated contaminants in runoff and excessive sediment in surface waters.
- Reduce dissolved contaminant loadings in runoff.
- Reduce suspended solids and associated contaminants in irrigation tailwater and excessive sediment in surface waters.

Conditions Where Practice Applies

Filter strips are established where environmentally sensitive areas need to be protected from sediment, other suspended solids, and dissolved contaminants in runoff.

This practice **DOES NOT** apply under the following conditions:

- The treatment of conditions where high levels of pollutants can be anticipated from areas such as: a) animal feed lots, b) feed storage areas, c) milking center waste areas, d) manure stacking areas, e) direct runoff from manure land application, f) construction sites, g) urban storm water runoff and h) timber harvest locations.
- Where soil loss is above Tolerable “T” rates within the contributing watershed.
- Where the predominant source of runoff is concentrated flow.

Criteria

General Criteria Applicable to All Purposes

Overland flow entering the filter strip will be uniform sheet flow.

Concentrated flow will be dispersed before it enters the filter strip.

The maximum gradient along the leading edge of filter strip will not exceed one-half of the up-and-down-hill slope percent, immediately upslope from the filter strip, up to a maximum of five percent.

Filter strips will not be used as a travel lane for equipment or livestock.

Additional Criteria to Reduce Dissolved Contaminants, Suspended Solids and Associated Contaminants in Runoff and Excessive Sediment in Surface Waters.

The filter strip will be designed to have a 10-year life span, following the procedure in Wisconsin Agronomy Technical Note 10, Planning, design management and maintenance of vegetative filter strips for sediment.

The minimum flow length through the filter strip will be 20 feet for suspended solids and associated contaminants in runoff and 30 feet for dissolved contaminants and pathogens in runoff.

The filter strip will be located immediately downslope from the source area of contaminants.

The drainage area immediately above the filter strip will have a slope of one percent or greater.

Vegetation. The filter strip will be established to permanent herbaceous vegetation.

Species selected will be:

- Able to withstand partial burial from sediment deposition.
- Tolerant of herbicides used on the area that contributes runoff to the filter strip.
- Stiff stemmed and a high stem density near the ground surface.
- Suited to current site conditions and intended uses including soil conditions, flooding, frequency, upland herbicide treatments, etc.
- Able to achieve adequate density and vigor within an appropriate period to stabilize the site sufficiently to permit suited uses with ordinary management activities.

Plant species, rates of seeding (lbs./acre), vegetative planting (plants/ac), minimum quality of planting stock (pure live seed [PLS] or stem caliper), and method of establishment shall be specified before application. Only viable, high quality seed or planting stock will be used.

Perform site preparation and seeding/planting at a time and in a manner that best ensures survival and growth of selected species. Successful establishment parameters, (e.g., minimum percent ground/canopy cover, percent survival, stand density) will be specified before application.

Schedule planting dates during periods when soil moisture is adequate for germination and establishment. Seeding will be timed so that tillage for adjacent crop does not damage the seeded filter strip.

Where the purpose is to remove phosphorus, remove (or harvest) the filter strip aboveground biomass at least once each year.

The minimum seeding and stem density will be equivalent to the seeding rate for a high quality grass hay seeding rate for the climate area or the density of vegetation selected in current water erosion technology to determine trapping efficiency, whichever is the higher seeding rate.

Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Irrigation Tailwater and Excessive Sediment in Surface Waters.

Filter strip vegetation will be a small grain or other suitable annual plant.

The seeding rate shall be sufficient to ensure that the plant spacing does not exceed 4 inches (about 16-18 plants per square foot).

Establish filter strips prior to the irrigation season so that the vegetation is mature enough to filter sediment from the first irrigation.

CONSIDERATIONS

General Considerations.

Filter strip width (flow length) can be increased as necessary to accommodate harvest and maintenance equipment.

Filters strips with the leading edge on the contour will function better than those with a gradient along the leading edge.

Seeding rates that establish a higher stem density than the normal density for a high quality grass hay crop will be more effective in trapping and treating contaminants.

When needed, invasive plant species may be controlled through mowing, herbicides, and hand weeding.

Consideration for Reducing Suspended Solids and Associated Contaminants in Runoff.

Increasing the width of the filter strip beyond the minimum required will increase the potential for capturing more contaminants in runoff.

Considerations for Creating, Restoring or Enhancing Herbaceous Habitat for Wildlife and Beneficial Insects and Pollinators.

Filter strips are often the only break in the monotony of intensively-cropped areas. The wildlife and pollinator benefits of this herbaceous cover can be enhanced by the following:

- When appropriate, use native grass species that fulfill the purpose(s) of the practice while also providing habitat for priority wildlife.
- Adding herbaceous plant species (including native forbs) to the seeding mix that are beneficial to wildlife and pollinators and are compatible for one of the listed purposes. Changing the seeding mix should not detract from the purpose for which the filter strip is established.
- Increasing the width beyond the minimum required. The additional area can increase food and cover for wildlife and pollinators.
- Management activities on filter strips (mowing, burning, or light disking), should not be done more often than every other year with frequency dependent on geographical location to maintain the purpose(s) of the practice.
- Management activities should be completed outside of the primary nesting, fawning, and calving seasons. Activities should be timed to allow for regrowth before the growing season ends.
- Organic producers should submit plans and specifications to their certifying agent for approval prior to installation, as part of the organic producer's organic system plan.

Considerations to Maintain or Enhance Watershed Functions and Values.

Filter strips may be used to enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed, enhance the aesthetics of a watershed, and be strategically located to reduce runoff, and increase infiltration and groundwater recharge throughout the watershed.

Increase Carbon Storage. Increasing the width of the filter strip beyond the minimum required will increase potential for carbon sequestration.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice will be prepared for each field or treatment unit. Record the specifications using the implementation requirements document. The specifications will identify at a minimum the following:

- Practice purpose(s).
- Length, width (width refers to flow length through the filter strip), and slope of the filter strip to accomplish the planned purpose(s).
- Plant species selection and seeding/planting/sprigging rates to accomplish the planned purpose.
- Planting dates and planting method(s).
- Specific care and handling requirements of the seed or plant material to ensure that planted materials have an acceptable rate of survival.
- A statement that only viable, high quality, and adapted seed will be used.
- Site preparation instructions sufficient to establish and grow selected species.

Operation and Maintenance:

- For the purposes of filtering contaminants, permanent filter strip vegetative plantings shall be harvested as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue.
- Control undesired weed species, especially State-listed noxious weeds.
- If prescribed burning is used to manage and maintain the filter strip, an approved burn plan must be developed.
- Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas, and take other measures to prevent concentrated flow through the filter strip.
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.
- Periodically regrade and reestablish the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function. Reestablish the filter strip vegetation in these regraded areas, if needed.
- If grazing is used to harvest vegetation from the filter strip, the grazing plan must ensure that the integrity and function of the filter strip is not adversely affected.

REFERENCES

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Natural Resources Conservation Service
Conservation Practice Standard

Residue and Tillage Management, No Till

Code 329
(Acre)

Definition

Limiting soil disturbance to manage the amount, orientation and distribution of crop and plant residue on the soil surface year round.

Purpose

- Reduce sheet, rill and wind erosion and excessive sediment in surface waters.
- Reduce tillage-induced particulate emissions.
- Maintain or increase soil health and organic matter content.
- Reduce energy use.
- Increase plant available moisture.
- Provide food and escape cover for wildlife.

Conditions Where Practice Applies

This practice applies to all cropland.

Criteria

General Criteria Applicable to All Purposes

- Residue shall not be burned.
- All residues shall be uniformly distributed over the entire field. Removing residue from the row area prior to, or as part of the planting operation is acceptable.
- This practice only involves an in-row soil disturbance operation during strip tillage, the planting operation, and a seed row/furrow closing device. No full width tillage shall be performed from harvest to harvest regardless of the depth of the tillage operation. No more than 30 percent of the entire soil surface shall be disturbed by the planting operation and associated nutrient placement activities, including injection of liquid manure.
- The annual Soil Tillage Intensity Rating (STIR) value for all field operations that are performed during the crop interval between harvest or termination of the previous crop and harvest or termination of the current crop (includes fallow periods). The STIR shall be no greater than 20.
- Manure injection will be allowed as long as all associated soil-disturbing activities are documented in the soil loss calculations and the resulting annual STIR value is no greater than 20.

Additional Criteria to Reduce Sheet/Rill and Wind Erosion, Reduce Excessive Sediment in Surface Water and Reduce Tillage-Induced Particulate Emissions

Soil erosion calculations shall account for the effects of all tillage passes and the effects of other conservation practices in the management system.

Use the current approved water and wind erosion prediction technology to determine:

- Minimum amount of randomly distributed surface residue needed,
- Time of year the residue needs to be present on the field, and
- The amount of surface soil disturbance allowed to reduce erosion to the desired level.

Additional Criteria to Maintain or Increase Soil Health and Organic Matter Content

Ensure the Soil Conditioning Index (SCI) for the cropping system results in a positive rating.

Additional Criteria to Increase Plant Available Water

- Maintain a minimum of 60 percent (2000 pounds) per acre of residue cover on the soil surface throughout the year.
- Maintain crop stubble height of at least 10-inches for row spacing less than 15-inches and at lease 15-inch stubble height for crop row spacing 15-inches or greater.
- To maximize retention of soil moisture, maintain crop residue standing during the winter period to trap snow.

Additional Criteria to Reduce Energy Use

Reduce the total energy consumption associated with field operations by at least 25 percent when compared to the benchmark conditions. Use the current approved NRCS tool for determining energy use to document energy use reductions.

Additional Criteria to Provide Food and Cover for Wildlife

Use an approved habitat evaluation to determine when residue needs to be present, the amount, orientation, and stubble height to provide adequate food and cover for target species.

Considerations

General Considerations

- Soil quality, porosity, and soil health will improve with each subsequent year of no till. Research has shown that maximum gain will be achieved after six consecutive years of no tillage.
- No till can reduce the potential for compaction by improving soil structure, infiltration rates and increasing the soil organic matter levels.
- Removing crop residue by baling or intensive grazing can have a negative impact on resources. These activities should not be performed without full evaluation of impacts on soil, water, animal, plant and air resources.
- Production of adequate crop residues to achieve the purpose of this practice can be enhanced through the use of:
    - » High residue producing crops and crop varieties.
    - » Cover crops, and double cropping.
    - » Increased plant populations through seeding rates and row spacing.

- Use of no till for all crops in the rotation or cropping system can enhance the positive effects of this practice by:
    - » Increasing the rate of soil organic matter accumulation.
    - » Keeping soil in a consolidated condition, which provides additional resistance to sheet and rill erosion.
    - » Sequester more carbon in the soil.
    - » Reducing the amount of particulate matter generated by field operations.
    - » Reducing energy inputs to establish crops.
    - » Increase formation of root channels and other near surface voids that increase infiltration.
- When providing technical assistance to organic producers, ensure residue management, and tillage management activities are consistent with the USDA Agricultural Marketing Service National Organic Program regulations.
- Residue should not be shredded after harvest. Shredding residue makes it more susceptible to movement by wind or water, and areas where residue accumulates may interfere with planting the next crop.

Considerations for Improving Soil Organic Matter Content and Improving Soil Health

Carbon loss is directly related to the volume of soil disturbed, the intensity of the disturbance, the soil moisture content and soil temperature at the time disturbance occurs. The following guidelines can reduce the loss of soil carbon:

- When deep soil disturbance is performed, such as by sub-soiling or fertilizer injection, make sure the vertical slot created by these implements are closed at the surface.
- Minimize soil disturbance at planting by using a single disk opener no-till drill, which will release less CO_2 and oxidize less organic matter.
- Limit soil disturbance when soil temperatures are above 50° F. Less oxidization occurs below 50° F.
- Maximize year round coverage of the soil with living vegetation (e.g. cover crops). Crop residue and living cover reduce soil temperature at hot, dry periods thereby slowing organic matter oxidation.
- Use a diverse crop rotation, incorporating multiple crop types (introduced grasses and legumes, warm-season grass and legume/forb) into the crop rotation.
- Plant a cover crop after every annual crop in the rotation to increase the time that roots are actively growing in the soil. Multi-species cover crop mixes provide greater benefits than single-specie cover crops.
- Implement management strategies to increase soil organic matter levels.
- Avoid planting or soil disturbance into wet soils to avoid compaction issues.

Considerations to Increase Plant-Available Moisture

- Leaving stubble taller than the 10-inch minimum required height to increase the relative humidity close to the soil surface and reduces the rate of evaporative loss from the soil.
- Leaving stubble taller than the 10-inch minimum height to trap more snow and provide better protection to plants from freezing or heat desiccation.
- Variable-height stubble patterns may be created to further increase snow storage.
- Performing all field operations on the contour will slow overland flow and allow more opportunity for infiltration.

Considerations for Wildlife Food and Cover

- Leave crop residues undisturbed after harvest (do not shred or bale) to maximize the cover and food source benefits for wildlife.
- Leaving rows of un-harvested crop standing at intervals across the field or adjacent to permanent cover to enhance the value of residues for wildlife food and cover. Leaving un-harvested crop rows for two growing seasons will further enhance the value of these areas for wildlife.

Plans and Specifications

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit. Specifications shall identify and include the following information in the conservation plan or job sheet:

- Resource concern to be treated or the purpose for applying the practice.
- Location Map.
- Planned crop(s).
- Summary of all field operations or activities that affect:
    - » Residue cover.
    - » Residue orientation.
    - » Disturbance of the soil surface.
- The amount of residue (pounds/acre or percent surface cover) required to accomplish the purpose, and the time of year it must be present.
- The planned maximum STIR value allowed to accomplish the purpose, and the time of year that soil disturbance is allowed.
- The minimum planned SCI value required to accomplish the purpose.
- The erosion rate.
- Target species of wildlife if applicable.
- Benchmark and planned fuel consumption if applicable.

Operation and Maintenance

Evaluate/measure the crop residues cover and orientation after each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to achieve planned residue amount and orientation, or adjust the planting and/or harvesting equipment.

Limited tillage is allowed to close or level ruts from harvesting equipment. No more than 10 percent of the field may be tilled for this purpose.

If the areas of heavy residue accumulation, as a result of movement by water, harvest equipment or wind in the field, spread the residue prior to planting so it does not interfere with planting operations.

Federal, Tribal, State and Local Laws

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

References

The following publications are available at the local NRCS field offices or on the Wisconsin NRCS home page located at http://www.wi.nrcs.usda.gov

Job Sheet 329: Residue and Tillage Management, No Till

Soil Conditioning Index Fact Sheet

Soil Tillage Intensity Rating Fact Sheet

USDA, Natural Resources Conservation Service, Tillage Equipment Pocket Identification Guide, 2005

USDA, Natural Resources Conservation Service, Wisconsin Agronomy Technical Note WI-4, Estimates of Residue Cover Remaining After Single Operation of Selected Machines

USDA, Natural Resources Conservation Service, Tillage Practice Guide, 2006

Additional Resources

Bolton, Ryan. 2003. Impact of the surface residue layer on decomposition, soil water properties and nitrogen dynamics. M.S. thesis. Univ. of Saskatchewan, Saskatoon, Saskatchewan, CA

Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO2 loss across an eroded landscape. Soil Tillage Res. 81:183-194

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting soil erosion by water: A guide to conservation planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture, Agriculture Handbook No. 703

Shaffer, M.J., and W.E. Larson (ed.). 1987. Tillage and surface-residue sensitive potential evaporation submodel. In NTRM, a soil-crop simulation model for nitrogen, tillage and crop residue management. USDA Conserv. Res. Rep. 34-1. USDA-ARS

Skidmore, E.L. and N.P. Woodruff. 1968. Wind erosion forces in the United States and their use in predicting soil loss. U.S. Department of Agriculture. Agriculture Handbook No. 346

USDA, Natural Resources Conservation Service, National Agronomy Manual, 190-V. 4th Ed.

Natural Resources Conservation Service
Conservation Practice Standard

Residue and Tillage Management, Reduced Till

Code 345
(Acre)

Definition

Managing the amount, orientation, and distribution of crop and other plant residue on the soil surface year round while limiting the soil-disturbing activities used to grow and harvest crops in systems where the entire field surface is tilled prior to planting.

Purpose

- Reduce sheet, rill, and wind erosion and excessive sediment in surface water - (Soil Erosion).
- Reduce tillage-induced particulate emissions - (Air Quality Impacts).
- Improve soil health and maintain or increase organic matter content - (Soil Quality Degradation).
- Reduce energy use - (Inefficient Energy Use).

Conditions Where Practice Applies

This practice applies to all cropland.

Criteria

General Criteria Applicable to All Purposes

This practice includes tillage methods commonly referred to as reduced (conservation/mulch) tillage where the entire soil surface is disturbed by tillage operations such as chisel plowing, field cultivating, tandem disking, or vertical tillage. It also includes tillage/planting systems with few tillage operations such as ridge till, hoe drills, air seeders, and certain “no till” drills that do not meet the STIR criteria for WI NRCS Conservation Practice Standard (WI NRCS CPS), Residue and Tillage Management, No Till (Code 329).

Residue shall not be burned.

Residues shall be uniformly distributed over the entire field. Removing residue from the row area prior to or as part of the planting operation is acceptable.

Minimum planned residue levels will be maintained from harvest until after planting of the next crop. Removing residue from the row area prior to or as part of the planting operation is acceptable.

The Soil Tillage Intensity Rating (STIR) value shall include all field operations that are performed during the crop interval between harvest of the previous crop and harvest or termination of the current crop (includes fallow periods).

The annual STIR value rating shall be no greater than 80, and no primary inversion tillage implements such as a moldboard plow shall be used.

Additional Criteria to Reduce Sheet/Rill and Wind Erosion and Excessive Sediment in Surface Waters

Soil loss estimates shall be calculated for the dominate critical soil map units using the current erosion prediction technology.

Use the current water and/or wind erosion prediction model to document/determine:

- Minimum amount of randomly distributed surface residue required,
- Time of year the residue needs to be present on the field,
- The amount of surface soil disturbance allowed to reduce erosion to the desired level. All practices on the management system will be reflected,
- For ridge-till systems, plan ridge height and ridge orientation to manage runoff and to minimize erosion, ridges shall have a maximum row grade of 4 percent.

Additional Criteria to Reduce Tillage Induced Particulate Emissions

Reduce or modify tillage operations that create dust, especially during critical air quality periods.

Avoid tillage activities during periods when the soil is most vulnerable to wind erosion.

Additional Criteria to Maintain or Increase Soil Health and Maintain or Increase Organic Matter Content

Ensure the Soil Conditioning Index (SCI) for the cropping system results in a rating of greater than zero.

Additional Criteria to Reduce Energy Use

Reduce the total energy consumption associated with field operations by at least 25 percent compared to the benchmark condition. Use the current approved NRCS tool for determining energy use to document energy use reductions.

Considerations

General Considerations

Removal of crop residue, such as baling or grazing, can have a negative impact. These activities should not be performed without full evaluation of impacts on soil, water, animal, plant, and air resources.

Reduced till may be practiced continuously throughout the crop sequence, or may be managed as part of a residue management system that includes other tillage methods such as no till.

Production of adequate amounts of crop residue necessary for the proper functioning of this practice can be enhanced by selection of high residue producing crops and crop varieties in the rotation, use of cover crops and adjustment of plant populations and row spacing.

When providing technical assistance to organic producers, ensure residue and tillage management activities are consistent with the USDA - Agricultural Marketing Service National Organic Program Regulations.

Considerations for Maintaining or Improving Soil Organic Matter Content and Soil Health

Carbon loss is directly related to the volume of soil disturbed, intensity of soil disturbance, soil moisture content, and soil temperature at the time the disturbance occurs. The following guidelines can make this practice more effective:

- When deep soil disturbance is performed, such as by sub-soiling or fertilizer injection, make sure the vertical tillage slot created by these implements is closed at the surface.
- Minimize soil disturbance by planting with a single-disk opener, planter or no-till drill.
- Soil disturbance that occurs when soil temperatures are below 50° F release less CO_2 than operations done on warmer soils, thus reducing organic matter losses.
- Use a diverse crop rotation, incorporating multiple crop types (cool-season grass, cool-season legume/forb, warm-season grass, warm-season legume/forb) into the crop rotation.
- Maximizing year round coverage of the soil with living vegetation and/or crop residues builds organic matter and reduces soil temperature there by slowing organic matter depletion by oxidation.
- Plant a cover crop after every annually tilled crop in the rotation to increase the time the roots are actively growing in the soil. Multi-species cover crop mixes provide greater benefits than single-specie cover crops.
- Use undercutting tillage tools rather than burying tillage tools to enhance accumulation of organic material in the surface layer.
- Conduct soil-disturbing field operation when soil moisture is optimal, in order to maintain soil tilth, and reduce the need for additional tillage in the future.

Additional Considerations for Wildlife Food and Cover

Avoid tillage and other soil and residue/stubble disturbing operations during the nesting season and brood-rearing period for ground-nesting species.

Leave crop residues undisturbed after harvest (do no shred, bale, or till) to maximize the cover and food source benefits to wildlife during critical winter months.

Leaving rows of un-harvested crops standing at intervals across the field or adjacent to permanent cover will enhance the value of residues for wildlife food and cover. Leaving un-harvested crop rows for two growing seasons will further enhance the value of these areas for wildlife.

Use approved habitat evaluation procedure to determine the appropriate time and amount of residue and stubble needed to provide adequate food and cover for target wildlife species.

Plans and Specifications

Specifications for establishment and operation of this practice shall be prepared for each field or treatment unit. Record the following as documentation:

1. Resource concern to be treated or the purpose for applying the practice.
2. Location map with planned crops identified.
3. Summary of all field operations or activities that affect:
    - Amount of residue produced for each crop
    - Amount of residue cover with all field operations reflected

- Residue orientation
- Disturbance of the soil surface including all disturbances

4. The amount of residue (pounds/acre or percent surface cover) required to accomplish the planned purpose, and the time of year it must be present.
5. The maximum STIR value allowed to accomplish the planned purpose, and the time of year soil disturbance is allowed.
6. The minimum Soil Conditioning Index (SCI) value required to accomplish the purpose.
7. Erosion rate.
8. Benchmark and planned energy consumption.

Operation and Maintenance

Evaluate/measure the crop residues cover and orientation for each crop to ensure the planned amounts and orientation are being achieved. Adjust management as needed to achieve planned residue amount and orientation. Adjust planting, tillage or harvesting equipment.

If there are areas of heavy residue accumulation as a result of harvest equipment or movement by water or wind in the field, spread the residue prior to planting so it does not interfere with planter operation.

Federal, Tribal, State and Local Laws

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

References

Soil Conditioning Index Fact Sheet located in the Conservation Planning section of Wisconsin's NRCS web page.

Soil Tillage Intensity Rating Fact Sheet located in the Conservation Planning section of Wisconsin's NRCS web page.

USDA, Natural Resources Conservation Service, Tillage Equipment Pocket Identification Guide, 2005.

USDA, Natural Resources Conservation Service, Wisconsin Agronomy Technical Note WI-4, Estimates of Residue Cover Remaining After Single Operation of Selected Machines.

USDA, Natural Resources Conservation Service, Tillage Practice Guide, 2006.

Kuepper, George, 2001. Pursuing conservation tillage systems for organic crop production—ATTRA.

http://attra.ncat.org/attra-pub/organicmatters/conservationtillage.html

Reicosky, D.C., M.J. Lindstrom, T.E. Schumacher, D.E. Lobb and D.D. Malo. 2005. Tillage-induced CO2 loss across an eroded landscape. Soil Tillage Res. 81:183-194.

Reicosky, D.C. 2004. Tillage-induced soil properties and chamber mixing effects on gas exchange. Proc. 16th Triennial Conf., Int. Soil Till. Org. (ISTRO).

USDA, Natural Resources Conservation Service, National Agronomy Manual, 190-V. 4th Ed.

Natural Resources Conservation Service
Conservation Practice Standard

WASTE TREATMENT

Code 629
(No.)

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 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.

   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; and
   - 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 percent passing the No. 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 Conservation Practice Standard (WI NRCS CPS) Waste Storage Facility (Code 313), 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 NRCS CPS Waste Transfer (Code 634),
- 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 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:

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 percent 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.

4. 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 NRCS CPS Vegetated Treatment Area (Code 635).

5. 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.

6. 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 Criteria - Section 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 unless a liquid-tight concrete or concrete-composite liner is used. 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 and initial runoff volume shall be collected and conveyed to a transfer and/or storage system.

      2) The leachate design volume is

based on the harvest that will produce the largest silage weight. The leachate design volume is ½ cubic foot of leachate per ton of stored feed. This represents the estimated 30-day volume. Unless determined otherwise, use 33.3 cubic feet per ton of stored feed.

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

4) Storage or transfer systems that require manual empting shall be sized to contain a minimum of 20 percent of the leachate design volume and any initial runoff volume collected.

5) Transfer – All transfer components (pipes, reception structures, tanks, and channels) shall meet the criteria contained in WI NRCS CPS Waste Transfer (Code 634). 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 NRCS CPS Waste Storage Facility (Code 313). Leachate and/or contaminated runoff are considered to be less than 2 percent 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 NRCS CPS Critical Area Planting (Code 342).

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) Note 1	---	≥ 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 Note 4, 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 Note 4, over non-woven geotextile Note 5	
• Soil Note 6	Increase earthen liner thickness by ≥ 2 feet	
4. Separation Distances Note 7		
• 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, non-woven 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 Note 1	Placed under crushed stone surface - 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) Placed under concrete or asphalt pavement surface - 40 mil HDPE, 40 mil VFPE, 40 mil LLDPE, or 45 mil EPDM
2. Leachate Drainage Layer Note 2	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 Note 3 over non-woven geotextile Note 4
4. Separation Distances Note 5	
• 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 non-woven. 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			
• 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 1 criteria, then Table 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 percent 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 NRCS CPS Waste Separation Facility (Code 632).

   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 NRCS CPSs Waste Transfer (Code 634), and Waste Storage Facility (Code 313).

   Byproducts land applied to supply plant nutrients shall meet the criteria in WI NRCS CPS Nutrient Management (Code 590).

   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 – 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 – Water movement in a surface drainage feature including, but not necessarily limited to: swales, draws, grassed waterways, ditches, gullies, creeks, or rivers.

Confined Space – 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 – 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 – 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 – 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 – 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 – 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.

Flood Prone Areas – 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 – 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 – 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 – 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 – Concentrated liquid which has percolated through or drained from animal feed. It contains much higher concentrations of contaminants than Contaminated Runoff.

Leachate Drainage Layer – Material that allows leachate to flow to a collection point.

Milking Center – 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 – 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 – 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 – Perched conditions describe a soil moisture regime where saturated soil is located above unsaturated soil.

Permanent feed storage area – An area used to store livestock feed for more than 12 months at one location.

Sinkholes – 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 – 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 – 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 – Lakes, ponds, wetlands, open channel flow, grassed waterways, streams, sinkholes and karst features.

Tower Silo – Vertical high moisture feed storage structure confined on the sides and bottom.

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

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