



September 21, 2015

WISCONSIN FIELD OFFICE TECHNICAL GUIDE
450-11-TECHNICAL GUIDE
FOTG NOTICE WI-74

SUBJECT: WISCONSIN FIELD OFFICE TECHNICAL GUIDE

Purpose: Revisions to Wisconsin Conservation Practice Standards and Specifications

The following revisions to the Wisconsin FOTG have been posted on the Wisconsin e-FOTG website:

Section IV: Conservation Practice Standards and Specifications:

- Index
- Conservation Crop Rotation (Code 328)
- Denitrifying Bioreactor (Code 605)
- Forest Stand Improvement (Code 666)
- Forest Trails and Landings (Code 655)
- Phosphorus Removal System (Interim Code 782)
- Seasonal High Tunnel System (325)
- Roof Runoff Structure (Code 558)
- Wetland Enhancement (Code 659)
- Forest Trails and Landings Job Sheet (Code 655)
- Managed Grazing Conservation Reserve Program Job Sheet (Code 147)
- Tree and Shrub Establishment Job Sheet (612)
- Aluminum or Steel Roof Gutters (Specification 23)

Explanation of Changes/Revisions:

Conservation Crop Rotation (Code 328) – The revised standard incorporates minor changes to the national standard and specifications.

Denitrifying Bioreactor (Code 605) – New standard.

Forest Stand Improvement (Code 666) – The revised standard incorporates minor changes to the national standard and specifications.

Forest Trails and Landings (Code 655) – The revised standard incorporates minor changes to the national standard and specifications.

Phosphorus Removal System (Interim Code 782) – New interim standard for use primarily within GLRI.

Roof Runoff Structure (Code 558) – The revised standard incorporates minor changes to the national standard and specifications.

Seasonal High Tunnel System (Code 325) – The revised standard incorporates minor changes to the national standard and specifications. Code was changed from 798 to 325.

Wetland Enhancement (Code 659) – The revised standard incorporates minor changes to the national standard and specifications.

Aluminum or Steel Roof Gutters (Specification 23) – Section 2 c. Wood paragraph updated to include the sentence “Lumber treated with micronized copper and labeled for “above ground use” may be used in direct contact with aluminum and steel.

Remove the following outdated Standards and Specifications from any printed copies of the WI FOTG:

- Index
- Conservation Crop Rotation (Code 328)
- Forest Stand Improvement (Code 666)
- Forest Trails and Landings (Code 655)
- Roof Runoff Structure (Code 558)
- Seasonal High Tunnel System (Code 325)
- Wetland Enhancement (659)
- Aluminum or Steel Roof Gutters (Specification 23)

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

- Index
- Conservation Crop Rotation (Code 328)
- Denitrifying Bioreactor (Code 605)
- Forest Stand Improvement (Code 666)
- Forest Trails and Landings (Code 655)
- Phosphorus Removal System (Interim Code 782)
- Roof Runoff Structure (558)
- Seasonal High Tunnel System (Code 325)
- Wetland Enhancement (Code 659)
- Aluminum or Steel Roof Gutters (Specification 23)

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/>



JIMMY BRAMBLETT
State Conservationist

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Natural Resources Conservation Service
Conservation Practice Standard

CONSERVATION CROP ROTATION

Code 328
(Acres)

I. DEFINITION

A planned sequence of crops grown on the same ground over a period of time known as the rotation cycle.

II. PURPOSE

This practice is applied to support one or more of the following purposes:

- Reduce sheet, rill and wind erosion.
- Maintain or increase soil health and organic matter content.
- Reduce water quality degradation due to excess nutrients.
- Improve soil moisture efficiency.
- Reduce plant pest pressures.
- Provide feed and forage for domestic livestock.
- Provide food and cover habitat for wildlife, including pollinator forage, and nesting.

III. CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all cropland where at least one annually-planted crop is included in the crop rotation.

IV. CRITERIA

A. General Criteria Applicable To All Purposes

Crops shall be grown in a planned sequence as outlined in Plans and Specifications. The crop rotation shall include a minimum of two different crops. For purposes of these criteria, a cover crop is considered a different crop.

Where applicable, plan suitable crop substitutions when the planned crop cannot be planted due to weather, soil conditions, or other local situations.

B. Additional Criteria to Reduce Sheet, Rill and Wind Erosion

Select crops, a tillage system, and cropping sequences that will produce sufficient and timely quantities of biomass or crop residue which, in conjunction with other practices in the management system, will reduce sheet, rill and wind erosion to the planned soil loss objective.

Determine the amount of biomass or crop residue needed by using current approved erosion prediction technology.

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

Grow crops that will produce a positive trend in the Organic Matter (OM) subfactor value over the life of the rotation, as determined by the Soil Conditioning Index. Make appropriate adjustments for additions to or subtractions for biomass.

D. Additional Criteria to Reduce Water Quality Degradation Due to Excess Nutrients

To recover excess nutrients from the soil profile, use crops with:

- Quick germination and root system formation,
- A rooting depth sufficient to reach the nutrients not removed by the previous crops, and
- Nutrient requirements that readily utilize the excess nutrients.
- Credit nutrients provided by legumes and manure/compost.

E. Additional Criteria to Improve Soil Moisture Efficiency

Select crops, varieties of crops, and the sequence of crops based on local climate patterns, soil conditions, and irrigation water availability.

F. Additional Criteria to Reduce Plant Pest Pressures

Design the crop sequence to suppress the pest(s) lifecycle of concern, which may include weeds, insects, and pathogens. Use University of Wisconsin or industry standards to determine a suitable crop sequence.

G. Additional Criteria to Provide Feed and Forage for Domestic Livestock

Select crops that balance the feed supply with livestock numbers. Determine the required amount of selected crops using an approved forage-livestock balance procedure.

H. Additional Criteria to Provide Food and Habitat for Wildlife, Including Pollinator Forage, and Nesting

Select the crops and crop management activities that provide either food or cover for the targeted wildlife species using an approved habitat evaluation procedure.

V. CONSIDERATIONS

When used in combination with Wisconsin NRCS Conservation Practice Standard (WI CPS) Stripcropping (585), the crop sequence should be consistent with the stripcropping design.

Crop rotation can be beneficial in removing excess plant nutrients. Whole plant harvest as forage will further enhance nutrient uptake.

Soil compaction can be reduced by adjusting crop rotations to include deep rooting crops with deep roots that extend to and penetrate compacted soil layers.

Where improving water use efficiency on deep soils is a concern, rotating or combining deep-rooted crops with shallow rooted crops can help utilize all available water in the soil profile.

Select crops that have the potential to provide larger amounts of biologically fixed nitrogen.

A. Considerations to Reduce Water Quality Degradation Due to Excess Nutrients

Include perennial or annual legume crops in the rotation to provide nitrogen for the non-legume crops, especially in fields where manure applications are restricted by high or excessive soil phosphorus or potassium levels.

Use carbon/nitrogen ratio of 25:1 to 35:1 crop residues returned to the soil throughout the rotation. This ratio can build the soil's capacity to provide slow-release N to crops while minimizing N leaching.

B. Considerations to Increase Cropping System Diversity

Minimize the fallow years in the rotation and where the climate and soils are favorable establish cover crops during the fallow periods.

For crop diversity, the planned crop sequence should contain different crop types; for example a mix of the following: warm season grass; warm season broadleaf; cool season grass; cool season broadleaf.

- A two-crop sequence that contains a warm season and a cool season crop.
- A three-crop sequence that contains warm and cool season crops. The same crop species should not be grown in successive years in the same field.
- A four-crop sequence that contains two different crop types, neither should occupy more than half of the sequence.
- Longer crop sequences (four or more years) are more effective with no more than two consecutive years with the same crop.

C. Additional Considerations to Reduce Sheet and Rill or Wind Erosion.

When used in combination with WI CPS Residue and Tillage Management (329 and 345), selection of high-residue producing crops and varieties, use of cover crops and adjustment of plant density and row spacing can enhance production of the kind, amount, and distribution of residue needed.

When used in combination with WI CPS Stripcropping (585) or Contour Buffer Strips (332) on steeper slopes, the effectiveness of each practice is significantly enhanced by inclusion of the other practice(s) in the conservation system.

Crop damage by wind erosion can be reduced with this practice by selecting crops that are tolerant to abrasion from windblown soil or tolerant to high wind velocity.

If crops sensitive to wind erosion damage are grown, the potential for plant damage can be reduced by crop residue management, field windbreaks, herbaceous wind barriers, intercropping, or other methods of wind erosion control.

D. Additional Considerations to Improve Soil Health

Consider including perennial sod crops with deep or extensive fibrous root systems to build organic matter throughout the soil profile.

Reduce the intensity of tillage and increase soil surface coverage with vegetation and crop residues.

The effects of this practice can be enhanced by utilizing animal wastes, green manure crops (cover crops), or applying non-synthetic mulches to supplement the biomass produced by crops in the rotation.

Other considerations for soil health/ organic matter management include:

- For at least one-third of the crop sequence (time basis) include high-biomass annual or perennial crops.

- Utilize cover crops and high residue production crops comprising at least one-half of the rotation sequence.
- For rotations dominated by low-residue crops, such as vegetables, include sufficient cover crops and high residue crops for one-half the rotation.

E. Additional Considerations to Reduce Plant Pest Pressures

Consider lengthening the rotation to include several years of perennial cover to break pest life cycles.

Use a mix of crops from at least three different plant families, and allow three years or longer between successive plantings of production crops within the same family.

Enhance biological pest control by designing the crop rotation to:

- Include flowering annuals or perennials that provide food and habitat for beneficial insects, such as buckwheat, clovers, or Phacelia.
- Include plant species that release into the soil, natural substances that suppress plant pathogens, nematodes or pests (bio-fumigation).
- Include crops in the rotation that provide habitat for natural enemies of pests.
- Retain bolting or flowering crops after harvest to provide food for beneficial insects.

F. Additional Considerations to Provide Food and Cover Habitat for Wildlife, Including Pollinator Forage, and Nesting

Crop residues may be a valuable food source for wintering wildlife where winter browse is sparse. Leaving several rows un-harvested around the edges of the field, or planting borders of various forbs, will provide protection and/or food for overwintering wildlife and for beneficial insects and pollinators.

Crop plantings may be developed to benefit particular communities, species, or life stages of wildlife. Food plots

or crops for wildlife can provide part of a habitat restoration, an initial food and cover for wildlife until food and cover producing vegetation becomes established.

Retaining bolting or flowering crops after harvest may provide beneficial insects with an important food source.

Careful consideration should be given to pesticides applied to crops raised for wildlife, particularly if nesting habitat or pollinator forage species are present.

When insect-pollinated crops are part of the rotation, planting the insect-pollinated crop no more than 800 feet from their previous location may help maintain local populations of native bees that have become established because of the presence of that crop.

To maintain stable pollinator and beneficial insect populations, ensure that the same overall density of floral resources is maintained from year-to-year. For example two years of flower-rich plantings, followed by a year of only grasses, will cause a rapid decline in pollinator populations.

VI. PLANS AND SPECIFICATIONS

Develop plans and for each field or treatment unit according to the Criteria and Operation and Maintenance requirements of this standard. Specifications shall describe the requirements to apply this practice to achieve the intended purpose. The following items will be documented as a minimum:

- Field number and acres,
- Purpose(s) of the crop rotation,
- The sequence of crops to be grown,
- The crop types to be grown,
- Tillage type and dates of each operation,
- Length of time each crop/crop type will be grown in the rotation, and
- Total length of rotation
- Suitable crop substitutions to address weather, soil conditions, market, or other situations that may prevent the planned crop from being planted.

VII. OPERATION AND MAINTENANCE

Rotations shall provide for acceptable substitute crops in case of crop failure or shift in planting intentions for weather related or economic reasons. Acceptable substitutes are crops having similar characteristics that will accomplish the purpose of the original crop.

Evaluate the rotation and the crop sequence to determine if the planned system is meeting the planned purposes.

VIII. 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 conservation crop rotation. This standard does not contain the text of federal, tribal, state or local laws.

IX. REFERENCES

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USDA, NRCS. 2014. Preventing or mitigating potential negative impacts of pesticides on pollinators using IPM and other conservation practices. Nat. Agron. Tech Note 9. Washington, DC. <http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=34828.wba>

DEFINITION

A planned sequence of crops grown on the same ground over a period of time which is referred to as the rotation cycle.

PURPOSE

- » Reduce sheet, rill and wind erosion
- » Maintain or increase soil health and organic matter content
- » Reduce water quality degradation due to excess nutrients
- » Improve soil moisture efficiency
- » Reduce plant pest pressures
- » Provide feed and forage for domestic livestock
- » Provide food and cover habitat for wildlife, including pollinator forage, and nesting



PLANS AND SPECIFICATIONS

Develop plans and for each field or treatment unit according to the Criteria and Operation and Maintenance requirements of this standard. Specifications shall describe the requirements to apply this practice to achieve the intended purpose. The following items will be documented as a minimum:

- » Field number and acres,
- » Purpose(s) of the crop rotation,
- » The sequence of crops to be grown,
- » The crop types to be grown,
- » Tillage type and dates of each operation,
- » Length of time each crop/crop type will be grown in the rotation, and
- » Total length of rotation
- » Suitable crop substitutions to address weather, soil conditions, market, or other situations that may prevent the planned crop from being planted.

OPERATIONS AND MAINTENANCE

Rotations shall provide for acceptable substitute crops in case of crop failure or shift in planting intentions for weather related or economic reasons. Acceptable substitutes are crops having similar characteristics that will accomplish the purpose of the original crop.

Acceptable substituted crops are those that offset the crop residue levels and do not increase soil loss or decrease Soil Condition Index. Examples may include: increasing hay in rotation, small grains for row crops, corn grain rather than corn for silage, or corn grain in place of soybeans. Always make certain RUSLE2 shows the soil loss is acceptable and the Soil Condition Index has not been reduced.

Evaluate the rotation and the crop sequence to determine if the planned system is meeting the planned purposes.



CONSERVATION CROP ROTATION

Client Name: _____ Planner: _____

PRACTICE PURPOSE

- Reduce sheet, rill and wind erosion
- Reduce plant pest pressures
- Maintain or increase soil health and organic matter content
- Provide feed and forage for domestic livestock
- Reduce water quality degradation due to excess nutrients
- Improve soil moisture efficiency
- Provide food and cover habitat for wildlife, including pollinator forage, and nesting

Producer:	Tract:	Tract:	Tract:	Tract:	Tract:	Tract:	
Fields:	Fields:	Fields:	Fields:	Fields:	Fields:	Fields:	
**List all fields that share this tillage/rotation:							
Year in rotation:	1st	2nd	3rd	4th	5th	6th	7th
Crop							

Notes:

Corn Production	Alfalfa/Hay Production	Other crop (details) Crop Name:
Planter type: _____ Row spacing: _____ Planter attachments (coulters, etc.): _____ Other residue removal (gleaning, etc.): _____	Seeding: <input type="checkbox"/> Direct seed <input type="checkbox"/> With nurse crop Seeding: <input type="checkbox"/> Straight alfalfa <input type="checkbox"/> Grass mix Seeding: <input type="checkbox"/> Spring <input type="checkbox"/> Fall If nurse crop: <input type="checkbox"/> Forage <input type="checkbox"/> Grain Alfalfa/Hay seeding rates: _____	Seeding date: _____ Harvest date: _____ Planter type: _____ Row spacing: _____ Residue removed: <input type="checkbox"/> Yes <input type="checkbox"/> No
Small Grain Production	Soybean Production	
Used as cover crop: <input type="checkbox"/> Yes <input type="checkbox"/> No Seeding date: _____ Planter type: _____ Used as forage: <input type="checkbox"/> Yes <input type="checkbox"/> No Date removed: _____	Row spacing: <input type="checkbox"/> Narrow (-10) <input type="checkbox"/> Wide (+10) No till: <input type="checkbox"/> Yes <input type="checkbox"/> No Type of drill/planter: _____ <input type="checkbox"/> Double disk w/ coulters & airway <input type="checkbox"/> Single disk <input type="checkbox"/> Double disk & airway	



PRACTICE CERTIFICATION

Contract Number	Contract Item Number (CIN)	Tract Number	Field Number(s)	Acres Planned	Actual Acres Applied (NRCS USE ONLY)

COST SHARE DOCUMENTATION

Before payment can be made, the following information is required to be in the case file:

- ⇨ Location map with fields and acres identified
- ⇨ Photographs of crops being grown
 - » Statement "photo was taken in the field by _____ (name)"
 - » Date photo was taken in the field
 - » Statement of what the photo represents if clarification is needed
- ⇨ Field verification is documented and certified planner verified "as installed" this practice meets the NRCS standards and specifications

Practice Certification (NRCS USE ONLY)

I certify that the practice as installed is complete and meets the applicable Wisconsin NRCS Conservation Practice Standard and all applicable practice specifications. Any changes to the original practice design have been approved and are documented on the original practice design "as installed."

Certified Planner (print) _____ (sign) _____ Date _____



STATEMENT OF WORK

USDA, Natural Resources Conservation Service Wisconsin

Conservation Crop Rotation (328)

DESIGN (911)

Deliverables:

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices
 - a. List all required and/or facilitating practices.
 - b. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
 - i. Crops to be grown.
 - ii. Sequence of crops and length of crop rotation.
 - iii. Soil loss estimates utilizing RUSLE2.
 - iv. Soil quality considerations.
 - v. Wildlife considerations.
2. Written plans and specifications including location map, sketches, drawings shall be provided to the client that adequately describes the requirements to apply the practice and obtain necessary permits. Plans and specifications shall be developed in accordance with the requirements of the conservation practice standard for Conservation Crop Rotation (Code 328).
3. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
4. Documentation requirements for design modifications during practice installation.
5. Itemized cost estimate.

INSTALLATION (912)

Deliverables:

1. Documentation of pre-application conference with client.
2. Verification that client has obtained required permits.
3. Application guidance as needed.
4. Facilitate, implement and document required design modifications with client, original designer, permitting and funding agencies.
5. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during application.
6. Certification that the application process and materials meets design and permit requirements.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Conservation Crop Rotation (328)

CHECKOUT (913)

Deliverables:

1. Records of application.
 - a. Extent of practice units applied and location identified on a map.
 - b. Revised RUSLE2 calculations and where applicable Soil Conditioning Index calculations as necessary.
2. Certification that the application meets NRCS standards and specifications and is in compliance with permits.
3. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
 - a. Technical Service Provider Name
 - b. Customer name
 - c. USDA program funding the practice (if known)
 - d. Location of work (state, county, conservation district, land tract identifier)
 - e. Land use of field where the practice was installed (cropland, etc.)
 - f. NRCS practice name and quantity of practice installed in appropriate units
4. Documentation of exit conference with client and contractor.

REFERENCES

- WI NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard Conservation Crop Rotation (328)
- NRCS National Agronomy Manual
- NRCS National Biology Manual
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

CERTIFICATION OF COMPLETION
USDA, Natural Resources Conservation Service
Wisconsin

Conservation Crop Rotation (328)

Program Participant Information

Name (print): _____

Contract Number: _____ Contract Item #(s): _____

Technical Service Provider Information

Name (print): _____

TSP ID Number: _____ Expiration Date: _____

Technical Service Provided

- Design (911)
- Installation (912)
- Checkout (913)

I hereby certify that the technical services I provided as a Technical Service Provider for this component(s) checked above: (1) comply with all applicable Federal, State, Tribal, and Local laws and requirements, (2) meet applicable USDA NRCS conservation practice standards, specifications, and program requirements, (3) are consistent with and meet the particular conservation program goals and objectives, (4) that I have provided the above named Program Participant the Deliverables in this Statement of Work for this component, and (5) comply with all "Certification Terms" as identified in the Technical Service Provider Certification Agreement.

Technical Service Provider Signature

Date

Received By (NRCS Staff)

Date

Natural Resources Conservation Service
Conservation Practice Standard

DENITRIFYING BIOREACTOR

Code 605
(Acre)

DEFINITION

A structure that uses a carbon source to reduce the concentration of nitrate nitrogen in subsurface agricultural drainage flow via enhanced denitrification.

PURPOSE

This practice is applied to achieve the following purpose:

Improve water quality by reducing the nitrate-nitrogen content of subsurface agricultural drainage flow.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to sites where there is a need to reduce nitrate nitrogen concentration in subsurface drainage flow.

This practice does not apply to underground outlets from practices such as terraces, where the drainage source is primarily from surface inlets.

CRITERIA

General Criteria Applicable to All Purposes

Performance and Capacity. Design the capacity of the bioreactor based on one of the following:

- Treat peak flow from a 10-year, 24-hour drain flow event.
- Treat at least 15 percent of the peak flow from the drainage system.
- Treat at least 60 percent of the long-term average annual flow from the drainage system using locally proven criteria (e.g., drainage coefficient).

Disregard flow from surface inlets when calculating design subsurface drain flow for capacity purposes.

Design the bioreactor hydraulic retention time for a minimum of 3 hours at the peak flow capacity. Account for the porosity of the media and use the average depth of flow through the media. The

effective volume of the reactor is calculated as:

$$V = L \times W \times (d_{in} - d_{out})/2 \times P$$

Where:

V = effective volume of media (ft³)

L and W are the length and width of media chamber (ft)

d_{in} and d_{out} are the depth of the inlet water and outlet water (ft)

P is the porosity of the material (decimal percentage)

Design the bioreactor to achieve at least a 30-percent annual reduction in the nitrate-nitrogen load of the water flowing through the bioreactor.

If reducing conditions may result in the production of methyl mercury, make additional provisions to ensure that stagnant conditions do not develop in the media chamber.

Media Chamber. Use a medium for the carbon source that is reasonably free from dirt, fines, and other contaminants. Distribute the media within the bioreactor to achieve a uniform flow path.

Use geotextile or plastic lining for the bottom, sides, and top of the bioreactor as needed to prevent migration of soil particles into the bioreactor and minimize bypass of treatment flow by leaching from the media chamber.

Design the bioreactor media for an expected life of at least 10 years. To create a longer lifespan, provide provisions for periodic renewal of the media.

Design the media chamber to prevent development of preferential flow pattern. For a media chamber with a length to width ratio of 4:1 or greater, use a perforated distribution pipe at the chamber inlet and a perforated collection pipe at the chamber outlet. For wider chambers, design a multiple-header distribution system so that the

width served by each header is no greater than 25 percent of the chamber length.

Specify the carbon media that goes in the chamber. If wood chips are the media, specifically note that no high tannin content wood such as oak, cedar or redwood are to be used. Do not use any wood that has been treated for ground contact.

Water Control Structures. Design the bioreactor inlet and outlet water control structures to provide the required capacity and hydraulic retention time. Use the criteria in Wisconsin NRCS Conservation Practice Standard (WI CPS) *Structure for Water Control (587)*, for the design.

Select or design water control structures that control the upstream water elevation and provide safe bypass of flows in excess of the design capacity.

Select a design water surface elevation at the upstream water control structure that will prevent upslope crop damage from an elevated water table.

Provide a low elevation orifice or opening of some type on the outlet structure to assure the media chamber drains in a maximum of 48 hours during periods of no-drain flow.

Provide an outlet that will completely drain the media chamber to facilitate bioreactor management and maintenance.

Protection. Protect the bioreactor from intermittent surface storm flows that could result in flushing out of the established biofilm.

Construct the ground surface above the bioreactor to shed water and to allow for settlement. Dispose of excess soil excavated during the installation of the bioreactor by blending with the adjacent landscape or hauling away.

To prevent compaction of the bioreactor media, identify the bioreactor location with appropriate signage or fence the site to avoid equipment travel over the bioreactor. If there will be equipment traffic for mowing or other purposes provide adequate cover to prevent damage to the bioreactor.

During release of tile drainage water from the water control structures, flow velocity in the tile lines must not exceed the maximum velocity prescribed by WI CPS *Subsurface Drain (606)*.

Protect all disturbed noncrop construction areas by seeding or mulching within 14 days of construction. See WI CPS *Critical Area Planting (342)*, for criteria on seed selection, seedbed preparation, fertilizing, and seeding. For installation of the denitrifying bioreactor in an existing filter strip or other conservation practice, revegetate disturbed areas according to the seeding requirements of the conservation practice disturbed by construction.

CONSIDERATIONS

Other practices and management systems can achieve a reduction of nitrate-nitrogen levels separately or in conjunction with the denitrifying bioreactor. Examples include WI CPS *Nutrient Management (590)*; *Cover Crop (340)*; and *Drainage Water Management (554)*.

Determining the normal nitrate levels expected in the tile discharge water prior to design work will aid in establishing design parameters.

Add inoculants to improve the function of the bioreactor.

Mix inert materials such as gravel with the required amount of reactive carbon source to provide the required bioreactor volume, porosity, and flow rate.

Situating the bioreactor on a low bench will minimize interference with the drainage needs of the area served during the growing season.

Exclude surface water from the bioreactor as much as possible by selecting a location away from areas that will pond surface water during storm events.

When designing the bioreactor using methods based on a percentage of the peak flow from the drainage system, target 15 to 20 percent of peak flow for best performance.

Be aware of the effects on downstream flows or aquifers that would affect other water uses or users. For example, the initial flow from the bioreactor at start up may contain undesired contaminants.

If site topography is such that planned elevated water table upstream of the bioreactor might negatively affect crop performance, manage water levels at the upstream end of the bioreactor according to criteria in WI CPS *Drainage Water Management (554)*.

Maintain the design water elevations throughout the year if an elevated water table upstream of the bioreactor will not negatively affect crops.

PLANS AND SPECIFICATIONS

Develop plans and specifications for the denitrifying bioreactor that describe the requirements for applying the practice to achieve its intended purpose.

As a minimum, the plans and specifications should include:

- A plan view of the layout of the denitrifying bioreactor and associated components
- Typical cross section(s) of the bioreactor
- Profile(s) of the bioreactor including inlet(s) and outlet(s)
- Details of required structures for water level control
- Material specifications for the bioreactor media
- Seeding requirements, if needed
- Construction specifications describing site-specific installation requirements of the bioreactor and associated components.

OPERATION AND MAINTENANCE

Provide an operation and management (O&M) plan and review this with the land manager. Specified actions should include normal repetitive activities in the application and use of the practice, along with repair and upkeep of the practice. The plan must be site specific and include, but not be limited to, a description of the following:

- Planned water level management and timing.
- Inspection and maintenance requirements of the bioreactor and contributing drainage system, especially upstream surface inlets.
- Requirements for monitoring the status of the bioreactor media and replacement/ replenishment of media as needed.
- Monitoring and reporting criteria that demonstrate system performance
- Monitoring information to improve the design and management of this practice as needed.

REFERENCES

- Christianson, L. E., A. Bhandari, M.H. Helmers, and M. St. Clair. 2009. Denitrifying Bioreactors for Treatment of Tile Drainage. In: Proceedings of World Environmental and Water Resources Congress, May 17-21, 2009.
- Christianson, L., A. Bhandari, and M. Helmers. 2011. Potential design methodology for agricultural drainage denitrification bioreactors. In: Proc. 2011 EWRI Congress. Reston, Va.: ASCE Environmental and Water Resources Institute.
- Christianson, L., M. Helmers, A. Bhandari, K. Kult, T. Sutphin, and R. Wolf. 2012. Performance evaluation of four field-scale agricultural drainage denitrification bioreactors in Iowa. *Trans. ASABE*. 55(6):2163-2174.
- Cooke, R.A. and N.L. Bell. 2012. Protocol and Interactive Routine for the Design of Subsurface Bioreactors. Submitted to: *Applied Engineering in Agriculture*, August, 2012.
- Woli, K.P., David, M.B., Cooke, R.A., McIsaac, G.F., and Mitchell, C.A. 2010. Nitrogen balance in and export from agricultural fields associated with controlled drainage systems and denitrifying bioreactors. *Eco. Eng.*, 36: 1558-1566.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Denitrifying Bioreactor (605)

DESIGN (911)

Deliverables:

1. Design documents that will demonstrate that the criteria in the NRCS practice standard have been met and are compatible with planned and applied practices.
 - a. Practice purpose(s) as identified in the conservation plan.
 - b. List all required permits to be obtained by the client.
 - c. Compliance with NRCS national and state utility safety policy (NEM part 503-Safety).
 - d. List of facilitating/component practices.
 - e. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
 - i. Geology and Soil Mechanics
 - ii. Hydrology/Hydraulics
 - iii. Structural Components
 - iv. Vegetation Requirements
 - v. Environmental Considerations
 - vi. Safety Considerations (NEM Part 503-Safety)
2. Written plans and specifications including drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Operation and Maintenance plan.
4. Quality Assurance Plan describing the type and frequency of testing, items requiring inspection, the documentation required, and the qualifications of the person doing the work.
5. Cost estimate.
6. Certification that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Part 505, Non-NRCS Engineering Services).

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Denitrifying Bioreactor (605)

INSTALLATION (912)

Deliverables:

1. Pre-installation conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Installation inspection (according to quality assurance plan as appropriate).
 - a. Actual materials used
 - b. Inspection records
 - c. Maintaining a job diary with the dates and record of inspections made, testing completed, instruction provided to the contractor, etc., to document compliance with standards and specifications.
5. Facilitate and implement required design modifications with client and original designer.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Documentation of design modifications during installation.
8. Certification that the installation process and materials meet design and permit requirements.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service Wisconsin

Denitrifying Bioreactor (605)

CHECKOUT (913)

Deliverables:

1. Supporting documentation.
2. As-Built drawings
 - a. Drawings with changes from the original construction plans clearly shown.
 - b. Certification that the application meets NRCS standards and specifications and is in compliance with permits (NEM Part 505, Non-NRCS Engineering Services).
3. Extent of practice units applied and location identified on a map:
 - a. Completed job diary noting inspections made, testing completed, etc.
 - b. Material documentation.
 - c. Testing reports.
 - d. Survey notes for layout, inspections, and final checkout documenting compliance with standards and specifications.
4. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
5. Technical Service Provider name,
6. Customer name,
7. USDA program funding the practice (if known)
8. Location of work (state, county, conservation district, land tract identifier),
9. Land use of field where the practice was installed (cropland, etc.), and
10. NRCS practice name and quantity of practice installed in appropriate units.

REFERENCES

- WI NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard 605, Denitrifying Bioreactor.
- National Engineering Handbook, Part 624, Section 16, Drainage
- NRCS National Engineering Handbook (NEH), Part 650, Chapter 14, Water Management (Drainage)
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

CERTIFICATION OF COMPLETION

USDA, Natural Resources Conservation Service
Wisconsin

Denitrifying Bioreactor (605)

Program Participant Information

Name (print): _____

Contract Number: _____ Contract Item #(s): _____

Technical Service Provider Information

Name (print): _____

TSP ID Number: _____ Expiration Date: _____

Technical Service Provided

- Design (911)
- Installation (912)
- Checkout (913)

I hereby certify that the technical services I provided as a Technical Service Provider for this component(s) checked above: (1) comply with all applicable Federal, State, Tribal, and Local laws and requirements, (2) meet applicable USDA NRCS conservation practice standards, specifications, and program requirements, (3) are consistent with and meet the particular conservation program goals and objectives, (4) that I have provided the above named Program Participant the Deliverables in this Statement of Work for this component, and (5) comply with all "Certification Terms" as identified in the Technical Service Provider Certification Agreement.

Technical Service Provider Signature

Date

Received By (NRCS Staff)

Date

Natural Resources Conservation Service
Conservation Practice Standard

FOREST TRAILS AND LANDINGS

Code 655 (Acres)

I. DEFINITION

A temporary or infrequently used route, path or cleared area.

II. PURPOSE

- Provide routes for temporary or infrequent travel by people or equipment for management activities.
- Provide periodic access for removal and collection of forest products.

III. CONDITIONS WHERE PRACTICE APPLIES

Trails and landings including skid trails are applicable on forestland. They typically connect to an Access Road (560).

IV. CRITERIA

A. General Criteria

Trails and landings will be of a size, gradient, number and location to economically and efficiently accomplish the intended purpose. They shall be configured to minimize adverse onsite and offsite impacts such as accelerated erosion, riparian zone degradation, wetlands, critical wildlife habitat, stream channel and stream bank damage, hydrology modification and aesthetics. Trails and landings will be installed with a minimum amount of damage to advanced regeneration, residual growing stock and wildlife habitat located on the contour when possible. Set back from water bodies.

1. Temporary Roads

The minimum width of trails will be 10 feet. Trails will be located at intervals no closer than 300 feet. A minimum number of trails and landings will be installed to meet the intended purpose.

Typically no closer than 1/4 mile of existing access or temporary road.

Minimize temporary roads by maximizing skidding and forwarding distances.

All surface water runoff from trails shall be diverted onto well-vegetated and stable areas before entering a riparian zone.

Water bars, broad based dips, fords, diversions, culverts and other drainage measures for trails shall be of sufficient size, interval and gradient to provide adequate drainage and erosion control.

The type of equipment used and timing of equipment use will take into account site and soil conditions in order to maintain site productivity and minimize soil erosion, displacement and compaction.

2. High Speed Skid Trail

A temporary, non-structural pathway over forest soil created by dragging or skidding felled trees or logs from a stump to a log deck. Skidders, fellers and other harvesting equipment use skid trails. Development requires removal of stumps by a dozer and general shaping of roads. Average distance to temporary road/landing is approximately 1/4 miles. Trails should not exceed 15% of stand area.

3. Skid Trail

A temporary, non-structural pathway over forest soil created by dragging or skidding felled trees or logs from a stump to a

log deck. Skidders, fellers and other harvesting equipment use skid trails. Development does not require excavation with equipment. The average distance skidder will travel from a temporary road is approximately 1320 feet.

4. Landings

Landing size is dependent on logging equipment.

Landings are typically no larger than 1/4 acre in size. Depending on volume of product extraction, typically one landing is used per 10 acres.

Landings will be located on soils that can support heavy equipment, e.g. moderately well to well drained soils. Landings will be located on areas where water will not accumulate and where there is safe access including visibility when entering onto public roads.

Landings will be located a safe distance from overhead and underground utilities according to utility company specifications, typically no larger than 1/3 of an acre.

5. All ruts and berms shall be smoothed to grade level as soon as practical after completion of the harvest operation.

6. Establishment of Vegetation

Trails and landings where appropriate shall be re-vegetated through natural or artificial means to control erosion. Natural regeneration of native species shall be used in lieu of seeding and mulching to re-vegetate a site, unless it is determined that existing seed banks or the residual stand will not reestablish adequate plant density. For artificial re-vegetation, refer to Wisconsin NRCS Conservation Practice Standards (WI NRCS CPS) *Tree and Shrub Establishment (612)*; and *Critical Area Planting (342)*. All non-native plants used for re-vegetation will be

evaluated for potential to become invasive species.

7. Slash

Eliminate long, narrow bands of slash, debris and vegetative material left on the site after construction by lopping and scattering, chipping, removal or piling slash for wildlife habitat.

8. Stream Crossings

Stream crossing design and construction will conform to WI NRCS CPS *Stream Crossing (578)*.

9. Comply with applicable federal, state and local laws and regulations during the installation, operation and maintenance of this practice.

B. Criteria Applicable to Temporary Trails and Landings

Temporary trails and landings will be designed and constructed for short-term use for a specific project such as forest stand improvement activities. Temporary trails and landings will only be used when the ground is frozen or firm.

When the activity is complete, the trails and landings will be closed.

Temporary landings and trails will be re-vegetated according to the plan developed for the site.

All stream crossing and temporary water management structures will be removed and all disturbed areas will be re-vegetated according to the plan developed for the site.

V. CONSIDERATIONS

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

1. Consider impact to wildlife because of fragmentation of forest. Openings can benefit early successional and edge species, while detrimental to forest interior species.

2. Assure safe ingress and egress to site.
 3. Locate landings and trails to preserve aesthetic qualities.
 4. Access to landings and trails may be limited outside of logging periods to minimize erosion, safety and liability risks, and maintenance costs.
 5. Landings and trails may be used for wildlife food and cover plantings.
 6. Landings and trails may be utilized as firebreaks.
 7. Consider cultural resources and environmental concerns such as threatened and endangered species of plants and animals, natural areas and wetlands. Take measures to protect against invasive species.
 8. For permanent access to Forest Land, refer to WI NRCS CPS *Access Road (560)*.
 9. Location and layout for trails and landings should conform to "Wisconsin's Forestry Best Management Practices for Water Quality" Field Manual, publication no. PUB-FR-093, by Bureau of Forestry, Wisconsin Department of Natural Resources.
- Minimum documentation to include this practice in a conservation plan (including a Conservation Activity Plan) includes:
 - Approximate length, width and slope of new trails or trail segments and landings and/or those needing treatment.
 - Information about the timing of practice installation.
 - General description of the installation or treatments anticipated.
 - Location of buffer zones for streams, special areas and other sensitive areas that need protection, including wetlands and locations of threatened and endangered species.
 - Minimum documentation required prior to installation of this practice includes all items listed above and:
 - Site map, preferably with topographic information, showing location(s) of trails, landings, and stream crossings.
 - Length, width, and slope of trails or trail segments and landings.
 - Location and/or spacing (on site map or described in plan) of structural erosion control measures, and other required treatments.
 - Detailed design information, including standard drawings, for all erosion control measures, stream crossings, cuts and fills, and other earthwork, structures, etc.
 - Identification of trails and landings intended or anticipated for management activities in subsequent years.
 - Specifications for operation during wet or dry weather periods to avoid soil erosion, compaction, and potential fires.
 - Location or description of sites needing seeding.
 - Species, rates, and planting information for any areas that require seeding.
 - Operation and maintenance requirements

VI. PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable documentation. Specifications for re-vegetation of landings and trails should include species, timing and method of application. The type location and construction plans for erosion control and water management structures shall be provided as needed.

Because Forest Trails and Landings are often designed in conjunction with a timber harvest or other management activity, it may not be feasible to fully design and layout the practice in advance. Therefore, two levels of planning documentation are required as detailed below:

VII. OPERATION AND MAINTENANCE

An operation and maintenance plan shall be developed that is consistent with the purpose of this practice, intended life of the components, and criteria for design. The plan shall include but is not limited to:

Periodic inspections of landings, trails, and water management structures will be conducted and where necessary, repairs will be made.

Landings and trails utilized as firebreaks will be properly maintained to accomplish this purpose. See WI NRCS CPS *Firebreak (394)*.

Landings and trails may be closed for erosion control, safety, liability, and reduced maintenance costs, refer to WI NRCS CPS *Critical Area Planting (342)* for additional information.

VIII. FEDERAL, STATE, AND LOCAL LAWS

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

IX. REFERENCES

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

Wisconsin Department of Natural
Resources, Bureau of Forestry, Publication
No. PUB-FR-093, Forestry Best
Management Practices for Water Quality
Field Manual, Chapter 6.

DEFINITION

A temporary or infrequent used route, path or cleared area.

PURPOSES

- Provide routes for temporary or infrequent travel by people or equipment for management activities.
- Provide periodic access for removal and collection of forest products.

CONDITIONS WHERE PRACTICE APPLIES

Trails and landings, including skid trails, are applicable on forest land. They typically connect to an Access Road (see Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS) *Access Road (560)*).

CRITERIA

Trails and landings should typically be no more than 1/4 acre out-sloped, specifying number and location to accomplish the intended purpose.

Avoid locating trails and landings on poorly suited soils of low-bearing strength and sites such as wetlands, riparian areas, critical wildlife habitat, or other environmentally sensitive areas. Locate trails on the contour to the greatest extent possible and incorporate breaks in grade (rolling dips or rolled grades) for trails on slopes. Skid logs uphill (with front ends off the ground) as practicable to minimize mechanical displacement of soil. Trails and landings shall be set back adequately from water bodies and water courses. Stream Crossings, if necessary, shall be minimized in size and number.

Assure safe ingress and egress from trails and landings to junctions with access roads. Use WI NRCS CPS *Access Road (560)* for travel-ways including logging spur roads needing construction design and possibly surfacing to accommodate frequent, intensive, or repeated vehicular traffic.

Trails and landings shall be located and minimized in number and size to reduce adverse onsite and off-site impacts such as accelerated erosion; slope failure; water quality and riparian area degradation; stream channel and streambank damage; hydrologic modification; aesthetics; unacceptable damage

to advance regeneration, residual growing stock, and threatened and endangered species; or fragmentation of wildlife habitat.

Those trails and landings intended or anticipated for management activities in subsequent years shall be designated for reuse to minimize the need for new trails and landings and associated site impacts.

Timing and use of equipment shall be appropriate for site and soil conditions to maintain site productivity and minimize soil rutting, erosion, displacement and compaction.

Drainage and erosion control measures, e.g., water bars, broad-based dips, box culverts, shall be integrated with trails and landings and located to minimize detrimental effects of concentrated flow, erosion and sedimentation rates both during and after trail/landing use. Refer to applicable drainage and erosion-sedimentation prediction technology and applicable WI NRCS CPSs, e.g., *Critical Area Planting (342)*, *Structure for Water Control (587)*, *Stream Crossing (578)* and *Mulching (484)*.

Road Grade (%)	Maximum distance between water bars (feet)		Maximum distance between all other drainage structure (feet)	
	High Erosion Risk (most sandy soils and silt soils)	Low Erosion Risk (most rocky soils and clay soils)	High Erosion Risk (most sandy soils and silt soils)	Low Erosion Risk (most rocky soils and clay soils)
0-3	175	250	250	350
4-6	125	200	175	250
7-9	100	175	125	175
10-12	75	150	75	125
13-15	60	100	60	100
16-20	50	75	50	75
21-30	40	65	40	65
30+	30	50	30	50

After usage, stream crossings shall be restored and stabilized.

Ensure that slash, debris, and vegetative material left on the site after practice installation will not present an unacceptable fire or pest hazard or interfere with the intended purpose.

After use, re-vegetate trails and landings sufficiently to control erosion. If needed, use the WI NRCS CPS *Critical Area Planting (342)*



or *Conservation Cover (327)* for recommended seeding mixtures on steeply sloping trails, landings, and other areas where erosion control is a major concern (critical areas).

On areas where a seed bank of desirable native herbaceous vegetation exists, allow natural re-vegetation (succession) to occur to reduce future forest fragmentation and protect native species.

Take measures to mitigate invasion and spread of invasive species. Comply with federal and state NRCS policy on invasive species (see Invasive Plant Species List in Section II of eFOTG).

CONSIDERATIONS

Consider impacts to wildlife from increased fragmentation of the forest stand. Creation of openings can benefit some wildlife species, e.g., early successional and edge species, yet be detrimental to others, e.g., forest interior species.

Trails and landings, particularly after usage, may be utilized and managed for wildlife food and cover plantings. Refer to appropriate WI NRCS wildlife habitat CPSs, e.g., *Upland Wildlife Habitat Management (645)*, and *Early Successional Habitat Development/ Management (647)*.

Properly located trails and landings of sufficient width and location may be utilized and managed as firebreaks.

Favor native species for re-vegetating trails and landings.

Place slash, debris, and rocks a minimum of four feet from the edge of all landings and harvest trails, and pile such material to a height not to exceed four feet.

Locate landings and trails to preserve the aesthetic quality.

Locate landings and trails a minimum of 100 feet from riparian areas if feasible.

During construction, stockpile all topsoil and re-spread after final grading to maintain natural fertility and promote re-growth of native vegetation.

Discontinue hauling and harvesting operations when any rutting occurs.

Regularly inspect landings and trails to remove refuse and garbage. Report lubricant, solvent, and fuel spills to the Wisconsin Department of Natural Resources Spill Emergency Hotline: 1-800-934-0003.

Close trails as needed for erosion control, safety and liability, and to reduce maintenance costs.

Refer to the WI NRCS CPS *Road/Trail/Landing Closure and Treatment (655)*.

Consider using forest trails and landings secondarily for other purposes, e.g., recreation wildlife food and cover plantings, provided it does not compromise the purpose of the practice. Refer to WI NRCS CPS *Trails and Walkways (575)* if primary use is to be for recreation.

Meet or exceed the applicable guidelines for trails and landings in the following chapters of Wisconsin's Forestry Best Management Practices for Water Quality Field Manual:

4. Forest Roads
5. Stream Crossings
6. Timber Harvests
8. Wetlands

OPERATION AND MAINTENANCE

Regular and timely inspections for adverse effects shall be conducted with trails and landings and associated measures maintained or restored as necessary.

Trails and landings utilized and managed as firebreaks shall be properly maintained to accomplish this purpose while maintaining acceptable mitigation of other concerns.

Access to trails and landings shall be controlled when and where needed for erosion abatement, safety and liability, and reduced maintenance costs. Refer to the WI NRCS CPS *Access Control (472)* as needed.

Trails and landings no longer needed may be decommissioned. Refer to the WI NRCS CPS *Road/Trail/Landing Closure and Treatment (654)* as needed.

Protect watercourses and water quality during and after removal and transport of trees. Remove temporary bridges in a timely manner and stabilize channels and banks as needed. Use the WI NRCS CPS *Stream and Shoreline Protection (580)*, and *Stream Channel Stabilization (584)* as needed.

Upon completion of harvest, leave all loading areas, landings, and trails in a stable, vegetated condition.



FOREST TRAILS AND LANDINGS (655) SPECIFICATIONS

Note: General Information and Purpose sections are to be completed during conservation plan development. Design and Plant Materials Information sections are to be completed prior to the practice installation.

GENERAL INFORMATION

Landowner Name: _____ Total acres of treatment planned: _____

Tract No.: _____

Specifications Date: _____ Planned Installation Date: _____

General description of the installation or treatment anticipated:

Existing trail segments or landings needing treatment:		New trails and landings:	
Approximate length of trail segments:		Approximate length of new trail:	
How many existing landings:		How many new landings:	
Approximate acres of landings:		Approximate acres of new landings:	

Map of site: Attach a topographic map or aerial photo indicating the management unit that the practice will be installed on and showing the location of any buffer zones for streams, special areas and other sensitive areas that need protection, including wetlands and locations of threatened and endangered species. Map must include all activities planned for the next 5 years that justifies the need for trails and landings.

PURPOSE (check all that apply)

- Provide routes for temporary or infrequent travel by people or equipment for management activities
- Provide periodic access for removal and collection of forest products.

DESIGN (describe trail segments and landings below. Segments with similar characteristics, e.g., soil types, slope, design, anticipated use, required treatment, etc., may be grouped together)

Segment ID	Length (ft.)	Width (ft.)	% Slope	Design Details (include number, type, spacing, and size of erosion control structures, stream crossing details, cut and fills, and other earthwork, structures, etc. Reference additional design sheets, drawings, etc., as needed)

Is permit required? Yes No If yes, has it been obtained? Yes No Permit #: _____

Additional information necessary to install this practice:

Provide all necessary additional details here to meet ALL criteria and all documentation requirements (from the Plans and Specifications section) in the 655 Conservation Practice Standard. Attach and reference additional information, standard drawings, references, etc., as needed.



Operation and Maintenance:

Provide all necessary additional details here to operate and maintain this practice, including inspection schedule, maintenance activities and schedule, etc. Refer to the Operations and Maintenance section of the 655 Conservation Practice Standard.

Map of site: Attach a map or aerial photo showing location(s) of trails, landings and stream crossings, as described in the General Information section above.

PLANT MATERIALS INFORMATION (refer to the Wisconsin NRCS Conservation Practice Standards Conservation Cover (327) and Critical Area Planting (342), for species recommendations, seeding rates, etc.)

Species	Seed (lbs./ac. or lbs./1000 ft.)	Lime (lbs./ac. or lbs./1000 ft.)	Fertilizer (lbs./ac. or lbs./1000 ft.)	Mulch type and amount	Planting date	Location and other planting details
Additional information, including O&M, site prep, planting method, etc., necessary to establish vegetation:						

FOREST TRAILS AND LANDINGS COST SHARE DOCUMENTATION AND VERIFICATION FOR CASE FILE

Practice amount applied is field verified by: _____ on: _____ (date)

Before payment is made, the following information is required to be in the case file:

- Photographs of established practice that must include:
 - Statement "Photo was taken in the field by (enter name)"
 - Date photo was taken in the field
 - Statement of what the photo represents if it needs clarification
- Field verification documented and a certified planner verified "as installed" this practice meets WI NRCS standards and specifications.

Practice Certification (NRCS USE ONLY)

I certify that the practice as installed is complete and meets the applicable Wisconsin NRCS Conservation Practice Standard and all applicable practice specifications. Any changes to the original practice design have been approved and are documented on the original practice design "as installed."

Certified Planner (print)

(sign)

Date



STATEMENT OF WORK

USDA, Natural Resources Conservation Service Wisconsin

Forest Trails and Landings (655)

DESIGN (911)

Deliverables:

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices.
 - a. Compliance with NRCS national and state utility safety policy (NEM part 503-Safety, Section 503.00 through 503.22).
 - b. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
 - i. Determination of appropriate site coverage, trail and landing dimensions, gradient, timing of use, and water drainage to allow safe ingress and egress for intended purpose(s).
 - ii. Designating appropriate setbacks from wetlands, water bodies and streams and other environmentally sensitive areas.
 - iii. Mitigation measures to reduce wildfire and pest hazards, control erosion, runoff, soil compaction and soil displacement to acceptable levels.
2. Written plans and specifications including location map, sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Documentation of needed operation and maintenance.
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
5. Documentation requirements for design modifications during practice installation.
6. Itemized engineers cost estimate.

INSTALLATION (912)

Deliverables:

1. Documentation of pre-construction conference with client.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Application guidance as needed.
5. Facilitate, implement and document required design modifications with client, original designer, permitting and funding agencies.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the application process and materials meet design and permit requirements.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service Wisconsin

Forest Trails and Landings (655)

CHECKOUT (913)

Deliverables:

1. Records of application.
 - a. Extent of practice units applied and location identified on a map.
 - b. Actual mitigation measures used and applied.
2. Certification that the application meets NRCS standards and specifications and is in compliance with permits.
3. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
 - a. Technical Service Provider Name
 - b. Customer name
 - c. USDA program funding the practice (if known)
 - d. Location of work (state, county, conservation district, land tract identifier)
 - e. Land use of field where the practice was installed (cropland, etc.)
 - f. NRCS practice name and quantity of practice installed in appropriate units
4. Documentation of exit conference with client and contractor.

REFERENCES

- WI NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard 655, Forest Trails and Landings
- National Engineering Manual, Utility Safety Policy
- NRCS National Forestry Handbook (NFH), Part 636.4
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

CERTIFICATION OF COMPLETION

USDA, Natural Resources Conservation Service
Wisconsin

Forest Trails and Landings (655)

Program Participant Information

Name (print): _____

Contract Number: _____ Contract Item #(s): _____

Technical Service Provider Information

Name (print): _____

TSP ID Number: _____ Expiration Date: _____

Technical Service Provided

- Design (911)
- Installation (912)
- Checkout (913)

I hereby certify that the technical services I provided as a Technical Service Provider for this component(s) checked above: (1) comply with all applicable Federal, State, Tribal, and Local laws and requirements, (2) meet applicable USDA NRCS conservation practice standards, specifications, and program requirements, (3) are consistent with and meet the particular conservation program goals and objectives, (4) that I have provided the above named Program Participant the Deliverables in this Statement of Work for this component, and (5) comply with all "Certification Terms" as identified in the Technical Service Provider Certification Agreement.

Technical Service Provider Signature

Date

Received By (NRCS Staff)

Date

CRP Owner: _____
 Grazer: _____
 This plan is for CRP-1 No.: _____
 Farm Number: _____
 Tract Number: _____
 Field Number(s): _____
 Total Acreage: _____
 Total to be Grazed: _____

PURPOSE

To provide grazing for a limited time period on eligible Conservation Reserve Program (CRP) fields for livestock producers in need of forage, which follows Wisconsin NRCS Conservation Practice Standard (WI CPS) Prescribed Grazing (528).



REQUIREMENTS

Participants must request authority for grazing of CRP acreage from the Farm Service Agency (FSA) each year prior to grazing and follow this plan. Participants may not graze and hay the same acreage in the same year. Grazing cannot occur until 12 months after the vegetation is considered fully established. Producers can graze or hay the same CRP acreage only once every 3 years.

Grazing may start August 2nd. All livestock will be removed from CRP fields by September 30th, or once minimum grazing heights are present, whichever occurs first.

Livestock will not be permitted to graze on CRP ground that is within 120 feet of any stream or other permanent water body or ineligible practices (see FSA for list).

ELIGIBLE CRP PRACTICES

- CP1: Establishment of Permanent Introduced Grasses and Legumes
- CP2: Establishment of Permanent Native Grasses
- CP4B: Permanent Wildlife Habitat - Corridors
- CP4D: Permanent Wildlife Habitat
- CP10: Vegetative Cover - Grass - Already Established

Use the following tables to determine stocking rates.

TABLE 1: ANIMAL UNIT GUIDE

1000 pound cow + up to 3 month old calf	1.00 AU
Bull, mature	1.35 AU
Cow, yearling	0.60 AU
Sheep, mature	0.20 AU
Lamb, 1 year old	0.15 AU
Goat, mature	0.15 AU
Bison, mature	1.00 AU

If livestock are grazed for less than the full 60 days allowed, it may be possible to increase the numbers grazed. The following table provides guidance for increasing livestock numbers based on shorter grazing periods.

In no case will the forage be grazed lower than a

TABLE 2: STOCKING RATES

Grazing Period	Maximum AU/Acre
60 days	1.25
45 days	1.70
30 days	2.50
15 days	5.00
7 days	10.00
3 days	25.00
1 day	75.00

minimum height of four (4) inches for cool season grasses (orchard, bluegrass, smooth brome) and to a minimum of seven (7) inches for warm season grasses (big bluestem, little bluestem, indiagrass, switchgrass, and any combination).

If the cover fails as a result of grazing, the producer must re-establish the CRP cover at their own expense.



TOTAL ANIMAL UNITS CALCULATION

Animal Type*	Animal Units (AU)*
Total AU:	

*See Table 1

GRAZING PLAN

CRP Field Number(s): _____ Total CRP Field Acres: _____
 Planned Grazing Period: _____ days. Planned Stocking Rate AU/ac. (see Table 2): _____
 Maximum AU per Field: _____ (*maximum stocking AU/ac. x CRP acres*)
 Date grazing to start: _____ Grazing end date: _____

CRP Field Number(s): _____ Total CRP Field Acres: _____
 Planned Grazing Period: _____ days. Planned Stocking Rate AU/ac. (see Table 2): _____
 Maximum AU per Field: _____ (*maximum stocking AU/ac. x CRP acres*)
 Date grazing to start: _____ Grazing end date: _____

CRP Field Number(s): _____ Total CRP Field Acres: _____
 Planned Grazing Period: _____ days. Planned Stocking Rate AU/ac. (see Table 2): _____
 Maximum AU per Field: _____ (*maximum stocking AU/ac. x CRP acres*)
 Date grazing to start: _____ Grazing end date: _____

CRP Field Number(s): _____ Total CRP Field Acres: _____
 Planned Grazing Period: _____ days. Planned Stocking Rate AU/ac. (see Table 2): _____
 Maximum AU per Field: _____ (*maximum stocking AU/ac. x CRP acres*)
 Date grazing to start: _____ Grazing end date: _____



GOALS AND OBJECTIVES

SITE CONDITION

Species present or originally planned: _____

The conservation plan map shall include:

- » All fields where managed grazing will occur
- » Location of all fencing
- » Soil types (part of CRP plan)
- » Sensitive areas to be protected
- » Areas within 120 feet of streams or other permanent water bodies where livestock are not permitted to graze
- » Waterers (off site)

This CRP grazing plan meets the basic criteria of Wisconsin NRCS Conservation Practice Standard Prescribed Grazing (528) as outlined by the NRCS Field Office Technical Guide. The balance sheet assumes the cover is of marginal value and will be monitored daily to assure minimum crop height will be maintained. This practice balance sheet takes into account that this grazing period is no longer than 60 days during the less productive portion of the year.

By signing below, it is agreed that these items will be followed:

- » Livestock may graze until the forage supply reaches a minimum average height
- » Records of grazing dates and quantity of animal units are available
- » Job sheet will be followed
- » Photos will be submitted to assure cover has not been grazed below 4 inches for introduced species, and 7 inches for native species

Landowner/Producer Date

Certified Planner Date



NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

FOREST STAND IMPROVEMENT

CODE 666

(Acre)

I. DEFINITION

The manipulation of species composition, stand structure and stocking by cutting or killing selected trees and understory vegetation.

II. PURPOSES

- Increase the quantity and quality of forest products by manipulating stand density and structure.
- Timely harvest forest products.
- Initiate forest stand regeneration.
- Reduce the potential of damage from wildfire.
- Improve forest health by reducing the potential of damage from pests and moisture stress.
- Restore natural plant communities.
- Development of renewable energy systems.
- Achieve a desired plant community.
- Improve aesthetic and recreation values
- Improve wildlife habitat
- Improve water conservation and yield.
- Achieve a desired level of stocking and density.
- Increase carbon storage in selected crop trees.

III. CONDITIONS WHERE PRACTICE APPLIES

All forest land.

This standard is not applicable for Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), *Alley Cropping (311)*, *Multi-story Cropping (379)*, *Windbreak/Shelterbelt Establishment (380)* operation and maintenance, or *Windbreak/Shelterbelt Renovation (650)*.

IV. CRITERIA

A. General Criteria

The structure management strategy will be identified for all planned forest stand improvement activities:

- Uneven-aged management systems (single-tree selection, group selection).
- Even-aged management (clear-cut, seed-tree, shelterwood, coppice).

Separate stands with different cover types or timber types into separate management units (stands) and plan them individually.

Base all management decisions on a thorough and current forest inventory and the intended purpose. Crop tree inventories, fixed area plot inventories, and point sampling methods are examples of forest inventories. At a minimum, the inventory must be adequate to generate basal area (for even or uneven-aged stands) or average diameter at breast height (DBH) and average spacing/trees per acre (for even-aged stands).

Base forest stand improvement choices on the following selection criteria:

- Tree and forest health
- Tree size, position and spacing
- Crown size, position, and condition
- Bole quality
- Species
- Species diversity

Plan post-treatment basal appropriately for community/cover type. See WI NRCS CPS, *Forest Stand Improvement (666) Job Sheet* for more information.

Kill unwanted trees, shrubs, and vines by any of the following means:

- Cutting
- Girdling
- Frilling
- Stem injection of herbicides
- Foliar or basal bark spraying of herbicides

If needed, supplement mechanical cutting, girdling, or frilling with an application of herbicide to increase mortality and decrease stump sprouting.

Time tree cutting to avoid a buildup of insect or disease populations.

Conduct tree cutting in forest stands that contain oak species only during dormant seasons, October 1 through March 1, to reduce chance of infection to the residual stand by oak wilt disease (*Ophiostoma fagacearum*).

Perform forest stand improvement activities in such a way as to minimize soil erosion, compaction, rutting, damage to remaining vegetation, and hydrologic conditions, and other site resources.

Limit damage to the site by:

- Using directional felling compatible with skid trail layout
- Aligning cut tree stems for efficient skidding
- Cutting out forks and large branches
- Limiting trails to less than 15% of the site
- Logging when soils are dry or frozen
- Using the lowest-impact equipment available
- Using well-organized access trails

Refer to WI NRCS CPS, *Forest Trails and Landings (655)* for more information about trail establishment and maintenance.

Comply with applicable laws and regulations, including Wisconsin's Best Management Practices (BMPs) for forestland contained in "Sustainable Soil and Water Quality Practices on Forest Land," published by the Wisconsin Department of Natural Resources.

Protect all forestland from livestock grazing.

Retain a minimum of 2 large (>12" DBH) active den trees per acre, if possible.

Retain or create a minimum of 2 large (>12" DBH) snags per acre, if possible.

Treat slash and debris such that they do not present an unacceptable fire, safety, environmental, or pest hazard and will not interfere with the intended purpose or other management activities.

If burning is used to reduce slash and other debris on-site, follow WI NRCS CPS, *Prescribed Burning (338)*.

B. Additional Criteria to Increase the Quantity and Quality of Forest Products (Intermediate Thinning Treatments)

For management of, or conversion to, uneven-aged stands (hardwoods, conifers, or mixed forest types), perform Forest Stand Improvement when basal area is greater than 110 sq. ft. per acre. Remove 20 to 33% of the basal area, ensuring that residual basal area is no lower than 75 sq. ft. per acre to regenerate shade tolerant species, e.g., sugar maple, and no lower than 60 sq. ft. per acre to regenerate shade intolerant or intermediate species, e.g., red oak.

For even-aged hardwood stands, perform Forest Stand Improvement when basal area is greater than 110 sq. ft. per acre. Remove 20 to 33% of the basal area, ensuring that residual basal area is no lower than 75 sq. ft. per acre.

For even-aged conifer stands, perform Forest Stand Improvement when average tree spacing is less than D+4 or crown is less than one third of the total tree height. Increase average tree spacing to D+6, if possible, but do not remove more than half the trees in one treatment.

See WI CPS, *Forest Stand Improvement (666)* Job Sheet for more information.

C. Additional Criteria to Develop Renewable Energy Systems

Intensity and frequency of energy biomass removals will be managed to prevent long-term negative impacts on the stand. The harvesting of energy biomass shall be accomplished in a manner that will not compromise the other intended purpose(s) and functions. Refer to Wisconsin Biomass Harvesting Guidelines.

D. Additional Criteria to Increase Carbon Storage

Manage for tree species that are longer lived and stocking rates that have higher rates of growth and potential for carbon sequestration.

E. Additional Criteria to Harvest Forest Products and to Initiate Forest Stand Regeneration

Use a harvest-regeneration system appropriate for the growth characteristics and shade tolerance of the species and forest cover type to be regenerated:

- For uneven-aged systems, follow guidance in previous section.
- For management of, or conversion to, even aged system, including pine plantations and aspen stands, use even-aged harvest-regeneration strategies, e.g., shelterwood, seed tree harvests, and clear-cutting.

If natural regeneration is not likely, or is not present two years after the harvest, initiate reforestation. Refer to WI NRCS CPS, *Tree/ Shrub Establishment* (612).

F. Additional Criteria to Reduce Wildfire Hazard

Reduce stocking rates of trees to minimize crown-to-crown spread of fire.

Remove "ladder" fuels to minimize the risk of crown fires.

Further treat or eliminate slash accumulations next to roads and trails.

Reduce or eliminate species with high volatility.

For additional wildfire risk and damage reduction, refer WI CPS, *Firebreak* (394).

G. Additional Criteria to Improve Wildlife Habitat

Manage for a variety of native tree species and stocking rates that meet desired wildlife and pollinator species' food and cover requirements.

Create and/or maintain 2 to 5 snags per acre (12" DBH+), and 2 to 5 den trees per acre (12" DBH+), if possible, depending on the requirements of the desired wildlife species.

Create and/or maintain adequate down woody material to meet requirements of desired wildlife.

Minimize improvement actions that disturb seasonal wildlife activities.

Refer to WI NRCS CPS, *Early Successional Habitat Development/Management* (647), *Rare and Declining Habitat Management* (643), *Upland Wildlife Habitat Management* (645), and *Wetland Wildlife Habitat Management* (644) to further develop and manage wildlife-related activities.

V. CONSIDERATIONS

- A. Use of a professional forester (Technical Service Provider (TSP), professional consulting forester, etc.) to mark and layout practice will generally yield better

results. This should be considered especially for large or complex sites.

- B. Silvicultural objectives and harvest-regeneration strategies may change over time and may be limited by prior management.
- C. Successful regeneration of desirable species is usually dependent upon timely application of forest stand improvement and other practices, e.g., Prescribed Burning, Site Preparation, Tree and Shrub Establishment, Prescribed Grazing, and Use Exclusion.
- D. Landowners should secure a written contract with any service provider that specifically describes the extent of activity, duration of activity, liability and responsibilities of each party and amount and timing of payments for services provided.
- E. The practice should be timed to minimize disturbance of seasonal wildlife activities.
- F. Timing of treatment and retention of dead or dying trees will minimize impacts on nesting wildlife.
- G. Consider wildlife food and cover needs.
- H. In areas where heavy brush or weeds may cause severe competition for moisture and nutrients, it may be necessary to reduce competing vegetation by:
 - I. Mechanical release of target residual trees.
 - J. Chemical or mechanical treatment to release tree seedlings from heavy brush.
- K. Consider environmental effects of harvest on threatened and endangered species and natural areas where present.

VI. PLANS AND SPECIFICATIONS

Specifications for applying this practice shall be prepared for each site and recorded using approved specification sheets, job sheets, technical notes, and narrative statements in the conservation plan, or other acceptable

documentation.

Specifications will include, but are not limited to:

- Purpose(s) of treatment,
- Map indicating location of practice,
- The harvest regeneration strategy,
 - Uneven-aged management (e.g., single tree selection, group selection, coppice selection)
 - Even-aged management (e.g., clear-cut, seed-tree, shelterwood, coppice)
- Pre-treatment and post-treatment basal area (for even or uneven-aged stands) or average DBH and spacing/trees per acre (for even-aged stands)
- Number, species, and size class of trees to be removed
- The method, timing, and type of equipment to be used
- Mitigation measures, e.g., slash and debris disposal to mitigate wildfire or pest hazards
- Operation and Maintenance requirements

VII. OPERATION AND MAINTENANCE

Periodic inspections during and after treatment activities are necessary to ensure that purposes are achieved and resource damage is minimized, e.g., assessment of insects, disease and other pests, storm damage, and damage by trespass. The results of inspections shall determine the need for additional treatment under this practice.

For treatments intended to initiate forest stand regeneration, inspect the site after 2 years to determine if natural regeneration is adequate. If not, initiate artificial regeneration using WI NRCS CPS, *Tree/Shrub Establishment (612)*.

Forest Stand Improvement may be needed at 5 to 15 year intervals, depending on site type and site quality.

VIII. 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 forest stand improvement. This standard does not contain the text of federal, tribal, state, or local laws.

IX. REFERENCES

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

Smith, David Martyn, 1962. *The Practice of Silviculture*. 578 pp.

U.S. Department of Agriculture, Forest Service, 1965. *Silvics of Forest Trees of the United States*, Agriculture Handbook No. 271. 762 pp.

Stoddard, Charles H., 1968. *Essentials of Forestry Practice*. 362 pp.

Wisconsin Forestry Management Guidelines. <http://dnr.wi.gov/topic/ForestManagement/guidelines.html>

Wisconsin Forestry Best Management Practices. <http://dnr.wi.gov/>

Wisconsin Department of Natural Resources. 2009. *Herbicides for Forest Management*. Madison, WI. <http://dnr.wi.gov/topic/foresthealth/herbicides.html>

Natural Resources Conservation Service
Interim Conservation Practice Standard

PHOSPHORUS REMOVAL SYSTEM

Code 782
(Number)

DEFINITION

A system installed to intercept subsurface (tile) flow, groundwater or surface runoff flow, and reduce the concentration of phosphorus.

PURPOSES

To improve water quality by reducing the phosphorus content of subsurface drain flow or surface runoff.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to reducing the amount of phosphorus from subsurface drain (tile) flows and other subsurface and surface phosphorus-containing runoff outflows. Sources of agricultural outflows may include agricultural tile drains, ditches and animal heavy use areas such as milkhouse wastewater, feed bunks, and silage leachate runoff.

CRITERIA

General Criteria Applicable to All Purposes

Design the system to achieve a planned reduction in the phosphorus concentration of the water flowing through the system.

Provide a hydraulic retention time through the phosphorus removal system sufficient to achieve the planned reduction in phosphorus concentration at the design flow rate.

Determine the phosphorus removal system size and configuration using the design procedures based on the design flow rate, permeability of the media, phosphorus retention capacity of the media and the desired hydraulic retention time.

Ensure that the media has a phosphorus retention capacity of at least 0.50 percent by weight of materials, or 10 pounds of phosphorus per ton of media. Ensure that the particle diameter of the media provides sufficient permeability for the anticipated flow. Use material that is recyclable and/or disposable when it has used up its phosphorus removal capacity. Ensure all used

media is disposed of in a proper manner following applicable permits, which may include disposal in a landfill.

Design the system for an expected life of at least 10 years unless provisions are made for periodic media replacement.

Do not subject the system to pressure greater than needed to provide gravity flow.

Use geotextile lining, sediment basin or a containment vessel to prevent the migration of soil particles into the phosphorus removal system, based on the soils and geology of the site.

Design water control structures as needed, to maintain the water level in the system at desired elevations. See Wisconsin NRCS Conservation Practice Standard (WI CPS), *Structure for Water Control (587)*.

Construct the surface of the system to shed water from the top of the system and to allow for settlement. Excess soil removed during the installation of the system shall be disposed of by blending with the adjacent landscape or hauling away.

For safety, and to prevent compaction of the system, identify the system location with appropriate signage or fence the site to avoid equipment travel over the system.

Protect all disturbed areas from erosion within 14 days of construction by seeding and mulching. See WI CPS, *Critical Area planting (342)* for criteria on seed selection, seedbed preparation, fertilizing, and seeding.

Restore the pH of the discharge water leaving the treatment to acceptable levels.

Use media for restoring pH levels that is recyclable and disposable, according applicable permits, when it has used up its pH restoration capacity.

Package systems will be installed according to manufacturer's recommendations.

Depending on the site specific conditions, the phosphorus reducing filter can be:

- Housed in either polyethylene or polypropylene tanks. The tank manufacturing facility for the phosphorus removal system shall be ISO 9002 certified. Proof of certification shall be required as part of the submittals. If the plant is not ISO 9002 certified, then the contractor shall submit material testing as defined in the submittals.
- Excavated in ground (as a trench filled with phosphorus reducing media and pH reducing media).
- In either case, there will be an access port for a filter cleanout and inspection as appropriate.

Additional Criteria for Treating Subsurface Drain Flow

Design the phosphorus removal system with capacity to treat subsurface base flow using either a minimum drainage coefficient of 0.125 inches from the serviced area, or a minimum of 20 percent of the calculated peak subsurface drain flow.

Base the surface flow peak discharge calculations on storm frequency records (or available discharge data) and phosphorus and suspended solids concentrations if available. If these are not available, size the phosphorus removal system according to standard peak flow equations (e.g. using the Rational formula, Cook's method, Curve Number method, Soil Conservation Service method etc.).

Design the phosphorus removal system with a maximum design capacity of the 10-year, 24 hour storm frequency event.

CONSIDERATIONS

Other practices and management systems can achieve a reduction of phosphorus levels separately or in conjunction with this practice. Consider implementation of WI CPS, *Nutrient Management (590)*, *Cover Crop (340)*, and *Drainage Water Management (554)*.

Consider the effects on downstream waterbodies or groundwater that may affect other water uses or users. For example the initial flow from

the system at start up may contain undesired contaminants.

Consider impacts of system installation on the proper flow and function of drainage systems such as tile systems and surface ditches.

PLANS AND SPECIFICATIONS

Plans and specifications for the phosphorus removal system shall describe the requirements for applying the practice to achieve its intended purpose.

As a minimum the plans and specifications should include:

- A plan view of the layout of the phosphorus removal system and associated components,
- Typical cross sections of the phosphorus removal system,
- Profile(s) of the phosphorus removal system including inlet(s) and outlet(s),
- Details of required structures for water level control,
- Seeding requirements, if needed,
- The type of phosphorus removal media to be used, its phosphorus retention capacity, life expectancy and planned method of recycling or disposal, and
- Construction specifications that describe in writing site specific installation requirements of the phosphorus removal system and associated components.

OPERATION AND MAINTENANCE

Review the provided operation and management (O&M) plan with the land manager. Include normal repetitive activities in the application, use, and repair and upkeep of the practice. Keep the plan site specific and include a description of the following as appropriate:

- Anticipated flow rates, phosphorus and total suspended solids concentrations, reduction targets, etc.
- Planned water level management and timing.
- Inspection and maintenance requirements of the phosphorus removal system and contributing drainage system, especially upstream surface inlets.
- Monitoring and reporting is required

to confirm system performance and provide information to improve the design and management of this practice. Monitoring shall include water testing for phosphorus (both dissolved and total P) in milligrams per liter, at the phosphorus removal system inlet and outlet, at certain frequencies or specific dates, with a corresponding record of water level elevations.

REFERENCES

Drizo, Aleksandra, 2010. Innovative Technologies for Phosphorus Reduction From Non Point Pollution Sources. ASA, CSSA, SSSA 2010 International Meetings, held in Long Beach, CA, 10/31-11/3, 2010.

Drizo, Aleksandra, 2011, "Phosphorus and Suspended Solids Reduction from Agricultural Tile Drainage via Passive Filtration Systems" final report.

Drizo, Aleksandra, 2011, Phosphorus and E.Coli Reduction from Silage Leachate via Innovative Passive Filtration Systems, final report

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

SEASONAL HIGH TUNNEL SYTEM

CODE 325

(Ft²)

I. DEFINITION

An enclosed polyethylene, polycarbonate, plastic, or fabric covered structure that is used to cover and protect crops from sun, wind, excessive rainfall, or cold, to extend the growing season in an environmentally safe manner.

II. PURPOSE

Improve plant health and vigor.

III. CONDITIONS WHERE PRACTICE APPLIES

This practice applies to land capable of producing crops. This practice applies where sun or wind intensity may damage crops, or where an extension of the growing season is needed due to climatic conditions.

This practice does not apply to crops grown in the non-natural soil profiles such as tables/benches, portable pots, and hydroponically.

IV. CRITERIA

1. Supportive conservation practices and or treatment measures shall be implemented to address all environmental concerns associated with the installation and use of the high tunnel systems (structures) such as erosion, irrigation, and runoff.
2. Crops must be grown in the natural soil profile. Raised beds may be installed to improve soil condition, fertility, and access. Raised beds shall not exceed 12 inches in depth.
3. This practice does not include greenhouses or low tunnel systems and shall not be used to provide shelter or housing for any livestock, or to store supplies or equipment.
4. The footprint of these structures shall be placed in locations, away from buried public utilities.
5. Structures shall be located near a viable water source for irrigation, where practical.
6. The high tunnel structure must be planned, designed, and constructed from a manufactured kit in accordance with manufacturers' recommendations. The high tunnel frame must be constructed of metal, wood, or durable plastic; and be at least 6 feet in height at the peak of the structure. If required for enclosure, end wall covering may be of greenhouse-grade plastic, polycarbonate, wood, or other recommended material. Structures shall be designed and sized to accommodate entry/exit points to facilitate movement of equipment and supplies needed for the production of planned crops.
7. Select the high tunnel covering material of a significant thickness to withstand the temperature change for the period required and shall have a 4-year-minimum lifespan. For polyethylene covers, use a minimum 6-mil greenhouse grade, UV-resistant material.
8. Organic producers, shall make sure that all permissible activities, design, material used, and material specifications are consistent with the USDA Agricultural Marketing Service National Organic Program, National Standards on Organic Agricultural Production and Handling.

9. These structures shall be constructed on level grade or naturally occurring slopes, of five percent or less.
 10. Where snow loads may damage the structure, the tunnel cover shall be removed or rolled up at the end of the growing season unless the structure is designed by the manufacturer to withstand expected snow loads.
 11. Where wind loads may damage the structure, select the tunnel cover and structure designed by the manufacturer to withstand expected wind loads or manage the tunnel system in a manner that limits wind damage.
 12. Where the intensity or duration of sunlight can shorten the growing season, the appropriate thickness of shade cloth may be used in place of, or in addition to impervious plastic covers. When shade cloth is used alone, end walls are not required.
 13. High tunnels shed a large amount of water and can create drainage and ponding issues where none previously existed. Direct runoff away from the structure to avoid ponding and provide detention basins, storage reservoirs, or stable outlet when runoff from tunnel covers empties onto the ground surface with potential to cause erosion.
 14. Vegetate all exposed surface areas disturbed during construction in accordance with Wisconsin NRCS Practice Standard, Critical Area Planting (342).
 15. Significant modifications to the high tunnel structure design must be verified and approved by the manufacturer prior to construction to ensure that any warranties remain in effect.
2. Runoff should not be relied on as the only source of irrigation water. Use the criteria for Wisconsin NRCS Practice Standard Roof Runoff Structure (558), to design any structure needed to meet the runoff criteria above.
 3. Runoff may empty into surface or underground outlets, or onto the ground surface when properly protected. Size surface and underground outlets according to the criteria for Wisconsin NRCS Practice Standard, Underground Outlet (620), to ensure adequate capacity. Surface or ground outlets such as rock pads, rock-filled trenches with subsurface drains, concrete and other erosion-resistant pads, or preformed channels may be used.
 4. Consider managing the high tunnel system to maintain or improve soil health by following a soil management system that creates a favorable habitat for soil microbes by:
 - Minimizing soil disturbance, resulting in the improvement of the physical, chemical and biological, condition of the soil medium,
 - Using plant diversity in the rotation to increase diversity below ground,
 - Keeping a living root growing year round as much as possible, and
 - Keeping the soil covered with residue and growing plants year round.
 5. Locate the high tunnel conveniently for ingress/egress of plant materials, equipment, and other operation and maintenance activities.
 6. Remove or manipulate side covers to control internal temperatures and humidity.
 7. Installation of vents, fans, or heaters should be considered and included in the manufacturer's design and recommendations. When the objective is to provide protection from the sun and extend the growing

V. CONSIDERATIONS

1. Runoff may be captured and used for irrigation purposes, if allowed by state law.

season, consider a high tunnel structure that includes shade cloth.

8. Consider installing a supplemental manufacturer's kit to provide additional structural support.
9. Consider setting end posts in concrete, the use of heavier 12 to 14 gauge steel, and a double layer of plastic to increase integrity of the structure.
10. Consider a minimum clearance of 10 to 20 feet between side by side high tunnel installations for snow removal and cover installation.
11. Consider potential shading of high tunnel structures by other structures or trees and consider locating the structure footprint at a distance of two times the height of the tree or structure.
12. Consider managing weed populations by using soil fabrics, covers, or mulches.
13. Consider additional conservation practices where appropriate to include:
 - Crop rotation
 - Irrigation water management
 - Salinity management
 - Nutrient management
 - Integrated pest management
 - Critical area planting
 - Mulching
 - Roof runoff structure
 - Diversion
 - Underground outlets
 - Heavy use protection
 - Cover crop

VI. VII. PLANS AND SPECIFICATIONS

Prepare plans and specifications in accordance with the criteria of this standard.

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

- Identify purpose.
- Document the planned growing season.
- Layout and location of the high tunnel.

- Site preparations and the required supporting practices for erosion control, runoff, and vegetative cover according to the requirements of the corresponding conservation practice standard.
- The planned width and length of the seasonal high tunnel.
- Statement that the seasonal high tunnel will be installed per the manufacturer's recommendations.
- List of all material used and material specifications.
- Procedure and timing to remove or roll up the high tunnel cover prior to inclement weather conditions.
- Procedure and timing to add or replace shade cloth for protection from the sun for the high tunnel cover.

VII. OPERATION AND MAINTENANCE

1. Prepare an operation and maintenance (O&M) plan and review with the landowner and/or operator responsible for the practice. Provide specific instruction for proper operation and maintenance of each component of this practice and detail the level of repairs needed to maintain the effectiveness and useful life of the practice.
2. Periodically inspect the high tunnel and repair, reinstall, or replace materials, as needed to accomplish the intended purpose.
3. Manage the structure in a manner that limits wind and/or snow damage. Close sides and ends before storm events.
4. In areas that receive snow and ice, the structure shall be closed prior to winter weather.
5. Remove snow and ice from the structure cover and sides promptly to prevent structure failure.
6. When the structure is at serious risk of collapse due to weather conditions, consider slashing the plastic cover to relieve pressure and save the framework.

7. Perform soil tests regularly to monitor nutrients and to monitor salt build-up. The soils under immobile high tunnels may require periodic "flushing" to remove salt build-up. This is accomplished by removing the cover for a season to allow natural precipitation to infiltrate, or by artificially flooding the ground under cover.
8. Seed all disturbed earth surfaces outside of the high tunnel and maintain the vegetation throughout the structure's life.
9. Removal of cover materials shall be consistent with the intended purpose and site conditions.
10. Plan for proper disposal of the cover at the end of its useful life.
11. Operation of equipment near and on the site shall not compromise the intended purpose of the high tunnel structure or its cover.

"Growing Under Cover: A Guide to Polyunnel Options for Kansas Growers"; Kansas Rural Center; Kim Scherman, 2014.

VIII. 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.

IX. REFERENCES

Community Garden Guide Season Extension - High Tunnel, NRCS. Rose Lake Plant Materials Center, East Lansing, Michigan.

"High Tunnel Production Manual". Penn State University College of Agriculture, Department of Horticulture. White, L. and Orzolek, M. 2003

"High Tunnels: Using Low-Cost Technology to Increase Yields, Improve Quality and Extend the Season". Ted Blomgren, Cornell Cooperative Extension, and Tracy Frisch, Regional Farm and Food Project. Published by the University of Vermont Center for Sustainable Agriculture. 2007.

"Minnesota high tunnel production manual for commercial growers". Edited by: Terrance T. Nennich, Sr., University of Minnesota Extension and Suzanne Wold-Burkness, University of Minnesota. 2013.

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

ROOF RUNOFF STRUCTURE

CODE 558

(NO.)

DEFINITION

A structure that will collect, control and convey precipitation runoff from a roof.

PURPOSE

This practice is applied to achieve one or more of the following purposes:

- Protect surface water quality by excluding roof runoff from contaminated areas
- Protect a structure foundation from water damage or soil erosion from excess water runoff
- Increase infiltration of runoff water
- Capture water for other uses

CONDITIONS WHERE PRACTICE APPLIES

Where roof runoff from precipitation needs to be:

- Diverted away from a contaminated area or the foundation of a structure;
- Collected and conveyed to a stable outlet or infiltration area; or
- Collected and captured for other uses such as evaporative cooling systems, livestock water and irrigation.

CRITERIA

General Criteria Applicable to All Purposes

Supports. Evaluate the condition of the existing roof structure prior to installation of a gutter. Install new fascia boards as needed to support gutters and downspouts for the practice life span. Mount gutters on plumb fascia boards.

Ensure that the gutter support system will withstand the anticipated loading, including loads from snow and ice, as applicable. If structural support is missing or insufficient, design the required support for the selected gutter. As an

alternative to increasing the structural supports, use a ground gutter design to convey the roof runoff.

Gutter supports shall have a maximum spacing of 18 inches for aluminum gutters and 24 inches for steel gutters. Supports shall consist of either a heavy duty gutter hanger and a roof strap, or a heavy duty gutter hanger screwed to the fascia. For gutter sizes greater than 6 inches, maximum hanger spacing shall be reduced to 12 inches for aluminum gutters and 18 inches for steel gutters.

Lateral support shall be provided with wedges, wrap-around straps, rigid supports, or any combination thereof which will provide the necessary inward and/or outward support. Lateral supports shall have a maximum spacing of 8 feet.

Where snow and ice damage will occur, install the roof gutter below the projection of the roof line. Otherwise, the design shall include one or more of the following:

- Wrap-around straps at a maximum spacing of 8 feet.
- Rigid supports at a maximum spacing of 8 feet.
- "Snow guards" installed per manufacturer's recommendations.

Gutter Design Capacity. When a roof runoff structure is used to protect roof runoff from contamination by manure, design the roof runoff structure to convey the flow rate generated from a 25-year, 5-minute rainfall event (see Figure 2).

For other applications, design the roof runoff structure to convey the flow rate generated from a 10-year, 5-minute rainfall event (see Figure 1).

Downspout. Use downspouts, collector pipes, lateral downspouts or cross-pipes with a capacity equal or exceeding the roof gutter flow rate.

Downspouts shall be securely fastened at the top and bottom with intermediate supports that are a maximum of 10 feet apart. Lateral downspouts

and cross pipes shall have supports that are a maximum of 5 feet apart.

When a downspout outlets at the ground level, place an elbow and energy dissipation device at the outlet to provide erosion protection and direct water away from the foundation of the structure.

Use a pipe guard or pipe casing where necessary to protect the downspout, lateral or cross-pipe pipelines of the roof runoff structure from damage by livestock or equipment.

Ground Gutter. Where runoff from the roof eave drops onto the ground surface, provide a ground gutter with adequate provision to convey runoff away from the foundation of the structure.

Ground gutter designs can use a rock pad, a rock filled trench with a subsurface drain, a concrete channel, or a pre-cast channel to convey the roof runoff water to a stable discharge location or infiltration area.

Outlet. Roof runoff can empty into a subsurface drain, underground outlet, a ground gutter, a storage tank or onto stabilized soil.

Size the outlet to ensure adequate design capacity. Provide for a clean-out of the outlet as appropriate.

Use Wisconsin NRCS Conservation Practice Standard (WI CPS) *Subsurface Drain (Code 606)* to design a subsurface drain used to dewater a ground gutter or infiltration ditch.

Use WI CPS *Underground Outlet (Code 620)* to design an underground outlet used to convey roof runoff to a stable outlet.

Materials. Roof gutters and downspouts may be made of aluminum, galvanized steel, wood, or plastic. Aluminum gutters and downspouts require a minimum nominal thickness of 0.027 inches and 0.020 inches, respectively. Galvanized steel gutters and downspouts require a minimum 28 gauge. Wood may be redwood, cedar, cypress, or other species that has the desired longevity and will be free of knots. Plastics must contain ultraviolet stabilizers.

All materials including gutters, downspouts, hangers, straps, and support components shall be as specified in Wisconsin Construction Specification 23, *Aluminum or Steel Roof Gutters*.

To prevent corrosion, avoid contact between components of dissimilar metals.

To enable infiltration with rock-filled trenches and rock pads use 'poorly graded rock' (rock fragments approximately all the same size) that is free of appreciable amounts of sand or soil particles. Do not use crushed limestone for backfill material unless it has been washed.

Use WI CPS *Heavy Use Area Protection (Code 561)* for design and installation of pads or slabs.

Additional Criteria to Increase Infiltration

Increase runoff infiltration by directing flow to existing landscapes (e.g., lawns, mass planting areas, infiltration trenches, rain gardens or natural areas). Ensure these areas have the capacity to infiltrate the runoff without adversely affecting the desired plant species and without creating a soil erosion problem.

Additional Criteria to Protect the Foundation of a Structure

For a design which outlets the roof runoff on the ground, slope the runoff discharge area away from the structure foundation. Use a minimum downspout extension of five (5) feet to discharge runoff away from the foundation of a structure built on expansive soils or a building foundation placed on bedrock.

Additional Criteria to Capture Water for Other Uses

Design a water storage tank of adequate size, strength and durability to hold water for the intended purpose. Install the tank on a firm, unyielding foundation. Anchor above-ground water storage tanks to prevent damage from wind loads.

Prohibit access to water storage tanks by children and animals to prevent drowning. Protect the area around the tank from erosion caused by overflow from the tank.

Construct or select water storage tanks of materials and in a manner that will not degrade the quality of the stored water. Design water supply attachments to meet system needs. Include a first flush diverter as necessary to reduce sediment, pathogens, and chemical pollutants in the collected water.

The water quality must be suitable for the intended use. The landowner is responsible for any water quality testing and treatment.

CONSIDERATIONS

Consider the use of multiple downspouts to reduce gutter size.

Discharge of outlets near wells and sinkholes or directly into drainage ditches, streams or ponds can cause point source pollution.

Consider installation of rain gardens at the outlets to clean, transpire and infiltrate runoff water.

When underground outlets are used, consider either a strainer at the head of the downspout, or a clean-out port on the riser pipe.

Consider the use of wrap-around straps in lieu of rigid supports on steep roofs where the outer edge of the gutter cannot be placed below the projected roof line.

On roofs subject to snow and ice slides, consider additional supports even if the gutter is installed below the projected roof line.

For cold climates, ensure the underground outlet is deep enough to avoid freezing or include a method to bypass the outlet without damage to the downspout.

PLANS AND SPECIFICATIONS

Provide plans and specifications for installing a roof runoff structure that describe the requirements for applying this practice to achieve its intended purpose. At a minimum, include the location, size and any specific installation instructions of all gutters and spacing of downspouts, type of ground gutters, outlets and the types and quality of material to be used.

Include plans and specifications for other practices essential for the proper functioning of the roof runoff structure.

Instruct landowner and contractor of responsibility to locate all buried utilities in the project area, including drainage tile and other structural measures.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, site conditions and safety requirements. The plan will contain, but not be limited to, the following provisions:

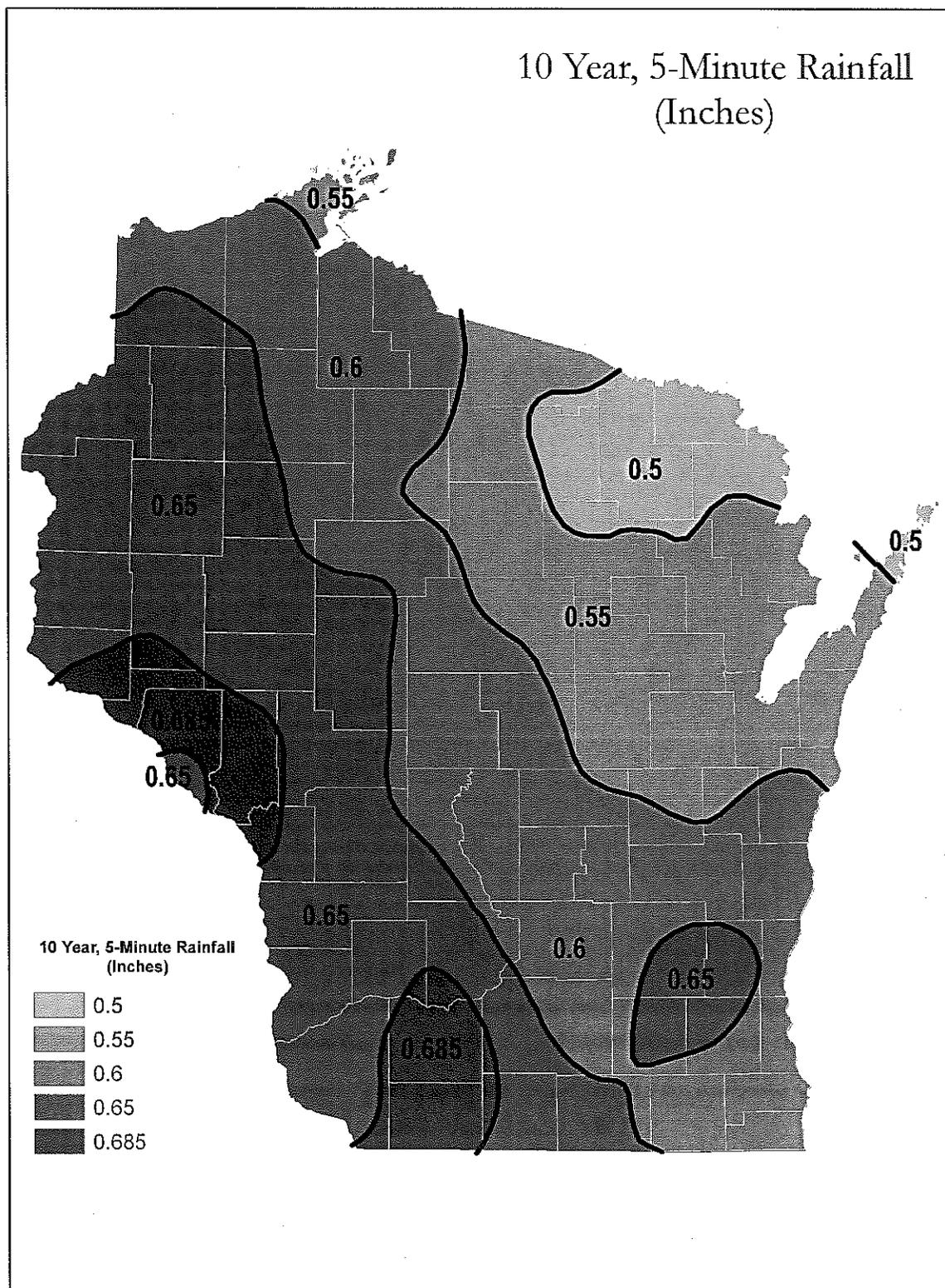
- Keep roof runoff structures clean and free of obstructions that reduce flow.

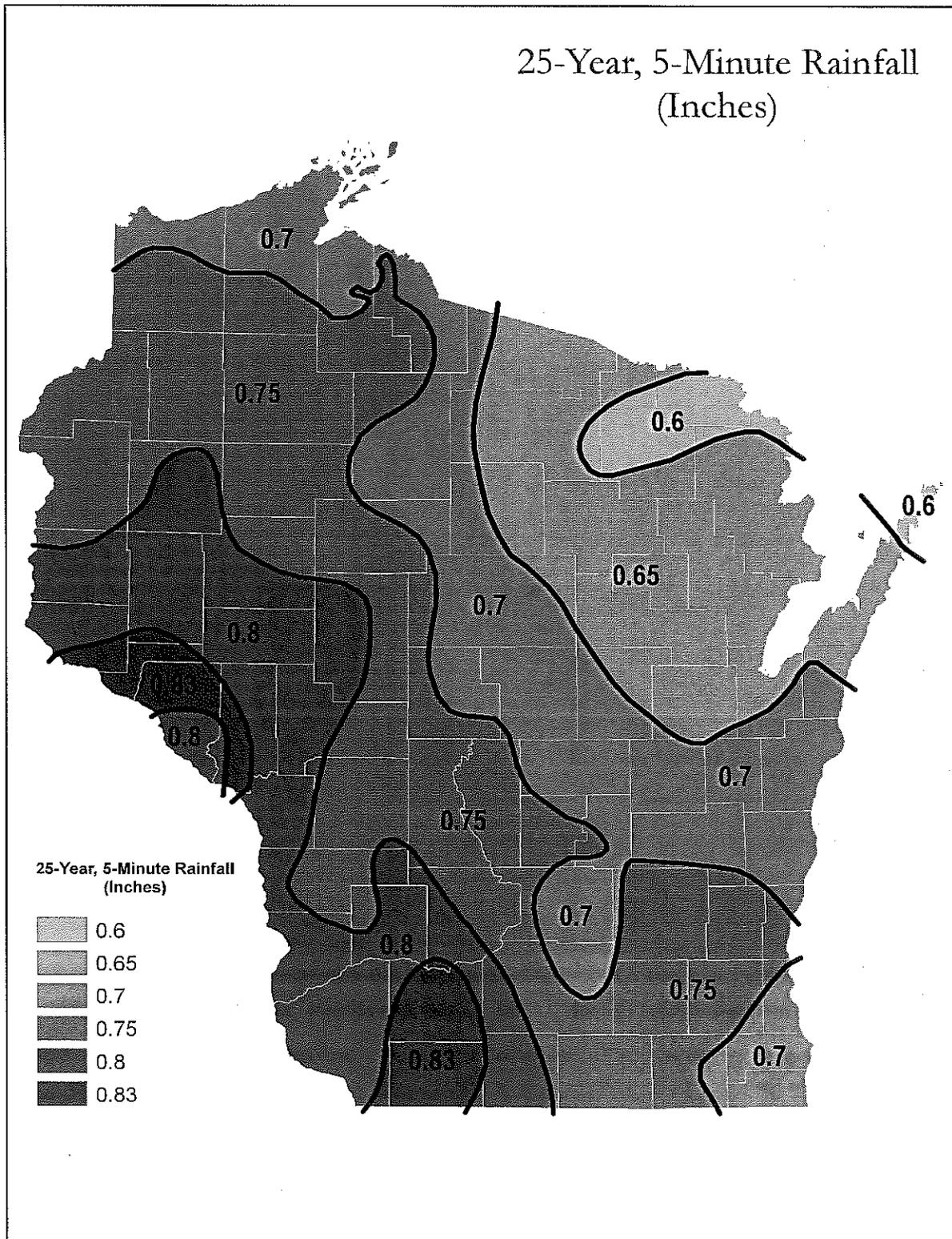
- Make regular inspections and perform cleaning and maintenance as needed.

REFERENCES

NRCS, 2009, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook, Chapter 10, Agricultural Waste Management System Component Design

NRCS, National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 2, Estimating Runoff





STATEMENT OF WORK
USDA, Natural Resources Conservation Service
Wisconsin
Roof Runoff Structure (558)

DESIGN (911)

Deliverables:

1. Design documentation that will demonstrate the criteria in the NRCS practice standard have been met and are compatible with other planned and applied practices.
 - a. Compliance with NRCS national and state utility safety policy (NEM Part 503 Safety).
 - b. List of associated eFOTG conservation practices included in the project.
 - c. Practice standard criteria substantiating data, computations, and analyses to develop plans and specifications including but not limited to:
 - i. Hydrology and hydraulics.
 - ii. Structural components.
 - iii. Outlet considerations (e.g., surface or underground and erosion protection).
 - iv. Appurtenances.
2. Adequate location map, plan view, profiles, cross sections, details, and specifications to ensure that the project can be properly constructed and permits secured.
3. Design Report and Quality Assurance Plan as appropriate (NEM Part 511, Design and Part 512, Construction).
 - a. The design report shall include, but is not limited to the following:
 - i. Summary of project objectives and work to be completed.
 - ii. Design documentation from item 1 listed above.
 - b. The quality assurance plan must describe the type and frequency of testing, items requiring inspection, the documentation required, and the qualifications of the person doing the work.
4. Operation and maintenance plan.
5. Itemized engineer's cost estimate.
6. Certification that the design meets practice standard criteria and complies with applicable laws and regulations (NEM Part 505, Non-NRCS Engineering Services).

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Roof Runoff Structure (558)

INSTALLATION (912)

Deliverables

1. Documentation of pre-construction conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout survey notes.
4. Installation inspection (according to quality assurance plan).
 - a. Materials used.
 - b. Inspection records.
 - c. Maintaining a job diary with the dates and record of inspections made, testing completed, instruction provided to the contractor, etc., to document compliance with standards and specifications.
5. Facilitate, implement and document required design modifications with client, original designer, permitting and funding agencies.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meet design and permit requirements.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Roof Runoff Structure (558)

CHECKOUT (913)

Deliverables

1. Supporting documentation.
2. As-Built drawings
 - a. Drawings with changes from the original construction plans clearly shown.
 - b. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Part 505, Non-NRCS Engineering Services).
3. Extent of practice units applied and location identified on a map.
 - a. Completed job diary noting inspections made, testing completed, etc.
 - b. Materials documentation.
 - c. Testing reports.
 - d. Survey notes for layout, inspections, and final checkout documenting compliance with standards and specifications.
4. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
 - a. Technical Service Provider Name
 - b. Customer name
 - c. USDA program funding the practice (if known)
 - d. Location of work (state, county, conservation district, land tract identifier)
 - e. Land use of field where the practice was installed (cropland, etc.)
 - f. NRCS practice name and quantity of practice installed in appropriate units

STATEMENT OF WORK
USDA, Natural Resources Conservation Service
Wisconsin

Roof Runoff Structure (558)

REFERENCES

- WI NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard 558, Roof Runoff Structure
- NRCS National Engineering Manual (NEM) and Wisconsin Supplements
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook
- NRCS National Engineering Handbook, Part 650, Engineering Field Handbook (EFH) and Wisconsin Supplements
- NRCS National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook (AWMFH) and Wisconsin Supplements

CERTIFICATION OF COMPLETION

Roof Runoff Structure (558)

Program Participant Information

Name (print): _____

Contract Number: _____ Contract Item #(s): _____

Technical Service Provider Information

Name (print): _____

TSP ID Number: _____ Expiration Date: _____

Technical Services Provided

- Design (911)
- Installation (912)
- Checkout (913)

I hereby certify that the technical services I provided as a Technical Service Provider for this component(s) checked above: (1) comply with all applicable Federal, State, Tribal, and Local laws and requirements, (2) meet applicable USDA NRCS conservation practice standards, specifications, and program requirements, (3) are consistent with and meet the particular conservation program goals and objectives, (4) that I have provided the above named Program Participant the Deliverables in this Statement of Work for this component, and (5) comply with all "Certification Terms" as identified in the Technical Service Provider Certification Agreement.

Technical Service Provider Signature

Date

Received By (NRCS staff)

Date

Natural Resources Conservation Service
Conservation Practice Standard

WETLAND ENHANCEMENT

Code 659 (Acres)

I. DEFINITION

The augmentation of wetland functions beyond the original natural conditions on a former, degraded, or naturally functioning wetland site; sometimes at the expense of other functions.

II. PURPOSE

To increase the capacity of specific wetland functions (such as habitat for targeted species, and recreational and educational opportunities) by enhancing:

- Hydric soil functions (changing soil hydrodynamic and/or bio-geochemical properties).
- Hydrology (dominant water source, hydroperiod, and hydrodynamics).
- Vegetation (including the removal of undesired species, and/or seeding or planting of desired species).
- Enhancing plant and animal habitats.

III. CONDITIONS WHERE PRACTICE APPLIES

This practice applies to any degraded or non-degraded wetland sites with hydric soils, where the objective is to enhance selected wetland functions to conditions different than those that originally existed on the site.

This practice does not apply to:

- The treatment of point and non-point sources of water pollution (Constructed Wetland – Code 656);
- The rehabilitation of a degraded wetland or the reestablishment of a former wetland so that soils, hydrology, vegetative community, and habitat are a close approximation of the original natural condition and boundary that existed prior

to the modification (Wetland Restoration - Code 657).

- The creation of a wetland on a site location that was historically non-wetland. (Wetland Creation – Code 658).
- The management of fish and wildlife habitat on wetlands enhanced under this standard.
- Excessive nutrient, pesticide, or other pollutant inflows shall be addressed. Examples of excessive inflows include direct runoff from a feedlot or other obvious pollution source, an actively eroding gully emptying into the site, or a poorly treated watershed that is contributing sediment and its associated pollutants.

IV. CRITERIA

A. General Criteria Applicable to All Purposes

The purpose, goals, and objectives of the enhancement shall be clearly defined in the enhancement plan, including soils, hydrology, vegetation, and fish and wildlife habitat criteria that are to be met and are appropriate for the site and the project objectives.

The planning process will evaluate the impact of this practice on existing non-degraded wetland functions and/or values. The relative increase or decrease in functions will be assessed with the use of a functional assessment procedure or state approved equivalent. The functions to be increased or decreased on wetlands found to be currently functioning at or near a “reference” condition will be documented.

The soils, hydrology, and vegetative conditions existing on the site, the adjacent landscape, and the contributing watershed shall be documented in the planning process.

The nutrient and pesticide tolerance of the plant and animal species likely to occur shall be evaluated where known nutrient and pesticide contamination exists. Sites suspected of containing hazardous material shall be tested to identify appropriate remedial measures. If remedial measures are not possible or practicable, the practice shall not be planned.

Upon completion, the site shall meet the appropriate wetland criteria and provide wetland functions as defined in the project's objectives.

Invasive species, federal/state listed noxious plant species, and nuisance species (e.g., those whose presence or overpopulation jeopardize the practice) shall be controlled on the site as necessary to enhance wetland functions. The establishment and/or use of non-native plant species shall be discouraged.

B. Criteria for Hydric Soil Enhancement

Enhancement sites will be located on soils that are hydric. Hydric soil that is excavated to improve wetland hydrology shall be removed when possible. Hydric soil that cannot be removed shall be spread to a minimum depth of 4 inches.

Changes to soil hydrodynamic and bio-geochemical properties such as permeability, porosity, pH, or soil organic carbon levels shall be made as needed to meet the planned objectives.

C. Criteria for Hydrology Enhancement

The hydroperiod, hydrodynamics, and dominant water source of the enhanced site shall meet the project objectives.

The enhancement plan shall document the adequacy of available water sources based on groundwater investigation, stream gage data, water budgeting, or other appropriate means.

The work associated with the wetland shall not adversely affect adjacent properties or other water users unless agreed to by signed written letter, easement or permit.

Timing and level setting of water control structures required for the establishment and maintenance of vegetation, soil, and wildlife and fish habitat functions shall be created to support the wetland type being established and create the wetland function(s) desired. Refer to Biology Technical Note 2 to create diversity of water depths and vegetative communities.

Other structural practices, macrotopography and/or microtopography may be used to meet the planned objectives.

If embankments, water control structures, surface or subsurface drainage manipulation, or grade stabilization structures are required, use Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), *Wetland Restoration (657)*, or *Structure For Water Control (587)*. Macrotopographic features, including ditch plugs installed in lieu of re-filling surface drainage ditches, shall meet the requirements of other practice standards to which they may apply due to purpose, size, water storage capacity, hazard class, or other parameters. If no other practice standard applies, they shall meet the requirements for WI NRCS CPS, *Dike (356)* unless there is no potential for damage to the feature or other areas on or off site due to erosion, breaching, or overtopping.

Water control structures that may impede the movement of target aquatic species or species of concern shall meet the criteria in WI NRCS CPS, *Fish Passage (396)*.

D. Criteria for Vegetative Enhancement

Hydrophytic vegetation restoration shall be of species typical for the wetland type(s) being established and the varying hydrologic regimes and soil types within the wetland. Preference

shall be given to native wetland plants with localized genetic material. Refer to Wisconsin Agronomy Technical Note 5 for specific details on seeding.

Where natural colonization of acceptable species can realistically be expected to occur within 5 years, sites may be left to re-vegetate naturally. It is beneficial to top-dress at least 50% of the site with soil containing a seed bank of desired native species to a minimum depth of 4 inches.

Adequate substrate material and site preparation necessary for proper establishment of the selected plant species shall be included in the plan.

Where planting and/or seeding is necessary, the minimum number of native species to be established shall be based on a reference wetland unless the objectives require a different plant community.

- If the targeted hydrophytic vegetation is predominantly herbaceous, species diversity will be maximized as appropriate to meet the targeted functions. Seeding rates shall be based upon the percentage of pure live seed and labeled with a current seed tag from a registered seed laboratory identifying the germination rate, purity analysis, and other seed statistics.
- Where the dominant vegetation will be forest or woodland community types, vegetation establishment will include a mix of woody species (trees and/or shrubs) adequate to establish the reference wetland community.

V. CONSIDERATIONS

A. Soil Considerations

Consider making changes to physical soil properties, including:

- Increasing or decreasing saturated hydraulic conductivity by mechanical compaction or tillage, as appropriate,
- Incorporating soil amendments,

- The effect of construction equipment on soil density, infiltration, and structure.

B. Hydrology Considerations

Consider the general hydrologic effects of the enhancement, including:

- Impacts on downstream stream hydrographs, volumes of surface runoff, and groundwater resources due to changes of water use and movement created by the enhancement.

Consider adverse effects on downstream flows or aquifers that would impact other water uses or users.

Consider the impacts of water level management, including:

- Increased predation due to concentrating aquatic organisms, including herptivores, in small pool areas during draw downs.
- Increased predation of amphibians due to high water levels that can sustain predator fish.
- Decreased ability of aquatic organisms to move within the wetland and from the wetland area to adjacent habitats, including fish and amphibians, as water levels are decreased.
- Increases in water temperature on-site, and in off-site receiving waters.
- Changes in the quantity and direction of movement of subsurface flows due to increases or decreases in water depth.
- The effect changes in anaerobic conditions have on soil biogeochemical properties; including oxidation/reduction, and maintenance of organic soils.
- The potential for water control structures, dikes, and macrotopographic features to negatively impact the movement of non-target aquatic organisms.

C. Vegetation Considerations

Consider:

- The relative effects of planting density on fish and wildlife habitat versus production rates in woody plantings.
- The potential for vegetative buffers to increase function by trapping sediment, cycling nutrients, and removing pesticides.
- The selection of vegetation for the protection of structural measures that is appropriate for wetland function.
- The potential for invasive or noxious plant species to establish on bare soils after construction and before the planned plant community is established.
- The use of prescribed burning to maintain wetland and adjacent upland plant communities.

D. Fish and Wildlife Habitat Considerations

Consider:

- The addition of coarse woody debris to provide an initial carbon source and fish and wildlife cover.
- The potential to restore habitat capable of supporting fish and wildlife with the ability to control disease vectors such as mosquitoes.
- The potential to establish fish and wildlife corridors linking the site to adjacent landscapes, streams, and water bodies and to increase the sites colonization by native flora.
- The need to provide barriers to passage for unwanted or predatory fish and wildlife species.
- Consider nutrients, pesticides, and other pollutants contained in surface and ground water as well as accumulated sediments, that may have an adverse effect on wetland vegetation. The nutrient and pesticide tolerance of the species planned along with the wetland objectives

should be considered where known nutrient and pesticide contamination exists.

- Consider the need for buffer practices beneficial to wildlife around the perimeter of the site. Plan practices such as WI NRCS CPS, *Filter Strip (393)*; *Field Border (386)*, and or *Conservation Cover (327)* to create a vegetative buffer between the management unit and the adjacent land uses. This buffer should be at least 30 feet wide and match WI NRCS CPS, *Filter Strip (393)*.
- Consider the use of these areas by reptiles and amphibians. Stacked logs and/or rock piles may be located near the water's edge to provide critical habitat for local reptile and amphibian species.

VI. PLANS AND SPECIFICATIONS

Plans and specifications for this practice shall be prepared for each site. Plans and specifications shall be recorded using approved specifications sheets, job sheets, or other documentation. The plans and specifications for structural features will include, at a minimum, a plan view, quantities, and sufficient profiles and cross-sections to define the location, line, and grade for stakeout and checkout. Plans and specifications shall be reviewed and approved by staff with appropriate job approval authority.

VII. OPERATION AND MAINTENANCE

A separate Operation and Maintenance Plan will be prepared for sites that have structural features. The plan will include specific actions for the normal and repetitive operation of installed structural items, especially water control structures, if included in the project.

The plan will also include the actions necessary to assure that constructed items are maintained for the life of the project. It will include the inspection schedule, a list of items to inspect, a checklist of potential damages to look for, recommended repairs, and procedures for documentation.

Management and monitoring activities needed to ensure the continued success of the wetland enhancement objectives may be included in the above plan, or in a separate Management and Monitoring Plan. In addition to the monitoring schedule, this plan may include the following:

- The timing and methods for the use of fertilizers, pesticides, prescribed burning, or mechanical treatments.
- Circumstances when the use of biological control of undesirable plant species and pests (e.g. using predator or parasitic species) is appropriate, and the approved methods.
- Actions which specifically address any expected problems from invasive or noxious species. Management needed to maintain vegetation, including control of unwanted vegetation.
- The depth of sediment accumulation circumstances which requires the removal of accumulated sediment.
- Repair and upkeep of the practices shall be carried out as needed such as repair or replacement of vegetative or structural components.
- Timing and level setting of water control structures required for establishment of desired hydrologic conditions or for management of vegetation.
- Inspection schedule of embankments and structures for damage assessment.
- Conditions which indicate the need to use haying or grazing as a management tool, including timing and methods.

VIII. FEDERAL, STATE, AND LOCAL LAWS

Users of this standard should be aware of applicable federal, state, and local laws, rules, regulations, or permit requirements governing wetland enhancement. All laws and regulations pertaining to flooding, surface and subsurface drainage will be followed.

IX. REFERENCES:

Executive order 13112, Invasive Species, February 3, 1999. Federal Register: Vol.64, No.25. Feb. 8, 1999.
<http://www.invasivespeciesinfo.gov/laws/execorder.shtml>

Galatowitsch, Susan, et al, 1994. Restoring Prairie Wetlands: an ecological approach. Iowa State University Press, Ames, IA. 246 pp.

Hall, C.D. and F.J. Cuthbert. 2000. Impact of a controlled wetland drawdown on Blanding's Turtles in Minnesota. Chelonian Conservation Biology. Vol. 3, No. 4, pp. 643-649
 Hurt, G.W. and V.W. Carlisle, 2001.

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Kingsbury, Bruce & Joanne Gibson, 2002. Habitat Management Guidelines for Amphibians and Reptiles of the Midwest. Partners in Amphibian & Reptile Conservation, Ft Wayne IN, 57 pp.

M.J. Vepraskas and S. W. Sprecher editors, 1997. Aquic Conditions and Hydric Soils: The Problem Soils. Soil Science Society of America Special Publication Number 50. SSSA, Inc. Madison, WI.

Maschhoff, Justin T & James H. Dooley, 2001. Functional Requirements and Design Parameters for Restocking Coarse Woody Features in Restored Wetlands, ASAE Meeting Presentation, Paper No: 012059.

USDA, NRCS, 2003. ECS 190-15 Wetland Restoration, Enhancement, Management & Monitoring. 425 pp.
<ftp://ftp-fc.sc.egov.usda.gov/WLI/wre&m.pdf>

USDA, NRCS. 2010. Field Indicators of Hydric Soils in the U.S., Version 6.0. G.W. Hurt, P.M. Whited and R.F. Pringle (eds.). USDA, NRCS in cooperation with the National Technical Committee for Hydric Soils, Fort Worth, TX.

http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_050723.pdf

USDA, NRCS. Hydric Soil Technical Note 13, Deliberations of the National Technical Committee for Hydric Soils (NTCHS).
http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_051928.pdf

USDA, NRCS. Wetland Restoration,
Enhancement, or Creation, Engineering
Field Handbook Chapter 13, Part 650. 121
pp. [ftp://ftp-fc.sc.egov.usda.gov/WL/wre&m.
pdf](ftp://ftp-fc.sc.egov.usda.gov/WL/wre&m.pdf)

USDA, NRCS Wisconsin Agronomy
Technical Note 5

USDA, NRCS Wisconsin Biology Technical
Note 2

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Wetland Enhancement (659)

DESIGN (911)

Deliverables:

1. Design documentation that will demonstrate that the criteria in NRCS practice standard have been met and are compatible with other planned and applied practices.
 - a. Impacts on adjacent properties and structures.
 - b. Compliance with NRCS national and state utility safety policy (NEM Part 503-Safety, Subpart A - Engineering Activities Affecting Utilities 503.00 through 503.06).
 - c. List of facilitating practices.
 - d. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
 - i. Compliance with wetland functional assessment and hydric soils determination.
 - ii. Hydrology/hydraulics.
 - iii. Structural including hazard class as appropriate.
 - iv. Vegetation.
2. Written plans and specifications including location map, sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits.
3. Design Report and Inspection Plan as appropriate (NEM Part 511, Subpart B Documentation, 511.11 and Part 512, Subpart D Quality Assurance Activities, 512.30 through 512.32).
4. Operation and maintenance plan
5. Certifications that the design meets practice standard criteria and comply with applicable laws and regulations (NEM Subpart A, 505.03(b)(2)).
6. Documentation requirements for design modifications during practice installation.
7. Itemized engineer's cost estimate.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service Wisconsin

Wetland Enhancement (659)

INSTALLATION (912)

Deliverables:

1. Documentation of pre-construction conference with client and contractor.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes.
4. Results of installation inspection (according to inspection plan as appropriate) to include but not limited to:
 - a. Actual materials used.
 - b. Inspection records.
5. Facilitate, implement and document required design modifications with client, original designer, permitting and funding agencies.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
7. Certification that the installation process and materials meets design and permit requirements.

CHECKOUT (913)

Deliverables:

1. As-Built documentation.
 - a. Extent of practice units applied and location identified on a map.
 - b. Drawings.
 - c. Final quantities.
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits (NEM Subpart A, 505.03(c)(1)).
3. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
 - a. Technical Service Provider Name
 - b. Customer name
 - c. USDA program funding the practice (if known)
 - d. Location of work (state, county, conservation district, land tract identifier)
 - e. Land use of field where the practice was installed (cropland, etc.)
 - f. NRCS practice name and quantity of practice installed in appropriate units
4. Documentation of exit conference with client and contractor.

STATEMENT OF WORK

USDA, Natural Resources Conservation Service
Wisconsin

Wetland Enhancement (659)

REFERENCES

- WI NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard 659, Wetland Enhancement
- NRCS National Engineering Manual (NEM)
- NRCS Engineering Field Handbook (EFH), Part 210, Chapter 13, Wetland Restoration, Enhancement, or Creation
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Procedures Handbook
- NRCS National Biology Manual
- NRCS National Biology Handbook
- National Food Security Act Manual

CERTIFICATION OF COMPLETION

USDA, Natural Resources Conservation Service
Wisconsin

Wetland Enhancement (659)

Program Participant Information

Name (print): _____

Contract Number: _____ Contract Item #(s): _____

Technical Service Provider Information

Name (print): _____

TSP ID Number: _____ Expiration Date: _____

Technical Service Provided

- Design (911)
- Installation (912)
- Checkout (913)

I hereby certify that the technical services I provided as a Technical Service Provider for this component(s) checked above: (1) comply with all applicable Federal, State, Tribal, and Local laws and requirements, (2) meet applicable USDA NRCS conservation practice standards, specifications, and program requirements, (3) are consistent with and meet the particular conservation program goals and objectives, (4) that I have provided the above named Program Participant the Deliverables in this Statement of Work for this component, and (5) comply with all "Certification Terms" as identified in the Technical Service Provider Certification Agreement.

Technical Service Provider Signature

Date

Received By (NRCS Staff)

Date

INTRODUCTION

This job sheet describes the necessary techniques to establish woody plants for conservation purposes.

This document does not completely cover the facilitating practices often used in conjunction with tree/shrub establishment, such as site preparation and follow-up weed control, that are also necessary to ensure plant survival. For these additional practices, refer to Wisconsin NRCS Conservation Practice Standard (WI CPS), *Tree/Shrub Site Preparation (490)*, *Herbaceous Weed Control (315)*, *Mulching (484)*, and/or other applicable conservation practice standards and associated job sheets.

PURPOSE

This practice can be used to establish woody plants for:

- » Forest products such as timber, pulpwood, etc.
- » Wildlife habitat
- » Long-term erosion control and improvement of water quality
- » Treating waste
- » Storing carbon in biomass
- » Reducing energy use
- » Developing renewable energy systems
- » Improving or restoring natural diversity
- » Enhancing aesthetics
- » Reducing air pollution
- » Uptake of soil and water-borne chemical and nutrients

COVER CROPS

Cover crops or permanent sod strips may be needed between tree/shrub rows on sandy or highly erosive sites in order to prevent erosion and damage to seedlings by sandblasting. Cover crops are also used to minimize the risk of more aggressive or invasive vegetation (e.g., Canada thistle) establishing.

Ideally, cover crops should be allowed one growing season prior to planting the trees. This will provide

flexibility in case the cover crop doesn't establish adequately, due to unfavorable weather conditions, for instance. If cover crops are needed, use WI CPS, *Cover Crop (340)*.

SITE PREPARATION

Site preparation prior to tree/shrub planting is typically necessary on any site with existing vegetation to reduce competition and assure tree survival. Site preparation likely is not needed on bare or very sparsely vegetated sites – recently tilled, following an annual crop (e.g. annual grains, soybeans), moss, sparse Junegrass, etc. Refer to WI CPS, *Tree/Shrub Site Preparation (490)* and job sheet for more information.

CARE OF SEEDLINGS



Proper care of seedlings prior to and during the planting process is critical to ensuring a successful planting. Seedlings that have had roots dried, frozen, or subjected to mold or high temperature should be assumed dead and not suitable for planting.

Seedlings should be packed and shipped in wet moss or other similar medium, kept cool (ideal temperature between 33 and 37 degrees F) and moist through the planting process. Make plans for cold storage in case planting is delayed, if possible. Exposure to direct sun and wind can kill a seedling in less than 30 seconds.



Plant seedlings as soon as possible after received, keeping roots moist throughout the planting process.

If seedlings can't be planted right away, store them in a cool, moist, shaded location up to 7 days. Do not stack bundles of trees in layers of more than two deep to allow adequate air circulation and prevent heating.

If planting is delayed for longer than seven days after receipt and they can not be kept in cold storage, heel in the seedlings in a shaded area and keep them moist. To heel-in seedlings: Dig a trench in the soil, place the seedling in the trench and cover the roots with soil, wetting the soil and roots during the process. Refer to Figure 2. Transplant heeled in seedlings and resume normal tree planting as soon as suitable conditions exist.

Do not immerse roots in water or wash soil off of seedling roots. Mist seedlings to keep them moist.

Water absorbent/retention dip may help conserve moisture on seedling roots when planting in dry weather.

PLANTING REQUIREMENTS

Planting Dates

Plant bare-root stock, seedling plugs, live cuttings, containerized stock or balled and burlapped stock during the dormant season in the Spring after the ground thaws until June 1 as soil moisture and local weather conditions permit or in the Fall, after October 1 until the ground freezes when soil moisture is adequate.

Do not plant seedlings (bare-root or plugs) in the Fall on soils subject to frost-heave action (clays, clay loam, silty clay loams, silts, silt loams, and loams).

Planting Seedlings

The planting trench or hole must be deep and wide enough to permit roots to spread out and down without J-rooting or L-rooting. If the roots are too long for the planting equipment, minimal pruning of small end roots may be needed. Do not prune back into the main root system or more than 25% of the total root length (excluding long individual fibrous roots), or to less than 8 inches. Pack soil around each plant firmly to eliminate air pockets after planting.

Plant trees/shrubs vertically with the root collars equal to or up to one inch below the soil surface to ensure adequate coverage of the roots with soil.

Planting Cuttings

Plant cuttings within 2 days of collection or shipping arrival in the spring before June 1. Plant, with buds pointing up, in firm ground with 1" of cutting exposed above ground.

Planting Containerized Trees

Dig a hole slightly larger than the container diameter. Gently remove plants from containers before placing in the ground and firmly pack soil around roots to eliminate air pockets. Before planting, loosen any spiraling or compacted roots. Water should be applied generously.

Planting Balled and Burlapped Trees

When handling stock, never lift a tree at the stem or trunk. Handle stock at the root ball. Dig a hole 1 1/2 times as wide as the root ball and about the same depth as the root ball. Remove any rope, wire, or plastic twine from the tree. Pull back burlap around trunk and fold down into the hole. Carefully place the tree in the hole and firmly pack soil around roots to eliminate air pockets. Water should be applied generously.

Other Planting Information

Use equipment and plant on the contour or across the slope, as possible to minimize erosion potential.

Use of a professional tree planting contractor has been shown to significantly increase the chances for successful tree establishment.

Use of a professional tree planting contractor has been shown to significantly increase the chances for successful tree establishment.

If damage from deer, rabbits or other herbivores is anticipated, use tree shelters or repellents to protect seedlings.

MAINTENANCE

Weed Control

Maintain a 36" diameter weed-free area in all directions from planted seedlings or cuttings until average tree/shrub height is taller than the surrounding weeds. This will typically take 3 to 5 years. Use WI CPS, *Mulching (484)* for organic or inorganic mulch, including fabric weed barriers.



Use WI CPS, *Herbaceous Weed Control (315)* for chemical or mechanical (tillage) weed control.

If tillage is used for weed control, care must be taken not to damage plant stems. Keep tillage depths shallow to avoid root damage.

Note: Mowing is not considered a weed control practices in field plantings, as it tends to stimulate root growth of grasses. It can be used between tree rows, however, to improve access, and reduce cover for potentially damaging herbivores.

Mulch and Fabric Weed Barriers

Note: organic or inorganic mulch, including fabric weed barriers, should be specified as WI CPS, *Mulching (484)*. However, some additional guidance is provided here.

Mulch is organic or inorganic material that is spread around the individual seedling to help retain soil moisture, moderate soil temperature, and prevent weed growth. Apply mulch in a 3' diameter circle around each seedling, 2 to 3" deep, and pulled back from the plant stem slightly. Straw or other similar mulch generally should be avoided as it can encourage mice and other small herbivores that may damage the seedlings.

Freshly chipped wood mulch should be aged for a few months to minimize the risk of heat damage to the seedlings (chips heat up significantly during the early stages of decay), and nitrogen deficiency

problems (decaying organic matter can deplete the soil of nitrogen).

Fabric weed barriers are porous, yet opaque material that is installed over a tree or shrub seedling. They permit water to seep through to the seedling, but prevent weed growth. They are installed as 3' x 3' squares over individual plants, or as long rolls that can be rolled out over rows of trees.

If weed barriers or mulch will be used for follow-up weed control, site preparation may not be required. However, in sites with aggressive difficult-to-kill weeds (e.g., reed canary grass), mechanical or chemical site preparation should be used prior to planting and installation of the weed barriers or mulch.

Other Maintenance Information

Supplemental planting is recommended if survival drops below 80% of the minimum allowed stocking level (see "Spacing Requirements" above).

Protect trees and shrubs from fire, insects, disease, and animals until established. Refer to WI CPS, *Firebreak (398)* or other applicable standards as needed.

Pruning may be required to remove damaged, diseased or unwanted limbs to improve health and quality. Refer to WI CPS, *Tree/Shrub Pruning (660)*.

Figure 1

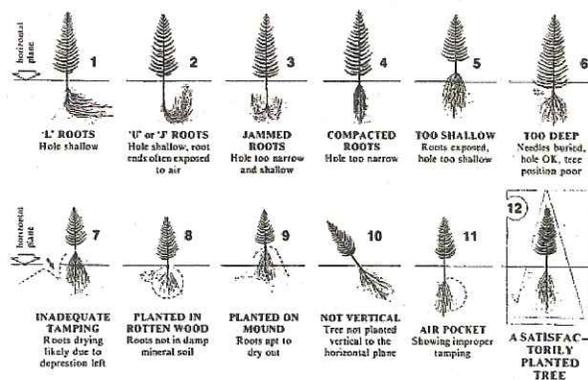
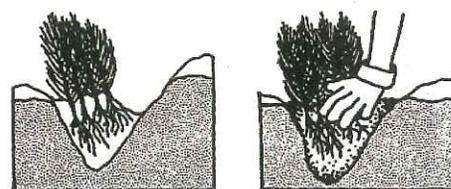


Figure 2



One method of long-term tree storage is the "heeling-in" technique. Roots must be packed tightly in soil and kept moist, and the heel-in trench must be shaded and protected from the wind.



GENERAL INFORMATION

Client Name*: _____ Tract No.: _____ Field No.: _____

Site Specifications: _____ Acres To Be Planted*: _____

Soil Map Unit(s): _____ Cons. Tree/Shrub Suit. Group: _____

Map of site* - attach a sketch, map, or aerial photo indicating the location of area to be treated with FSI.

PURPOSES* (check all that apply). Establish Woody Plants For...

- Forest products (such as timber, pulpwood, etc.)
- Wildlife habitat
- Treating waste
- Storing carbon in biomass
- Reducing energy use
- Long-term erosion control and improvement of water quality
- Developing renewable energy systems
- Improving or restoring natural diversity
- Enhancing aesthetics
- Reducing air pollution
- Uptake of soil and water-born chemicals and nutrients

SITE PREPARATION (for information only - include site preparation in plan as separate conservation practice: Tree/Shrub Preparation (490))

Initial Site Preparation Method*: _____ Date*: _____

Additional Information: _____

TREE/SHRUB ESTABLISHMENT

Planting Method*: _____ Planting Date*: _____

Storage Requirements (if any): _____

Average Spacing Between Rows*: _____ Average In-Row Spacing*: _____

Average Stems Per Acre*: _____ Average Seedling Size/Type: _____

Number of Trees/Acre at Various Spacings:

Spacing	Stems Per Acre	Spacing	Stems Per Acre	Spacing	Stems Per Acre
5 x 5	1742	8 x 10	544	15 x 15	194
6 x 6	1210	9 x 9	538	16 x 16	170
6 x 8	907	9 x 10	484	18 x 18	134
6 x 10	726	10 x 10	436	20 x 20	109
7 x 10	622	10 x 12	363	30 x 30	48
7 x 7	889	12 x 12	302	40 x 40	27
8 x 8	681	14 x 14	222		

To calculate stems/acre for other spacings: 43,560 divided by (row spacing in feet x stem spacing in feet).

*required for practice certification



SPECIES COMPOSITION

Species/Cultivars*:	Form	Kind of Stock ¹	Total Stems Planted	Total Stems Contracted	Total Stems "As Installed"
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
	<input type="checkbox"/> Tree <input type="checkbox"/> Shrub				
Total number of trees/shrubs needed for planting:					

¹Bareroot, container, balled and burlapped, etc. Include size, caliper, height, and age as applicable.

POST-PLANTING WEED CONTROL

Method/Practice Used*: _____ Date(s) Planned*: _____

Additional Information (if any): _____

REQUIRED DOCUMENTATION AND VERIFICATION

Practice amount applied is field verified by*: _____ on: _____ (date)

Before payment is made, the following information is required to be in the case file:

- Photographs of established filter strip that must include*:
 - Statement "Photo was taken in the field by (enter name)"*
 - Date photo was taken in the field*
 - Statement of what the photo represents if it needs clarification*
- Field verification is documented and a certified planner verified "as installed" this practice meets NRCS standards and specifications.*

Practice Certification (NRCS USE ONLY)

I certify that the practice as installed is complete and meets the applicable Wisconsin NRCS Conservation Practice Standard and all applicable practice specifications. Any changes to the original practice design have been approved and are documented on the original practice design "as installed."

Certified Planner (print) _____ (sign) _____ Date _____

*required for practice certification



WISCONSIN CONSTRUCTION SPECIFICATION

23. ALUMINUM OR STEEL ROOF GUTTERS

1. SCOPE

The work consists of furnishing and installing roof gutters and downspouts as specified in the construction plans.

2. MATERIALS

a. Aluminum and Steel

- i. Gutters, downspouts, and associated hardware shall be aluminum, galvanized steel, painted steel, or coated galvanized steel. Dissimilar metals shall not be in contact with each other.
- ii. Accessories for gutters or downspouts shall be of like materials. Hardware and accessories shall be of sufficient strength to secure the gutters and downspouts.
- iii. Aluminum, galvanized steel, painted steel, and coated galvanized steel shall have the following minimum thickness.

	Thickness	
	Galvanized Steel, Painted Steel, and Coated Galvanized Steel	Aluminum Materials
Gutters	28 gauge	0.032 inches
Downspouts	28 gauge	0.019 inches
Heavy-duty Hangers	16 gauge	0.060 inches ¹
Roof Straps	19 gauge	0.060 inches
Wrap-around Straps	28 gauge	0.032 inches

¹ If hangers do not have self-bracing sides and/or reinforcing ribs that run the entire length of the hanger, and continue through the points of greatest stress, the nominal thickness shall be 0.075 inches or greater.

b. Plastic

Plastic downspouts may be used for metal or aluminum gutters. They shall meet requirements of ASTM D-1785 schedule 40.

c. Wood

New fascia board (treated/untreated) shall be straight and graded lumber #2 or better and shall be sound and free of or contain minimal knots. If treated lumber is used as fascia, wedges, or rigid supports, it shall have treatment retention applicable for exterior, above ground use and be non-corrosive to aluminum and steel. Lumber treated with micronized copper and labeled for "above ground use" may be used in direct contact with aluminum and steel. Lumber treated with ACQ, AC2, or other corrosive preservatives are not acceptable unless a waterproof coating is applied between the lumber and the gutter.

3. INSTALLATION

a. Gutters

- i. The slope and placement of the gutter shall be as specified in the construction plans.
- ii. Hangers and straps shall be securely anchored in a manner which will not prevent the entry of water into the gutter.

b. Supports

i. Vertical support

Vertical support shall be provided as specified in the construction plans using either, a heavy duty gutter hanger and a roof strap, or a heavy duty gutter hanger screwed to the fascia. They shall have a maximum spacing of 18 inches for aluminum gutters and 24 inches for steel gutters. For gutter sizes greater than 6 inches, maximum hanger spacing shall be reduced to 12" for aluminum gutters and 18" for steel gutters.

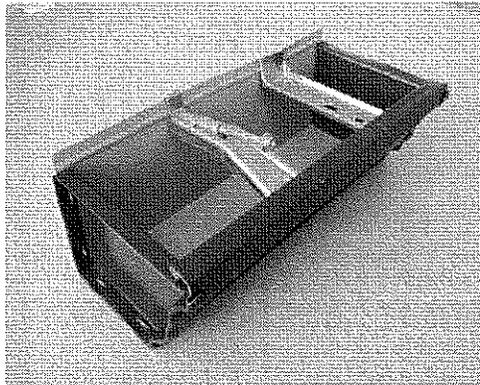


Figure 1: Typical Hangers Screwed to Fascia

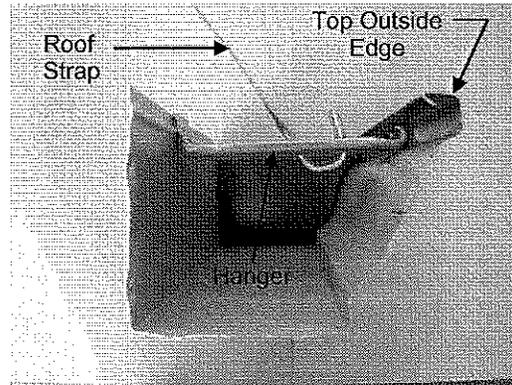


Figure 2: Typical Gutter Hanger and Roof Strap Attachment

Roof straps shall be securely fastened to each gutter hanger and the roof. Hangers shall have self-bracing sides and/or reinforcing ribs that run the entire length of the hanger, and continue through the points of greatest stress (Figure 3). Alternative gutter hangers shall be approved by the technician prior to installation.

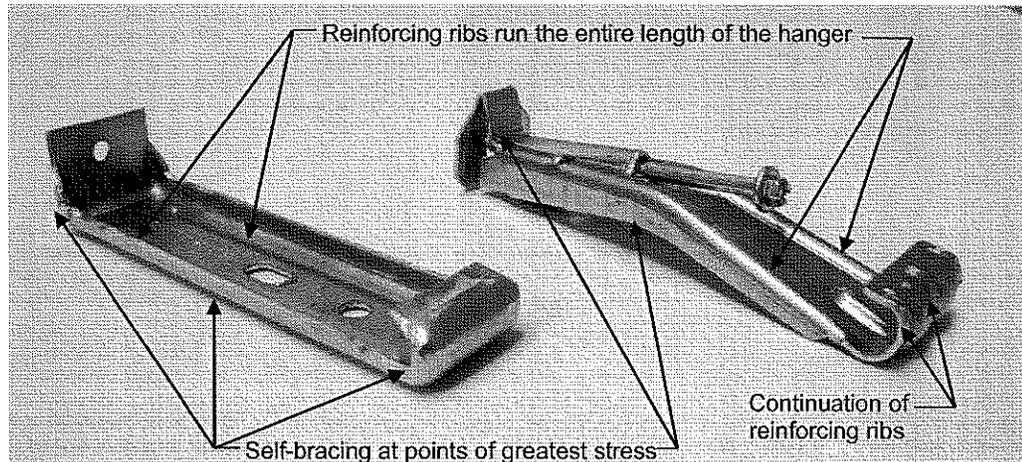


Figure 3: Heavy Duty Gutter Hanger Details

ii. Lateral Support

Lateral supports, if required, shall be as specified in the construction plans, with a maximum spacing of 8 feet.

Lateral support may be provided with wedges, wrap-around straps, rigid supports, or any combination thereof which will provide necessary inward and/or outward support. Wrap-around straps and rigid supports shall be as specified in Section 3.b.iii, Snow and Ice Support.

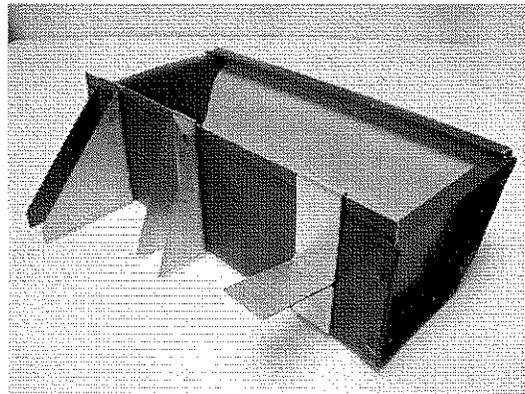


Figure 4: Typical wedges used for inward lateral support

iii. Snow and Ice Support

Wrap-around straps and rigid supports, if required, shall be as specified in the construction plans, with a maximum spacing of 8 feet. Wrap-around straps shall be a minimum of 1 inch wide stock gutter material and be securely fastened to the fascia board or building, and the roof. They shall be in full contact with the bottom and outside face of the gutter, and extend a minimum of 6 inches onto the roof.

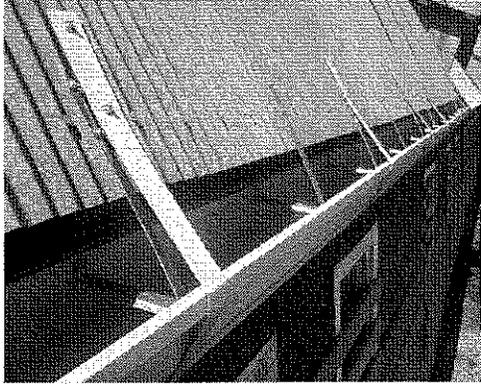


Figure 5: Typical wrap-around strap attachment to roof.

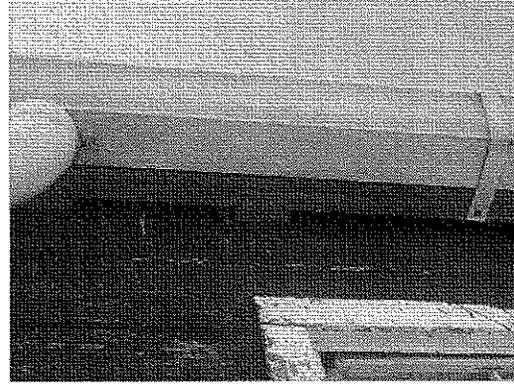


Figure 6: Typical wrap-around strap attachment to fascia board.

Rigid supports may be used in lieu of wrap-around straps. They shall be a minimum of 1 inch wide, and shall have a minimum thickness of 1/8 inch for steel and 3/16 inch for aluminum. Materials with equivalent strength and durability are acceptable.

The supports shall be securely attached to the fascia board or building and shall contact the entire gutter bottom width. If supports are screwed into the bottom of the gutter, the screw holes shall be sealed to prevent leakage.

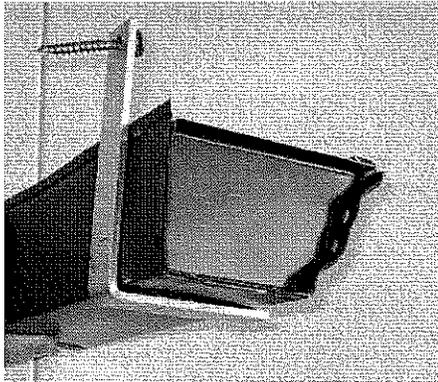


Figure 7: Rigid Support

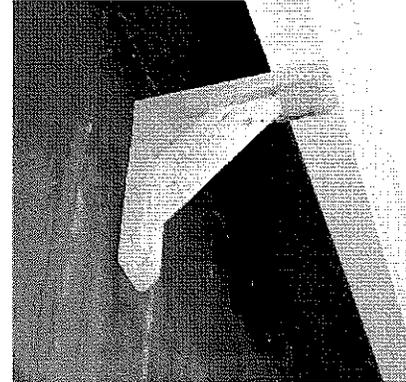


Figure 8: Rigid Support

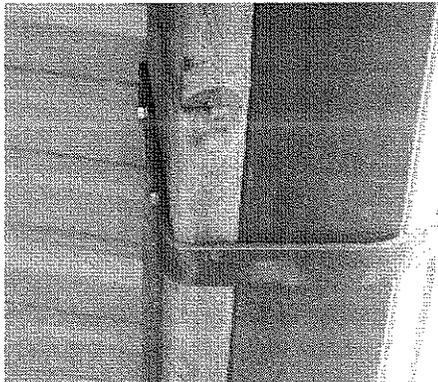


Figure 9: Rigid Support

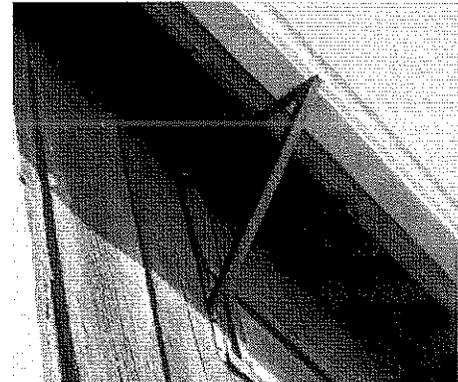


Figure 10: Rigid Support

Snow guards, if required in the construction plans, shall be installed per manufacturer's recommendations.

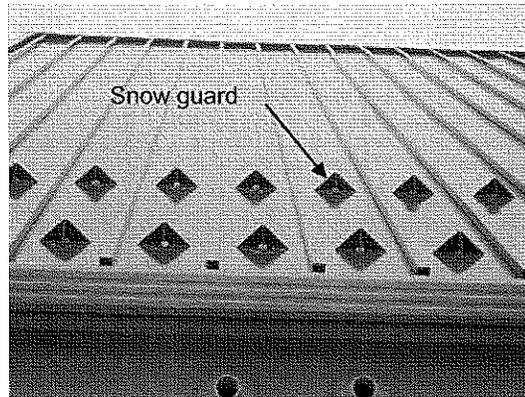


Figure 11: Typical snow guards to prevent snow and ice slides

Alternative snow and ice support systems shall be approved by the Technician prior to installation.

c. Downspouts

- i. Supports for vertical downspouts shall be securely fastened at the top and bottom with intermediate supports placed such that the maximum spacing between supports is 10 feet.
- ii. Supports for lateral downspouts and cross pipes shall be placed at a maximum spacing of 5 feet.

d. Underground Outlet Conduits

- i. Underground conduits shall be installed according to the construction plans and the applicable Wisconsin construction specification.
- ii. Install appurtenances according to the recommendations of the manufacturer and as noted in the construction plans.