

**WISCONSIN FIELD OFFICE TECHNICAL GUIDE
450 – 11 – TECHNICAL GUIDE
FOTG NOTICE WI-96**

September, 15 2018

Purpose. Revisions to Wisconsin Conservation Practice Standards and Specifications.

Effective Date. This notice is effective upon receipt.

Explanation of Changes.

Section IV: Conservation Practice Standards and Specifications:

Drilled Well Abandonment / Decommissioning (WCS 19) – The Reporting Section was revised to include who must prepare the abandonment report. The WDNR website to obtain and electronically submit the report was added.

Aluminum or Steel Roof Gutters (WCS-23) – Corrected discrepancy with CPS 558, Roof Runoff Structure.

Topsoiling (WCS 26) – Minor word edits only.

Corrugated Polyethylene Tubing (WCS-44) – Removed obsolete ASTM and made minor word edits.

Organic Fill for Ditch Fills or Filling (WCS-50) – Removed some criteria related to control of moisture content in Section 6. Made minor word edits.

Organic Fill for Embankments and Ditch Plugs (WCS-51) – Minor word edits only.

Steel Sheet Piling (WCS-201) – Minor word edits only.

Earthfill For Waste Storage Facilities (WCS-204) – Added a paragraph for and material that may be under concrete slabs or walls

Vinyl Sheet Piling (WCS-211) – Minor word edits only

Roof Runoff Structure (CPS-558) - Corrected discrepancy with WCS 23 Aluminum Steel Root Gutters. Corrected Qp equation to determine peak discharge.

DIST: Wisconsin Statewide

The following revisions have been posted on the Wisconsin eFOTG website:

Remove the following outdated Standards and Specifications from any printed copies of the WI FOTG:

- Index
- Drilled Well Abandonment / Decommissioning (WCS 19)
- Aluminum or Steel Roof Gutters (WCS-23)
- Topsoiling (WCS 26)
- Corrugated Polyethylene Tubing (WCS-44)
- Organic Fill for Ditch Fills or Filling (WCS-50)
- Organic Fill for Embankments and Ditch Plugs (WCS-51)
- Steel Sheet Piling (WCS-201)
- Earthfill For Waste Storage Facilities (WCS-204)
- Vinyl Sheet Piling (WCS-211)

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

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- Organic Fill for Ditch Fills or Filling (WCS-50)
- Organic Fill for Embankments and Ditch Plugs (WCS-51)
- Steel Sheet Piling (WCS-201)
- Earthfill For Waste Storage Facilities (WCS-204)
- Vinyl Sheet Piling (WCS-211)
- Roof Runoff Structure (CPS-558)

A link to the Wisconsin FOTG is located on the NRCS website at:

<https://www.nrcs.usda.gov/wps/portal/nrcs/main/wi/technical/cp/>



ANGELA L. BIGGS
Wisconsin State Conservationist

Attachments

WISCONSIN CONSTRUCTION SPECIFICATION

19. Drilled Well Abandonment / Decommissioning

1. SCOPE

The work shall consist of furnishing all required materials, equipment, and labor to properly abandon the designated well or drill hole.

Wisconsin statutes require that an individual sealing a water supply well must be:

- A licensed well driller or a licensed pump installer or an individual under their supervision.
- A certified water system operator or an individual under their supervision, and the well is within the service area of the local governmental water system for which the certified operator works.

2. PROCEDURE

- A. Remove any pump, pump piping, debris or other obstacles that could interfere with sealing operations. In most situations the well casing should be left in place. The casing may be cut off three (3) feet below the ground surface. When the casing is removed, it shall be pulled during the abandonment filling process to prevent drillhole collapse.
- B. Select the appropriate sealing material(s) from Chapter NR 812, Wisconsin Administrative Code.
- C. The sealing material shall be placed with a conductor (tremie) pipe either by pumping or by gravity except when chipped bentonite is used. The bottom end of the conductor pipe must initially reach the bottom of the well and must be kept submerged in the sealing material as it is placed.
- D. The discharge from a flowing well shall be reduced as much as possible with a packer or by extending the well casing to an elevation higher than the artesian head.
- E. When bentonite chips are used, the chips shall be poured onto a "U" shaped coarse mesh screen that is a minimum of two (2) feet long. One end of the screen shall be placed on the top of the well casing. Support the screen at a steep angle to allow the chips to tumble under their own weight. The chips should not be poured at a rate faster than a fifty (50) pound bag per three (3) minutes.

If water does not rise to the surface during the filling procedure, clean water from a known uncontaminated source shall be poured into the well. Pour water through the chips until it rises to the top of the well and maintains that level.

- F. The well shall be drilled out and refilled if the quantities of filling material calculated for the size and depth of well are not used.

3. MATERIALS

- A. Neat cement grout shall consist of a mixture of cement and water in the proportion of one (1) bag of Portland cement (94 pounds, ASTM C 150, Type I or API-10A, Class A) per five (5) to six (6) gallons of clean water from a known safe and uncontaminated source. Powdered bentonite may be added up to a ratio of five (5) pounds per 94 pound bag of cement.
- B. Concrete (sand-cement) grout shall consist of a mixture of cement, sand, and water in the proportion of one (1) bag of Portland cement, (94 pounds, ASTM C 150, Type I or API-10A, Class A) and one (1) cubic foot of dry sand per five (5) to six (6) gallons of clean water from a known safe and uncontaminated source. The sand shall conform to ASTM C 33, fine aggregate for concrete.
- C. Sodium bentonite water slurry (drilling mud and cuttings) shall have a mud weight of at least eleven (11) pounds per gallon and a sand content of ten (10) to twenty-five (25) percent by volume of the slurry. When a bentonite slurry is used to seal a well, the top five (5) feet of the well shall be filled with neat cement grout, concrete (sand-cement) grout, concrete or approved bentonite chips.
- D. Clay slurry is a fluid mixture of water, clean native or commercial clay and drill cuttings. The clay slurry shall have a mud weight of at least eleven (11) pounds per gallon.
- E. Bentonite chips are irregularly shaped pieces of sodium bentonite that look very much like crushed limestone. The most current revision of the Wisconsin Department of Natural Resources publication PUB-DG-016 contains a list of approved brands of bentonite chips that shall be used.
- F. Concrete shall consist of a commercially prepared mixture of sand, gravel, portland cement, and water. It shall contain at least 6 bags (94 pounds each) Portland cement per cubic yard and a maximum of 6 gallons of water per bag of cement. The maximum gravel size shall not exceed 1/3 of the inside diameter of the conductor pipe used to place the material.
- G. Conductor (tremie) pipe shall be: a) Metal pipe, b) rubber-covered hose reinforced with braided fiber or steel with a minimum rating of 300 psi, or c) thermoplastic pipe with a minimum rating of 100 psi. Thermoplastics include PVC, CPVC, PE, PB, or ABS and shall not be used for depths greater than 100 feet.

4. MARKINGS AND CERTIFICATION

Markings on material identifying the manufacturer and indicating compliance with appropriate specification(s) can be accepted as evidence that the material meets the requirements of this specification. If the material does not bear these markings, the manufacturer must certify that it complies with the requirements of this specification.

5. REPORTING

An abandonment report shall be completed by a licensed well driller, licensed pump installer, or a certified water system operator and submitted electronically to the Wisconsin Department of Natural Resources (WDNR) within 30 days for every well that has been permanently abandoned. A copy to the County Land Conservation Department (LCD)/Natural Resources Conservation Service (NRCS) office is also required. Form 3300-005, Well/Drillhole/Borehole Filling & Sealing Report, is available from the DNR website at dnr.wi.gov/topic/wells/filling_sealing.

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	0.020 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.

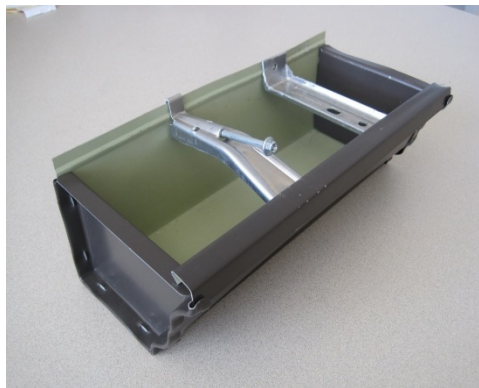


Figure 1: Typical Hangers Screwed to Fascia

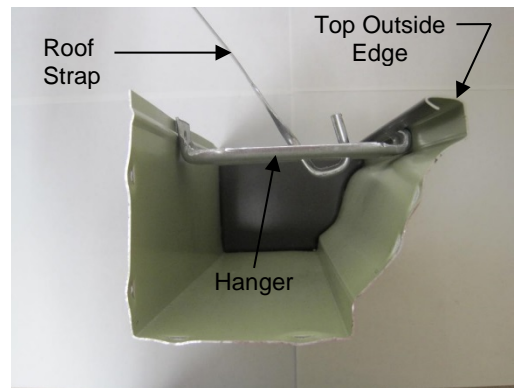


Figure 2: Typical Gutter Hanger and Roof Strap Attachment

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.

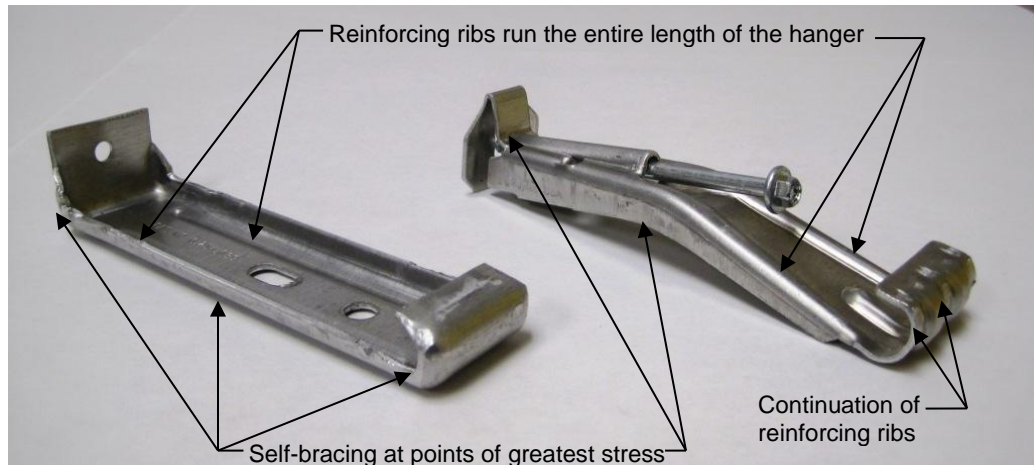


Figure 3: Heavy Duty Gutter Hanger Details

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.

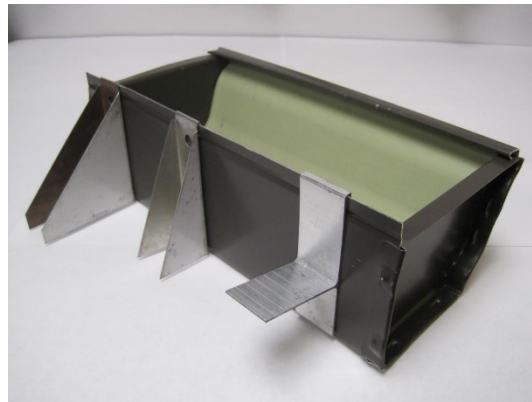


Figure 4: Typical wedges used for inward lateral support

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

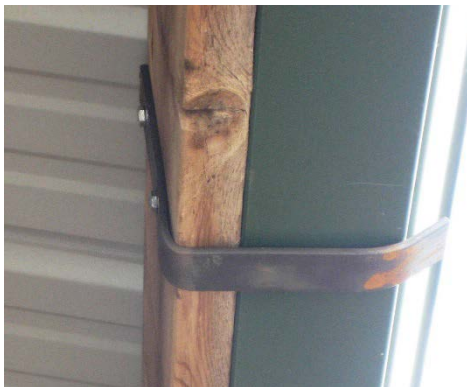


Figure 9: Rigid Support



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.

WISCONSIN CONSTRUCTION SPECIFICATION

26. Topsoiling

1. SCOPE

The work consists of furnishing and spreading topsoil to specified depths at locations shown on the drawings. This specification does not apply to any other earthfill.

2. MATERIALS

Topsoil shall consist of naturally occurring friable surface soil reasonably free of grass, roots, weeds, sticks, rocks, other unsuitable material, herbicides, or other compounds whose presence would prevent establishment of grass and/or legume sod cover.

Topsoil shall be obtained from soil surfaces containing USDA soil textural classifications of loam, sandy loam, silt loam, silty clay loam, sandy clay loam, or clay loam soils shown on the drawings or approved by the Technician.

Topsoil shall:

- be salvaged from designated areas that will be disturbed by construction activities or be furnished from an offsite source designated by the Contractor. The Technician shall be granted access to the source for inspection and acceptance of the topsoil before delivery to the site.
- meet the following requirements (when testing is required):
 - 100% passing the ¾-inch sieve.
 - minimum 95% passing the #10 sieve.
 - minimum 25% passing the #200 sieve.
 - 3% - 15% organic material.
 - non-positive herbicide carryover (UW Extension Publication A3819, Herbicide Persistence and Carryover).

3. TESTING

The Technician will determine the need for testing the topsoil for gradation, percent organic matter content, and herbicide carryover effect. The testing will be at the expense of the Contractor.

4. FOUNDATION PREPARATION AND PLACEMENT

The surfaces designated to receive a topsoil application shall be cleared of all objectionable materials including trees, stumps, roots, brush, rubbish, and stones having a maximum dimension greater than 6 inches. The surfaces shall be lightly scarified just before the spreading operation. Topsoil shall not be placed until the required excavation, fill and preparation of the surfaces is complete and approved by the Technician.

Spreading shall not be conducted when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to uniform spreading operations. Snow, ice, or frozen material shall not be incorporated in the topsoil.

Topsoil shall be placed in approximately horizontal layers no greater than 8 inches thick.

Placement of topsoil adjacent to concrete structures may begin after the concrete has cured for the minimum time specified. Heavy equipment shall not be operated within 2 feet of any structure.

Following the spreading operation, the topsoil surface shall be left reasonably smooth and without ruts or surface irregularities that could contribute to concentrated waterflow downslope.

5. MOISTURE CONTENT

Topsoil shall have a moisture content sufficient to insure the spreading of the material to the required thickness. When kneaded in the hand the soil will form a ball which does not readily separate and will not extrude out of the hand when squeezed tightly. The adequacy of the moisture content will be determined by the Technician.

6. COMPACTION

The Contractor shall furnish and operate the types and kinds of equipment necessary to compact the topsoil material when specified. The Technician shall determine if adequate compaction is being achieved.

Adequate compaction is defined as a firm surface able to support the growth of vegetation. Methods for compaction may include back-blading or a single pass from a rubber tire, track, or roller. A pass shall consist of complete coverage by the rubber tire, track, or roller over the entire surface of the topsoil. Care must be taken to avoid excessive compaction of topsoil.

Adjacent to structures or in confined areas, compaction of topsoil shall be accomplished by means of manually directed power tampers or plate vibrators or hand tamping, unless otherwise specified.

Where compacted earthfill is designated to be topsoiled, the topsoil shall be placed concurrently with the earthfill and shall be bonded to the compacted fill with the compac

WISCONSIN CONSTRUCTION SPECIFICATION

44. CORRUGATED POLYETHYLENE TUBING

1. SCOPE

The work shall consist of furnishing and installing corrugated polyethylene tubing with the necessary fittings and appurtenances as shown on the drawings and as outlined in this specification.

2. MATERIALS

Corrugated polyethylene tubing and fittings shall conform to the material requirements for the appropriate tubing size as shown in the following specifications:

- ASTM F 667/667M: 3 to 24 inch diameter pipe
- ASTM F 894: 18 to 120 inch diameter profile wall pipe
- AASHTO M 252: 3 to 10 inch diameter pipe
- AASHTO M 294: 12 to 60 inch diameter pipe

The tubing shall be appropriately marked with the ASTM or AASHTO designation.

When perforations are specified, the water inlet area shall be a minimum of 1 square inch per lineal foot of tubing. The inlets shall either be circular perforations or slots equally spaced along the length and circumference of the tubing. Unless otherwise specified, circular perforations shall not exceed 3/16 inch in diameter, and slot perforations shall not be more than 1/8 inch wide.

Geotextile filter socks, when required, shall meet the material requirements specified by the manufacturer for the intended use of the tubing.

Granular bedding material, when specified, shall conform to the requirements specified on the drawings.

3. HANDLING AND STORAGE

Tubing shall be delivered to the job site and handled by means that provide adequate support to the tubing and do not subject it to undue stresses or damage. When handling and placing corrugated polyethylene tubing, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting (by metal edges and/or surface or rocks). The manufacturer's special handling requirements shall be strictly observed. Special care shall be taken to avoid impact when the pipe must be handled at a temperature of 40 degrees Fahrenheit or less.

4. EXCAVATION

Unless otherwise specified or approved, excavation for and subsequent installation of each tubing line shall begin at the outlet end and progress upgrade. The trench or excavation for the tubing shall be constructed to the lines, depths, cross sections, and grade shown on the drawings.

Trench shields, shoring and bracing, or other suitable methods necessary to safeguard the workers shall be furnished, placed, and subsequently removed by the contractor.

5. BEDDING THE TUBING

Tubing shall not be laid on a rock foundation. In the event that boulders, rock or ledge rock, or other cemented materials that prevent satisfactory bedding are encountered at the required grade, the trench shall be excavated to a depth of at least 6 inches below the grade and backfilled to the required grade with a sand-gravel mixture or other approved material.

If the bottom of the trench does not provide a sufficiently stable or firm foundation for the tubing, a sand-gravel mixture or other approved materials shall be used to stabilize the bottom of the trench.

When a granular filter or envelope is specified, the filter or envelope material shall be placed in the bottom of the trench just before the tubing is laid. The tubing shall then be laid and the filter and envelope material placed to a depth over the top of the tubing of not less than that shown on the drawings.

When a granular filter or envelope is not specified, the bottom of the earthen trench shall be shaped to form a semicircular, trapezoidal, or 90-degree "V" groove in its center. This groove shall provide support for not less than a fourth of the outside circumference of the tubing. After the tubing is placed in the excavated groove, it shall be capped with friable material from the sides of the trench. The friable material shall be placed around the tubing, completely filling the trench to a depth of at least 3 inches over the top of the tubing. For material to be suitable, it must not contain hard clods, rocks, frozen soil, or fine material that will cause a silting hazard to the drain. Tubing placed during any day shall be blinded (place required soil material around and over pipe) and temporarily capped before construction activities are completed for that day.

6. PLACEMENT AND JOINT CONNECTIONS

All tubing shall be installed to the grade shown on the drawings. After the tubing is placed in the trench and blinded, sufficient time shall be allowed for the tubing to adapt to the soil temperature before backfilling.

Maximum allowable stretch of the tubing is 5 percent. Special precautions must be implemented on hot, bright days to ensure that the stretch limit is not exceeded and excessive deflection does not occur as a result of installation procedures, including backfill operations.

Perforated pipe shall be laid with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions when the tubing is laid.

Lateral connections shall be made with manufactured junctions comparable in strength with the specified tubing.

The pipe ends and the couplings shall be free of foreign material when assembled. During the placement of the tubing, each open end shall be closed off with a suitable cover or plug at the end of the workday until work resumes.

All split fittings shall be securely fastened with nylon cord or plastic zip ties before any backfill is placed.

All buried ends of the tubing shall be supplied with end caps unless otherwise shown on the drawings.

7. BACKFILLING

The backfilling of the trench shall be as shown on the drawings and completed as rapidly as is consistent with the soil conditions. Automatic backfilling machines may be used. Backfill shall be placed so that displacement or deflection of the tubing will not occur. Backfill shall extend above the ground surface to allow for settlement and be well rounded and centered over the trench.

WISCONSIN CONSTRUCTION SPECIFICATION

50. Organic Fill for Ditch Fills or Filling

1. SCOPE

The work shall consist of placing the organic fill required by the drawings.

2. MATERIALS

Organic fill includes the classifications of OL, OH, and PT (peat) as defined in ASTM D2488, Description and Identification of Soils (Visual-Manual Procedure).

All organic fill shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of materials shall be subject to approval by the Technician. Rubbish and trash is not an acceptable fill material and shall be disposed of in a legal manner.

Organic fill shall meet the following criteria as approved by the technician: 1) minimal sod, brush, roots or frozen material and 2) no stumps or woody vegetation greater than 3” in diameter. Stones larger than 9 inches in diameter shall be removed from the materials prior to placement of the fill.

3. FOUNDATION PREPARATION

The foundation area shall be cleared of trees greater than 3” in diameter. Foundations shall be stripped to remove vegetation to the depth shown on the drawings or as approved by the Technician. The materials removed from the foundation shall be disposed of as required by the drawing, or as approved by the Technician. The brush material does not need to be removed if it meets the fill material criteria above.

4. BORROW EXCAVATION

The borrow area shall be cleared of trees greater than 3” in diameter, stumps, and stones having a maximum dimension greater than 9 inches. The borrow area shall be stripped to remove vegetation to the depth shown on the drawings or as approved by the Technician. The materials removed from the borrow area shall be disposed of as required by the drawings.

The brush and roots do not need to be removed if it meets the fill material criteria above.

This work shall be performed immediately prior to use of the borrow material to reduce the time the area is exposed to erosion.

The extent of excavation and the selection of materials from the borrow area shall be as directed by the Technician. On completion of the excavation, all borrow areas shall be left to contain microtopography features (topography less than 6 inches in height or depth) or as directed by the Technician. All borrow areas shall be graded to blend with existing topography or as shown on the drawings.

5. PLACEMENT

Organic fill shall not be placed until the required excavation and preparation of the underlying foundation is completed, inspected, and approved by the Technician. No organic fill shall be placed upon a frozen surface nor shall snow nor ice, be incorporated in the organic fill. Organic fill shall be placed to fill the ditch(es) as shown on the construction plan unless otherwise approved by the Technician.

The contractor shall furnish and operate the types and kinds of equipment necessary to place and shape the organic fill.

6. CONTROL OF MOISTURE CONTENT

Organic fill shall have a moisture content sufficient to insure the required placement and compaction. When kneaded in the hand, the soil will retain a shape which does not readily separate and will not extrude out of the hand when squeezed tightly. The adequacy of the moisture content will be determined by the Technician.

Organic fill or the top surface of the preceding layer of organic fill that becomes too wet shall be either removed or allowed to dry to an acceptable moisture content before compaction or placement of additional layers of organic fill.

7. COMPACTION

Compaction will be accomplished by pushing and shaping the organic fill unless additional compaction is specified by the construction plans. The Technician shall determine if adequate compaction is being achieved.

WISCONSIN CONSTRUCTION SPECIFICATION

51. Organic Fill for Embankments and Ditch Plugs

1. SCOPE

The work shall consist of placing the organic fill required by the drawings.

2. MATERIALS

Organic fill includes the classifications of OL, OH, and PT (peat) as defined in ASTM D2488, Description and Identification of Soils (Visual-Manual Procedure).

All organic fill shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of materials shall be subject to approval by the Technician.

Organic fill shall contain no sod, brush, trees, stumps, roots, woody vegetation, or frozen material. Stones larger than 9 inches in diameter shall be removed from the materials prior to placement of the organic fill.

3. FOUNDATION PREPARATION

The foundation area shall be cleared of trees, stumps, roots, brush, and rubbish. Stones larger than 9 inches shall also be removed. Foundations shall be stripped to remove vegetation to the depth shown on the drawings or as approved by the Technician. The materials stripped from the foundation shall be disposed of as required by the drawings.

4. BORROW EXCAVATION

The borrow area shall be cleared of trees, stumps, roots, brush, and rubbish. Stones larger than 9 inches shall also be removed. The borrow area shall be stripped to remove vegetation to the depth shown on the drawings or as approved by the Technician. The materials removed from the borrow area shall be disposed of as required by the drawings.

This work shall be performed immediately prior to use of the borrow material to reduce the time the area is exposed to erosion.

The extent of excavation and the selection of materials from the borrow area shall be as directed by the Technician. On completion of excavation, all borrow areas shall be left to contain microtopography features (topography less than 6 inches in height or depth) or as directed by the Technician. All borrow areas shall be graded to blend with existing topography or as shown on the drawings.

5. PLACEMENT

Organic fill shall not be placed until the required excavation and preparation of the underlying foundation is completed, inspected, and approved by the Technician. No organic fill shall be placed upon a frozen surface nor shall snow, ice, or frozen material be incorporated in the organic fill.

Organic fill shall be placed to the neat lines and grades shown on the construction plan unless otherwise approved by the Technician.

The contractor shall furnish and operate the types and kinds of equipment necessary to place and shape the embankment or ditch plug organic fill.

6. CONTROL OF MOISTURE CONTENT

Organic fill shall have a moisture content sufficient to insure the required placement and compaction. When kneaded in the hand, the soil will retain a shape which does not readily separate and will not extrude out of the hand when squeezed tightly. The adequacy of the moisture content will be determined by the Technician.

Organic fill or the top surface of the preceding layer of compacted organic fill that becomes too dry to permit suitable bond shall either be removed or scarified and wetted by sprinkling to an acceptable moisture content prior to placement of the next layer of organic fill.

Organic fill or the top surface of the preceding layer of compacted organic fill that becomes too wet shall be either removed or allowed to dry to an acceptable moisture content before compaction or placement of additional layers of organic fill.

7. COMPACTION

The foundation surfaces shall be scarified parallel to the centerline of the embankment to a minimum depth of 2 inches. The surface materials of the foundation shall be bonded with the first layer of organic fill.

Organic fill shall be placed in approximately horizontal layers (lifts) beginning at the lowest elevation of the foundation. The thickness of each layer of organic fill, prior to compaction, shall not exceed 12 inches. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than 12 inches prior to compaction.

Unless additional compaction is specified by the construction plans, each lift shall be traversed by 2 passes of the construction equipment. Each pass, parallel to the main axis of the embankment, shall consist of complete coverage of the entire surface of the organic fill layer.

Adjacent to structures or in confined areas, compaction of the organic fill shall be accomplished by means of manually directed power tampers or plate vibrators or hand tamping, unless otherwise specified. Heavy equipment shall not be operated within 2 feet of any structure.

The Technician shall determine if adequate compaction is being achieved.

WISCONSIN CONSTRUCTION SPECIFICATION

201. Steel Sheet Piling

1. SCOPE

The work shall consist of furnishing, transporting, and installing steel sheet piling as shown on the construction drawings.

2. MATERIALS

Sheet Steel Piling shall conform to the requirements of ASTM Specification A 328, Standard Specification for Steel Sheet Piling; A 572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel; or A 857, Standard Specification for Steel Sheet Piling, Cold Formed, Light Gage.

Appurtenant Materials (steel plates, bars, structural shapes) shall conform with ASTM Specification A 36, Standard Specification for Carbon Structural Steel.

Protective Coatings shall be a coal tar polyamide epoxy paint suitable for use on structural steel and shall meet Paint Specification No. 16, Type 1, Class II, of the Steel Structures Painting Council (SSPC) or a zinc (hot-dip galvanized) coating conforming to the requirements of ASTM Specification A 123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

3. SITE PREPARATION

All clearing or other site preparation within the area to be occupied by the steel sheet piles shall be completed before the piling is installed.

4. PLACEMENT OF STEEL SHEET PILING

Steel sheet piling shall be installed as specified in the construction plans by one of the following methods:

a. Driving Sheet Piling

The Contractor shall provide driving heads and other devices for sheet pile driving and shall conform to the recommendations of the manufacturer.

The piling shall be driven in such a manner as to insure perfect interlocking throughout the entire length of each pile. The piles shall be held in proper alignment during driving by means of assembling frames or other suitable temporary guide structures. Temporary guide structures shall be removed when they have served their purpose.

At any time the forward edge of the sheet pile wall is found to be out of correct alignment: (a) the piling already assembled and partly driven shall be driven to the required depth, and (b) taper piles shall be then driven to bring the forward edge into correct alignment before additional regular piling is assembled and driven. The maximum permissible taper in a single pile shall be one-fourth inch per foot of length.

The Contractor shall not attempt to drive sheet piles beyond the point of refusal, as indicated by excessive bouncing of the hammer or kicking of the sheet pile.

b. Trench Embedment of Sheet Piling

Steel sheet piling is embedded by excavating a trench and backfilling to the dimensions and lines shown on the drawings.

Backfill material shall be placed and compacted to the density of the surrounding material, taking care not to displace or damage the steel sheet piling or its protective coating.

Backfill material shall contain no frozen soil, sod, brush, roots or other perishable material.

5. CUTTING OFF PILES

The Contractor shall cut off the steel sheet pile at the specified elevations. The length of the pile cut off shall be sufficient to permit the removal of all damaged material.

6. DEFECTIVE PILES AND DAMAGED COATINGS

Any sheet pile ruptured in the interlock or otherwise damaged during installation shall be pulled and replaced.

Damaged coatings on painted steel sheet piles shall be prepared and repainted in accordance with the manufacturer's specifications of the original coating.

Damaged galvanized coatings shall be repaired in accordance with ASTM A 780, Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.

WISCONSIN CONSTRUCTION SPECIFICATION
204. EARTHFILL FOR WASTE STORAGE FACILITIES

A. SCOPE

The work shall consist of all operations necessary to place the earthfill or soil liner required by the drawings or directed by the Technician.

B. MATERIALS

All fill materials shall be obtained from required excavations and designated borrow areas. The selection, blending, routing, and disposition of materials shall be subject to approval by the Technician.

Fill materials shall contain no sod, brush, roots, frozen soil, or other perishable materials. Stones larger than two-thirds of the uncompacted layer thickness shall be removed from the materials prior to compaction. Additional soil properties are shown on the drawings.

Sand and gravel fill required below concrete footings and floor slabs as indicated on any Wisconsin Standard Drawings shall consist of either in place or imported granular soils. These granular soils shall contain no rocks greater than 4" in maximum dimension and be reasonably well graded such that the surface is firm once wetted and compacted. The material shall have no more than 15%, by weight, passing the Number 200 sieve size.

Foundry sand shall be ferrous foundry sand with minimal concentrations of hazardous constituents, cores and other over-sized materials crushed or removed, and contain at least 5% bentonite.

C. GENERAL

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution will be minimized. The completed job shall present a professional appearance and shall conform to the lines, grades, and elevations as shown on the drawings or as staked in the field. All operations shall be carried out in a safe and skillful manner. Safety and health regulations shall be observed and appropriate safety measures used by the contractor.

D. FOUNDATION PREPARATION

The foundation area shall be cleared of trees, stumps, roots, brush, rubbish, frozen soil, and stones having a maximum dimension greater than 6 inches. Foundations shall be stripped to remove vegetation and other unsuitable materials to a minimum depth of 6 inches or to a greater depth if so shown on the drawings. Topsoil shall be stripped from the foundation area and stockpiled for use as a top dressing for vegetation establishment unless otherwise shown on the drawings.

The moisture content of the scarified foundation materials shall be maintained as specified for the earthfill in Section 7. The surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

E. EXCAVATION

The required excavations shall conform to the lines, grades, and elevations as shown on the drawings. Excavation beyond specified limits shall be corrected by filling with approved compacted materials.

The required dimensions and side slopes of all structure and trench excavations shall be as shown on the drawings. Trenches deeper than 4 feet shall have side slopes above the 4-foot depth excavated at 0.5:1 or flatter depending on the materials being excavated or the trench shall be braced to safeguard the work and workers. When backfilling pipe trenches in the waste storage facility embankment, the trench slopes shall be cut back to 1:1 from 12 inches above the top of the pipe. The backfill material and compaction shall be equivalent to the surrounding embankment.

To the extent that they are needed, all suitable materials removed from the specified excavations shall be used in the construction of the required earthfill or soil liner. The suitability of materials for specific purposes will be determined by the Technician.

All surplus or unsuitable excavated materials shall be disposed of at the locations shown on the drawings or as approved by the Technician. Surplus materials shall not be placed in wetlands.

F. BORROW AREAS

When the quantities of suitable materials obtained from specified excavations are insufficient to construct the specified fill portions of the permanent works, additional materials shall be obtained from the designated borrow areas. The borrow area shall be stripped to remove vegetation or other unsuitable materials to a minimum depth of 6 inches or to the depth shown on the drawings. This stripping shall be performed immediately prior to use of the borrow material to reduce the time the area is exposed to erosion. For large borrow areas, only a portion of the area should be stripped at a time.

G. FILL MOISTURE CONTENT

Fill materials shall have a moisture content sufficient to insure the required compaction. When kneaded in the hand, the soil will form a ball which does not readily separate and will not extrude out of the hand when squeezed tightly. The adequacy of the moisture content will be determined by the Technician.

If the top surface of compacted fill is too dry to permit suitable bond, it shall either be removed or scarified and wetted by sprinkling to an acceptable moisture content prior to placement of the next layer of fill. The applied water must be allowed time to be absorbed by the fill or disked into the dry layer.

Fill material that is too wet shall be allowed to dry to an acceptable moisture content before placement. If the top surface of compacted fill is too wet, it shall be either removed or allowed to dry to an acceptable moisture content before compaction or placing additional layers of fill.

H. FILL PLACEMENT

Fill shall not be placed until the required excavation and preparation of the underlying foundation is completed and approved by the Technician. Fill shall be placed beginning at the lowest elevation of the foundation. No fill shall be placed on a frozen surface.

If the surface of any layer becomes too hard and smooth for proper bond with the succeeding layer, it shall be scarified parallel to the axis of the fill to a depth of not less than 2 inches before the next layer is placed.

Available topsoil shall be placed on the top and the exposed outside slopes of the waste storage facility embankment, the borrow areas, and any other area where the topsoil was removed during construction and where vegetation will be established.

The pre-compacted thickness of each layer of fill and compaction requirements shall be as stated below unless otherwise specified in the construction plans. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified layer thickness prior to compaction. The Technician shall determine if adequate compaction is being achieved and may require more than the minimum specified passes of the compaction equipment.

- (1) Embankments. The fill shall be placed in horizontal layers extending the entire length and width of the embankment. Unless otherwise specified in the construction plans, compaction requirements shall be as shown in Table 1. Each layer shall be compacted by a minimum of one pass over the entire surface of the fill by the compaction equipment.
- (2) Adjacent to Structures and Pipes. Adjacent to structures or pipes, earthfill shall be placed in 4-inch lifts (prior to compaction) in a manner adequate to prevent damage to the structure and to allow the structure or pipe to gradually and uniformly assume the backfill loads. Compaction shall be accomplished by means of manually directed power tampers or plate vibrators or hand tamping unless otherwise specified. Heavy equipment shall not be operated within 2 feet of any structure or pipe. Compaction by means of drop weights operating from a crane or hoist of any type will not be permitted.

All intrusions into or penetrations of a clay or other soil liner will be backfilled with equivalent material and compacted to maintain its integrity. Pipe trenches into a storage facility will be backfilled with the same soils and compaction required for the storage facility for the distance shown on the drawings.

- (3) Soil Liners. A soil liner shall be installed as designated on the drawings. This work shall consist of constructing a low permeability earthliner for the inside slopes and the bottom of the earthen basin to the thickness shown on the drawings. It also includes the soil liner material placed in conjunction with other liner materials to form a composite liner as shown on the drawings. Only soils approved by the Technician will be used.

The soil liner fill shall be placed in layers with a maximum thickness of 6 inches prior to compaction. The liner material shall be disked or worked in such a manner as to obtain a maximum clod size of 4 inches prior to compaction. Each layer of liners that do not require a specified density shall be compacted by a minimum of one pass over the entire surface of the fill by a:

- Rubber-tired front end loader (fully-loaded); or
- Scraper (fully-loaded); or
- Articulated haul truck (fully-loaded); or
- Sheepsfoot; or
- Tamping roller

Smooth drum rollers are not suitable for compaction of fine-grained liners.

Operation of the compaction equipment will be continuous over the entire area during fill operations. Any liner area disturbed by subsequent construction operations will be scarified and recompacted as specified.

- (4) Small Areas of Unsuitable Materials. Lenses or pockets of soil not meeting the criteria requirements in the applicable NRCS Standard or shown on the drawings, shall be removed and replaced with specified materials. The extent of removal and the quality of replacement materials will be as shown on the drawings or approved by the Technician. Excavated slopes shall be 1:1 or flatter. Replacement soil material placement, layer thickness, and compaction will be as stated for soil liners. Manually directed power tampers may be used for compaction and the soil shall be placed in 4-inch lifts prior to compaction.

Table 1 - Embankment Compaction Requirements

Equipment Type	Applicable Soils¹	Maximum Fill Height² (feet)	Layer Thickness³ (inches)
Sheepsfoot or tamping roller 10,000 lb. min. operating weight	ML, MH, CL, CH, SM, SC, GM, GC	None	9
Vibratory tamping roller 9,000 lb. min. operating weight	SM, SC, GM, GC	None	6
Smooth steel drum vibratory roller 10,000 lb. min.	SP, SW, GP, GW	20	6
Rubber-tired scraper or articulated haul truck (fully loaded)	ML, MH, CL, CH, SM, SC, GM, GC	None	9
Rubber-tired front end loader (fully loaded)	ML, MH, CL, CH, SM, SC, GM, GC	20	6
Track-type crawler standard tracks 30,000 lb. min.	SM, SC, GM, GC, ML, CL, SP, SW, GP, GW	10	6
Farm tractor 2,400 lb. min.	ML, MH, CL, CH, SM, SC, GM, GC	15	6

¹ Unified Soil Classification System.

² Measured from the top of the fill to the lowest point along the centerline of the fill.

³ Prior to compaction.

WISCONSIN CONSTRUCTION SPECIFICATION

211. Vinyl Sheet Piling

1. SCOPE

The work shall consist of furnishing, transporting, and installing vinyl sheet piling as shown on the construction drawings.

2. MATERIALS

All sheet piling shall be manufactured entirely from a rigid, high impact, ultraviolet- (UV) inhibited, weatherable vinyl compound. All exposed surfaces of the sheet piling shall be UV resistant, and comprised of virgin material with a minimum ASTM D4216 Cell Classification of 1-42443-33. If mono-extrusion technology is used, the entire sheet pile must be comprised of virgin material with a minimum ASTM D4216 Cell Classification of 1-42443-33. The virgin capstock thickness for coextruded material shall be no less than 0.015 inches at any point.

The sheet piling shall meet the following properties shown on the drawings:

- Minimum sheet thickness (inches)
- Minimum length (feet)
- Minimum section modulus (inches³)
- Minimum moment of inertia (inches⁴)
- Minimum sheet width (inches)
- Maximum section depth (inches)

The interlocks shall be designed to remain intact during installation and achieve effective seal to minimize seepage.

3. SITE PREPARATION

All clearing or other site preparation within the area to be occupied by the vinyl sheet piles shall be completed before the sheet piling is installed.

4. INSTALLATION OF VINYL SHEET PILING

Vinyl sheet piling shall be installed as specified in the construction plans or as directed by the Technician.

The sheet piling shall be placed by one of the following methods:

A. Driving Sheet Piling

The Contractor shall provide driving heads and other devices for sheet pile driving that conform to the recommendations of the manufacturer.

The sheet piling shall be driven in such a manner as to insure lock engagement and integrity throughout the entire length of each sheet pile. The sheet piles shall be held in proper alignment during driving by means of assembling frames or other suitable temporary guide structures. Temporary guide structures shall be removed when they have served their purpose.

At any time the forward edge of the sheet pile wall is found to be out of correct alignment: (a) the sheet piling already assembled and partly driven shall be driven to the required depth, and (b) taper sheet piles shall be then driven to bring the forward edge into correct alignment before additional regular sheet piling is assembled and driven.

The Contractor shall not attempt to drive sheet piles beyond the point of refusal, as indicated by excessive bouncing of the hammer or kicking of the sheet pile as concurred by the Technician.

B. Trench Embedment of Sheet Piling

Vinyl sheet piling is embedded by excavating a trench to the dimensions and lines shown on the drawings and backfilling.

Backfill material shall contain no frozen soil, sod, brush, roots or other perishable material.

Backfilling shall be performed with soil, bentonite slurry, grout, or flowable fill, depending on the depth of the trench and project specification. Compacted backfill shall not be used due to difficulties in getting proper compaction in and around the flanges and angled webs of the sheet piling.

5. CUTTING OFF SHEET PILES

The Contractor shall cut off the sheet pile at the specified elevations. The length of the sheet pile cut off shall be sufficient to permit the removal of all damaged material.

6. DEFECTIVE OR DAMAGED SHEET PILES

Defective or damaged sheet piles delivered to the site shall not be installed. Any sheet pile ruptured in the interlock or otherwise damaged during installation shall be pulled and replaced.

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 EFH-2 for rainfall depth).

For other applications, design the roof runoff structure to convey the flow rate generated from a 10-year, 5-minute rainfall event (see EFH-2 for rainfall depth).

Peak discharge for all roofs will be determined with the following equations:

The unit peak discharge (q_u) is defined as;
 q_u in unit of CFS/1000 sq. ft.

$$q_u = \frac{0.28 \text{ precipitation (inches)}}{1000 \text{ sq. ft.}}$$

Peak discharge from a roof drainage area is:
 $Q_p = q_u * DA \text{ (sq. ft.)}$

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 0.032 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