

CONSTRUCTION PLAN

PRACTICE(S) 634-Waste Transfer

LANDOWNER Kevin Zajackowski

ADDRESS N2565 Champagne Dr Merrill, WI 54452

LANDOWNER PHONE NO. 715-921-2505 COUNTY Lincoln

TOWNSHIP Merrill T 32 N, R 06 E/W, Sec. 34

FIELD OFFICE Lincoln County TELEPHONE NO. 715-539-1087

DIGGERS HOTLINE

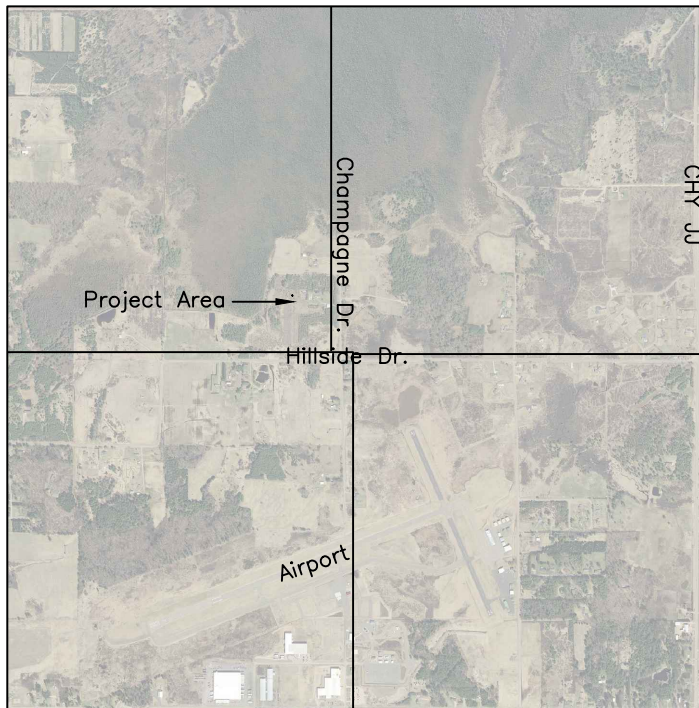
Call 3 Work Days
 Before You Dig!

Nationwide
 811

Toll Free
 1-800-242-8511

TDD
 1-800-542-2289

Website
www.diggershotline.com



Not to
 Scale

LOCATION MAP

NOTICE TO LANDOWNERS AND EXCAVATORS

Any representation made by the USDA, Natural Resources Conservation Service, or the LINCOLN County LCD, as to the approximate location or nonexistence of above or under ground hazards does not relieve the owner of the property or the excavator that is hired to complete construction, from notifying Diggers Hotline of the pending construction. You will be liable for damages resulting from construction activities.
 Call Diggers Hotline! Ticket Number _____

CONSTRUCTION DRAWINGS AND SPECIFICATIONS ACCEPTANCE

I have reviewed and understand the construction plans and specifications and agree to complete the work accordingly. Failure to meet these plans and specifications may jeopardize any continued NRCS technical assistance or program cost sharing applied for. I understand that it is my responsibility to secure all necessary permits and licenses, and to complete the work in accordance with all local, state, and federal laws. Modification of these construction plans or specifications must be approved by the NRCS before installation. I assume all responsibility for negotiations and contract agreements with the construction contractors.

Landowner Signature: _____ Date: _____

Designed by: Mitchell McCarthy Date: 9-2018

Checked by: _____ Date: _____

Approved by: _____ Date: _____

The installed practices comply with applicable NRCS technical standards and specifications. The "redlined" construction plans (as-built drawings) reflect changes made during construction.

Construction Approved by: _____ Date: _____

Job Approval Class III

Sheet 1 of 8

CONSTRUCTION NOTES

1. It is the landowner's responsibility to notify the owners of any utility, such as a buried cable or pipelines that may be present in the construction area, before the start of construction, so that they may locate and stake such utilities. To find if there are any buried utilities, be sure to call Diggers hotline, 1-800-242-8511 at least three days in advance.
2. The Land Service Department office 715-539-1087 must be contacted 3 days before the start of construction, to stake the project and review the plans with construction workers.
3. All material must be inspected 72 hours prior to placement to insure they meet specifications. Proper documentation on items results in fast approval.
4. Clean all manure and bedding out from under cages prior to starting.
5. 24" HDPE gasket pipe shall meet AASHTO M294 Type S or ASTM F2306.
6. 24" HDPE pipes shall be cut in half and the bottoms scored to allow exposed HDPE corrugations to drain and to protect from freezing. Rubber gasket on belled end of pipe shall be cut with caution so that the integrity of the gasket is not compromised.
7. All hardware used to mount and connect halved pipes in place shall be corrosion resistant. Rubber washers shall be used on bolts that secure pipe joints together.
8. The landowner is responsible for distributing plans and receiving bids from contractors. It is the landowners' choice of whom they choose for a contractor. Landowner and contractor should talk daily to make sure the project is being built within the received bid.



United States
Department of
Agriculture

Natural Resources
Conservation Service

CONSTRUCTION NOTES

CLIENT: Kevin Zajackowski
COUNTY: Lincoln

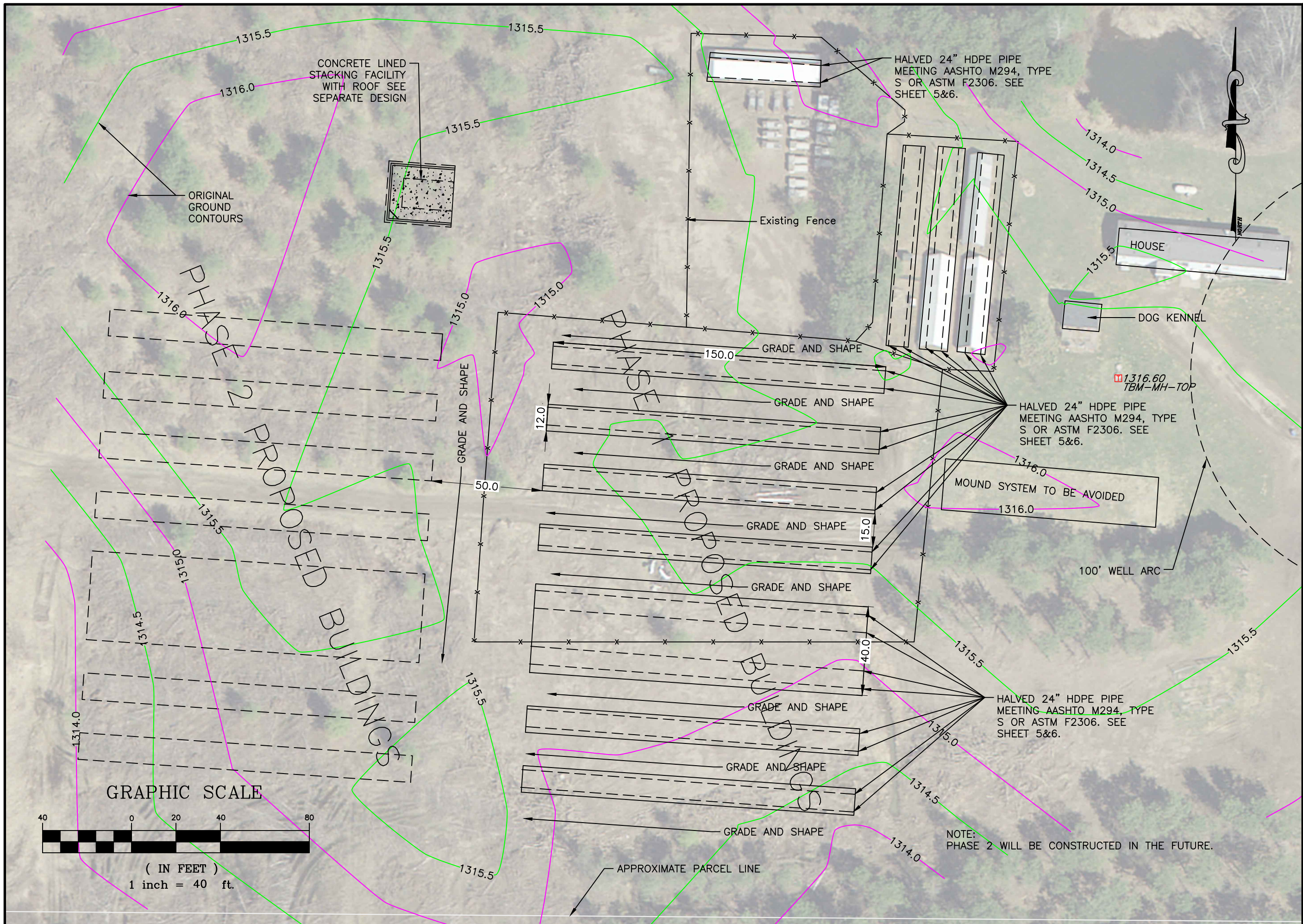
		Date
Designed	MRM, DDD	9-2018
Drawn	MRM	9-2018
Checked	DDD	9-2018
Approved	DDD	9-2018

File Name

Date

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Date	9-2018
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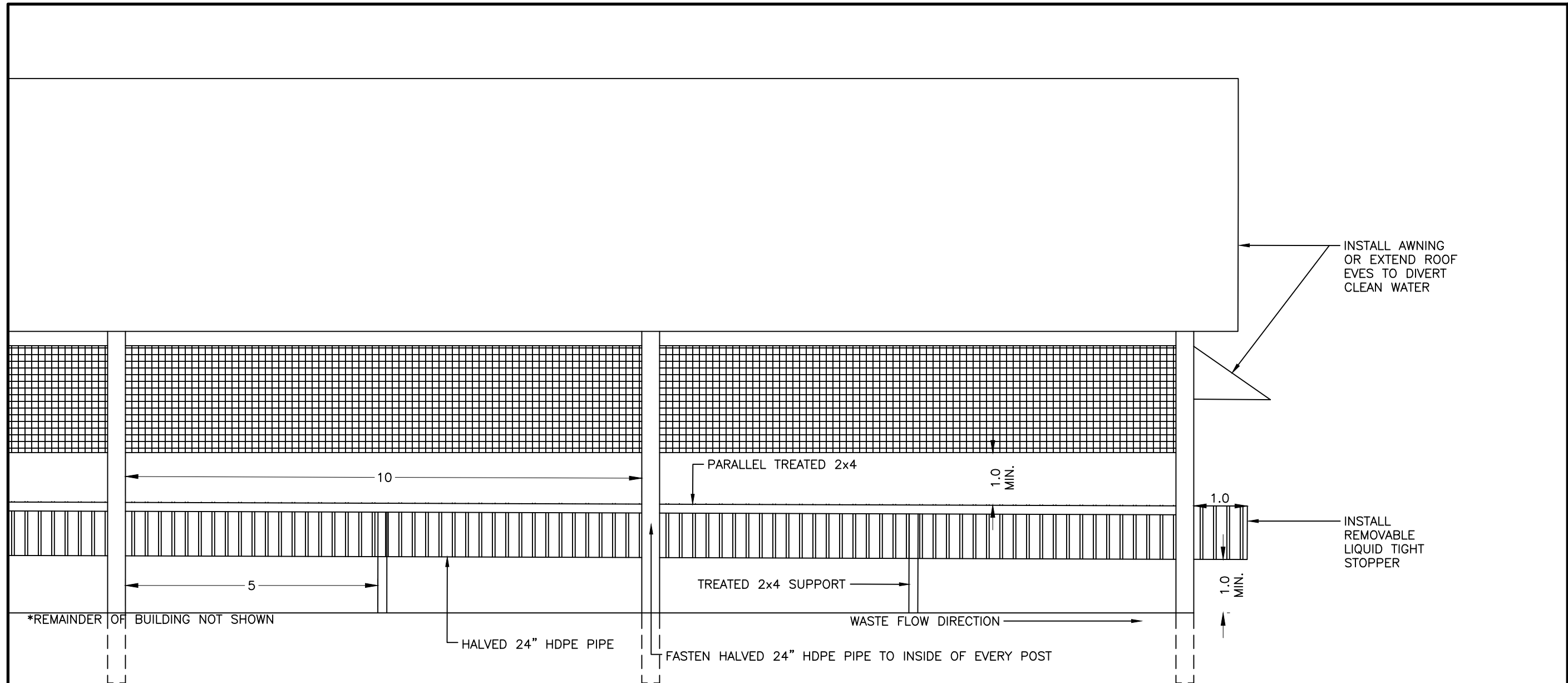
PLAN VIEW

OWNER: Zajackowski, Kevin

COUNTY: Lincoln

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USDA
 Natural Resources Conservation Service

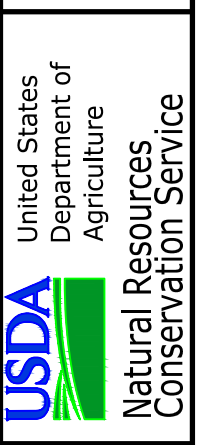
File Name: WI-006
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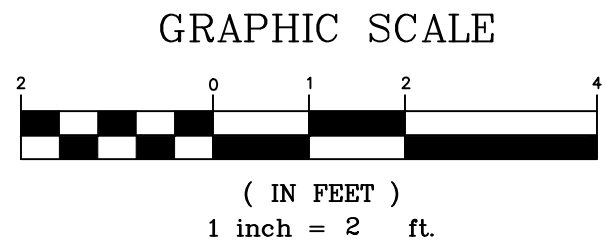
TYPICAL BUILDING PROFILE VIEW

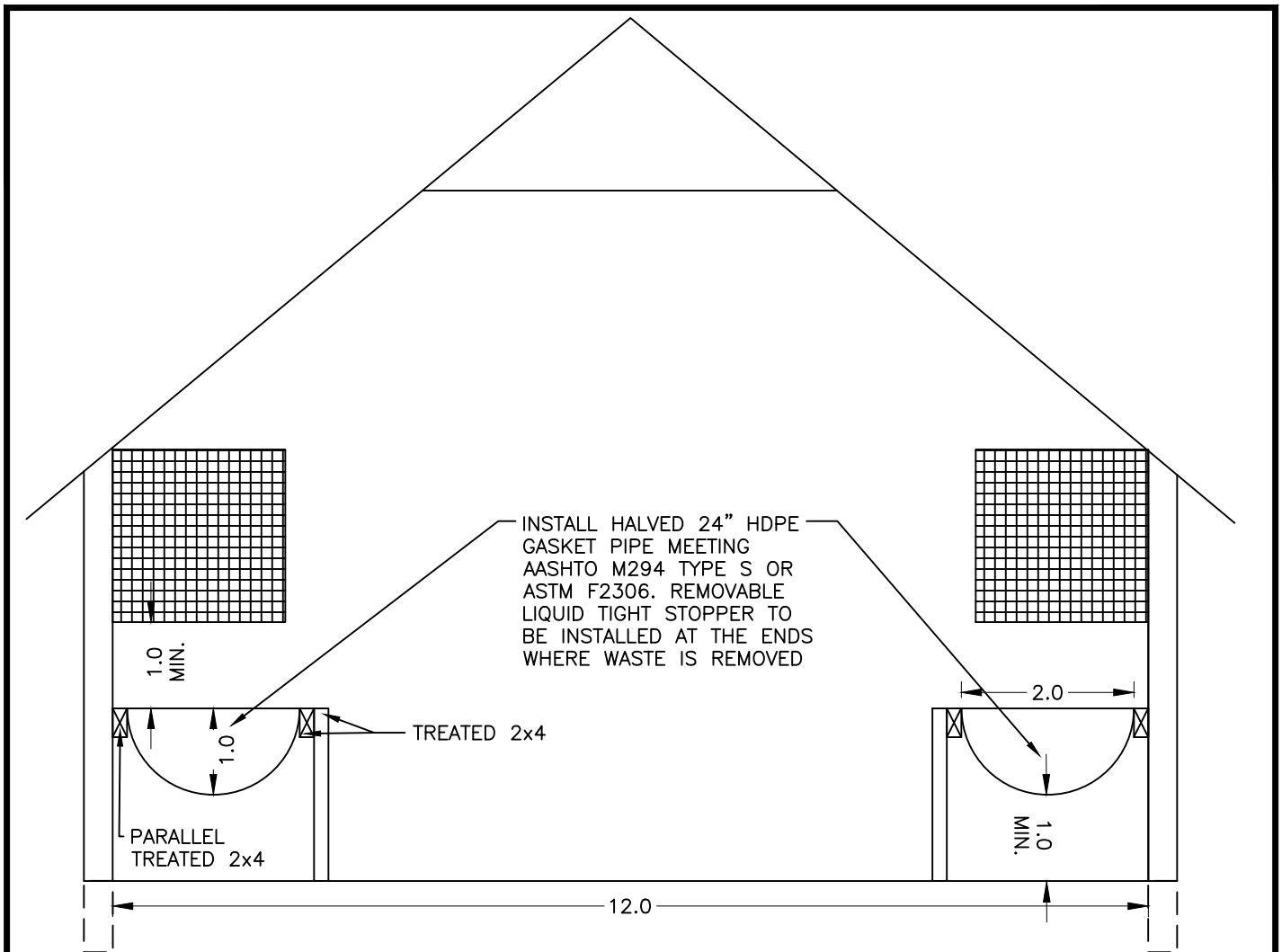
OWNER: Zajackowski, Kevin
 COUNTY: Lincoln



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- NOTE:
- HALVED 24" HDPE GASKET PIPE TO MEET AASHTO M294 TYPE S OR ASTM F2306
 - CUT 24" HDPE PIPES IN HALF AND SCORE BOTTOM OF HALVED PIPES TO ALLOW LIQUID TO DRAIN FROM EXPOSED CORRUGATIONS.
 - HALVES SHALL BE BOLTED TOGETHER ALONG GASKET SO THAT THE RUBBER GASKET IS NOT DAMAGED AND PROPER PRESSURE IS APPLIED ACROSS JOINT.
 - EACH JOINT SHALL HAVE 4 BOLTS WITH FENDER WASHERS, RUBBER WASHERS, AND LOCK NUTS.
 - ATTACH ALL HALVED 24" HDPE PIPE TO BUILDINGS STRUCTURAL POSTS AND 2x4 SUPPORTS USING STRUCTURAL SCREWS OF THE APPROPRIATE LENGTH AND WASHERS.
 - USE ADDITIONAL SCREWS AND WASHERS TO FASTEN THE HDPE PIPE TO THE PARALLEL 2x4 HALFWAY BETWEEN THE STRUCTURAL POST AND 2x4 SUPPORT.
 - REMOVABLE LIQUID TIGHT STOPPERS SHALL BE INSTALLED AT THE ENDS WHERE THE WASTE WILL BE REMOVED.





NOTE:

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GRAPHIC SCALE



(IN FEET)

1 inch = 2 ft.

TYPICAL BUILDING CROSS-SECTION

CLIENT: Kevin Zajackowski
 COUNTY: Lincoln

		Date
Designed	MRM, DDD	9-2018
Drawn	MRM	9-2018
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SEEDING DATES

NORTH

TIME PERIOD	DATES			TYPE OF SEEDING
Spring	May 1	through	June 15	Permanent
Summer	June 16	through	see WI-710 s s pg 2	Temporary *
Late Summer	July 15	through	August 10	Permanent
Fall	August 11	through	see WI-710 s s pg 2	Temporary *
Late Fall	November 1	through	Snow Cover	Dormant
Winter	Snow Cover	through	April 30	Not Allowed

MATERIALS

If no soil test is available, apply a minimum of 150 pounds of 20-10-10 fertilizer per acre. This is equivalent to 30 pounds nitrogen (N), 15 pounds phosphate (P205), and 15 pounds potash (K2O) per acre. Apply two tons of 80-89 lime or equivalent.

* Seed a temporary cover crop of _____ at #N/A #/ac (#N/A bu/ac)
 A permanent seeding shall be completed during the next acceptable time period following a temporary seeding.

MINIMUM PURE LIVE SEED (PLS)¹ RATE PER ACRE AND TOTAL POUNDS OF SEED NEEDED

SEEDING MIX (DESIGN)	12	LOCATION: ACRE(S)	1 1.00
SPECIES	RATE	POUNDS	
Kentucky Bluegrass	4.4	4.4	
Creeping Red Fescue	3.3	3.3	
**	#N/A	#N/A	

SEEDING MIX (AS-BUILT)	LOCATION ACRE(S)	
SPECIES	RATE	POUNDS

1 PLS lbs. = (Total % Germination / 100 * % Purity / 100) * Net Weight (lbs.)

ADDITIONAL SEED PERCENT: 10 %
 Mulching Required Yes

** Companion Crop

Total % Germination may also be termed Total % Viable Seed on a tag. If a tag only shows % Germination, the user must include percentage of the seed that germinated during the lab test (% Germination) plus the percentage of hard and/or dormant seed. Hard seed and dormant seed are seeds that are still capable of germinating and producing a plant but did not germinate under the conditions of the test in the lab.

Additional native seeds may be required by permitting agencies. These addition are allowed.

Seed mixture shall meet all requirements of the WI weed laws.

Species identified as restricted or prohibited by law shall not be planted.

Certified seed shall be used, and the seeding rates will be based on pure live seed.

For dormant seedings, increase the seeds per square foot by 15%.

SEEDBED PREPARATION

Seedbed preparation shall immediately follow construction activities.

Prepare a fine, firm seedbed to a minimum depth of three inches. A seedbed is considered firm when a footprint penetrates 1/4 to 1/2 inch deep.



INTRODUCED SPECIES SEEDING ESTABLISHMENT

CLIENT: Kevin Zajackowski
 COUNTY: Lincoln

		Date
Designed	MRM	9-2018
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SEEDING

Inoculate legumes with the specific inoculum for the species in accordance with the manufacturer's recommendations. When using a hydroseeder, five times the recommended rate of inoculant shall be added to the hydroseeder. Inoculant shall not be mixed with liquid fertilizer.

Seed may be broadcast or drilled as appropriate to the site.
Seed, fertilize, and lime as soon as possible after construction.
Seeding perpendicular to direction of flow is required to limit erosion.

Seed grasses and legumes no more than 1/4 inch deep.

Consider seeding at a lower rate and making 2 passes to ensure more uniform distribution.

TEMPORARY SEEDING OPTIONS

Select one of the following species for temporary cover if:

- 1) The required seeds or plant stock are not available or the normal permanent seeding period for the species has passed
 - Forage Sorghum - 1/2 bushel per acre (May 15-July 15)
 - Sorghum - Sudangrass Hybrid - 1 bushel per acre (May 15-July 15)
 - Sudangrass - 1 bushel per acre (May 15-July 15)
 - Winter Wheat - 2 bushels per acre (Aug 1-Oct 1)
 - Winter Cereal Rye - 2 bushels per acre (Aug 1-Oct 15)
 - Oats - 2 bushels per acre (Apr 1-Sept 1)
 - Annual Ryegrass - 20 Pounds per acre (Apr 1-Sept 1)

- 2) Triazine herbicide carryover will not allow establishment of permanent cover immediately.
 - Forage Sorghum - 1/2 Bushel per acre (May 15-July 15)
 - Sorghum - Sudangrass Hybrid - 1 Bushel per acre (May 15-July 15)
 - Sudangrass - 1 Bushel per acre (May 15-July 15)

DORMANT SEEDING

Seed is broadcast and incorporated, no-tilled, or drilled into the seedbed .
Seedbed preparations and conditions are similar to conventional seeding.

MULCHING

Mulching shall be done immediately after seedbed preparation and seeding.
Mulch shall be applied immediately after final grading for areas seeded at a later date.
Mulch material shall be relatively free of disease, pesticides, chemicals, noxious weed seeds, and other pests and pathogens.

Spread straw and hay mulch uniformly and at the rate of 1.5-2.0 tons per acre (60-70 bales). This application results in a layer of 6 to 7 stems, 1 to 2 inches thick, and provides a minimum 70% ground cover. Some soil surface can be seen after the application. Crimping (disking), wood cellulose fiber, tackifiers, netting, pinning, or other acceptable methods of anchoring will be used if needed to hold the mulch in place.

If other mulch materials are used, the rate of application shall meet the manufacturer's recommendations.



United States Department of Agriculture

Natural Resources Conservation Service

INTRODUCED SPECIES SEEDING ESTABLISHMENT

CLIENT: Kevin Zajackowski
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Approved	DDD	9-2018

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Operation and Maintenance Plan Waste Storage Facility

Cooperator: KEVIN ZAJACKOWSKI

Date: 9-2018

By: MITCHELL MCCARTHY

Title: CONSERVATION PROGRAM MANAGER

Project Location: N2565 Champagne Dr Merrill, WI 54452

I agree to the following for the next 10 years, or until the facility is no longer used.

The system is sized for:

Animals:

Female Mink: 1,000

Male Mink: 200

Kits: 5,000

Total Animal Units: 18 A.U.s

1. Inspect the facility periodically. A thorough inspection of the HDPE pipes, fittings, and mounts should be made each time the system is emptied. Separations and/or cracks, indicate potential failure. Repairs should be made immediately.
2. Liquid waste inside mink barns is not expected to be a resource concern. However if leakage occurs from HDPE troughs in the future, A liquid containment system shall be installed. Notify County staff if leakage occurs.
3. Inspect and maintain halved 24" HDPE pipes to ensure they are liquid tight.
4. Waste in the halved HDPE pipes shall be transferred to the stacking facility. The waste should then be hauled and land applied as specified in the NMP, typically during the spring and fall seasons. Manure shall not be land applied during the winter or on frozen ground.

Cooperator's signature: _____ Date: _____

I have discussed the maintenance guidelines with the above cooperator.

Conservationist's signature: _____ Date: _____



United States
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OPERATIONS & MAINTENANCE PLAN

CLIENT: Kevin Zajackowski

COUNTY: Lincoln

		Date
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Approved	DDD	9-2018

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Date

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Construction Quality Assurance Plan Waste Storage Facility & Waste Transfer

(page 1 of 2)

LANDOWNER: KEVIN ZAJACKOWSKI

LOCATION OF PRACTICE OR PLAN ID: N2565 Champagne Dr Merrill, WI 54452

INSPECTOR: MITCHELL MCCARTHY APPROVER: _____ Date: 9-2018

ENGINEERING JOB CLASS: III

Initial and date items as completed. Reference the diary page that the documentation can be found. Date all additional documentation and keep in construction file.

PRE-CONSTRUCTION

- Verify that the landowner or contractor notified all utilities prior to construction. Document Digger's Hotline Ticket Number
- Obtain copies of permits, or documentation that they aren't needed.

MATERIAL INSPECTION

- TRANSFER PIPE materials. Document diameter and material markings. Verify materials meet the plans and specifications.
ASTM F2306 or AASHTO M294, Type S _____
- SEED. Document species and quantities of pure live seed. Verify that it meets requirements of WI-710 drawing. Place seed tag in construction documentation file.
- Mulch. Document type used and quantity.

CONSTRUCTION

- Stake the location of the practices. Set grades if necessary.
_____ Waste transfer pipe

Other

Document seeding date, quantity of seed, area seeded. Verify mulch used, mulch type and area mulched. Document all of the above with photographs, data in engineering field book and job diary.

I have reviewed this plan and understand my responsibilities in the quality assurance needed for my project.

Landowner's Signature: _____ Date: _____



QUALITY ASSURANCE PLAN

CLIENT: Kevin Zajackowski
COUNTY: Lincoln

	Designed	MRM, DDD	Date	9-2018
Drawn	MRM		9-2018	
Checked	DDD		9-2018	
Approved	DDD		9-2018	

File Name
Date
08/14
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WISCONSIN CONSTRUCTION SPECIFICATION

1. Clearing

1. SCOPE

The work shall consist of the clearing and disposal of trees, snags, logs, brush, shrubs, stumps, and rubbish from the designated areas.

2. MARKING

The limits of the areas to be cleared will be marked by means of stakes, flags, tree markings, or other suitable methods. Trees to be left standing and uninjured will be designated by special markings placed on the trunks at a height of about 6 feet above the ground surface.

3. PROTECTION OF EXISTING VEGETATION

Trees and other woody vegetation designated to remain undisturbed shall be protected from damage throughout the entire construction period. Any damage resulting from the Contractor's operations or neglect shall be repaired by the Contractor.

Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the dripline of vegetation designated to remain in place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species.

Any cuts, skins, scrapes, or bruises to the bark of the vegetation shall be carefully trimmed and local nursery accepted procedures used to seal damaged bark.

Any limbs or branches 0.5-inch or larger in diameter that are broken, severed, or otherwise seriously damaged during construction shall be cut off at the base of the damaged limb or branch flush with the adjacent limb or tree trunk.

All roots 1 inch or larger in diameter that are cut, broken, or otherwise severed during construction operations shall have the end smoothly cut perpendicular to the root. Roots exposed during excavation or other operations shall be covered with moist earth and/or backfilled as soon as possible to prevent them from drying.

4. CLEARING

Trees, brush, shrubs, stumps, and other woody growth shall be cleared to a height not exceeding 12 inches above the ground surface. Such growth may be cleared by cutting, pulling, grubbing, or other approved methods.

Trees shall be felled in such a manner as to avoid damage to trees that are to be left standing, existing structures, utilities, and with regard for the safety of persons.

When the designated areas to be cleared include borrow areas and/or areas upon which improvements are to be constructed, the required grubbing of stumps, roots, and other objectionable material in these areas shall be a part of this specification. The grubbing shall consist of the removal of all stumps,

roots of 1 inch in diameter or larger, buried logs, and other objectionable material to a minimum depth of 2 feet below a structure subgrade and 1 foot below an embankment foundation.

5. SITE EROSION CONTROL

Measures shall be installed, or the work performed in a manner that will minimize site erosion, and the production of sediment. Protective measures shall include but are not limited to diversions, waterways, seeding, mulching, sediment basins, and silt fences.

6. DISPOSAL

All materials cleared from the designated areas shall be burned or buried at approved locations or otherwise removed from the site. Buried materials shall be covered with a minimum of 2 feet of earthfill (including any topsoil added for seeding).

The Contractor is responsible for complying with all rules and regulations for disposal at locations away from the construction site or for the burning of cleared materials.

WISCONSIN CONSTRUCTION SPECIFICATION

2. Excavation

1. SCOPE

The work shall consist of the excavation of all materials necessary for the construction of the work.

2. USE OF EXCAVATED MATERIALS

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. The suitability of materials for specific purposes will be determined by the Technician. The Contractor shall not waste or otherwise dispose of suitable excavated materials.

3. DISPOSAL OF WASTE MATERIALS

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

Material placed in designated waste disposal areas shall be left in a neat and sightly condition and sloped to provide positive drainage. Compaction of the waste materials will not be required unless specified by the construction plans.

Waste material excavated from channels may be deposited in leveled spoilbanks or areas adjacent to the channel work (if permissible). The shape and slopes of the spoilbanks shall be indicated on the drawings or as approved by the Technician. Spoil piles shall be located a minimum of 12 feet from the top of the channel side slope.

Spoil piles or disposal areas shall be protected to minimize site erosion and the production of sediment. Protective measures may include but are not limited to diversions, seeding, mulching, sediment basins, and silt fences.

4. SPECIAL REQUIREMENTS FOR STRUCTURE AND TRENCH EXCAVATION

The required dimensions and side slopes of all structure and trench excavations shall be as shown on the drawings.

Excavation beyond the limits of the specified lines and grades shall be corrected by filling the resulting voids with approved compacted materials.

Excavation for the installation of pipes shall follow the practices contained in the Occupational Safety and Health Administration (OSHA) Subpart P, Excavation, of 29 CFR 1926.650, .651 and .652.

Side slopes shall be excavated or braced to safeguard the work and workers. When bracing or supporting is required, the width of the excavation shall be adjusted to allow for the space occupied by the sheeting, bracing, or other supporting installations. The Contractor shall furnish, place, and subsequently remove such supporting installations.

5. REMOVAL OF WATER

The Contractor shall construct and maintain all necessary cofferdams, channels, flumes, pumping equipment, and/or other temporary diversion and protective work for dewatering the various parts of the work. Foundations, cutoff trenches, and other parts of the work shall be maintained free from water as required for constructing each part of the work. After having served their purpose, all cofferdams and other temporary protective works shall be removed, or leveled to give a sightly appearance and so as not to interfere in any way with the operation, usefulness, or stability of the permanent structure.

6. BORROW EXCAVATION

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.

When shown on the drawings, sediment basins, terraces, diversions, or other measures shall be constructed to protect the borrow areas from erosion and retain sediment within the borrow area.

The upper six (6) inches shall be stripped from all borrow areas. 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. This material shall be redistributed over the area from which it came after borrow excavation is completed.

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 pits shall be left in a neat and sightly condition. All borrow areas shall be graded to blend with existing topography and sloped to prevent ponding and provide positive drainage.

WISCONSIN CONSTRUCTION SPECIFICATION

3. Earthfill

1. SCOPE

The work shall consist of placing the earthfill required by the drawings. This specification does not apply to the earthfill required for waste storage facilities.

2. MATERIALS

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

3. FOUNDATION PREPARATION

The foundation area shall be cleared of trees, stumps, roots, brush, rubbish, and stones having a maximum dimension greater than six (6) inches. Foundations shall be stripped to remove vegetation and other unsuitable materials or to the depth shown on the drawings, whichever is greater. 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.

Earth foundations shall be graded to remove surface irregularities and slopes steeper than 1:1.

The foundation surfaces shall be scarified parallel to the centerline of the fill to a minimum depth of 2 inches. The moisture content of the scarified materials shall be maintained as specified for the earthfill. The surface materials of the foundation shall be compacted and bonded with the first layer of earthfill as specified for subsequent layers of earthfill.

4. PLACEMENT

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

Fill shall be placed in approximately horizontal layers beginning at the lowest elevation of the foundation. The thickness of each layer of fill prior to compaction shall be as specified in Table 1. Materials placed by dumping in piles or windrows shall be spread uniformly to not more than the specified layer thickness prior to compaction.

Adjacent to structures, 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 to gradually and uniformly assume the backfill loads.

The height of the fill shall be increased at approximately the same rate on all sides of the structure.

Placement of fill adjacent to concrete structures may begin after the concrete has cured for the minimum time specified.

Earthfill in dams, levees, and other structures designed to impound water shall be placed to meet the following additional requirements:

- a. The distribution of materials throughout each zone shall be essentially uniform, and the fill shall be free from lenses, pockets, streaks, or layers of material differing substantially in texture, moisture content, or gradation from the surrounding material.
- b. The embankment top shall be maintained approximately level during construction except for sectional construction as described in Section 7.
- c. Dam embankments shall be constructed in continuous layers from abutment to abutment, except where openings to facilitate construction or to allow passage of stream flow during construction are specified.
- d. If the surface of any layer becomes too hard and smooth to achieve a suitable 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.

5. CONTROL OF 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.

Fill material or the top surface of the preceding layer of compacted 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 fill.

Fill material that is too wet when deposited or the top surface of the preceding layer of compacted fill that becomes too wet shall be either removed or allowed to dry to an acceptable moisture content before compaction or placing additional layers of fill.

6. COMPACTION

The Contractor shall furnish and operate the types and kinds of equipment necessary to compact the fill materials.

Unless otherwise specified on the plans or approved by the Technician, compaction requirements for each layer of fill material are as shown in Table 1.

Each pass shall consist of at least one complete coverage by the wheel, track, or roller over the entire surface of the fill layer in a direction parallel to the main axis of the fill.

Adjacent to structures or in confined areas, compaction of the fill shall be accomplished by means of manually directed power tampers or plate vibrators or hand tamping, unless otherwise specified. The Technician shall determine if adequate compaction is being achieved. Heavy equipment shall not be

operated within 2 feet of any structure. Compaction by means of drop weights operating from a crane or hoist of any type will not be permitted.

7. SPECIAL REQUIREMENTS FOR SECTIONAL CONSTRUCTION OF EMBANKMENTS

When sectional (or phase) construction of embankments is authorized, the work shall be accomplished in the following manner:

Each section of the embankment that is constructed in the first phase shall be so placed that a slope not steeper than 3 feet horizontal to 1 foot vertical is maintained at the end of the embankment section adjacent to the gap in construction or closure section.

Prior to placement of the closure sections, the surfaces of completed fills and excavations that will be in contact with the closure shall be stripped of all loose material, scarified, moistened, and recompacted as necessary.

Table 1 - Equipment Compaction Requirements

Equipment Type		Applicable Soils ¹	Maximum Fill Height ² (feet)	Layer Thickness ³ (inches)	Minimum Passes ⁴
Sheepsfoot roller (10,000 lb. min. operating weight)		ML, MH, CL, CH or SM, SC, GM, GC with >20% fines	None	9	1
Vibratory tamping roller (9,000 lb. min. operating weight)		SM, SC, GM, GC	None	9	2
Rubber-tired scraper (fully loaded)		GM, GC, SM, SC, ML, MH, CL, CH	20	9	1
Rubber-tired front end loader (fully loaded)		GM, GC, SM, SC, ML, MH, CL, CH	20	6	1
Track-type crawler (standard tracks)	30,000 lb. min.	GM, GC, SM, SC, ML, CL	10**	6	2
		SP, SW, GP, GW	6**	12	4
		CL, ML, SC, SM	15 ^{###}	3	2
	less than 30,000 lb.	GM, GC, GP, GW, SM, SC, SP, SW, ML, CL	6**	6	2
Farm tractor (2,400 lb. min.)		GM, GC, SM, SC, ML, MH, CL, CH	15	6	2
Steel drum vibratory roller (10,000 lb. min.)		SP, SW, GP, GW	None**	12	2

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.

⁴ The Technician shall determine if adequate compaction is being achieved. Additional passes may be required.

** The fill shall not have a permanent body of water stored against it.

^{###} This method may only be used for embankments that will not have the potential for a permanent body of water stored against it that is greater than 1/4 acre in surface area or more than 6 feet deep.

WISCONSIN CONSTRUCTION SPECIFICATION

004-WS EMBEDDED OR EXPANSIVE WATERSTOP

1. Scope

The work shall consist of furnishing, welding, placing and installation of embedded waterstop base seal waterstop, or expansive waterstop as required on the construction drawings. All material shall meet the requirements of the latest edition of the applicable ASTM designation.

2. Quality Control and Quality Assurance During Concrete Placement

The contractor shall provide the technician a construction quality control plan at the pre-construction conference.

The plan shall detail the requirements for waterstop installation, including as a minimum:

- Waterstop placement and welding methods that will be utilized during construction,
- Name, contact information and responsibilities of a quality control (QC) individual providing continuous quality control during concrete placement around the embedded waterstop to ensure proper placement and consolidation.
 - » The quality control person may be an employee of the contractor or the owner of the project, without other duties during concrete placement.
- Name, contact information and responsibilities of an individual performing continuous quality assurance (QA) during concrete placement around the embedded waterstop to ensure proper placement and consolidation.
 - » The quality assurance individual shall be a person under the direction and control of the individual responsible for approving the as-built construction plan.

OR

- » A qualified consultant hired by the owner to assure and document the installation complies with the manufacturer's recommendations and procedures and this specification. The third party consultant shall provide documentation to the owner and the Technician.

3. Materials

The Contractor shall provide evidence from the manufacturer showing that the waterstop materials meet the requirements of this specification. All materials proposed for use shall be approved by the Technician.

Preformed expansion joint filler shall be commercially available products made of sponge rubber, closed cell foam, or boards containing bituminous materials. The joint filler shall have a minimum thickness of ½ inch and a width equal to the full cross sectional width of the concrete at the joint.

Embedded waterstops shall be made of polyvinyl chloride (PVC), thermoplastic elastomeric rubber (TPE-R), or polyethylene (PE or VLDPE). The minimum width of waterstop shall be 6 inches, or the width and material shown on an NRCS approved Wisconsin Standard Drawing. The waterstop web thickness shall be a minimum of 3/8 inches throughout the entire cross section of the waterstop. The maximum bulb size shall not exceed 1 inch. Waterstops shall be the type intended for placement entirely within the concrete cross section, or as shown on an NRCS approved Wisconsin Standard Drawing or other drawings as approved by the NRCS State Conservation Engineer. Waterstops shall have ribbed or “dumb-bell” type anchor flanges and a hollow tubular center bulb. Split flange waterstops are prohibited.

Base seal waterstops shall be made of polyvinyl chloride (PVC), thermoplastic elastomeric rubber (TPE-R), or polyethylene (PE or VLDPE). The minimum width of waterstop shall be 9 Inches. This waterstop shape is limited to NRCS approved Wisconsin Standard drawing for feed storage facilities and pre-engineered waste storage structures approved by the Wisconsin State Conservation Engineer (SCE).

Expansive waterstops shall consist of preformed strips or mastic (caulk) made of hydrophilic materials that expand when subjected to moisture and shall not contain bentonite. Use shall be limited to non-movement joints (fixed joints).

4. Welding of Waterstop

Manufacturers’ fabricated waterstop intersections shall be provided.

Only straight butt joint splices are allowed for field fabrication. Splices in waterstops shall be welded as recommended by the manufacturer. The specific splicing iron and the temperature of the iron shall be in accordance with the manufactures instructions for the type of waterstop being spliced.

Manufacturer-certified contractors may fabricate waterstop intersections in a controlled environment with the proper manufacturer’s equipment. Prior to the time of delivery of the fabricated intersections, documentation of certification must be presented to the Technician.

5. Placement and Installation of Waterstop

Embedded Waterstop

Joints with embedded waterstops shall not be placed horizontally across sloped slabs.

Embedded waterstops shall be located as shown on the drawings and secured in position so that displacement does not occur during concrete placement. Vertical applications (footing to wall joints and wall to wall joints) shall be secured to reinforcement using wire or “hog ring” type fasteners or factory installed grommets at the outermost rib at the spacing as recommended by the waterstop manufacturer (usually 12 inches on center). Hog rings shall be factory installed, if the manufacturer has that option available. Each waterstop shall be placed and secured with the hollow bulb aligned in the center of the planned joint.

Waterstop clearance shall be a minimum of 1½ inches from reinforcement and one half the waterstop’s width to the face of the concrete (3 inches for 6 inch wide waterstop).

Internal vibration is required along the entire length of all joints that contain embedded waterstops for both formed surfaces and slabs and shall be performed in the presence of the QC and QA individuals.

Continuous placement of concrete through a waterstop joint is not allowed, except for control joints in formed walls where preformed joint control formers are used in conjunction with the waterstops, or in control joints as shown on an NRCS approved Wisconsin Standard Drawing or other drawings as approved by the NRCS SCE.

Expansive Waterstop

Expansive waterstop shall be placed at the locations shown on the drawings in accordance with the manufacturer’s instructions.

Preformed strips may require adhesive or other forms of mechanical fastening to existing concrete based on the manufacturer’s instructions. The adhesive for preformed expansive waterstop and the mastic for caulk type expansive waterstop shall be allowed to cure for the duration as indicated by the manufacturer prior to placing concrete over the waterstop.

Mastic (caulk) type expansive waterstops shall be placed to the bead size as recommended by the manufacturer based on the amount of concrete cover provided.

Colder temperatures will require longer curing periods prior to concrete placement. Do not allow the expansive waterstop to become wet prior to placing concrete over the waterstop.

6. Repair protocol

Waterstop which does not comply with this specification, damaged or otherwise defective shall be repaired or replaced by the Contractor in accordance with the manufacturer’s recommendations or a repair plan developed by the contractor and approved by the Technician. All repairs shall be completed prior to additional work on the waterstop joint.

WISCONSIN CONSTRUCTION SPECIFICATION

4. CONCRETE

A. SCOPE

The work shall consist of furnishing, forming, placing, consolidating, finishing, and curing Portland cement concrete and the furnishing and placing of steel reinforcement or other appurtenances as required on the construction drawings. All materials, test procedures, and admixtures shall meet the requirements of the latest edition of the applicable ASTM designation.

Failure to meet any requirements contained in this specification may be cause for rejection of the concrete or delay of placement.

B. DEFINITIONS

The following definitions are provided for the purpose of this specification. The words that are defined in this section are italicized the first time they are used in the text.

- (1) *Batch delivery ticket* refers to the form showing the total weights of all the ingredients used to mix the contents of the rotating drum mixer (total weights of all ingredients on the load) and other job pertinent information.
- (2) *Consolidating* refers to the process of reducing the volume of entrapped air in a fresh cementitious mixture, usually accomplished by inputting mechanical energy.
- (3) *Construction joints* are those joints where two successive placements of concrete meet, through which reinforcement is continuous and bond is required between the two pours.
- (4) *Finishing* refers to the process of treating surfaces of fresh or recently placed concrete or mortar to produce desired appearance and service.
- (5) *Firm* refers to the condition of the subgrade where it is not significantly displaced or deformed by foot traffic during construction, and is able to properly support reinforcement chairs.
- (6) *Flatwork* refers to concrete slabs poured on slopes flatter than 5:1 (Horizontal:Vertical).
- (7) *Form release agent* refers to commercially manufactured formwork release agents that prevent formwork absorption of moisture, prevent bond with concrete, and do not stain the concrete surfaces.
- (8) *Formed surfaces* are those that require a temporary structure or mold for the support of concrete while it is setting and gaining sufficient strength to be self-supporting, such as walls or poured-inplace tank lids.
- (9) *Hand tamping* refers to the operation of consolidating freshly placed concrete by hand-held implements.
- (10) *Honeycomb* refers to voids left in concrete due to failure of the mortar to effectively fill the spaces among coarse aggregate particles.
- (11) *Jitterbug* refers to a grate tamper for pushing coarse aggregate slightly below the surface of a slab to facilitate finishing.
- (12) *Liquid-containment concrete* refers to concrete applications using specific placement and finishing techniques, and design features to minimize the loss of liquids.
- (13) *Manufacturer* refers to the producer/supplier of the ready-mixed concrete.

- (14) *Mesh roller* refers to a finishing tool consisting of a rolling drum attached to a handle, of which the surface of the drum is made of mesh, sometimes used for rolling over the surface of fresh concrete to embed coarse aggregate
- (15) *Rock pocket* refers to a porous, mortar-deficient portion of hardened concrete consisting primarily of coarse aggregate and open voids; caused by leakage of mortar from the form, separation (segregation) during placement, or insufficient consolidation.
- (16) *Sloped slabs* refers to concrete slabs poured on slopes of 5:1 (Horizontal:Vertical) or steeper.
- (17) *Technician* refers to an individual trained in specific technical processes, and may include an engineer, government agency representative, private sector technical service provider, qualified independent third party quality assurance inspector, or a similar person that is primarily responsible for the project quality assurance.
- (18) *Ternary mix* is a mixture using three cementitious materials, such as Portland cement, fly ash, and ground granulated blast-furnace slag (slag).
- (19) *Top bars* are horizontal reinforcements placed such that more than 12 inches of fresh concrete is cast below the reinforcing bar (such as horizontal wall bars).
- (20) *Vibration* refers to mechanical energetic agitation of freshly mixed concrete during placement by mechanical devices, either pneumatic or electric, that create vibratory impulses of moderately high frequency to assist in consolidating the concrete.
 - (i) Internal vibration employs one or more vibrating elements that can be inserted into the fresh concrete at selected locations.
 - (ii) Surface vibration employs a portable horizontal platform on which a vibrating element is mounted.
- (21) *Water-cement ratio (w/c)* is the ratio of the weight of free water (excluding that absorbed by the aggregates) to the weight of Portland cement in a concrete mix expressed as a decimal.
- (22) *Water-cementitious material ratio (w/cm)* is the ratio of the weight of free water (excluding that absorbed by the aggregates) to the weight of cementitious material (fly ash, Portland cement, and slag) in a concrete mix expressed as a decimal.

C. MATERIALS

The Contractor shall provide test data, independent laboratory reports, or other evidence from the concrete manufacturer showing that all materials meet the requirements of this specification. All materials proposed for use shall be approved by the Technician.

- (1) Portland cement shall conform to ASTM C 150 and shall be Type I, II, or III.
- (2) Fine aggregate shall conform to ASTM C 33 and be composed of clean, uncoated grains of material. Refer to the fine aggregate gradation table in Section 4 of this specification.
- (3) Coarse aggregates shall be gravel or crushed stone conforming to ASTM C 33 and be clean, hard, durable, and free from clay or coating of any character. Refer to the coarse aggregate gradation table in Section 4 of this specification.
- (4) Water shall be clean and free from injurious amounts of oil, salt, acid, alkali, organic matter, or other deleterious substances.
- (5) Air entraining agent shall conform to ASTM C 260.
- (6) Pozzolan (fly ash) shall conform to ASTM C 618, Class C or F. The loss of ignition shall not exceed 2 percent for Class C and 6 percent for Class F.
- (7) Ground granulated blast furnace (GGBF) slag shall conform to ASTM C 989.

- (8) Chemical admixtures shall be used in strict compliance with the manufacturer's recommendations, conform to ASTM C 494, and may be the following types:
- (i) Type A - Water-reducing admixtures.
 - (ii) Type B - Retarding admixtures.
 - (iii) Type C - Accelerating admixtures.
 - (iv) Type D - Water-reducing and retarding admixtures.
 - (v) Type E - Water-reducing and accelerating admixtures.
 - (vi) Type F - Water-reducing, high range admixtures (superplasticizers).
 - (vii) Type G - Water-reducing, high range, and retarding admixtures (superplasticizers).
 - (viii) Type S - Specific performance admixtures
 - If Type C or E is used, the manufacturer shall provide the Technician a product data sheet verifying that the product is a non-chloride accelerator.
 - If Type S is used the manufacturer shall provide the Technician a report stating the specific performance characteristic(s) of the admixture and data to substantiate the performance characteristic(s).
 - Calcium chloride or admixtures containing chloride ions other than from impurities in admixture ingredients shall not be used.
- (9) Deformed reinforcing bars shall be free from loose rust, oil, grease, paint, or other deleterious matter. Steel bars for concrete reinforcement shall meet the requirements of ASTM A 615. The steel shall be deformed Grade 40 or Grade 60 billet-steel bars as noted on the plans.
- (10) Deformed welded wire reinforcement (WWR) shall conform to the requirements of ASTM A 1064 and shall be furnished in flat sheets, and shall be size D4 or larger as indicated on the plans. This material may only be used for non-structural elements such as slabs on grade. Spacing of welded intersections shall not exceed 16 inches.
- (11) Curing compound shall be a liquid membrane-forming compound suitable for spraying on the concrete surface. The curing compound shall meet the requirements of ASTM C 309, Type 2 (white pigmented).

D. DESIGN OF THE CONCRETE MIX

No less than seven (7) days prior to the start of concrete placement the Contractor is responsible for submitting documentation of the proposed design mix to the Technician. The Contractor is responsible for providing a mix with the minimum required 28-day compressive strength in the construction plan and meet the following:

- (1) The water-cement (w/c) or the water-cementitious material (w/cm) ratio shall not exceed 0.45 for all concrete construction.
- (2) The cementitious material required shall be 564 pounds per cubic yard of concrete.
 - (i) The cementitious material may include a maximum of 25 percent (by weight) of fly ash or a maximum of 30 percent (by weight) of ground granulated blast-furnace (GGBF) slag. The remaining cementitious materials shall be Portland cement.
 - (ii) Mixes containing both fly ash and GGBF slag shall not exceed 30 percent in combination (ternary mix) and no more than 25 percent shall be fly ash. The remaining cementitious materials shall be Portland cement.
- (3) The air content (by volume) shall be 6 percent of the volume of the concrete.
- (4) The maximum (not to exceed) slump, with the use of water reducers, shall be 5 inches.
- (5) The maximum (not to exceed) slump, with the use of superplasticizers, shall be 8 inches.

- (6) The fine aggregate oven dry weight shall be 30-45 percent of the total oven dry weight of the combined coarse and fine aggregates. The well-graded fine aggregate shall conform to the following ASTM C 33 or Wisconsin DOT gradation requirements shown below:

FINE AGGREGATE GRADATION

Sieve Size	Percent Passing By Weight	
	ASTM C 33	WI DOT
3/8" (9.5 mm)	100	100
No. 4 (4.75 mm)	95-100	90-100
No. 8 (2.36 mm)	80-100	---
No. 16 (1.18 mm)	50-85	45-85
No. 30 (600 μm)	25-60	---
No. 50 (300 μm)	5-30	5-30
No. 100 (150 μm)	0-10	0-10
No. 200 (75 μm)	0-5	0-3.5

- (7) The well graded coarse aggregate shall conform to the following ASTM C 33 gradation requirements for size number 67 aggregate shown below:

COARSE AGGREGATE GRADATION

Sieve Size	Percent Passing By Weight
1" (25.0 mm)	100
3/4" (19.0 mm)	90-100
3/8" (9.5 mm)	20-55
No. 4 (4.75 mm)	0-10
No. 8 (2.36 mm)	0-5
No. 200 (μm)	0-1.5

E. MIXING

- (1) Ready-mixed concrete shall be in accordance with ASTM C 94 for ordering (OPTION C, Minimum Cement Content), batching, mixing, and transporting.
- (2) Batching Tolerances (maximum w/c or w/cm ratio shall not exceed 0.45):
 - (i) Cementitious Material: The weight of the cementitious material shall be within plus or minus 1 percent (+/- 1%) of the required weight of the cementitious material.
 - (ii) Aggregate: The weight of the fine and coarse aggregate shall be within plus or minus 2 percent (+/- 2%) of the required weight.
 - (iii) Mixing Water: The water added to the batch, including free water on the aggregates, shall be measured by weight or volume to an accuracy of 1 percent of the required total mixing water. Added ice shall be measured by weight.
 - (iv) Admixtures: The admixtures shall be within plus or minus 3 percent (+/- 3%) of the required weight or volume for each specific admixture.
 - (v) Air: The air content (by volume) shall be 6 ± 1.5 percent of the volume of the concrete at the location and time of placement.

- (3) Concrete shall be uniform and thoroughly mixed when delivered to the forms.
- (4) The water-cement (w/c) ratio or water-cementitious material (w/cm) shall not exceed 0.45 at any time, including the addition of water at the site.
- (5) The concrete shall be batched and mixed such that the temperature of the concrete at time of placement shall not be less than 55 degrees Fahrenheit or, at no time during its production or transportation more than 90 degrees Fahrenheit.

F. BATCH DELIVERY TICKET INFORMATION

- (1) The Contractor shall obtain from the manufacturer a batch delivery ticket for each load of concrete before unloading at the site. Any concrete load delivered without a batch delivery ticket containing all the following information shall not be allowed to be discharged in any part of the construction project covered under this specification.
- (2) The following minimum information shall be included on the batch delivery ticket.
 - (i) Job-pertinent information
 - Name of concrete manufacturer and batch plant
 - Name of purchaser and job location
 - Date of delivery
 - Truck number
 - Amount of concrete delivered
 - Time loaded or time of first mixing of cement and aggregates
 - (ii) Ingredients used to mix the batch
 - Mixing water in the load added as free water
 - Percent moisture content, or weight of free water contained in the aggregates
 - Percent moisture content, or weight of free water absorbed by the aggregates
 - Type and amount of cementitious materials
 - Type and amount of admixtures
 - Weights of fine and coarse aggregates
 - (iii) The Contractor is responsible for adding the following information:
 - Volume of water added by the receiver of the concrete
 - Time the concrete arrived at the site
 - Time the concrete was completely unloaded
- (3) Upon completion of the concrete placement, copies of all batch delivery tickets shall be provided to the Technician.

G. PLACEMENT OF SUBGRADE, FORMS, AND REINFORCING STEEL

- (1) Subgrade
 - (i) The site shall be graded to the dimensions and elevations as specified in the construction plans.
 - All surfaces shall be firm and damp prior to placing concrete.
 - Concrete shall not be placed on mud, dried earth, uncompacted fill, frozen subgrade, or in standing water.
 - The use of plastic sheeting to isolate the concrete from unsuitable foundations shall not be permitted.

(2) Forms

- (i) The forms, associated bracing, and stakes shall be substantial, unyielding and constructed so that the finished concrete will conform to the specified dimensions and contours.
- Forms shall be mortar tight.
 - Forms shall be coated with a form release agent before being set into place.
 - Form release agent shall not come in contact with the steel reinforcement, waterstop, or with hardened concrete against which fresh concrete is to be placed.
 - For structures which are to store liquids, form ties shall be used that permit their removal to a depth of at least ½ inch.
 - Concrete joints shall be placed at locations and be of the type shown on the construction drawings.

(3) Reinforcing Steel

Reinforcement shall be accurately placed as shown on the drawings and secured in position in a manner that will prevent its displacement during the placement of concrete.

- (i) Tolerances - The following tolerances will be allowed in the placement of reinforcement:
- Where 1½ inches clear distance is shown between reinforcing steel and forms, or embedded objects, allowable clear distance is 1⅞ to 1½ inches.
 - Where 2 inches clear distance is shown between reinforcing steel and forms, allowable clear distance is 1⅞ to 2 inches.
 - Where 3 inches clear distance is shown between reinforcing steel and earth or forms, allowable clear distance is 2½ to 3 inches. Over-excavation backfilled with concrete shall not be considered as clear distance.
 - The maximum variation from the reinforcing steel spacing shown, shall be 1/12 of the spacing, without a reduction in the amount of reinforcing steel specified.
 - The ends of all reinforcing steel shall be covered with at least 1½ inches of concrete, with an allowable minimum distance of 1⅞ inches.
- (ii) Reinforcement Support - Holding steel reinforcement in position with temporary supports is not permitted. Tack welding of bars is not permitted.
- Metal chairs, metal hangers, metal spacers, plastic chairs, or concrete chairs shall be used to support the reinforcement.
 - Precast concrete chairs shall be manufactured from concrete equal in compressive strength to the concrete being placed.
 - Reinforcement shall be supported at a minimum as follows:
 - Deformed reinforcing bars for flatwork and sloped slabs shall be supported by a minimum of 1 support chair every 4 feet in each direction. Reinforcement shall not deflect or sag between supports. Deformed reinforcing bars shall be tied at every other rebar intersection or as approved by the Technician.
 - Deformed welded wire reinforcement (WWR) shall be supported no further than as indicated in the table below.
 - When two layers of deformed reinforcing bars or deformed welded wire reinforcement are used for wall footings, flatwork and sloped slabs, the bottom layer may be supported by precast concrete chairs. The upper layer must be

supported by metal chairs, metal spacers, plastic spacers, or rebar with legs tied to the lower mat and supporting the upper layer of reinforcing bars.

WWR SUPPORT

Welded Wire Reinforced Size ⁽¹⁾	Welded Wire Spacing	Maximum Support Spacing in Each Direction ⁽²⁾ , feet
D9 or larger	12 inches or more	4 to 6 feet
D5 to D8	12 inches or more	3 to 4 feet
D9 or larger	Less than 12 inches	3 to 4 feet
D4 to D8	Less than 12 inches	2 to 3 feet

Notes:

(1) "D" is the standard designation for deformed wire.

(2) Support spacing shall be adequate to support all loads, including construction personnel and equipment. If excessive deflections occur, closer support spacing is required.

- (iii) Flatwork reinforcement may be driven on prior to placement of supports if both of the following conditions are met:
 - The subgrade is firm so that minimal displacement is made by equipment. If significant displacement occurs, the steel shall be removed, the subgrade regraded and compacted before steel and concrete placement.
 - The reinforcing steel is not deformed by the equipment. If the steel is deformed, it shall be replaced before concrete placement.
- (iv) Steel tying to protruding steel from a previous pour or form construction for new concrete that will be in contact with previously poured concrete shall not be started until the previously poured concrete has cured a minimum of 12 hours.
- (v) Reinforcement Splice Lengths and Bend diameters:
 - Deformed reinforcing bars
 - Bend diameter: 6 bar diameters for #3 through #8 bar sizes and 8 bar diameters for larger bars. Reinforcing bars shall not be heated to facilitate bending.
 - Splice Length: The minimum splice lengths in the table below are for concrete designed with a 28-day compressive strength of 3,500 psi. (NRCS standard wall designs) Other higher concrete design strengths and reinforcement grades require different splice lengths (typically shorter) in accordance with ACI 318. Deformed reinforcing bars shall not be spliced by welding. All lap splices shall be adequately tied together to firmly hold the reinforcement in position to maintain the proper splice length.

MINIMUM SPLICE LENGTHS ^{NOTE 1}

	Grade 40	Grade 60
#3 through #6 bars		
<i>Top bars</i>	27 bar diameters	41 bar diameters
all other bars	21 bar diameters	32 bar diameters

#7 and larger bars		
Top bars	34 bar diameters	51 bar diameters
all other bars	26 bar diameters	40 bar diameters

Note 1: Splice lengths shall be the greater of that indicated in the Table or 12-inches.

- (vi) Deformed welded wire reinforcement (WWR) - Splice length shall be in accordance with the requirements of ACI 318-08 or ACI 318-11 Part 12.18. Deformed welded wire reinforcement shall not be spliced by welding. All lap splices shall be tied to firmly hold the reinforcement in position to maintain the proper splice length.

H. DELIVERING, PLACING, CONSOLIDATING, AND FINISHING CONCRETE

- (1) The Contractor shall notify the Technician of the proposed method of placement, consolidation, and finishing of the concrete at least seven (7) days prior to the start of concrete placement. The Contractor shall furnish the Technician a record of daily data including:
 - (i) Ambient temperature
 - (ii) Relative humidity
 - (iii) Wind velocity
- (2) General
 - (i) Prior to placement of concrete, the forms and subgrade shall be free of chips, sawdust, debris, water, ice, snow, extraneous oil, mortar, or other harmful substances or coatings. Any oil on the reinforcing steel or other surfaces required to be bonded to the concrete shall be removed. Concrete shall not be placed until the subgrade, forms, waterstop, and steel reinforcement have been inspected and accepted by the Technician. Any deficiencies shall be corrected before the concrete is delivered for placement. Forms, reinforcing steel, and subgrade shall be moistened prior to placing concrete.
- (3) Delivery
 - (i) Concrete shall be delivered to the site and discharged into the forms within 1½ hours after the introduction of the mixing water to the cement and aggregates, or when a superplasticizer is used, the manufacturer’s recommended time limit for discharge after addition shall apply. The 1½ hour time may be extended if the concrete is of a slump that it can be placed, consolidated, and finished without the addition of water to the batch. Upon arrival at the job site, addition of water will be allowed to adjust the slump, provided such addition does not exceed the water-cement (w/c) ratio or water-cementitious material ratio (w/cm). Final placement of the batch shall begin immediately after mixing of the added water is completed.
 - (ii) Additional superplasticizer shall not be added to the concrete mix after discharge of the concrete at the job site has commenced.
- (4) Placement
 - (i) The slump of the placed concrete shall not exceed the maximum slump of 5 inches with the use of water reducers.
 - (ii) The slump of the placed concrete shall not exceed the maximum slump of 8 inches with the use of superplasticizers.
 - (iii) Concrete shall be deposited as closely as possible to its final position. Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items in a manner to prevent segregation of aggregates. All placement shall be done in a manner that prevents incorporation of subgrade material into the concrete.

- (iv) Methods for placing concrete on sloped slabs shall only include chutes, pumps, conveyors, wheelbarrows, or similar means of directly depositing concrete as near as possible to its final position. Placement of concrete by other methods where concrete is deposited upslope and flows to its final position downslope (commonly called “lava flow”, “glacial pours”, etc.) shall not be permitted.
 - (v) Concrete shall not be dropped more than 6 feet vertically unless suitable equipment is used to prevent segregation. Concrete containing superplasticizer shall not be dropped more than 12 feet vertically and shall not be placed in lifts exceeding 6 feet in depth. Non-superplasticized concrete shall be placed in forms in horizontal layers not more than 24 inches deep. Each layer shall be thoroughly consolidated before the next is placed, at a rate such that previously placed concrete has not yet set when the next layer of concrete is placed upon it.
- (5) Consolidation
- (i) All concrete required to be consolidated with internal type mechanical vibrator shall be capable of transmitting vibration to the concrete at frequencies not less than 8,000 impulses per minute, unless otherwise specified or approved before placement.
 - Vibration shall compact the concrete and bring it into intimate contact with the forms, reinforcing steel, and other embedded items while removing voids and pockets of entrapped air. The location, insertion, duration, and removal of the vibrators shall be such that maximum consolidation of the concrete is achieved without causing segregation of the mortar and coarse aggregate or causing water or cement paste to flush to the surface.
 - Vibration shall be supplemented by spading, rodding, and hand tamping as necessary to ensure smooth and dense concrete along the form surface, in corners, and around embedded items. The contractor shall provide a sufficient number of vibrators to properly consolidate the concrete immediately after it is placed. Placement rate will be restricted if an inadequate number of vibrators are available.
 - The use of vibrators to transport concrete in the forms, slabs or conveying equipment will not be permitted.
 - (ii) *Formed Surfaces*
 - All concrete walls shall be vibrated.
 - Immediately after the concrete is placed in the forms, it shall be consolidated by internal vibration or hand tamping as necessary to insure dense concrete. Vibration shall be applied to the freshly deposited concrete by rapidly inserting the vibrator and slowly, in an up and down motion, removing the vibrator at points uniformly spaced at not more than 1.5 times the radius of the area visibly effected by vibration. Generally, this is at 5 to 10 seconds per foot on 14-inch spacings or less. The area visibly effected by the vibrator shall overlap the adjacent, just vibrated area. The vibrator shall extend vertically into the previously placed layer of fresh concrete by at least 6 inches at all points. Concrete supplied with superplasticizer shall be placed with a minimum amount of vibrating and finishing effort. Vibration shall not be applied directly to the reinforcement steel or the forms, nor to concrete which has hardened to the degree that it does not become plastic when vibrated. Each pour shall be consolidated to insure a monolithic bond with the preceding pour.
 - (iii) Slabs and footings

- Immediately after the concrete is placed, it shall be consolidated by hand or mechanical methods as necessary to insure dense concrete.
 - Surface vibrators may be used to consolidate slabs 8 inches and less in thickness. In thin slabs the internal vibrator(s) should be sloped toward the horizontal to allow operations in a fully embedded position, but shall not contact the subgrade.
 - Slabs and footings more than 8 inches thick shall be consolidated with internal vibration and may be augmented through use of a surface vibrator.
- Surface vibrators include vibrating screeds, plate or grid vibratory tampers, or vibratory roller screeds. (Mesh rollers, jitterbugs, and grate tampers are finishing tools and not consolidation tools.) When the concrete slab is to be consolidated using surface vibration methods, the contractor shall detail how this work is to be performed in writing to the technician for review and approval. This report must be submitted no less than 7 calendar days before placing concrete by this method. It includes equipment selection and specifications.

(6) Finishing

- (i) All screed support devices shall be removed from the concrete or driven down flush with the subgrade prior to finishing.
- (ii) All formed concrete surfaces shall be true and even, and shall be free of depressions, holes, projections, bulges, or other defects in the specified surface finish or alignment. All surface defects shall be repaired as stated in the “Form Removal” section of this specification.
- (iii) All flatwork and sloped slabs shall be worked to a uniform grade, maintaining the specified thickness. Concrete shall be worked to minimize segregation and in a manner that does not adversely affect the structural integrity, durability or function of the structure. Surfaces shall be free from rock pockets, or honeycomb areas or other harmful irregularities or defects.
- (iv) Water shall not be sprinkled or added to the surface of the concrete to facilitate finishing. An additional finish shall be applied if specified in the construction plans.
- (v) The proposed finished texture (broom, float, mesh roller, trowel, non-slip, etc.) of the concrete surface shall be approved by the Technician.
- (vi) Evaporation reducer may be used during the finishing operation if approved by the Technician. Curing of the concrete is still required as per Section 11, Curing.
- (vii) If a protective concrete coating is specified on the drawings, the coating manufacturer’s recommendations for curing and surface preparation shall be followed.

I. CONSTRUCTION JOINTS

- (1) If the concrete sets during placement to the degree that it will not flow and merge with the succeeding pour when tamped or vibrated, the Contractor shall discontinue placing concrete and install a formed construction joint. The Contractor shall be prepared to install unplanned construction joints in the event that there is an interruption of the pour, equipment breakdown, or other problem which makes it necessary to stop placement of concrete at locations other than those previously planned. The reinforcement shall pass through the joint, unless otherwise indicated on the construction plan.

- (2) Prior to the succeeding pour, the joint surface shall be cleaned to remove all unsatisfactory concrete, laitance, coatings, stains, or debris by one of the following methods:
 - (i) The joint surface shall be cleaned to expose the fine aggregate and sound surface mortar, but not so deep as to undercut the edges of coarse aggregate. Cleaning shall be by wire brush, sandblasting, or high pressure air-water cutting after the concrete has gained sufficient strength to prevent displacement of the coarse aggregate. The joint surface shall be washed to remove all loose material after cutting.
 - (ii) According to methods specified by the person approving the construction plans.
- (3) The surfaces of all construction joints shall be wetted and standing water removed immediately prior to placement of the new concrete. The new concrete shall be placed directly on the cleaned and washed surface. New concrete shall not be placed until the hardened concrete has cured at least 12 hours. The newly placed concrete shall be consolidated to achieve a good bond with the previously hardened concrete.

J. FORM REMOVAL AND CONCRETE REPAIR

(1) Form Removal

- (i) Forms shall be removed without damage to the concrete. Supports shall be removed in a manner that permits the concrete to take the stresses due to its own weight uniformly and gradually. The minimum period from completion of the concrete placement to the removal of the forms shall be based on either strength tests or cumulative times.
 - The strength of the in-place concrete is determined by testing concrete cylinders specifically cast for this purpose and cured adjacent to the member in accordance with the ASTM C 31 methods for determining removal time. Unless otherwise specified, forms supporting the weight of the concrete member may be removed after the concrete strength is 70 percent of that specified for the 28-day compressive strength.
 - The total accumulated time, not necessarily continuous, that the air adjacent to the concrete is above 50 degrees Fahrenheit will be determined by the Contractor and accepted by the Technician. The forms may be removed after the total accumulated time shown in the following table:

FORM REMOVAL

Forms		Time
Sides of slabs or beams without waterstop		12 hours
Sides of slabs or beams with waterstop		16 hours
Undersides of slabs or beams	Clear Span < 10 feet	4 days
	10-20 feet	7 days
	> 20 feet	14 days
Sides of walls or columns	Height of forms < 20 feet	24 hours
	> 20 feet	72 hours

- (ii) For structures which are not required to store liquid, form ties shall be removed flush with or below the concrete surface. For structures which are to be store liquid, form ties shall be removed to a minimum depth of ½ inch. All cavities or depressions resulting from form tie removal shall be patched in accordance with J.(2)(iv).

- (iii) Forms shall be removed and the concrete inspected by the Technician before walls are backfilled. Concrete loading shall be in accordance with Section N, Loading New Reinforced Concrete Structures.
- (2) Repair of Surface Defects (other than tie holes)
- (i) Immediately after removal of the forms, concrete which is honeycombed, damaged or otherwise defective as identified by the Technician shall be repaired or replaced by the Contractor. All repairs of surface defects shall be completed prior to the application of curing compound. Repair of surface defects such as honeycombed or otherwise defective concrete shall be made using bonding grout and site mixed Portland cement mortar or other products specifically intended to repair surface defects that are applied in accordance with the manufacturer's recommendations.
 - (ii) Bonding grout and site mixed Portland cement mortar:
 - Outline the honeycombed or otherwise defective concrete with a ½ to ¾ inch deep saw cut and remove such concrete down to sound concrete. When chipping is necessary, leave chipped edges perpendicular to the surface or slightly undercut. Do not feather edges.
 - Dampen the area to be patched plus another 6 inches around the patch area perimeter.
 - Prepare bonding grout by mixing approximately one part Portland cement and one part fine sand with water to the consistency of thick cream.
 - Thoroughly brush the bonding grout into the surface. When the bond coat begins to lose water sheen, apply repair mortar. Repair mortar is made by mixing 1 part Portland cement to 2½ parts fine sand (approximately finer than the No. 16 sieve size) by damp loose volume. The mortar shall be at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and manipulate the mortar frequently with a trowel without adding water.
 - Thoroughly consolidate the mortar into place and strike off, leaving the patch slightly higher than the surrounding surface to compensate for shrinkage. Leave the patch undisturbed for 1 hour before finishing. The repair shall be cured as specified Section 10, Curing.
 - (iii) Repair materials other than site mixed Portland cement:
 - Portland cement mortar modified with a latex bonding agent conforming to ASTM C 1059, Type II.
 - Epoxy mortars and epoxy compounds that are moisture-insensitive during application and after curing and that embody an epoxy binder conforming to ASTM C 881. The type, grade, and class shall be appropriate for the application as specified in ASTM C 881.
 - Nonshrink Portland cement grout conforming to ASTM C 1107.
 - Packaged dry concrete repair materials conforming to ASTM C 928.
 - Other products specifically intended to repair surface defects that are applied and cured in accordance with the manufacturer's recommendations.
 - (iv) Repair of Form Tie Holes
 - Liquid Containment Concrete Structures – Repair tie holes immediately after formwork removal and prior to the application of curing compound. All cavities or depressions resulting from form tie removal shall be patched with commercially available patching products or site mixed Portland cement repair mortar.

- Site-mixed Portland cement repair mortar
 - Repair mortar is made by mixing 1-part cement to 2.5-parts fine sand (approximately finer than the No. 16 sieve size) by damp loose volume. Mortar shall be at a stiff consistency with no more mixing water than is necessary for handling and placing. Mix the repair mortar and manipulate the mortar frequently with a trowel without adding water. Clean and dampen tie holes before applying the mortar. Cure in accordance with Section 10, Curing.
- Repair materials other than site mixed Portland cement:
 - All those materials listed in J.2.(iii).
 - Other products specifically intended to fill form tie holes for liquid containment applications that are applied and cured in accordance with the manufacturer's recommendations.

K. CURING

- (1) Concrete shall be cured for a period of at least 7 consecutive days (curing period) after it is placed, except as stated in Section 12. Exposed concrete surfaces shall be kept continually wet during the entire curing period or until curing compound is applied.
- (2) Curing compound shall be applied at the rate and with the proper equipment recommended by the manufacturer. It shall form a uniform, continuous, adherent film that shall not check, crack, or peel and shall be free from pinholes or other imperfections.
- (3) Curing compound shall not be used at construction joints or other areas that are to be bonded to additional concrete. Surfaces subjected to heavy rainfall or running water within 3 hours after the application of curing compound, or surfaces damaged by subsequent construction operations during the curing period, shall be recoated in the same manner as the original application.
- (4) Concrete shall be allowed to cure for a minimum of 28 days before storing material that will produce leachate.

L. CONCRETE PLACEMENT IN HOT WETHER

- (1) Hot weather conditions exist at the time of proposed placement when:
 - (i) The rate of evaporation greater than 0.10 lb. /sq. ft. /hr. OR
 - (ii) Two or more of the following factors are exceeded:
 - Ambient temperature is greater than 80 degrees Fahrenheit
 - Relative humidity is less than 60 percent
 - Wind velocity (average) is greater than 10 mph
- (2) Concrete surfaces shall not be allowed to dry after placement and during the curing period.
- (3) Measures to reduce surface moisture loss and rate of cement hydration must be taken to immediately protect and cure the concrete due to rapid drying conditions.
 - (i) Plan placement to early morning, late afternoon or evening.
 - (ii) Use a set-retarding admixture meeting the requirements in Section 3 of WCS-4 when the time between the introduction of the mixing water to the cement and aggregates and discharge exceeds 45 minutes. The 45 minute time may be extended if the concrete is of a slump that it can be placed, consolidated, and finished without the addition of water to the batch.
 - (iii) Use a fog spray to raise the relative humidity of the ambient air.

- (iv) Moist cure the concrete surface as soon as the surfaces are finished and continue for at least 24 hours.
 - (v) Use a monomolecular film, or evaporation retarder in accordance with the manufacturers printed instructions.
- (4) Concrete placement shall be suspended when:
- (i) The rate of evaporation is greater than 0.25 lb./sq. ft./hr. OR
 - (ii) When all of the following factors, as measured at the time of concrete placement are exceeded:
 - The ambient temperature is greater than 80 degrees Fahrenheit,
 - Relative humidity is less than 40 percent, and
 - Wind velocity (average) is greater than 15 mph

$$E = (T_c^{2.5} - R * T_a^{2.5}) (1 + 0.4V) \times 10^{-6}$$

where:

E = evaporation rate, lb. /sq. ft. /hr.

T_c = concrete temperature, °F

T_a = air temperature, °F

R = percent relative humidity /100 (decimal form 20% = 0.20) V = wind velocity, mph

- (5) Wind speeds at reporting station are taken above the ground surface, so V = average reported wind speeds x 0.66).

M. CONCRETING IN COLD WEATHER

- (1) The following provisions shall apply when the minimum air temperature at the local job site is less than 35 degrees Fahrenheit (the forecasted temperature, which shall be verified with a maximum/minimum thermometer at the start of the morning job shift).
 - (i) No concrete shall be placed without the required thermometers at the job site.
 - (ii) The Contractor shall furnish the Technician a record of daily temperature data including:
 - Outside air maximum and minimum temperatures at the local job site, and
 - Temperatures, of the air adjacent to the surface of the concrete, at several points along the concrete surface for all concrete curing periods.
 - (iii) When the cement is initially added to the mix, the temperature of the mixing water shall not exceed 100 degrees Fahrenheit nor shall the temperature of the aggregate exceed 100 degrees Fahrenheit.
 - (iv) The temperature of the concrete at the time of placement shall be not less than 55 degrees Fahrenheit or at no time during its production or transport more than 90 degrees Fahrenheit.
 - (v) Placed concrete may be protected by covering, housing, insulating or heating concrete structures.
 - (vi) The minimum air temperature adjacent to the surface of the concrete shall be maintained above 40 degrees Fahrenheit for a period of at least 7 accumulated days. These 7 days must occur during the first 10 days after the concrete is placed. At no time, during the first 10 days after concrete is placed, shall the minimum air temperature adjacent to the surface of the concrete be less than 32 degrees Fahrenheit unless Type III cement or an approved accelerating admixture is used (see Item (vii) below).

- (vii) The curing period may be reduced from 7 cumulative days to 3 consecutive days when Type III cement or an approved accelerating admixture is used. The accelerating admixture shall be used at the proportions recommended by the manufacturer. The minimum air temperature adjacent to the surface of the concrete shall be maintained above 40 degrees Fahrenheit for the 3 day curing period.
- (viii) Combustion heaters shall have exhaust flue gases vented out of the concrete protection enclosure. The heat from heaters and ducts shall be directed in such a manner as to not overheat or dry the concrete in localized areas or to dry the exposed concrete surface.
- (ix) At the end of the curing period, the concrete shall be allowed to cool gradually. The maximum temperature decrease at the concrete surface in a 24-hour period shall not exceed 40 degrees.

N. LOADING NEW REINFORCED CONCRETE STRUCTURES

- (1) Backfill material shall be the type indicated on the drawings and shall be free of large stones or debris.
- (2) Compaction within 3 feet of the new structure wall will be by means of small manually directed tamping or vibrating equipment.
- (3) The age of concrete shall be at least 7 days before any load (including backfill) is applied other than the weight of the wall, forms, or scaffolds for succeeding lifts or light equipment. The 7-days may be reduced to 3 days when Type III cement or an approved accelerating admixture is used. Loads may also be applied to new concrete less than 7 days after placement when 75 percent of the design strength has been attained through compressive strength testing on cylinders that have been cured onsite under field conditions.

O. INSPECTION AND TESTING

- (1) The inspection and testing details of this section shall apply when specific concrete tests are required in the construction drawings or quality assurance plan. This testing does not relieve the Contractor of the responsibility to perform the work according to this specification. The Technician shall have free access to the work site and batching to obtain samples.
- (2) When testing is conducted, the following methods shall be used:

Type of Test	Test Method (ASTM Designation)
Sampling	C 172
Slump	C 143
Air Content	C 231 or C 173
Making and Curing Specimens in the Field	C 31
Obtaining and Testing Drilled Cores	C 42
Compressive Strength	C 39
Density (Unit Weight)	C 138
Temperature	C 1064

- (3) The contractor is responsible for determining who is responsible for testing, and providing results to all parties.
- (4) Compressive strength of the concrete shall be considered satisfactory if test results equal or exceed the 28-day design strength. For each ASTM C 39 strength test, three test specimens shall be made. The test result shall be the average of the compressive strength tests of any

two of the three test specimens. If one test specimen shows evidence of improper sampling, molding, or testing, it shall be discarded and the remaining specimens tested. The strengths of the remaining two specimens shall be averaged, and the result shall then be considered the compressive strength of the concrete. If more than one specimen shows such defects, the test is not valid and the remaining specimen shall be discarded.

- (5) If test results are invalid due to specimen defects, or the in-place concrete that is in question was not sampled, the in-place concrete may be sampled by coring in accordance with ASTM C 42. For core tests, at least three representative cores shall be taken from each area of the concrete in question. If one or more of the cores shows signs of being damaged before testing, it shall be replaced by a new one.

WISCONSIN CONSTRUCTION SPECIFICATION

5. Construction Site Pollution Control

1. SCOPE

The work shall consist of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities.

2. MEASURES

Erosion and sediment control measures and works shall be installed to prevent or minimize sediment production and transport offsite. The measures and works shall include, but are not limited to, the following:

- a. Diversions - Divert water from work areas and collect water from work areas for treatment and safe disposition. Temporary diversions shall be removed and the area restored to its near original condition when the diversions are no longer required or when permanent measures are installed.
- b. In-Channel Sediment Control - Sediment produced within the stream channel during construction will be retained in the work area. Sediment retention will be accomplished by using a temporary, excavated sediment trap and/or a barrier constructed of geotextile and hay bales. Turbid water in the retention area may be pumped to a well-vegetated area away from the stream. The vegetation will serve to filter the sediments before the flow returns to the stream. Discharge areas from all pump hoses shall be stabilized. At no time shall the pump discharge be allowed to cause erosion at the discharge point.
- c. Mulching - Mulch provides temporary protection of the soil surface from erosion. The method of application is specified on the construction drawings
- d. Sediment Basins - Sediment basins collect, settle, and eliminate sediment from eroding areas from impacting properties and streams below the construction site(s). These basins are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.
- e. Sediment Filters - Straw bale filters or geotextile sediment fences (silt fence) trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under or around them. These filters are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed. The method is shown on the construction drawings.
- f. Seeding - Seeding to protect disturbed areas shall occur as soon as reasonably possible following completion of that earthwork activity. All seeding operations shall be performed in such a manner that the seeds are applied in the specified quantities uniformly in the designated areas. The method and rate of seed application are specified on the construction drawings
- g. Silt Curtain or Turbidity Barrier - Silt Curtain and Turbidity Barriers can be used to minimize the transport of sediment from an area where construction activities are occurring within or directly adjacent to a waterway or waterbody. The fabric shall be removed after the construction activities have ceased and the sediment has settled. Care should be taken to prevent the re-suspension of sediment during removal.
- h. Staging of Earthwork Activities - The excavation and moving of soil materials shall be staged to minimize the area disturbed and the time these locations are vulnerable to erosion.

- i. Stockpiling Material - The stockpiled materials shall be protected from concentrated flows and/or flooding, to minimize sediment movement offsite.
- j. Stream Crossings - Culverts or bridges should be used where equipment crosses streams. They are temporary and shall be removed and the area restored to its near original condition when the crossings are no longer required or when permanent measures are installed.
- k. Waterways - Waterways shall be used to safely dispose of runoff from fields, diversions, and other structures or measures. These works are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.
- l. It is the responsibility of the contractor or their designee for the cleanup or removal of sediment transported offsite due to failure to maintain erosion control measures during all phases of the construction.

3. CHEMICAL POLLUTION

The contractor shall safely dispose of chemical pollutants (such as drained lubricating or transmission fluids, grease, soaps, concrete mixer washwater, or asphalt, produced as a byproduct of the construction activities) off site. The contractor is responsible for reporting and clean up of all accidental spills and leaks.

In the event a piece of equipment develops a leak during the construction work, the leak shall be repaired before work continues. All excess fluids will be cleaned from the machine prior to its return to the work area.

If a leak occurs when equipment is working in or near a waterbody, the machine shall be immediately moved a safe distance away from the waterbody.

4. AIR POLLUTION

The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.

Fire prevention measures shall be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards shall be constructed and maintained.

All public access or haul roads used by the contractor during construction of the project shall be treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the technician before the first application.

5. MAINTENANCE, REMOVAL, AND RESTORATION

All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition.

All equipment used within the construction site shall be well maintained. All equipment lines and fittings shall be checked on a daily basis to ensure that they are in good working order.

WISCONSIN CONSTRUCTION SPECIFICATION

7. Mobilization and Demobilization

1. SCOPE

The work consists of the mobilization and demobilization of the Contractor's forces and equipment necessary for performing the work required.

2. EQUIPMENT AND MATERIAL

Mobilization shall include:

- All activities and associated costs for transportation of the Contractor's personnel, equipment, and operating supplies to the site;
- Establishment of offices, buildings, and other necessary general facilities for the Contractor's operations at the site
- Premiums paid for performance and payment bonds including coinsurance and reinsurance agreements as applicable
- Construction and maintenance of haul roads and equipment parking areas
- Other job related items

Demobilization shall include:

- All activities and costs for transportation of personnel, equipment, and supplies not utilized in the project from the site
- Disassembly, removal, and site cleanup of offices, buildings, and other facilities assembled on the site.
- Repair of access roads, temporary haul roads, and equipment parking areas leaving the project site in the same or better condition than at the start of the project.
- General cleanup and house keeping needed to restore a neat and orderly project site.

Access to the site, equipment parking, and staging areas are limited to that shown on the drawings or as approved by the technician.

WISCONSIN CONSTRUCTION SPECIFICATION
11. SMALL ROCK AGGREGATE (NON-CONCRETE)

A. SCOPE

The work shall consist of furnishing, transporting, and placing small rock aggregate, where specified, in the construction of stream crossings, access roads, heavy use area protection, and other similar structures.

B. MATERIALS

The small rock aggregate material shall be virgin, clean, hard, and durable particles free from organic matter or other deleterious substances that would interfere with free-draining properties. No reclaimed concrete or asphalt is allowed.

Rock for equipment or cattle stream crossings, access roads, heavy use area protection, or similar minor structures need not be tested.

C. DEFINITIONS

- Virgin materials – mineral materials in a native or raw form, not previously used.
- Sand and fine gravel – a mixture of sand and gravel granular material with 100% passing ½-inch sieve and 5% maximum passing the #200 sieve.
- Fine aggregate – 100% passing ¾-inch sieve and 10% maximum passing the #200 sieve.
- Crushed stone – 100% passing ¾-inch sieve and 10% maximum passing the #200 sieve.
- Graded rock – 100% passing the base course thickness dimension and a maximum of 10% passing the ¾-inch sieve. All sizes between the limits shown on the drawings are to be represented.
- Breaker run – aggregate resulting from the mechanical crushing of quarried stone not screened or processed after primary crushing and 10% maximum passing the #200 sieve (typically 2 to 5 inches average diameter).

D. GRADATION

The gradation of the aggregate material shall be in accordance with one of the following:

- The gradation of the material shall be as shown on the drawings.
- If the gradation is not shown on the drawings, refer to definitions for graded rock, crushed stone, fine aggregate, and sand and fine gravel.

E. SUBGRADE PREPARATION

Required excavations shall be accomplished as shown on the drawings and in accordance with Wisconsin Construction Specification 2, Excavation.

Foundation surfaces shall be clean and free of organic matter, loose soil, and foreign substances when aggregate is placed.

Aggregate shall not be placed on the subgrade until it has been inspected and approved by the Technician.

F. PLACEMENT

The aggregate shall be placed in a manner to avoid segregation of particle sizes. No foreign materials will be allowed to become intermixed with or otherwise contaminate the material.

Any damage to the foundation surface occurring during placement of aggregate material shall be repaired before proceeding with the work.

Aggregate shall be placed in uniform layers not more than 12 inches in thickness and machine worked, to the depths specified on the drawings, so as to create a dense aggregate layer.

G. COMPACTION

Unless otherwise stated on the drawings, no compaction will be required beyond that resulting from the placing, spreading, and consolidating operations.

Compaction, when required, shall meet the requirements specified in Wisconsin Construction Specification 3, Earthfill, Table 1, Equipment Compaction Requirements.

WISCONSIN CONSTRUCTION SPECIFICATION

14. TIMBER FABRICATION AND INSTALLATION

1. SCOPE

This work shall consist of furnishing all materials, equipment, and the labor necessary for the installation of timber structures and timber portions of composite structures.

2. MATERIALS

Materials for timber and composite structures shall conform to the following requirements:

A. Wood

All wood shall be Grade 2 which has been pressure treated with an oil-base or waterborne preservative listed in Table 1. The following species are applicable to this specification:

Douglas Fir-Larch (North)
Douglas Fir South
Hem-Fir (North)
Red Oak
Ponderosa Pine
Red Pine
Southern Yellow Pine
Western White Pine
White Oak*
White Woods (Western Woods)

White Oak, while not normally treated, is included in this specification as an applicable wood species because of its application in timber construction.

The wood shall be sound, new and free of decay. No pieces of exceptionally light weight shall be accepted.

All lumber and timber dimensions refer to nominal size and the material furnished shall be in American Standard dressed sizes. Posts and planks used in the construction shall be relatively straight throughout their length.

Planks shall have square ends and shall be of uniform width and thickness.

B. Preservatives and Treatment

Unless otherwise specified on the construction plans, all wooden posts and planks, except white oak, shall be treated by a method listed in Table 1. The method used shall meet the applicable American Wood Protection Association (AWPA) Standard or possess an Evaluation Service Report (ESR) recognized by the International Code Council (ICC). A complete list of ICC recognized ESRs can be found at <http://www.icc-es.org>.

Unless otherwise specified on the construction plans, the minimum retention values shall be as listed in Table 1.

**Table 1
Preservative Treatment Retention (lbs/ft³)**

Treatment Method	UC4A Retention (lbs/ft ³) ²	UC3B Retention (lbs/ft ³)	Applicable Standard or ESR ²
	Posts & Planks with Ground Contact	Planks with No Ground Contact	
Creosote Solution ¹	10.0	8.0	AWPA P1
Copper Napthenate (CuN)	0.06	0.04	AWPA P9
Pentachlorophenol	0.40	0.30	AWPA P8
Alkaline Copper Quaternary (ACQ), Type B, C, D	0.40	0.15	AWPA P5
Chromated Copper Arsenate (CCA), Type A, B, or C	0.40	0.25	AWPA P5
Copper Azole – Type B (CA-B)	0.21	0.10	AWPA P5
Micronized Copper Azole (MCA)	0.15	0.06	ESR
Micronized Copper Quaternary (MCQ)	0.34	0.15	ESR

¹ Oil-base preservatives containing creosote-petroleum are not recommended with the wood species identified in this specification.

² ESR numbers are dependent on supplier and must be listed on the ICC website: <http://www.icc-es.org/reports/index.cfm?list=list>.

At a minimum, posts and planks for general use with ground contact shall meet AWPA Use Category UC4A*. Planks for exposed, no ground contact applications shall, at a minimum, meet AWPA Use Category UC3B*. Posts and planks for structural building components shall be as specified by the designer.

*AWPA U1-10 Use Category System: *User Specification for Treated Wood, May 2010.*

C. Hardware

All fasteners, connectors, and any other metal contacting wood with preservative treatment retentions as listed in Table 1 shall be hot-dip galvanized or stainless steel. **Stainless steel fasteners and connectors shall be used if the wood has preservative treatment retention higher than listed in Table 1.** Galvanizing for fasteners shall conform to ASTM A153. Galvanizing for connectors made from steel sheet shall conform to ASTM A653, Class G185. Galvanizing for all other metal in contact with preservative treated wood shall conform to ASTM A123. Stainless steel shall be AISI Type 304 or 316.

D. Marking

Each treated wood item delivered to the job site shall be identified with a label, brand, or stamp that lists: the product name or logo or treatment company name, name of the preservative, treatment end use category, minimum retention, and the applicable AWPA treatment standard or the number of the ESR. If the label, brand, or stamp is missing, acceptable documentation that the wood item meets the requirements of this specification must be provided to the Technician prior to installation.

3. HANDLING AND STORING WOOD MATERIALS

Lumber stored on the work site shall be close stacked off the ground. The ground beneath the stacked lumber shall be cleared of weeds and rubbish. Materials stacked on the work site for more than seven days shall be protected by a suitable waterproof covering.

4. CONSTRUCTION

Care shall be exercised during installation to avoid damage to the treated surface. All abrasions, saw cuts, and drill holes shall be treated with 3 coats of the same preservative used in the original treatment process, if available, or a wood preservative product that contains a minimum of 2 percent copper metal. The treatment material may be applied by brushing, spraying, or swabbing the entire surface in 3 successive applications.

Posts that have a field-cut and treated end should be installed with the treated end placed into the ground.

Backfill materials placed around the post shall be well consolidated. Sand/gravel backfill shall be compacted in layers not thicker than 4 inches. Concrete backfill shall be placed in layers not thicker than 12 inches before consolidation.

Planks used in wood walls, pumping docks, etc. shall have the end joints staggered except at a point of grade change in any adjacent concrete slab. If the drawings specify that the planks be double thickness, the joints shall not be at the same location. All joints shall be at a post. Nails shall be driven so the heads are flush with the surface of the wood. Deep setting shall be avoided.

Treated wood requires careful handling and disposal. Shirts with long sleeves, full length pants, and waterproof gloves should be worn to minimize skin contact with the wood during handling and installation. A dust mask and eye protection is recommended when sawing treated wood. Dispose of treated wood by ordinary trash collection or burial. The wood shall not be burned in open fires.

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 compaction equipment.

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 Soils ¹	Maximum Fill Height ² (feet)	Layer Thickness ³ (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.



NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
ROOFS AND COVERS
CODE 367
(NO.)

DEFINITION

A rigid, semirigid, or flexible manufactured membrane, composite material, or roof structure placed over a waste management facility, agrichemical handling facility, or an on-farm secondary containment facility.

PURPOSE

Provide a roof or cover to:

- Protect clean water from dilution in waste water in an existing or planned animal waste handling or storage area
- Improve waste management and utilization to protect nearby surface water quality
- Capture biogas emissions from an existing or planned animal waste storage facility to reduce the net effect of greenhouse gas emissions, improve air quality, and reduce odor as a result of:
 - ◊ Biological treatment with composite cover material
 - ◊ Combustion by flare
 - ◊ Combustion by engine generator for energy production
- Protect clean water by excluding it from a chemically contaminated area

CONDITIONS WHERE PRACTICE APPLIES

This practice applies where:

- Precipitation should be excluded from contaminated areas, such as animal feeding and management areas, facilities for waste storage, animal mortality, composting, waste transfer or waste treatment, and agrichemical handling.
- Biotreatment of emissions using a porous cover on a wastewater storage facility is needed to improve air quality, limit odors, and moderate the net effect of greenhouse gas emissions.
- A cover is needed to exclude precipitation from a wastewater storage facility. Auxiliary elements of the cover will also capture and manage biogas emissions, improve air quality, limit odors, and reduce the net effect of greenhouse gas emissions.
- Biogas capture for energy production is a component of an existing or planned waste management system. Biogas capture and utilization will also improve air quality, limit odors, and reduce the net effect of greenhouse gas emissions.

This practice does not apply to WI NRCS Conservation Practice Standard (WI NRCS CPS), High Tunnel System (Code 325).

CRITERIA

General Criteria Applicable to All Purposes

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

Materials. Select the type, thickness, and material properties of the roof or cover and any supporting members after accounting for all loads and stresses due to operational, environmental, and climatic conditions.

Loads. Include all anticipated loads in the structural design for facility components that serve as part of the foundation or support for a roof or cover. See section below, Additional Criteria for Rigid and Semi-rigid Roofs and Covers, and Flexible Covers.

Design. Refer to WI NRCS CPS, Waste Storage Facility (Code 313), or Agrichemical Handling Facility (Code 309), for structural design criteria of the foundations associated with these respective practices. Account for all items that will influence the performance of the roof or cover, including strength, durability, serviceability, material properties and construction quality in the current editions of the following material references as appropriate:

- Steel.—Manual of Steel Construction, AISC, American Institute of Steel Construction
- Timber.—National Design Specifications for Wood Construction, American Forest and Paper Association
- Concrete nonliquid tight.—Building Code Requirements for Structural Concrete, ACI 318, American Concrete Institute
- HDPE/LLDPE Geomembrane.—HDPE and LLDPE Geomembrane Installation Specification, International Association of Geosynthetic Installers

Access. Provide suitable access for normal operation and maintenance of a facility which is enclosed as the result of a roof or cover.

Venting. For an enclosed roof structure located over animals, manure storage, or petroleum product storage, provide ridge or end vent openings of at least 2 inches per 10-foot-width of building. This prevents buildup of moisture and gases in the attic area.

For enclosed buildings, provide mechanical (exhaust fans) or natural (adequate openings) ventilation in order to maintain a safe working environment when human entry is intended.

Safety. Provide safety features, including fences and warning signs, as appropriate, to prevent undue hazards from biogases and drowning. Refer to American Society of Agricultural and Biological Engineers' (ASABE's) document, ASAE EP470.1, Manure Storage Safety for guidance.

Design covers and grating over openings such that livestock or humans cannot accidentally displace them and fall into the facility.

Include provisions in the design to prevent the unintentional conveyance of biogas to any facilities connected to the installed roof or cover.

Additional Criteria for Rigid and Semirigid Roofs and Covers

Design rigid and semirigid roofs and covers to withstand all anticipated loads including, but not limited to, internal and external loads, uplift pressure, concentrated surface and impact loads and load combinations in compliance with this standard. Design roofs, covers and associated support systems to

resist all applicable loads including wind, snow, and seismic loads as specified in the current version of American Society of Civil Engineers (ASCE), Standard ASCE 7, Minimum Design Loads for Buildings and Other Structures.

Vertical supports for roofs shall support the roof for wind and snow loads described above. Design for vertical supports shall include anchoring to resist uplift forces. Fasteners shall be capable of supporting all horizontal and vertical loadings.

Design covers intended for vehicle, equipment and/or livestock traffic to withstand anticipated dead and live loads. The minimum live load design values for covers are contained in ASABE ASAE EP378.4, Floor and Suspended Loads on Agricultural Structures Due to Use, and ASAE EP393.3, Manure Storages. For tank wagons having more than a 2,000 gallon capacity, use the actual axle load for design.

Design roof structures to prevent waste located under the roof from becoming a pollution problem. Follow criteria outlined in WI NRCS CPS, Roof Runoff Structure (Code 558), for structural practices to collect, control and convey roof runoff away from the contaminated area. Divert any outside surface water from entering the roofed area.

Treated Wood. Use preservative-treated wood when wood members are exposed to animal waste or elements that deteriorate wood. Preservative-treated wood must meet the applicable American Wood Protection Association (AWPA) Standards or have an evaluation service report prepared by an organization recognized by the International Code Council (ICC). Treated wood in contact with animal wastes or as critical components that are difficult to replace, should meet AWPA UC4B or equivalent for heavy-duty ground contact. Allowable preservatives include but are not limited to CCA (Chromated Copper Arsenate), ACQ-C (Alkaline Copper Quat Type C), ACQ-D Carbonate (Alkaline Copper Quat Type D, Carbonate formulation), CuN (Copper Naphthenate), ACZA (Ammoniacal Copper Zinc Arsenate), CA-A, CA-B and CA-C (Copper Azole Types A, B and C), MCA (Micronized Copper Azole), ?CA-C (Dispersed Copper Azole).

Aluminum fasteners, connectors, or cladding must not be used in direct contact with treated wood unless specifically allowed by the preservative manufacturer. Use hot-dipped galvanized or stainless steel bolts, washers, nuts, nails, and other hardware which meet American Society for Testing and Materials (ASTM) specifications A153 for fasteners and ASTM A653 coating designation G185 for sheet metal connectors, or ASTM A240 for Type 304 or 316 stainless steel, except as noted below. Fasteners and connectors of other materials may be used if specifically allowed by the preservative manufacturer. All fasteners, connectors, and any other metal in contact with ACQ, CA, MCA, or ?CA-C treated wood shall be stainless steel if AWPA Use Category UC4B applies or if constant, repetitive, or long periods of wet conditions may occur. All fasteners, connectors, and any other metal in contact with wood treated with ACZA or any other preservative containing ammonia must be stainless steel.

Repair. Use of sectional replacement repair for rigid or semirigid roof and cover material is allowable.

Additional Criteria for Flexible Covers

For fabrication of flexible membrane inflated and floating covers, use only membrane materials which have been certified by the manufacturer as suitable for the intended application.

Design flexible membrane cover systems to resist snow, wind, and wind uplift loads as appropriate.

Design floating covers to fluctuate with rising and falling liquid levels to properly manage the waste storage facility.

Include floatation materials on floating membrane covers as necessary for proper cover performance, and operation and maintenance tasks.

Design impermeable floating covers with a biogas collection, transfer, and control system to provide protection for the cover and convey biogas to a flare, release, or control point.

Design the biogas handling system with the capacity to handle the large range in gas production that can occur as a result of changing ambient temperatures and substrate conditions.

Inflated covers must be:

- Equipped with a warning system to notify operator of blower failure for mechanically forced air systems.
- Provided with a support system to limit cover collapse.

Table 1: Flexible geomembrane cover materials.

Type for Purpose	Minimum Thickness Criteria	
	Contain Biogas	Divert Clean Water
HDPE	40 mil	30 mil
LLDPE	40 mil	30 mil
LLDPE-R	36 mil	24 mil
PVC	40 mil	30 mil
EPDM	45 mil	--
FPP	40 mil	30 mil
FPP-R	36 mil	24 mil
PE-R	NR	24 mil

1 mil = 1/1000 of an inch

HDPE – High Density Polyethylene Geomembrane

LLDPE – Linear Low Density Polyethylene Geomembrane

LLDPE-R – Reinforced Linear Low Density Polyethylene Geomembrane,

PVC – Polyvinyl Chloride Geomembrane

EPDM – Ethylene Propylene Diene Terpolymer Geomembrane

FPP – Flexible Polypropylene Geomembrane

FPP-R – Reinforced Flexible Polypropylene Geomembrane PE-R – Reinforced, Slit –Film, Woven Polyethylene Geomembrane

NR – Not Recommended

Repair. Use only flexible cover material which is readily repairable. Repair may be made by solvent, adhesive, thermoplastic welding, or other methods according to manufacturer’s recommendation.

Additional Criteria for Biogas Control/Utilization

Biogas Emissions. The cover system will provide for bio-reduction and treated release of gaseous emissions, contain and manage release of gaseous emissions, or capture and control or utilization of biogas, as appropriate.

Bioreduction and Treated Release. Select a cover fabricated of a permeable composite membrane designed to promote biological treatment of gaseous emissions which pass through the membrane for

treated release to the atmosphere. Maintenance of the cover media will be required for the life of the practice to ensure proper biofilter operation.

Contain and Manage Biogas when Excluding Rainfall. Design the cover system for rainfall exclusion on the stored manure and organic wastes with auxiliary elements to manage any biogas produced. For storage cover systems which collect biogas, provide for the safe handling, transfer and combustion of the biogas.

Capture Biogas and Control/Utilization. Design the cover system to capture biogas emissions and transfer biogas to the point of discharge without mixing with air. Equip the point of discharge with a flare or biogas utilization equipment as appropriate.

Equipment and material exposed to biogas must be resistant to corrosion and suitable for use within a potentially explosive environment. Materials, controls, motors and their installation must conform to the National Electrical Code (NEC). Motors must be rated explosion proof and properly sealed.

Design of aboveground pipe for biogas transfer must include pipe with fittings for expansion and contraction effects.

Aboveground biogas transfer pipe intended for pressurized biogas systems must be of steel or plastic materials. Steel pipe must meet the requirements of AWWA Specification C-200 or ASTM A53/A211 for stainless steel. Plastic pipe must be HDPE meeting AWWA Specification C-906 or ASTM D-3350. PVC is only acceptable for aboveground biogas transfer when pipe meets ASTM D2241, is ultraviolet light inhibited and pipe material is modified for high impact strength.

Anchorage. Design the cover anchorage system to withstand internal gas pressures, corrosive environment, wind loads, air tightness (as necessary), and other forces as appropriate to the cover system.

Pressure. Covers associated with biogas production must include provisions for fail-safe pressure relief when interior pressures exceed design operating pressures. Maximum pressure must not exceed manufacturer's recommendations.

Precipitation. Design features to direct precipitation on impermeable covers to collection points for removal by pumping or by controlled release to suitable grassed or otherwise stabilized areas for discharge or infiltration.

Biogas Capture. Design the cover materials and all appurtenances such as weights and floats, to capture and convey biogas to the gas collection system. The cover design shall provide for the following:

- **Air Exclusion.** Design the cover system and appurtenances, including perimeter soil slopes above the water line, for in-ground liquid waste storage, to exclude the entrance of air under all operating conditions.
- **Gas Collection, Control, and Utilization.** The collection, control, and utilization of biogas must meet appropriate criteria in WI NRCS CPS, Anaerobic Digester (Code 366).

Biogas Safety. As a minimum for all roofs and covers that contain or control biogas, post the following warning signs:

- "Warning Flammable Gas"
- "No Smoking"
- When human entry is possible: "Do Not Enter – Hazardous Gases"

Where biogas is captured, design the gas collection, transfer and control/utilization system in accordance with standard engineering practice for safely handling a flammable gas including safety criteria noted in WI NRCS CPS, Anaerobic Digester (Code 366).

CONSIDERATIONS

To further improve water quality, consider eliminating or reducing feedlot areas when placing livestock under roof.

Screening with vegetative plantings, landforms, or other measures may be implemented for aesthetic purposes.

Maintain storage capacity and functionality of covered liquid waste storage by minimizing solids accumulation. Consider the use of manure management practices such as solid/liquid separation, WI NRCS CPS, Waste Separation (Code 632).

For organic applications, consider using special construction material such as qualifying lumber as documented by an evaluation service recognized by the International Code Council (ICC). Other application considerations may also need to be made to address organic issues.

For areas where energy production is an option, consider adding energy recovery or production to the gas handling system. Energy recovery or production can offset air emissions from fossil fuel combustion.

Consider storage of biogas when installing flexible covers over waste storage facilities or waste treatment lagoons to attenuate gas supply for end use or treated release.

Waste facility covers which capture biogas may reduce nutrient volatilization of the stored manure. Consider the effect this may have on the nutrient management plan.

Waste facility covers which capture biogas may increase the odor nuisance during agitation, pump out, and land application. Consider the effect these activities may have on the surrounding areas and waste management options.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying this practice to meet its intended purpose.

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

- Define the purpose, goals and objectives of the practice installation.
- Include information about the location and sequence of the phases of construction.
- Specify layout and location of agricultural waste storage and handling facility, or agrichemical handling facility.
- Include roof or cover footprint and any waste collection points and all planned access features.
- Grading plan showing excavation and fill. Include appropriate drainage features and revegetation plan as needed.
- Materials and structural details of the roof or cover including all necessary appurtenances as appropriate for the complete system.
- For flexible geomembrane cover systems with biogas combustion, include a listing of associated biogas collection and transfer equipment, and necessary appurtenances.

- Specify that the manufacturer or installer of the geomembrane cover system must certify the installation of the cover. Require the same manufacturer or installer to provide the project owner with maintenance instructions for the cover material.
- Biosecurity measures during installation.
- Warning and safety signage placement.

OPERATION AND MAINTENANCE

Prepare an operation and maintenance (O&M) plan and review the plan with the landowner or operator responsible for the application of this practice. Provide specific instructions for proper operation and maintenance of each component of this practice and detail the level of inspection and repairs needed to maintain the effectiveness and useful life of the practice.

- Address biosecurity concerns in all aspects of operation and maintenance.
- For enclosed waste facilities, exercise caution and care during cover removal or access. If opening of the cover is required for facility management, include provisions to prevent exposure of workers to hazardous gases.
- If personnel are or may be required to enter an enclosed waste facility, include safety provisions recommended by the National Institute for Occupational Safety and Health (NIOSH) for working in confined spaces including, but not limited to, using a positive-pressure self-contained breathing apparatus, safety line, and standby personnel.
- Develop an emergency action plan for covered systems associated with biogas production. Include instructions as to limits of cover performance and emergency procedures if control equipment fails. Provide contact(s) and phone numbers of person(s) to contact for the event of an emergency.

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WISCONSIN CONSTRUCTION SPECIFICATION

634. Waste Transfer Pipe

1. SCOPE

The work shall consist of furnishing and installing waste transfer pipes, necessary fittings, and appurtenances as shown on the drawings.

2. MATERIALS

The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign matter, or other defects. The pipe shall be as uniform in color, opacity, density, and other physical properties as is commercially practicable.

PVC pipe material shall be Type 1 (1120/1220) for pressure transfer systems. ABS pipe material shall be virgin plastic resin and meet ASTM D 3965. PE pipe material shall meet ASTM D 3350.

Pipes shall meet the criteria in Table 1. Pipes of equivalent strength, durability, and liquid tightness are acceptable. All pipe and fittings proposed for use shall be submitted for approval prior to installation.

Fittings and couplers shall meet or exceed the same strength requirements as those of the pipe. Standard manufactured pieces shall be used for angles required to make direction changes.

3. HANDLING AND STORAGE

Pipe shall be delivered to the job site and handled by means which provide adequate support to the pipe and does not subject it to undue stresses or damage. When handling and placing plastic pipe, care shall be taken to prevent impact blows, abrasion damage, and gouging or cutting. All special handling requirements of the manufacturer shall be strictly observed. Special care shall be taken to avoid impact when plastic pipe must be handled at temperatures of 40°F or less.

Pipe shall be stored on a relatively flat surface so that the barrels are evenly supported. Unless the pipe is specifically coated to withstand exposure to ultraviolet radiation, it shall be covered with an opaque material when stored outdoors for a period of 15 days or longer.

4. LAYING THE PIPE

The pipe shall be laid to the lines and grades as shown on the drawings. The pipe shall be laid so that there is no reversal of grade between joints, unless otherwise shown on the drawings. The pipe shall not be dropped or dumped on the bedding or into the pipe trench. The ground surface near the pipe trench shall be free of loose rocks and stones greater than 1 inch in diameter.

The pipe shall be laid starting from one end proceeding continuously upstream or downstream.

The pipe shall not be laid at both ends and proceeding towards the middle.

Standard manufactured pieces shall be used for angles required to make direction changes. Directional pipe deflection shall be allowed in PVC and solid wall PE pipe per the manufacturer's allowable bend radius.

Just before placement, each pipe section shall be inspected to ensure that all foreign material is removed from inside the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline shall be temporarily closed off using a suitable cover or plug.

Care shall be taken to prevent distortion and damage to plastic pipe during unusually hot (over 90°F) or cold weather (under 40°F). After the pipe has been assembled in the trench, it shall be allowed to come within a few degrees of the ground temperature before backfilling to prevent pull out of joints due to thermal contraction.

Bell and spigot pipe should be laid with the bell pointed upstream. The pipe ends and couplings shall be free of foreign material when assembled.

The pipe shall be uniformly and continuously supported over its entire length on firm stable material. Blocking or mounding shall not be used to bring the pipe to final grade.

For pipe with bell joints, bell holes shall be excavated in the bedding material, as needed, to allow for unobstructed assembly of the joint and to permit the body of the pipe to be in contact with the bedding material throughout its length.

5. PIPE EMBEDMENT

Earth bedding – The pipe shall be firmly and uniformly placed on compacted earthfill bedding or an in-place earth material bedding of ample bearing strength to support the pipe without noticeable settlement. The earth material on which the pipe is placed shall be of uniform density to prevent differential settlement.

Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter.

Earth bedding shall be compacted to a density not less than adjacent undisturbed in-place earth material or be compacted earth backfill. Earthfill material used for compacted earth bedding shall be free of rocks or stones greater than 1 inch in diameter and earth clods greater than 2 inches in diameter. The pipe shall be loaded sufficiently during the compaction of bedding under the haunches and around the sides of the pipe to prevent displacement from its planned alignment. Pipe shall not be deformed to the extent that joint integrity is adversely impacted.

Sand, gravel, or crushed rock bedding – When sand, gravel, or crushed rock bedding is specified, the pipe shall be firmly and uniformly placed on the bedding material. Material for bedding shall not exceed 1 inch in diameter. Unless otherwise shown on the drawings, the coarse-grained bedding material shall be carefully placed and compacted to a depth equal to or greater than 0.3 of the diameter of the pipe above the bottom of the pipe. The pipe shall be loaded sufficiently during backfilling and compaction around the sides to prevent displacement of the pipe from its final approved placement.

Pipe encased in drainfill – The pipe shall be firmly and uniformly placed on bedding of specified drainfill. Drainfill shall be placed and compacted as specified in NRCS FOTG Section IV, Wisconsin Construction Specification 8, or as shown on the drawings. The pipe shall be loaded sufficiently during backfilling around the sides and during compaction to prevent displacement of the pipe.

Pipe encased in concrete – Concrete encasement shall be carefully placed to form a continuous uniform support around the entire circumference of the pipe or as shown on the drawings. Pipes encased in concrete shall be securely anchored to prevent movement of the pipe during concrete placement. A clear distance of 1.5 inches shall be maintained between the pipe and any reinforcing steel.

6. LIQUID TIGHT PIPE PENETRATIONS

- Hydrophilic sealants (swell in contact with water) shall be non-bentonite.
- Sealant, grout, flexible connections, fitting, etc. used to seal pipe penetration joints between wall and pipe shall be liquid tight.
- Pipes shall be continuous through walls. (i.e. no pressure from pumps shall be exerted on penetration joints between wall and pipe.)
- Pipes at penetration joints shall be properly supported to prevent undue stress on the seal.
- Grouted joints shall be pinned, keyed, or otherwise attached to structure to prevent joint separation.
- Flexible connection systems shall be installed according to manufacturer's recommendations for the specific application.

7. BACKFILL

Initial backfill – Unless otherwise specified or shown on the drawings, initial backfill to 6 inches above the top of the conduit is required. Earth haunching and initial backfill material shall consist of soil material that is free of rocks, stones, or hard clods more than 1 inch in diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill material.

Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the center of the pipe. In the second stage, it is placed to 6 inches above the top of the pipe.

The first stage material shall be worked carefully under the haunches of the pipe to provide continuous support throughout the entire pipe length. The haunching backfill material shall be placed in layers that have a maximum thickness of about 6 inches and are compacted as shown on the drawings or as stated in the NRCS Wisconsin Construction Specification appropriate for the backfill material. During compaction operations, care shall be taken to ensure that the tamping or vibratory equipment does not come in contact with the pipe and the pipe is not deformed or displaced.

Final backfill – Final backfill shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within 2 feet of the top of the pipe shall be free of debris or rocks larger than 3 inches nominal diameter. Coarse backfill material shall be the specified sand, gravel, crushed rock, or drainfill. Final backfill shall be placed in approximately uniform, compacted layers. Final backfill compaction and layer thickness requirements shall be as shown on the drawings or as stated in the NRCS Wisconsin Construction Specification appropriate for the backfill material.

8. PRESSURE TESTING

This pressure test procedure consists of filling, an initial expansion phase, a test phase, and depressurizing. Severe service transfer pipe shall be pressure tested in the following manner prior to being placed into service.

Before Pressure Testing

- a. Solvent welded or heat fused joints of the assembled severe service transfer pipe shall be allowed to cure. Solvent-welded joints should be allowed to cure for a minimum of 24 hours, or more time if recommended by the glue manufacturer.
- b. Severe service transfer pipe shall be flushed and cleaned.
- c. All thrust control structures shall be in place, and all cast-in-place thrust blocks shall be allowed to cure according to one of the following options:
 - i. 3 days for early strength concrete (5,000 psi);
 - ii. 7 days for normal strength concrete (3,500 psi); or
 - iii. A strength of 500 psi is reached, with data that's field- or lab-verified to support.
- d. Pipes shall be backfilled or otherwise restrained sufficiently along its length to anchor the pipe against movement during the pressure testing. The pipe shall also be braced and/or anchored at each end to prevent movement.
- e. The ends of the pipe shall be plugged, and a pressure gauge shall be attached to the upstream and downstream ends. All high points along the severe service transfer pipe shall be vented to permit the complete removal of all air within the pipe.

Filling

Slowly fill the restrained test section completely with clear water. **WARNING – Ensure that there is no air trapped in the test section. Failure to remove entrapped air can cause explosive release resulting in death or serious bodily injury. Use equipment vents at high points to remove air.**

Initial Expansion Phase

Gradually pressurize the test section with water to the working pressure (as specified in the construction plans) plus 10 psi and maintain that pressure for three hours. During the initial expansion phase, pipe may expand slightly, requiring additional water to maintain pressure.

Test Phase

Immediately following the initial expansion phase, reduce test pressure back to working pressure, stop adding water and isolate test section. If test pressure remains steady (within 5% of the target value) for one hour, no leakage is indicated and the test section passes.

Depressurizing

Following the test phase, and prior to putting the pipe into service, gradually reduce pressure on the test section, drain out and properly dispose of all test water.

Table 1
Pipe Specifications ^{Note 1,2}

Installation Type	Size	Material	Specification	Joint Performance Specs	Joint Fitting Spec. ^{Note 3}
GRAVITY PIPELINES (Including Abrasive Materials)	(4"-10")	HDPE Pipe	AASHTO M252, Type S	ASTM D 3212 (10.8 psi)	F2306/F477
	(12"-60")	HDPE Pipe	AASHTO M294, Type S or ASTM F2306	ASTM D 3212 (10.8 psi)	F2306/F477
	(18"-48")	PVC Pipe	ASTM F 679	ASTM D 3212, & D 3139 & D 2672	ASTM F 679
	(3"-15")	PVC Pipe	ASTM D 3034 (SDR 35)	ASTM D 3212, & D 3139 & D 2672	ASTM D 3034
	(1/8"-36")	PVC Pipe	ASTM D 2241 (SDR 32.5)	ASTM D 3212, & D 3139 & D 2672	ASTM D 2241
<i>Any pipe listed below is also acceptable.</i>					
PRESSURE PIPELINES • < 70 psi max. working pressure • Non-Abrasive Materials	(1/8"-24")	PVC Pipe	ASTM D 1785 (Sch. 40)	ASTM D 3212, & D 3139 & D 2672	ASTM D 2464 & D 2466
	(1/8"-36")	PVC Pipe	ASTM D 2241 (SDR 26)	ASTM D 3212, & D 3139 & D 2672	ASTM D 2467
	(4"-12")	PVC Pipe	AWWA C900 (DR 25)	ASTM D 3212, & D 3139 & D 2672	Per manufacturer recommendation
	(14"-48")	PVC Pipe	AWWA C905 (DR 25)	ASTM D 3212, & D 3139 & D 2672	Per manufacturer recommendation
	(3.5"-54")	PE Pipe	ASTM F 714 (DR 21)	Per manufacturer recommendation / ASTM D 3261 / ASTM F 2620	ASTM D 2683
	(1/8"-42")	Steel	ASTM A 53 / ANSI/ASME B36.10 (Sch. 40)	Flanged: to ANSI B16.5 Threaded: to ANSI B 16.11 Butt-Weld	Flanged: to ANSI B16.1 Thread to ANSI B16.11 Butt-Weld
<i>Any pipe listed below is also acceptable.</i>					
PRESSURE PIPELINES ^{Note 4} • ≥ 70 psi max. working pressure • Abrasive Materials • Recirculation Systems	(1/8"-24")	PVC Pipe	ASTM D 1785 (Sch. 80)	ASTM D 3212, & D 3139 & D 2672	ASTM D 2467
	(1/8"-36")	PVC Pipe	ASTM D 2241 (SDR 21)	ASTM D 3212, & D 3139 & D 2672	ASTM D 2467
	(1/8"-36")	PVC Pipe	ASTM D 2241 (SDR 17)	ASTM D 3212, & D 3139 & D 2672	ASTM D 2467
	(4"-12")	PVC Pipe	AWWA C900 (DR 18)	ASTM D 3212, & D 3139 & D 2672	Per manufacturer recommendation.
	(14"-48")	PVC Pipe	AWWA C905 (DR 18)	ASTM D 3212, & D 3139 & D 2672	Per manufacturer recommendation
	(3.5"-54")	PE Pipe	ASTM F 714 (DR 17)	Per manufacturer recommendation / ASTM D 3261 / ASTM F 2620	ASTM D 2683
	(1/8"-42")	Steel	ASTM A 53 / ANSI/ASME B36.10 / 19 (Sch. 80)	Flanged: to ANSI B16.5 Threaded: to ANSI B 16.11 Butt-Weld	Flanged: to ANSI B16.1 Thread to ANSI B16.11 Butt-Weld
	(3"-64")	Ductile Iron	ASTM A746 / AWWA C150 / C151	AWWA C111 / C115	AWWA C110 or AWWA C153

^{Note 1} Pipe, joints, and fittings must meet the designed maximum operating pressure (for both daily use and during cleanout.)

^{Note 2} PVC pipe material shall be Type 1 (1120/1220) for pressure pipelines. All glued PVC pipe joints shall meet ASTM D 2855 Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets

^{Note 3} Other joints and metal/cast fittings may be used if pressure rating of fitting is equal to, or greater than, pressure rating of pipe used.

^{Note 4} Use thicker walled pipes when waste contains abrasive material (i.e. sand) that may cause the pipe to wear (erode), or when pump operates at higher velocities.

Pipes and Fittings that Meet Wisconsin Construction Specification 634-Waste Transfer Pipe

ASTM/AWWA/ AASHTO	Description
ASTM A 53	Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM C 76	Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 478	Standard Specification for Reinforced Concrete Manhole Sections
ASTM C 1227	Standard Specification for Precast Concrete Septic Tanks
ASTM D 1785	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2321	Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2412	Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
ASTM D 2464	Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2466	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings
ASTM D 2661	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2672	Standard Specification for Joints for IPS PVC Using Solvent Cement
ASTM D 2683	Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
ASTM D 2729	Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets.
ASTM D 3034	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3139	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3212	Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3261	Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
ASTM D 3350	Standard Specification for Polyethylene Plastics Pipe and Fittings Materials
ASTM D 3965	Specification for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings

ASTM F 412	Standard Terminology Relating to Plastic Piping Systems
ASTM F 477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 480	Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80
ASTM F 679	Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 1417	Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air
ASTM F 1760	Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content
ASTM F 1668	Standard Guide for Construction Procedures for Buried Plastic Pipe
ASTM F 2306	Standard Specification for 12 to 60 in. [300 to 1500 mm] Annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications
ASTM F 2487	Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Corrugated High Density Polyethylene Pipelines
ASTM F 2620	Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.
ASTM F 2736	Standard Specification for 6 to 30 in. (152 To 762 mm) Polypropylene (PP) Corrugated Single Wall Pipe and Double Wall Pipe
ASTM F 2764	Standard Specification for 30 to 60 in. [750 to 1500 mm] Polypropylene (PP) Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications
AASHTO M252	Standard Specification for Corrugated Polyethylene Drainage Pipe
AASHTO M294	Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm Diameter
AASHTO M306	Standard Specification for Drainage, Sewer, Utility, and Related Castings
AWWA C110	AWWA Standard for Ductile-Iron and Gray-Iron Fittings
AWWA C111	Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	Standard for Flanged Ductile-Iron Pipe With Threaded Flanges
AWWA C150	American National Standard for Thickness Design of Ductile-Iron Pipe
AWWA C151	AWWA Standard for Ductile-Iron Pipe, Centrifugally Cast
AWWA C153	American National Standard for Ductile-Iron Compact Fittings for Water Service
AWWA C200	Steel Water pipe - 6 Inch and Larger
AWWA C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
AWWA C900	AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
AWWA C905	AWWA Standard for Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In. (350 mm Through 1,200 mm), for Water Transmission and Distribution
AWWA C909	AWWA Standard for Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 In. Through 24 In. (100 mm Through 600 mm), for Water, Wastewater, and Reclaimed Water Service

Pipes and Fittings that DO NOT meet Wisconsin Construction Specification 634-Waste Transfer Pipe

Note-Some of the ASTMs listed below allow a dual marking of the pipe. The second marking may include an ASTM that is included on the list of pipes that will meet this specification. This will make the dual marked pipe acceptable.

ASTM/AWWA/ AASHTO	Description
ASTM C 425	Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 700	Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 877	Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C 1244	Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM D 2665	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D 2680	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer
ASTM F 628	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core
ASTM F 667	Standard Specification for Large Diameter Corrugated Polyethylene Pipe and Fittings
ASTM F 891	Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
ASTM F 949	Standard Specification for Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
ASTM F 1803	Standard Specification for Poly (Vinyl Chloride) (PVC) Closed Profile Gravity Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 1866	Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Schedule 40 Drainage and DWV Fabricated Fittings
ASTM F 2648	Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications