Oneida Nation Farms – Barn Addition

Oneida Project No. 14-012

March 20, 2019

Project Scope

ONEIDA NATION
Engineering Department
P.O. Box 365
Oneida, Wisconsin 54155

Table of Contents

Scope of Work

1. Project Description

1.1. The project involves Design/Build Construction of a 29,522 square foot barn addition at N6010 County Road C in Seymour, WI 54165. Within that area, approximately 10,910 square feet will be utilized for manure waste storage. The projects purpose is to provide additional sheltered space for the brood cows and calves along with new designated areas for waste storage. The addition will provide facilities to optimize health, handle cattle in the most humane and stress-free manor possible, allow employees to work in a safe environment and to improve labor efficiency.

1.2. The Oneida Nation is collaborating with United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) on this project.

1.3. Detailed scope items are noted in the remainder of this document.

2. Design

2.1. All work shall conform to the *Design Standards & Criteria for Oneida Nation*, included in the Appendix.

2.1.1. In addition, all work for both designated "Waste Storage Areas" shall conform to all applicable USDA NRCS Standards and Practices required for this project. Those Practice Standards are:

- **Waste Storage Facility, Code 313**
- **Roofs and Covers, Code 367**
- **WI Construction Specification 004**
- **WI Construction Specification 004-WS**

Note: All other areas of building are not required to follow these Practice Standards. The remainder of the building can be engineered by Design/ Build Contractor and must comply with applicable building code and *Design Standards & Criteria for Oneida Nation*. However, if Contractor determines it is not cost/ labor efficient or causes challenges with design when separating the "Waste Storage Areas" from the remainder of building (when implementing NRCS Standards), the NRCS Standards and Practices can be used throughout the entire structure.

Example: Installation of Waterstop only applies to the Waste Storage Areas. Remainder of building does not require this material.

2.2. Contractor shall review the concept documents provided by Owner for compliance to building code and review any required changes with the Owner.

2.3. The scope descriptions noted under each Division are the Owner's recommendations for that section of work and are to only be used as a guideline. This is a Design-Build project, so all project

specifics may/ can vary dependent upon awarded contractor. Alternatives can be presented to owner if desired but must be clearly specified during bid phase.

2.4. Contractor shall prepare Construction Documents for the project to the extent necessary to define the scope of work to allow review by permitting agencies. Construction Documents shall be reviewed with Owner prior to submittal for permits. Design shall be provided for:

2.4.1. Architectural & Structural

2.4.1.1. Roof Design – Contractor to provide a roof plan to Owner prior to construction so NRCS can review. Design must follow NRCS Standard 367, Roof and Covers.

2.4.1.2. Building Steel Fabrication Drawings

2.4.1.3. Structural Calculations

2.4.1.4. Grounding and Bonding Plan for Equipotential Plane

2.5. Record Drawings will be required for completed project. Documents of all disciplines will be required.

2.6. The Owner will handle any Geotechnical investigations (soil borings, compaction test, etc.) that may be required for this project. Contractor to assist with coordination of any on-site testing.

2.7. Design documents of original barn structure are available to Contractor (in paper and AutoCAD formats) upon request.

3. Division 0 & 1 – General Requirements

3.1. All work shall conform to the Oneida Code of Laws, Chapter 603 – Building Code and Chapter 605 - Zoning and Shoreland Protection.

3.1.1. The Oneida Building Code incorporates by reference the State of Wisconsin Commercial Building Codes and the Uniform Dwelling Code.

3.1.2. Codes are available for download on the Oneida Nation website (https://oneida-nsn.gov/government/register/laws/).

3.2. Contractor shall obtain all required permits from the Oneida Zoning Department. Please contact 920-869-1600 for permit pricing.

3.3. Contractor shall coordinate all utility disconnects and new utility connections as required. Cost of utility fees shall be included in contract cost.

3.4. Contractor is responsible for all construction clean-up during project activities and prior to handing project over to Oneida Nation.

3.5. Contractor to schedule, coordinate and facilitate project meetings. Meeting minutes to be produced by contractor.

3.6. All Contractors, regardless of tier, are subject to the Oneida Code of Laws, Chapter 502 - Indian Preference in Contracting.

3.6.1. Codes are available for download on the Oneida Nation website (https://oneida-nsn.gov/government/register/laws/).

3.7. The awarded contractor is required to obtain an Oneida Vendor's License, prior to finalizing the contract for the work (if they do not currently hold a vendor's license). The annual fee for the license is due upon application; contact the Oneida Licensing Department at 920-496-5311.

3.7.1. An Oneida Vendor's License is not required for submission of a bid.

3.8. Contractor shall provide Performance and Payment Bonds for 100 percent of the contract price.

3.9. Wage Rates – Davis-Bacon wage rates do NOT apply to this project. Wage rates apply to workers hired from the Oneida Skills Bank workers (as required by the Chapter 502 - Indian Preference in Contracting) shall be paid according to the Wage Rate Determination established by the Indian Preference Office. Wage rates for workers not from the Oneida Skills Bank shall be determined by the normal salary practices of the Contractor.

3.10. Contractor shall provide a Gant chart schedule for the project and keep it current throughout the duration of the project.

3.11. Contractor will be required to produce project deliverables as noted on USDA NRCS "Roof Structures for Water Quality Practices, Wisconsin Conservation Practice Job Sheet 367". Refer to document provided in Appendix.

3.12. Contractor shall provide a Schedule of Values identifying, at a minimum, the following items (all requests for payments shall identify these items and their percentage complete at the time of the request for payment):

3.12.1. General Conditions
3.12.2. Sitework
3.12.3. Foundations & flatwork
3.12.4. Metals
3.12.5. Woods/ Plastics & Composites
3.12.6. Thermal & Moisture Protection
3.12.7. Openings
3.12.8. Finishes
3.12.9. Specialties
3.12.10. Electrical Systems

3.13. Schedule

3.13.1. The following schedule shall be used for this solicitation (subject to change due to required approvals):

March 20, 2019	**Invitation to Bid issued**
April 2, 2019	**Pre-Bid Site Visit**
April 16, 2019	**Bid Forms due to Oneida Engineering Department**
April 25, 2019	**Notification to firms of selection**
June 3, 2019	**Selected firm to receive signed contract**
ASAP	**Owner's preference is for Construction activities to commence ASAP following executed contract**

4. Division 2 – Existing Conditions

4.1. Bulk demolition will be completed by Contractor. The scope includes demolition of:
4.1.1. Portion of South concrete wall. Refer to Division 8 Opening for further details.
4.2. When developing the site in 2016, Oneida Nation constructed a 50' wide driveway along the South side of the existing barn (where new barn will be constructed) and a 30' wide driveway along the East end of the existing barn (where the new 30' wide apron and NE Waste Storage Area will be constructed). Activities consisted of: removing top soil, brought up to subgrade with fill material, crushed concrete and breaker run then compacted and applied a layer of ¾" crushed stone. With that being said, a large portion of the subgrade preparations have previously been completed. Contractor to verify subgrade conditions and elevations are sufficient for proposed additions.
4.3. All material removed by Contractor shall be properly disposed off-site.

5. Division 3 – Concrete

5.1. Pack Area, Feed Alley and water pads will consist of a reinforced concrete slab. Trowel finish at Feed area and around watering pads, broom finish on remainder of concrete. Match existing.
5.1.1. 6" thick concrete in Pack Areas.
5.1.2. 5" thick concrete in Feed Alleys.
5.2. 5" thick exterior reinforced concrete aprons as per plan.
5.3. 6' high reinforced pilaster/ piers for East Waste Storage addition.
5.4. 18" high reinforced Feed Alley Walls (except by Storage Area).
5.5. 5' high reinforced walls around perimeter of South-East Waste Storage area.
5.6. Exterior 5' high foundation walls poured on top of thickened grade beam.
5.7. All pipe bollards to be embedded and filled with concrete.

5.8. Equipotential Plane to prevent stray voltage must be incorporated.
Guidelines:
a. Rebar tied together with approved (welded or compression type) fitting.
b. Grounding to building steel (welded or drilled/ tapped for a compression lug).
c. Anything metal where livestock could come in contact must be bonded to equipotential plane.

6. Division 4 – Masonry

6.1. No work anticipated.

7. Division 5 – Metals

7.1. Exterior building columns & rafters will consist of fabricated structural steel I-beams.
7.2. Center support columns will consist of structural tube steel members welded to base plates embedded in concrete.
7.3. All structural steel to have a primer coating system applied.
7.4. Wall & Roof bracing as required by Structural design.
7.5. Provide conduit holes in rafters for electrical conduit runs.
7.6. Adjustable Feed Rail System at both sides of Feed Alley except at location of Waste Storage Area.
7.6.1. Note: Feed Rail height needs to be slightly lower than height of Feed Rail in existing barn due to smaller animal size.
7.7. Provide protective swing gates by all (3)- Pack Area overhead doors and (1)- Waste Storage overhead door. Include cattle panel & latches. All piping to be rust and corrosion resistant.
7.8. Provide 5-bar swing gates for all areas (pack areas, man pass areas, Feed Alley openings, 16' opening into existing barn, etc.) as designated on plan.
7.9. Provide hot dipped galvanized cattle panel 48" above concrete walls with supporting piping.
7.10. Protect around water pads and new 16' wide opening (along existing South wall) with embedded steel channels.
7.11. Interior and exterior pipe bollards to be provided by each overhead door.
7.11.1. In addition to pipe bollards for building, Contractor to include (4)- bollards (labor and materials) for around existing transformer pad located at South-West end of construction area.

8. Division 6 – Wood, Plastics, and Composites

8.1. End wall framing to consist of a structural steel main frame with SPF girts.
8.2. Roof purlins to be set between mainframes (same as existing) to prevent bird nesting. Purlins cannot be designed to be set on top of structural rafters. Purlins preferably to be #1 Southern Yellow Pine.
8.3. Provide header for Curtain system and mounting of hardware. Header preferably to be Doug Fir.
8.4. Provide treated lumber for lower curtain shelving.
8.5. At common wall of existing East end wall and proposed Waste Storage, all existing end wall framing/ sheeting to remain.

9. Division 7 – Thermal and Moisture Protection

    9.1. Wall Sheeting to consist of 29-gauge galvanized G-100 substrate, Match existing.
    9.2. Roof sheeting to consist of 26-gauge material with Moisture Lok (McElroy) to match existing.
    9.3. Neoprene washers to be used for roof assembly.
    9.4. Translucent paneling to be used on end walls above overhead door elevation, Match existing.
    9.5. NRCS Practice Standard **'367 Roofs and Covers'** must be followed.

10. Division 8 – Openings

    10.1. (2) - 16x12 insulated steel doors, 3" track with high lift, reverse C.A. mount and perimeter weatherseal. Door panels to be solid, no window lites. (2) - dual function radio transmitters to be provided with open/close/ stop controls. (2) - J-heavy duty jackshaft operators, ½ HP with (1) 3-button operator switch for interior and exterior. Both doors to have 2" standard rubber door seal.
    10.2. (3) - 12x12 insulated steel doors, 2" track with high lift, reverse C.A. mount and perimeter weatherseal. Door panels to be solid, no window lites.
    10.3. (1) - 16x16 insulated steel door for Waste Storage Area, 2" track with high lift, reverse C.A. mount and perimeter weatherseal. Door panels to be solid, no window lites.
    10.4. (1)- 3068 Service door with half lite.
    10.5. Provide 16'-0" clear opening in South foundation wall of existing building.

11. Division 9 - Finishes

    11.1. All exterior pipe bollards to be painted Yellow, match existing.

12. Division 10 – Specialties

    12.1. Furnish & Install a single drop curtain system along entire Southern sidewall with appropriate curtain boxes.
    12.2. Curtain system to be manual operation.
    12.3. Note: no curtain system required along North wall of new Waste Storage (Northeast side).

13. Division 11 – Equipment

    13.1. Automatic waterer equipment supplied and installed by Oneida Nation.

14. Division 12 – Furnishings

    14.1. No work anticipated.

15. Division 21 – Fire Suppression

    15.1. No work anticipated.

16. Division 22 – Plumbing

    16.1. All Plumbing related activities will be supplied and performed by the Oneida Nation.

17. Division 23 – HVAC

    17.1. No work anticipated.

18. Division 26 – Electrical

    18.1. Furnish & Install (7) - 6-lamp T8 high-bay light fixtures (Orion AG Barnliter or equivalent). Ceiling fixture to be an enclosed assembly designed for damp agricultural environments. Mounting height to match existing fixture height with use of KwikWire. Note: (6)- fixtures for main addition and (1)- in North-East Waste Storage Area. Refer to Design Documents in Appendix for additional details.
    18.2. Provide separate single switch for North-East Waste Storage light fixture.
    18.3. Include wiring of (2) - Feed Alley overhead doors and push controls.
    18.4. Provide 120V power to (3) - watering units as per plan location.
    18.5. Provide (3) - weatherproof GFCI receptacles. One at each gable end located on interior side and one located towards center of building.
    18.6. Equipotential Plane to prevent stray voltage must be incorporated.
    Guidelines:
    d. Rebar tied together with approved (welded or compression type) fitting.
    e. Grounding to building steel (welded or drilled/ tapped for a compression lug).
    f. Anything metal where livestock could come in contact must be bonded to equipotential plane.
    18.7. Note: Existing service is a 3-Phase 200amp panel

19. Division 27 – Communications

    19.1. No work anticipated.

20. Division 28 – Electronic Safety and Security

    20.1. No work anticipated.

21. Division 31 – Earthwork

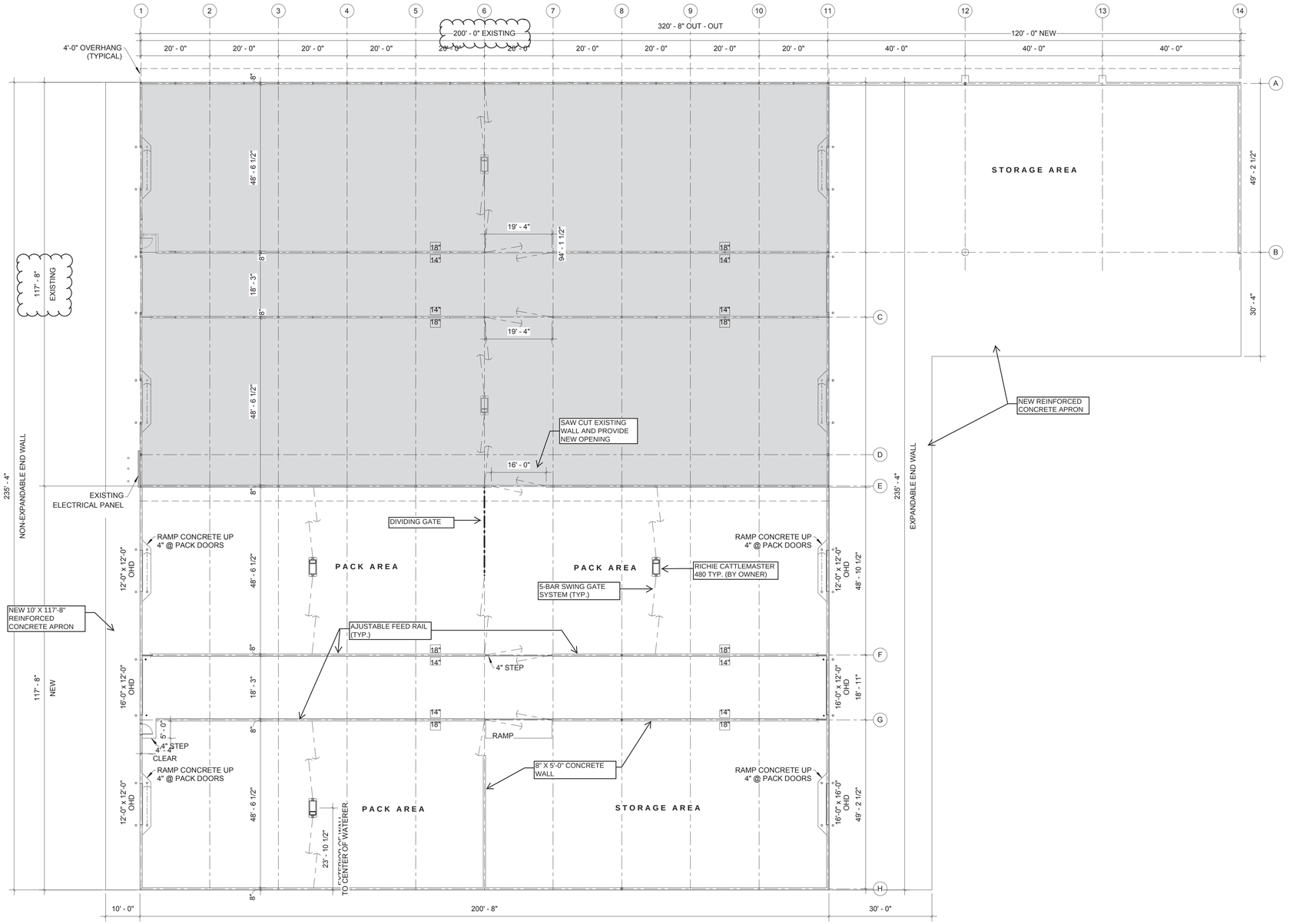
    21.1. Stripping of existing top soil. Refer to NRCS test pit logs for approximate depths.
    21.2. Supply, place and compact clay fill to bring to subgrade elevation.

21.3. Supply, place and compact 6" of crushed stone for concrete slab, barn, aprons and manure storage area.
21.4. Supply, place and compact 12" of crushed stone for 30' wide driveway. Starting at existing driveway going around south side of proposed barn and east end of barn to proposed manure storage area.
21.5. Dig footings for proposed barn and manure storage area.
21.6. Spread topsoil as necessary.

22. Division 32 – Exterior Improvements

22.1. Re-distribute any disturbed soil cause from project activity.
22.2. Existing fencing within project limits will be removed by Oneida Nation.

23. Appendices
23.1. Design Documents
23.2. NRCS Site Plan with Soil Log Reports
23.3. USDA NRCS Practice Standards (Waste Storage Facility Code 313, Roofs and Covers Code 367, WI Construction Specification 004 and WI Construction Specification 004-WS)
23.4. USDA NRCS- Roof Structures for Water Quality Practices Wisconsin Conservation Practice Job Sheet 367
23.5. *Design Standards & Criteria for Oneida Nation*



1 / A1.0 FINISH FLOOR PLAN
1/16" = 1'-0"

N

PROPOSED PACK BARN FOR:

ONEIDA NATION PACK BARN

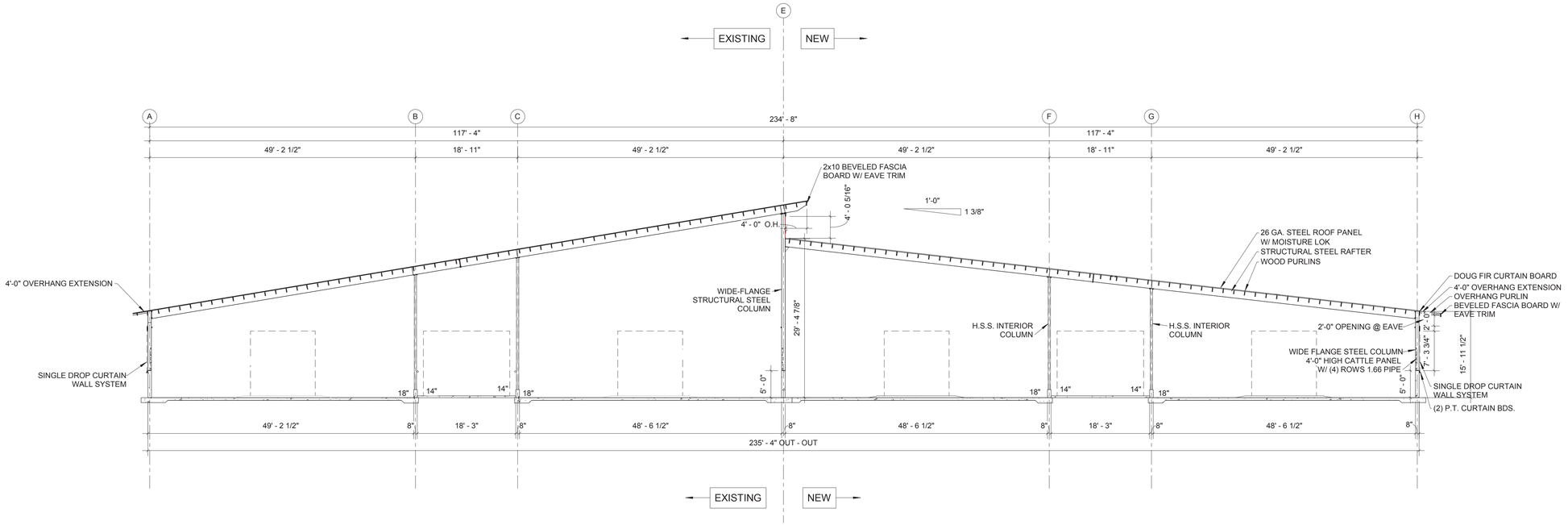
SEYMOUR, WISCONSIN; OUTAGAMIE COUNTY

ISSUED FOR:

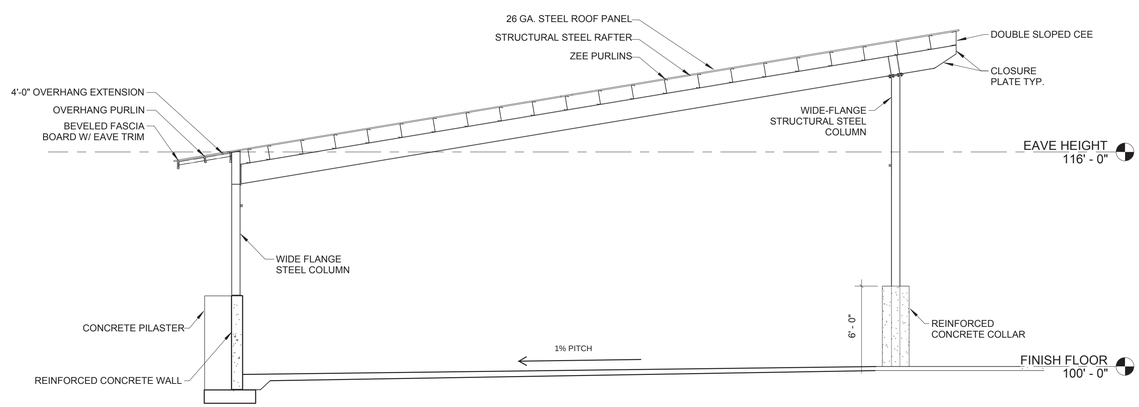
- [x] PRELIMINARY
- [ ] BID SET
- [ ] CONSTRUCTION

SHEET

A-1



2 A-2 BUILDING SECTION
3/32" = 1'-0"



1 A-2 SECTION @ MANURE STORAGE
3/16" = 1'-0"

PROPOSED PACK BARN FOR:

ONEIDA NATION PACK BARN

SEYMOUR,WISCONSIN; OUTAGAMIE COUNTY

ISSUED FOR:

- [x] PRELIMINARY
- [ ] BID SET
- [ ] CONSTRUCTION

SHEET

A-2

Luminaire Schedule			
Symbol	Qty	Label	Description
	6	WTAG6HL6W-CMR	6 Lamp Wet Barnliter -Highba

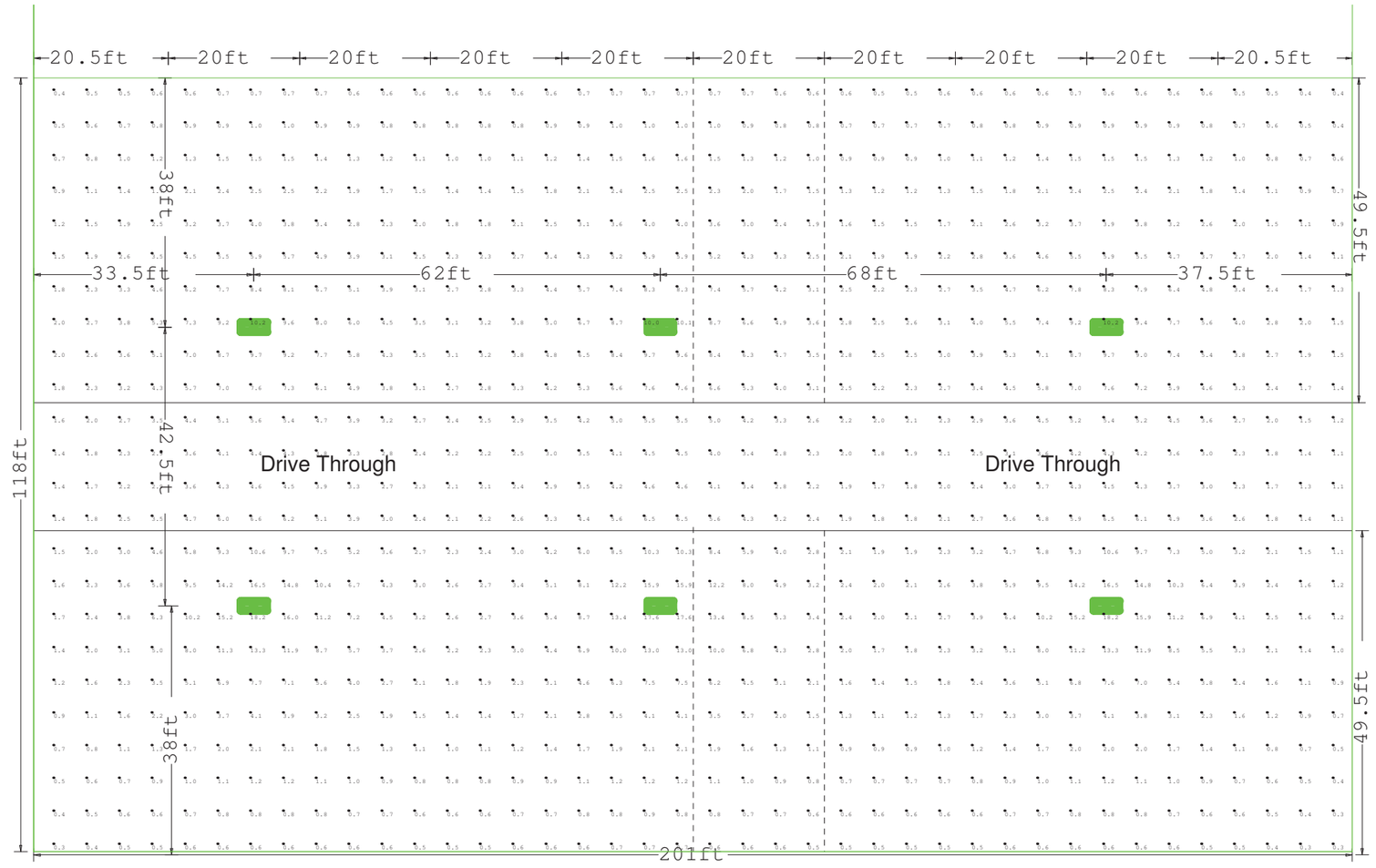
Reflectance Values
Ceiling: .8
Walls: .5
Floor: .2

Calculation Summary							
Label	CalcType	Units	Avg	Max	Min	Avg/Min	Max/Min
CalcPts	Illuminance	Fc	3.33	18.2	0.3	11.10	60.67

Ceiling Height: 16- 36'
Fixture Height: 20'- 28'
FC Readings @ 2.5'

AGH123 Brackets

Note: This lighting layout is from 2016 structure.
New addition will have similar layout as shown.
Fixture for NE Waste Storage Area not shown



Drawing of...
Beef Barn
T8 layout
Presented by...
Orion Energy Systems

Original Drawing
February 29, 2016
By: S Wetor

Orion Energy Systems Inc
2210 Woodland Drive
Manitowoc, WI 54220
www.oesx.com

NRCS Test Pit Summary
Topsoil Depths:
.
TP #1-18: 18"
TP #2-18: 23"
TP #3-18: 12"
TP #4-18: 34"
.
Refer to USDA NRCS Soil Logs for additional info

Benchmark description
TBM#1: NE corner concrete feed apron elevation = 818.57
TBM#2: SE corner concrete footing 2016 bedded pack barn. elevation = 813.75

GRAPHIC SCALE

50 0 25 50 100
(IN FEET)
1 inch = 50 ft.

NRCS
Natural Resources Conservation Service
United States Department of Agriculture

2019 PLAN VIEW

CLIENT: Oneida Nation Farms
COUNTY: Outagamie

	Date	Drawing Name
Designed bsb	3/2019	WI-006(MOD)
Drawn		Date 10/2006
Checked		
Approved		Sheet of

803-804

USDA
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

MN/WI LOG OF TEST PIT NUMBER 1-18

OWNER: Oneida Nation Beef Farm Cnty C	SURFACE ELEVATION: 809.7	COUNTY: Outagamie
PRACTICE: 313	PERCHED WATERTABLE ELEVATION: 806.3	~~LAT/LONG~~ northing / easting: N632573.5 E848164
EQUIPMENT: tractor back hoe	SEASONAL HIGH WATER TABLE ELEVATION: /	LANDSCAPE POSITION:
LOGGED BY: B. Bogucki J. Pomeroy	OBSERVED SUBSURFACE SATURATION ELEVATION: /	SOIL MAP UNIT:
DATE: 10/16/18	TOP OF BEDROCK ELEVATION: NA	KARST FEATURES WITHIN 1000 FT: NA

DEPTH FROM (FT.)	DEPTH TO (FT.)	USCS SYMBOL (i.e-ML)	USCS GROUP NAME (i.e.-Silt w/Sand)	GRADATION % B >12"	% C 3"-12"	% G 3"-1/4"	% S 1/4"-#200	% FINE <#200	PLASTICITY roll thread: Non, Slightly, Low, Medium, High.	MUNSELL COLOR AND % MATRIX (90% 10YR 4/4)	MUNSELL COLOR AND % REDOX. (10% 10YR 5/2)	MOISTURE Dry, Slightly Moist, Moist, Very Moist, Wet.	STRUCTURE Stratified, Laminated, Fissured, Slicken-sided, Blocky, Prismatic, Lensed, Massive.	GEOLOGY Alluvium, Slope Alluvium, Colluvium, Glacial Till, Glacial Lake Sed., Outwash, Residuum, Loess, Bedrock.	ADDITIONAL COMMENTS Dilatancy: None, Slow, Rapid; Odor (mention if unusual); Consistency (Mention if very soft or soft in wet condition); Location of Seepage and Other Items such as caving or sloughing of pit and how the water enters the pit; Description of lenses and / or mixed materials encountered.	SAMPLES FROM (FT)	SAMPLES TO (FT)	SAMPLES #
0	1.5 (808.2)														topsoil Disturbed			
1.5	2.0 (807.7)	SC					50	50	low	2.5YR 5/4	40% 5YR 4/6	Moist	Blocky		firm no seeps			
2.0	2.5 (807.2)	SP					95	5	/	10YR 5/3	/	wet	slight stratified					
2.5	3.0 (806.7)	SC				15	40	45	low	2.5YR 5/4	5YR 4/6 25% 10YR 6/1 25%	wet	Blocky		- roots			
3.0	3.4 (806.3)	ML					5	95	Med-High	10YR 6/1		wet	massive		Dilatancy High			
3.4	7.6 (802.1)	CL				15	15	70	Med-High	2.5YR 4/4		Moist	Blocky		- free water along root fibers - small sand pockets saturated - firm no seeps			

General Comments:

DISCLAIMER: ALL SOIL CLASSIFICATIONS FIELD CHECKED. IF CONCLUSIVE SOIL CLASSIFICATION RESULTS ARE REQUIRED FOR ENGINEERING PURPOSES

USDA
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

MN/WI LOG OF TEST PIT NUMBER 2-18

OWNER: Oneida Beef Farm County C	SURFACE ELEVATION: 810.2	COUNTY: Outagamie
PRACTICE: 313	PERCHED WATERTABLE ELEVATION: —	~~LAT/LONG~~: N 632458 E 848078
EQUIPMENT: Backhoe	SEASONAL HIGH WATER TABLE ELEVATION: —	LANDSCAPE POSITION:
LOGGED BY: B. Bogucki J. Powelett	OBSERVED SUBSURFACE SATURATION ELEVATION: —	SOIL MAP UNIT:
DATE: 10/16/18	TOP OF BEDROCK ELEVATION: NA	KARST FEATURES WITHIN 1000 FT: NA

DEPTH FROM (FT.)	DEPTH TO (FT.)	USCS SYMBOL (i.e-ML)	USCS GROUP NAME (i.e.-Silt w/Sand)	GRADATION % B >12"	% C 3"-12"	% G 3"-1/4"	% S 1/4"-#200	% FINE <#200	PLASTICITY Non, Slightly, Low, Medium, High.	MUNSELL COLOR AND % MATRIX (90% 10YR 4/4)	REDOX. (10% 10YR 5/2)	MOISTURE Dry, Slightly Moist, Moist, Very Moist, Wet.	STRUCTURE Stratified, Laminated, Fissured, Slicken-sided, Blocky, Prismatic, Lensed, Massive.	GEOLOGY Alluvium, Slope Alluvium, Colluvium, Glacial Till, Glacial Lake Sed., Outwash, Residuum, Loess, Bedrock	ADDITIONAL COMMENTS Dilatancy: None, Slow, Rapid; Odor (mention if unusual); Consistency (Mention if very soft or soft in wet condition); Location of Seepage and Other Items such as caving or sloughing of pit and how the water enters the pit; Description of lenses and / or mixed materials encountered.	SAMPLES FROM (FT)	SAMPLES TO (FT)	SAMPLES #
0	1.9 808.3	ML													Topsoil			
1.9	2.7 807.5	CL			5	15	20	60	Med-High	5YR 4/4	10% 5YR 4/6	Moist	Blocky		Dilatancy slow Ribbon weak soft structure isolated saturated sand pockets 5%	2	2.5	
2.7	9.0 801.2	CL			5	15	10	75	Med-High	25YR 4/4	—	Moist	subangular Blocky		-Dilatancy slow - Ribbon weak -firm structure -isolated saturated sand pockets	4	5	
																9		

General Comments:

DISCLAIMER: ALL SOIL CLASSIFICATIONS FIELD CHECKED. IF CONCLUSIVE SOIL CLASSIFICATION RESULTS ARE REQUIRED FOR ENGINEERING PURPOSES

USDA
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

MN/WI LOG OF TEST PIT NUMBER 3-18

OWNER: Oneida Nation Beet Farm Cnty C	SURFACE ELEVATION: 810.4	COUNTY: Outagamie
PRACTICE: 313	PERCHED WATERTABLE ELEVATION: 808.7	~~LAT/LONG~~: N 632372 E 847956
EQUIPMENT: Backhoe	SEASONAL HIGH WATER TABLE ELEVATION: —	LANDSCAPE POSITION:
LOGGED BY: B. Bogucki J. Powelert	OBSERVED SUBSURFACE SATURATION ELEVATION: —	SOIL MAP UNIT:
DATE: 10/16/18	TOP OF BEDROCK ELEVATION: NA	KARST FEATURES WITHIN 1000 FT: NA

DEPTH FROM (FT.)	DEPTH TO (FT.)	USCS SYMBOL (i.e-ML)	USCS GROUP NAME (i.e.-Silt w/Sand)	GRADATION % B >12"	% C 3"-12"	% G 3"-1/4"	% S 1/4"-#200	% FINE <#200	PLASTICITY Non, Slightly, Low, Medium, High.	MUNSELL COLOR AND % MATRIX (90% 10YR 4/4)	REDOX. (10% 10YR 5/2)	MOISTURE Dry, Slightly Moist, Moist, Very Moist, Wet.	STRUCTURE Stratified, Laminated, Fissured, Slicken-sided, Blocky, Prismatic, Lensed, Massive.	GEOLOGY Alluvium, Slope Alluvium, Colluvium, Glacial Till, Glacial Lake Sed., Outwash, Residuum, Loess, Bedrock.	ADDITIONAL COMMENTS Dilatancy: None, Slow, Rapid; Odor (mention if unusual); Consistency (Mention if very soft or soft in wet condition); Location of Seepage and Other Items such as caving or sloughing of pit and how the water enters the pit; Description of lenses and / or mixed materials encountered.	SAMPLES FROM (FT)	SAMPLES TO (FT)	SAMPLES #
0	1 (809.4)														Top Soil			
1	1.7 (808.7)	CL				20	20	60	Med-High	2.5YR 4/4		Moist	Blocky		- Dilatancy slow Ribbon weak - Soft structure	1.5	1.5	
1.7	2.5 (807.9)	CL			5	20	25	50	Med-High	2.5YR 5/4	580 2.5YR 4/6 2040 2.5YR 6/3	Very Moist	Blocky		Soft	2	2	
2.5	6.0 (804.4)	CL				15	15	70	Med-High	2.5YR 5/4	—	Moist	Blocky		firm - antecedent water moving through soil profile - chunks of soil sloughing in	3.5	4	
6.0	7.7 (802.7)	CL				30	20	50	Med-High	2.5YR 4/4	—	slighty moist	subangular blocky		- Dilatancy slow - Ribbon weak - firm very dense structure	7	7	

General Comments:

DISCLAIMER: ALL SOIL CLASSIFICATIONS FIELD CHECKED. IF CONCLUSIVE SOIL CLASSIFICATION RESULTS ARE REQUIRED FOR ENGINEERING PURPOSES

USDA
NATURAL RESOURCES CONSERVATION SERVICE (NRCS)

MN/WI LOG OF TEST PIT NUMBER 4-18

OWNER: Oneida Nation Beef Farm Coty C	SURFACE ELEVATION: 811.4	COUNTY: Outagamie
PRACTICE: 313	PERCHED WATERTABLE ELEVATION: 808.6	~~LAT/LONG~~: N 632629 E 848080
EQUIPMENT: Backhoe tractor	SEASONAL HIGH WATER TABLE ELEVATION: —	LANDSCAPE POSITION:
LOGGED BY: B. Bogucki J. Powelett	OBSERVED SUBSURFACE SATURATION ELEVATION: —	SOIL MAP UNIT:
DATE: 10/16/18	TOP OF BEDROCK ELEVATION: NA	KARST FEATURES WITHIN 1000 FT: NA

DEPTH		USCS		GRADATION					PLASTICITY	MUNSELL COLOR AND %		MOISTURE	STRUCTURE	GEOLOGY	ADDITIONAL COMMENTS	SAMPLES		
FROM (FT.)	TO (FT.)	SYMBOL (I.e-ML)	GROUP NAME (i.e.-Silt w/Sand)	% B >12"	% C 3"-12"	% G 3"-1/4"	% S 1/4"-#200	% FINE <#200	Non, Slightly, Low, Medium, High.	MATRIX (90% 10YR 4/4)	REDOX. (10% 10YR 5/2)	Dry, Slightly Moist, Moist, Very Moist, Wet.	Stratified, Laminated, Fissured, Slicken-sided, Blocky, Prismatic, Lensed, Massive.	Alluvium, Slope Alluvium, Colluvium, Glacial Till, Glacial Lake Sed., Outwash, Residuum, Loess, Bedrock.	Dilatancy: None, Slow, Rapid; Odor (mention if unusual); Consistency (Mention if very soft or soft in wet condition); Location of Seepage and Other Items such as caving or sloughing of pit and how the water enters the pit; Description of lenses and / or mixed materials ~~encountered.~~	FROM (FT)	TO (FT)	#
0	28 808.6	ML													Disturbed - manure odor organic			
2.8	806.8 46	CL				15	30	55	Med-High	2.5YR 5/4	2.5YR 5/1 5% 2.5YR 6/2 25%	Very moist	Blocky		firm slight indentation - seeps + sloughing	3	4	
4.6	803.9 7.5	CL				5	15	80	Med-High	2.5YR 4/4	—	Moist	subangular blocky		firm - no seeps - very firm - small isolated salt pockets 2%	4.5	5	

General Comments:

DISCLAIMER: ALL SOIL CLASSIFICATIONS FIELD CHECKED. IF CONCLUSIVE SOIL CLASSIFICATION RESULTS ARE REQUIRED FOR ENGINEERING PURPOSES

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD
WASTE STORAGE FACILITY
CODE 313
(No.)

DEFINITION

An agricultural waste storage impoundment or containment made by constructing an embankment, excavating a pit or dugout, or by fabricating a structure.

PURPOSE

To store manure, agricultural by-products, wastewater, manure processing derivatives, leachate, and contaminated runoff to provide the agricultural operation management flexibility for waste utilization.

CONDITIONS WHERE PRACTICE APPLIES

Use where regular storage is needed for wastes generated by agricultural production or processing, where soils, geology, and topography are suitable for construction of the facility, and where the construction, operation, and maintenance will protect the soil and water resources.

For structures and conduits used to transfer waste and other byproducts, use the Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS) Waste Transfer (Code 634).

For liquid waste storage facilities implemented with an embankment, this practice applies only to low hazard facilities as defined in the NRCS National Engineering Manual (NEM), Part 520 subpart C with a maximum effective height of 25 feet.

This standard applies to:

- Waste storage impoundments or structures up to 25 feet of impoundment depth; and
- Facilities that are part of a planned agriculture waste management system intended to meet the facility management goals, regulatory requirements, or nutrient management plans by providing storage of waste.

For the purposes of this standard, liquid waste is used to describe any waste that is too wet to stack. It includes both liquid and slurry waste.

This practice does not apply to the storage of human waste, routine animal mortality, the unstacked waste that accumulates in animal housing units (barns) or animal production areas not intended to store waste (animal confinement/feed areas).

CRITERIA

General Criteria Applicable to All Waste Storage Facilities.

The following criteria establish minimum allowable limits for design parameters, acceptable installation processes, or performance requirements for all waste storage facilities (impoundments and structures).

Laws and Regulations. Plan, design, and construct the waste storage facility to meet all Federal, Tribal, State, and local laws and regulations. This standard does not contain the text of the federal, tribal, state, or local laws governing waste storage facilities. Regulatory approval may be needed prior to accepting off-site material(s) or adding chemicals to the waste storage facility. The operator is responsible for securing required permits.

Location. Locate and design the waste storage facility such that it is outside the 100-year floodplain unless site restrictions require locating it within the floodplain. Where waste storage facilities are located in flood prone areas, protect these facilities from inundation, structural damage, and instability. Design these facilities to accommodate any additional loading resulting from static water levels or saturated soils. The lowest point at which floodwater could potentially enter the waste storage facility must be 2 feet above the maximum flood elevation resulting from a 100-year, 24-hour rainfall event. Additionally, follow the policy found in the NRCS General Manual (GM) 190, Part 410.25, Flood Plain Management.

Management Assessment

Conduct, document, and incorporate a management assessment into the design. Perform the assessment with the owner/operator to explore options and to determine the purpose of storage components, available resources, manure disposal schemes, sand and manure solids separation methods, and waste characteristics.

The management assessment shall address the following as appropriate to the system being designed:

- Waste Characterization
  - » Sources, volumes, and consistency of manure, contaminated runoff, manure processing derivatives, leachate, wastewater, and other inputs to the waste storage facility
  - » Animal type, size, number and weight
  - » Bedding types and quantity
  - » Chemical characteristics which may impact facility design
- Land base available for utilization of waste
- Method of distribution of manure onto the land base
- Planned storage period
- Waste handling and transfer methods from the waste source to the storage facility
- Facility waste removal methods
- Storage facility liner possibilities and preferences
- Access needs and limitations
- Safety needs, including those to address the hazards of manure gases
- Labor and equipment needs
- Potential odor concerns
- Provisions for facility expansion

When the intent of the owner/operator is to process and/or treat the various waste streams within the animal production area, provide a narrative describing the system. The description will include the intent and purpose of the processing or treatment strategies relative to land spreading or waste distribution strategies, stabilization of organic by-products, separation of sand bedding, reducing pollutant loads, nutrient concentration, waste consistencies, odor control, energy production, and volume reduction.

Site Assessment

Conduct, document, and incorporate a site assessment into the design. Perform the assessment to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed waste storage facility, liner(s) and transfer components. Include input from the owner/operator in the site assessment. The site assessment shall include:

- Locations and elevations of buildings, roads, lanes, soil investigations, property lines, setbacks, easements, wells, springs, floodplains, surface waters, surface drains, subsurface drains, utilities, overhead lines, cultural resources, and wetlands.
- The location of sinkholes and other karst features and conduits to groundwater within 1,000 feet of the facility. Features within 1,000 feet of the facility must be further analyzed per WI NRCS Engineering Field Handbook Supplement Chapter 4, Exhibit A (Chapter 4, Exhibit A) to determine if they pose a hazard to the facility or environment.
- Log subsurface investigations for all waste storage facilities sufficient in detail and analysis to support the design in accordance with Chapter 4, Exhibit A. Describe the soil material encountered, location of any seeps, depth to subsurface saturation, and depth to bedrock (Note: Chapter 4, Exhibit A follows NRCS NEM Part 531, Geology, by utilizing ASTM D2488 procedures).
    - » Document the location of test pits or soil borings, soil test results, photos taken during the soils investigation, and a narrative describing the design parameters that have been derived from the soils data. Note the bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.
    - » Locate test pits and borings used to meet the criteria within the footprint or no more than 100 feet from the footprint. A minimum of one test pit or boring per 15,000 square feet of facility footprint, with a minimum of two per facility, is required. Extend these test pits/soil borings to bedrock, a free water surface, or to a minimum depth to ensure subsurface saturation and bedrock separation distances required in this standard or associated Pond Sealing or Lining standards are achieved.
    - » Complete soil tests for soils (in-place), sub-soil or sub-liner soils in a laboratory on representative samples of soil beneath the proposed grade at a rate of 1 test per 30,000 square feet of facility footprint, with a minimum of two tests. The Plasticity Index (PI) shall be determined in accordance with ASTM D4318 and the percent fines (% fines) in accordance with ASTM D1140.
    - » Increase the number and distribution of test pits and soil borings needed to characterize the subsurface (soils, saturation, and bedrock) if there is inconsistency within or between test pits or borings.

» Characterize soil for liners and sub-liners according to Chapter 4, Exhibit A. Soils for liners and sub-liners may be located within the footprint of the storage, on site, or off site and transported to the site for construction. Include locations, dimensions and elevations, soil volumes, soil samples, testing results, and reclamation plans of any borrow areas. Complete soil characterization at a rate of one test per 30,000 square feet of borrow source, with a minimum of two tests per area. Distribute the test pit or borings evenly across the borrow source. Additional soils testing may be needed to meet the requirements of the selected liner type. See the appropriate Pond Sealing or Lining standards and Wisconsin construction specifications for additional criteria.

Separation from Subsurface Saturation or Bedrock. The separation is determined to be the closest distance from any point on the inside surface (bottom and sides) of the storage facility to the feature from which separation is required.

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

- Free water or wet soil identified by glistening, due to the slow release of water
- Gleyed soil, that may extend uninterrupted from an observed free water surface.
- The presence of distinct gray redoximorphic features with a chroma of 2 or less based on Munsell color charts.
- Depleted matrices having a value of 4 or more and chroma of 2 or less based on Munsell color charts. In some cases soil parent materials have a natural color with a chroma of 2 or less or gleyed color that is not due to saturation. In these cases other indicators may be used such as landscape position, relative elevation or soils in relation to nearby water features.

In soils not conducive to mottling, such as sand, establish the subsurface saturation elevation by evaluating the soil morphology of the soil profile. Other indicators that may be considered in making the determination are the position of the soil in the landscape, topography, nearby wetlands and well construction logs. In sites susceptible to groundwater contamination or complex hydrogeological sites, additional saturation verification methods may be required. Verification methods could include but are not limited to groundwater monitoring wells, piezometers, and soil test pits conducted during the wet season. Other information to consider includes historic precipitation and groundwater elevation records from nearby locations, which can indicate whether or not the area is experiencing a local high or low trend in groundwater elevation.

If the site assessment indicates artesian features, complete a hydrogeologic and geotechnical evaluation of the site to determine the site suitability for an in-ground waste storage facility. Include a groundwater monitoring well or piezometer below the apparent confining layer and a water table observation monitoring well in the evaluation. Monitor the site through the wettest portion of the annual groundwater recharge cycle.

Construct and develop groundwater monitoring wells and piezometers according to WI NRCS CPS Monitoring Well (Code 353) or appropriate state monitoring well construction requirements.

Subsurface saturation, pockets of sand and gravel, or water-bearing materials, if encountered, shall not be removed or drained except for perched conditions. Include documentation to demonstrate that subsurface saturation is perched and its effects can be eliminated.

Excavation of bedrock is permitted to achieve the required separation distance as specified in Table 5 of this standard and tables in associated Pond Sealing or Lining standards. Do not remove bedrock by blasting. Evaluate the exposed bedrock surface to ensure a structurally sound base for a liner or other soil material. Treat fractures or voids to prevent migration of soil material. The entire surface of the excavated bedrock shall have a positive grade, minimum of 1 percent, under and away from the storage facility, as to prevent any significant ponding on the rock surface. If bedrock is excavated, the material placed between the liner and the bedrock shall meet the requirements of sub-liner soil in the appropriate Pond Sealing or Lining standards.

Perched Conditions. Pockets of sand and gravel, or other water-bearing materials may be removed or drained to achieve separation distances in Tables 1 and 5 within this standard, or tables in associated Pond Sealing or Lining standards, and to relieve hydrostatic loads on the facility and its liner(s). All drainage systems shall drain to the ground surface or surface water by gravity. Evaluate the effect of temporary tailwater on the structure or liner and the effects of out-letting to perennial and intermittent waterways. Locate a drainage system around the outside perimeter of the facility footprint and drain to a surface outlet. Protect outlets against erosion and undermining of the conduit, entry of vegetation, damaging periods of submergences, and entry of rodents or other animals into the subsurface drain. A drainage system may also be located around the outside perimeter of an impoundment floor within the facility footprint if the drainage system enters an observation and pumping port and then continues by gravity to a surface outlet. Design the port such that the outlet can be blocked and a pump can be utilized to remove the polluted liquids until the source is identified and repairs can be completed.

Sensitive Environmental Settings. Wisconsin Sensitive Environmental Settings are sites where one or more of the following conditions are met:

- Bedrock or subsurface saturation separation distances are less than those listed in Tables 1 of this standard, Table 1 of WI NRCS CPS Pond Sealing or Lining – Compacted Soil Treatment (Code 520), Tables 5 and 6 of WI NRCS CPS Pond Sealing or Lining – Geomembrane or Geosynthetic Clay Liner (Code 521), or Table 2 of WI NRCS CPS Pond Sealing or Lining – Concrete (Code 522);
- Sub-liner soils do not meet both the required thickness and percent fines listed in Table 1 of WI NRCS CPS 520, Tables 5 and 6 of WI NRCS CPS 521, or Table 2 of WI NRCS CPS 522;
- For facilities with one or more sloped sides or structures with vertical sides with any part of the storage floor below existing ground surface, a sinkhole or other karst feature is present within 400 feet horizontally from the footprint of the proposed storage facility; or
- For above ground structures where the storage floor is entirely above existing ground surface, a sinkhole or other karst feature is present within 200 feet horizontally from the footprint of the proposed storage facility.

In-situ soils that do not meet both the sub-liner required thickness and percent fines listed in the applicable liner standard can be removed and replaced with compliant materials. When designed and constructed in this manner, the site is no longer classified as Wisconsin Sensitive Environmental Settings.

Where liquid-storage is to be provided in sensitive environmental settings, design according to WI NRCS CPS Pond Sealing or Lining – Concrete (Code 522), Sensitive Environmental Settings.

Storage Period. The storage period is the maximum length of time anticipated between emptying events. Base the minimum storage period on the timing required for environmentally safe waste utilization considering the climate, crops, soils, equipment, in accordance with the operations and maintenance plan, nutrient management plan and Federal, State, and local regulations.

Design Storage Volume. Calculate design storage volumes with the procedures and default values found in the Wisconsin supplement to Chapter 10 of the NRCS Agricultural Waste Management Field Handbook (AWMFH) or site-specific estimates and measurements documented in the design. Include the sum of the following during the storage period in the design volume:

The maximum operating level (MOL) for liquid storage facilities is the level that provides the operational volume (Figure 1 contains a diagram of this information). This includes the following:

- Manure, wastewater, bedding, and all other wastes accumulated during the storage period.
- For liquid storage facilities, include normal precipitation (omit diverted roof runoff) less evaporation during the storage period.
- Normal runoff from the facility's drainage area during the storage period. Exclude clean water from the facility to the fullest extent practical except where including the runoff is advantageous to the operation of the agricultural waste management system.
- Additional storage when required to meet management goals or regulatory requirements.

Emergency Volume (liquid storages only) includes the following:

- 25-year, 24-hour precipitation on the surface of the liquid storage facility at the maximum level of the required design storage.
- 25-year, 24-hour runoff from the facility's drainage area.

Remaining Waste. Add a minimum of two feet to storage depth for facilities with side slopes and one foot for vertical walled facilities for planned maximum remaining waste. The additional storage depth can be reduced if a sump is installed or other provisions to empty the facility have been made. The anticipated method for solids removal must be accommodated in design, particularly in determining the configuration of impoundments and the type of liner to be used and maintained.

Freeboard Volume. This volume applies to liquid waste storage exposed to precipitation. Add a minimum of one foot of depth to the design storage volume to reduce the risk of over-topping. This depth is not intended to add storage capacity.

Inlet. Design inlets to resist corrosion, plugging, freeze damage, and ultraviolet deterioration. Incorporate erosion protection for in-place earth (Table 1 of this standard), soil liner (WI NRCS CPS 520, Table 1), and geosynthetic clay liners (WI NRCS CPS 521, Table 6).

Waste Removal. Provide components for removing waste such as gates, pipes, docks, wet wells, pumping platforms, retaining walls, or ramps. Incorporate features to protect against erosion, tampering, and accidental release of stored waste as necessary. Design ramp slopes to accommodate anticipated equipment and traction available. Use WI NRCS CPS Nutrient Management (Code 590) for land application of stored material or follow other disposal options outlined in a Comprehensive Nutrient Management Plan (CNMP).

Outlet. An outlet that can automatically release stored material is not permitted except for outlets leading to another storage facility with adequate capacity for releases due to accident or system component failure. Design a permanent outlet that will resist corrosion and plugging. Provide a backflow prevention measure for an outlet that pumps wastewater to secondary storage located at a higher elevations.

Staff Gauge. Place a staff gauge or other permanent marker that does not compromise the integrity of the liner in the liquid storage facility to clearly indicate the following elevations:

- Maximum operating level (top of the operational volume)
- Emergency level (top of the design storage volume)
- State or local codes may require additional markers

For storages where the contents or staff gage are not visible, such as below a slatted floor, identify the method for the operator to measure the depth of stored waste.

Safety. Identify and minimize the hazards to animals and people in the safety design. In particular, waste storage facility designs may create confined spaces, which may pose significant hazards in terms of the inhalation of poisonous gases, asphyxiation, or explosion. At a minimum, the safety design shall include the following:

- Include appropriate safety features to minimize the hazards of the facility (refer to American Society of Agricultural and Biological Engineers (ASABE) Standard EP470, Manure Storage Safety for guidance, as needed). Design and operate confined spaces where human entry might occur in compliance with the provisions contained in ASABE EP470, Manure Storage Safety.
- Characterize and identify any combination of effluent and amendments currently in use that may have the potential to create hazardous conditions.
- Provide warning signs, fences, ladders, ropes, bars, rails, and other devices as appropriate, to ensure the safety of humans and livestock. Provide ventilation and warning signs for covered waste holding facilities, as necessary, to prevent explosion, poisoning, or asphyxiation.
- Install safety stops, gates, or both at push-off ramps and load-out areas of impoundments and structures to reduce the potential for accidental entry of machinery.
- Ensure equipment access ramps and embankment slopes are compatible with the equipment intended to be used.
- Design covers and grating over openings such that livestock or humans cannot accidentally displace them and fall into the facility.
- Design pipelines with a water-sealed trap and vent, or similar device, if there is a potential for gases from the pipe to accumulate in confined spaces.
- Place a fence around impoundments and uncovered tanks which have exposed walls less than 5 feet above ground surface. Use the WI NRCS CPS Fence (Code 382) for design of a fence that will restrict access to safety hazards by people and animals likely to be on-site.
- Post universal warning signs to warn children and others from entering liquid waste storage facilities.
- Safety features should be added to the Operation and Maintenance Plan.

Roofs and Covers. Use WI NRCS CPS Roofs and Covers (Code 367) for design of waste storage facility covers or roofs, as needed.

Failure Analysis. Evaluate the overall functionality of the waste storage facility for possible malfunctions which could lead to sudden breach of embankment or accidental release of waste from the storage facility under normal operational conditions. Identified failure modes should be addressed in the design phase, the operation and maintenance plan, and the emergency action plan.

The Failure Analysis should include features, safeguards, and/or management measures to minimize the risk of failure or accidental release, or to mitigate impact of this type of failure when any of the features listed below might be significantly affected:

- Human safety
- Surface water bodies – perennial and intermittent streams, lakes, wetlands and estuaries
- Conduits to groundwater
- Artesian well features
- Critical habitat for threatened and endangered species
- Riparian areas
- Farmstead, or other areas of habitation
- Off-farm property
- Historical and archaeological sites or structures

Seeding and Mulching. Seed and mulch disturbed areas and embankments in accordance with WI NRCS CPS Critical Area Planting (Code 342).

Additional Criteria for Liquid Waste Storage Impoundments

The following criteria establish additional design parameters, acceptable installation processes, or performance requirements for liquid waste storage impoundments.

Foundation. Locate the impoundment in soils with a permeability that meets all applicable regulations (Table 1 meets the specific discharge requirements specified in the National Engineering Handbook (NEH), Part 651, Agricultural Waste Management Field Handbook (AWMFH), Chapter 10, Appendix 10D). Alternately, line the impoundment with suitable material. If a liner is needed, use liners which meet or exceed WI NRCS CPS 520, 521, or 522. Construction shall not occur on or with organic soils.

A combination of liners is acceptable. Join the liners so as to preserve the performance and integrity of all liner types. Concrete walls used within impoundments shall maintain the integrity of any liner. Construct and maintain any penetration and overfall/outfalls of the liner to maintain the performance and integrity of the liner used.

Waste storage impoundments that store milkhouse waste or feed storage runoff may be subject to the requirements of Wisconsin Administrative Code, Chapter NR 213 (NR 213) if the operation is considered a concentrated animal feeding operation or if compliance with NR 213 is required by other NRCS standards. NR 213 contains requirements not contained within this standard. If the waste storage impoundment is regulated under NR 213, the design must meet the requirements of both NR 213 and this standard.

Embankments. Non liner components of an impoundment embankment shall be constructed with mineral soil material compacted to WCS-204 requirements. The impoundment embankment shall be lined with (CPS 313) Table 1 Soils (In Place) material, a soil liner (CPS 520), or the selected liner component and soil component (WI NRCS CPS 521 or 522). The soil component shall be compacted following the Wisconsin Construction Specification listed in the applicable standard. The bottom of the liner shall be extended until it daylights the embankment. Minimum embankment top widths are shown in Table 2. Design the combined side slopes of the settled embankment to be equal to or flatter than 5 horizontal to 1 vertical. Interior side slopes must meet the design requirements listed in either Table 1 or the selected liner requirements, found in the pond liner standards (WI NRCS CPS 520, 521, and 522). Exterior side slopes may be no steeper than 2 horizontal to 1 vertical.

The top of the embankment may be constructed to drain, either toward or away from the stored waste, as desired by the designer. Add additional material above the required top width to accommodate desired drainage.

Increase the constructed embankment height by at least 5 percent to allow for settlement. After settlement, the top of the embankment shall be greater than or equal to 1 foot above the surrounding grade. Stabilize all embankments to prevent erosion or deterioration. Compact according to WI FOTG Construction Specification 204, Earthfill for Waste Storage Facilities or Construction Specification 300, Clay Liner, as applicable. For an impoundment with greater than one acre of surface area and where wave action is a concern, increase the embankment height to account for calculated wave height.

Any diversion or waterway along the embankment shall have a capacity for 25-year, 24-hour storm plus 0.5 feet of freeboard, with a minimum depth of 1 foot.

Construct a core trench whenever the settled embankment fill height at the centerline is greater than or equal to 10 feet. Minimum dimensions of the core trench shall be 8-foot bottom width, 2-foot depth, and 1 horizontal to 1 vertical or flatter side slopes.

Spillway or Equivalent Protection. For a facility having an effective height greater than 20 feet, construct an auxiliary (emergency) spillway designed to handle the peak flow or routed peak flow from the 25-year, 24 hour precipitation event, as defined in the Design Storage Volume section of this standard. The crest of the spillway shall be sited above the design storage volume elevation.

Excavations. Design embankments and excavated side slopes to meet the requirements of WI NRCS CPS 313, 520, 521 and 522, as applicable.

Table 1. In-Place Earth Criteria for Waste Storage Facility Impoundments 20 Feet Deep or Less [Note 1, 2]

Size		
Design Storage Volume	≤ 300,000 cu. feet	> 300,000 cu. feet
Manure Produced at Farm per Year	≤ 600,000 cu. feet	> 600,000 cu. feet
Waste Characteristics	≥ 4% manure solids in stored waste, ruminant animals only	All
Soils (In Place)		
% Fines	≥ 40%	≥ 40%
Plasticity Index (PI)	≥ 7	≥ 12
Total Thickness (measured perpendicular to storage surface, includes thickness of recompacted layer)	≥ 5 feet [Note 3]	≥ 5 feet [Note 3]
Thickness of Recompacted Surface Layer	≥ 1 foot	≥ 1 foot
WI FOTG Construction Specification for Recompacted Layer	204, Earthfill for Waste Storage Facilities	300, Clay Liner
Sub-Soil [Note 4]		
% Fines	≥ 20%	≥ 20%
Plasticity Index (PI)	—	—
Thickness (bottom and sides)	≥ 3 feet	≥ 3 feet
Separation Distances		
Well Distance [Note 5]	≥ 250 feet	≥ 250 feet
Sinkholes or Other Karst Features	≥ 800 feet	≥ 400 feet
Subsurface Saturation	≥ 8 feet	≥ 8 feet
Bedrock	≥ 8 feet	≥ 8 feet
Impoundment		
Inside Slope	2.5:1 or flatter	
Other		
Scour Protection	Agitation and Pumping Locations	Minimum 20 feet wide x 30 feet long x 4 inches thick concrete pad or sump in bottom and 20 feet wide ramp or a 16-foot wide ramp with 12-inch high curbs to the top of the facility.
	Scraping and Other Mechanical Means of Removing Solids and Sand	Protect with hard surfacing designed for the expected conditions and loads, a minimum of 4 inches thick.
Existing Field Drain Tile	Additional site investigation shall be completed to determine the presence of existing subsurface drain or underground outlet within 100 feet of the footprint of the facility. Any tile found must be abandoned or removed.	

Note 1 The depth is measured from the bottom of the impoundment to the maximum operating level.
Note 2 Facilities in this table do not meet the requirements of NR 213.
Note 3 Thickness is calculated based on a maximum permeability of 1x10 cm/sec
Note 4 Sub-soils are located beneath the required in place soils and above subsurface saturation or bedrock. Sub-soils must be in situ materials.
Note 5 Community water system wells may require larger separation distances (see Wisconsin Administrative Code, Chapter NR 811 (NR 811)).

Table 2. Minimum Embankment Top Widths

Effective Height (feet)	Top width (feet)
< 15	8
15–19.9	10
20–25	12

Additional Criteria for Fabricated Structures

The following criteria establish additional design parameters, acceptable installation processes, or performance requirements for waste storage structures.

Foundation. Based on subsurface investigation, provide a foundation for fabricated waste storage structures to safely support all superimposed loads without excessive movement or settlement.

Total and Differential Settlement. Where a non-uniform foundation cannot be avoided or where applied loads may create highly variable foundation loads, calculate both total and differential settlement based upon site-specific soil test data. Index tests (such as Atterberg limits, moisture content, etc.) of site soils may allow correlation with similar soils for which test data is available.

Bearing Capacity. If no site specific test data are available, presumptive bearing strength values for assessing actual bearing pressures obtained from Table 3 or another nationally recognized building code may be used. In using presumptive bearing values, provide adequate detailing and articulation to avoid distressing movements in the structure (i.e., settlement).

Structural Loadings. Design the waste storage structure to withstand all anticipated loads in accordance with the requirements in NRCS NEM, Part 536, Structural Design. Such loads should include internal and external loads, hydrostatic uplift pressure, concentrated surface and impact loads, and water pressure due to subsurface saturation, frost or ice. If a dense ice cover can be expected, account for the additional point load associated with an ice sheet against a vertical wall.

Calculate loading from lateral earth pressures using soil strength values determined from the results of appropriate soil tests and procedures described in NRCS Technical Release 210-74, Lateral Earth Pressures. Table 4 provides minimum lateral earth pressure values when soil strength tests are not available. If heavy equipment will operate near the wall, use an additional soil surcharge as indicated in footnote 4 in Table 4 in the wall analysis.

For the lateral load from stored waste not protected from precipitation, use a minimum 65 pounds/square foot/foot of depth as the design internal lateral pressure. Use a minimum value of 60 pounds/square foot/foot of depth for the lateral load from stored waste protected from precipitation and not likely to become saturated. Use a minimum internal lateral pressure of 72 pounds/square foot/foot of depth for sand-laden manure storage if the percentage of sand exceeds 20 percent. Designers may use lesser values if supported by measurement of actual pressures of the waste to be stored.

Design structure covers to withstand both dead and live loads. Use the minimum live load values for covers contained in ASABE EP378, Floor and Suspended Loads on Agricultural Structure Due to Use, and in ASABE EP393, Manure Storages. Use the actual axle load for tank wagons having more than a 2,000 gallon capacity.

If the structure is to have a roof, use WI NRCS CPS Roofs and Covers (Code 367) for design of waste storage facility covers or roofs, as needed. Use snow and wind loads specified in American Society of Civil Engineers (ASCE) SEI/ASCE 7-10 or newer version, Minimum Design Loads for Buildings and Other Structures. If the facility is to serve as part of a foundation or support for a building, consider the total load in the structural design.

Concrete Joints. Wall control joints with embedded waterstop – Cast-in-place cantilevered vertical walls shall have a control joint spacing less than or equal to 100 feet of running wall length, including around corners and bends. This criterion does not apply to hoop strength design or tanks with pin connections at both the top and bottom of the wall or to liquid-tight concrete walls designed in compliance with ACI-350.

Table 3. Presumptive Allowable Foundation and Lateral Pressure [Note 1]

Class of materials	Allowable foundation pressure (pounds per square foot)	Lateral bearing	Coefficient of friction	Cohesion (pounds per square foot)
Crystalline bedrock	12,000	1,200	0.70	-
Sedimentary and foliated rock	4,000	400	0.35	-
Sandy gravel or gravel (GW and GP)	3,000	200	0.35	-
Sand, silty sand, clayey sand, silty gravel, clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	-
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	-	130

[Note 1] International Building Code (IBC), 2015, International Code Council (ICC)

Waterstop. Use embedded or expansive waterstop in accordance with WI Construction Specification 004-WS Embedded or Expansive Waterstop. The type of waterstop is based on the joint movement criterion indicated below.

Install an embedded waterstop at the wall to footing intersection if the joint is designed for movement. Install either an expansive or embedded waterstop at this joint if it is not designed for movement (fixed).

If there is no embedded waterstop at the wall base, cast the wall joint waterstop a minimum of 4 inches into the footing. If there is an embedded waterstop between the footing and the bottom of the wall, weld the wall joint waterstop to a factory fabricated intersection at the base of the wall.

Floor joints in vertical walled structures, if used, should be extended through the footing and continue to the top of the vertical wall. Joints and liner shall meet the criteria listed in WI NRCS CPS Pond Sealing or Lining – Concrete (Code 522).

Joints for pre-cast walls shall demonstrate evidence of equivalent performance to waterstop joints as determined by the NRCS State Conservation Engineer.

Make transitions from concrete wall footings to concrete slabs at a ratio of one inch of thickness change to one inch of run (1:1) or flatter.

Table 4. Lateral Earth Pressure Values [Note 1]

Description of Backfill Material [Note 2]	Unified Soil Classification [Note 3]	Design lateral soil load (pounds/square foot/foot of depth) [Note 4]
Well-graded, clean gravels; gravel-sand mixes [Note 5]	GW	60
Poorly graded clean gravels; gravel-sand mixes	GP	60
Silty gravels, poorly graded gravel-sand mixes	GM	60
Clayey gravels, poorly graded gravel-sand mixes	GC	60
Well-graded, clean sands; gravely sand mixes	SW	60
Poorly graded, clean sands; gravely sand mixes	SP	60
Silty sands, poorly graded sand-silt mixes	SM	60
Sand-silt clay mix with plastic fines	SM-SC	100
Clayey sands, poorly graded sand-clay mixes	SC	100
Inorganic silts and clayey silts	ML	100
Mixture of inorganic silt and clay	CL-ML	100
Inorganic clays of low to medium plasticity	CL	100
Inorganic clayey silts, elastic silts	MH	Note 6
Inorganic clays of high plasticity	CH	Note 6

Note 1 Table 1610.1, Lateral Soil Load, International Building Code (IBC), 2015, International Code Council (ICC). For lightly compacted soils (85% to 95% maximum standard density). Includes compaction by use of typical farm equipment.

Note 2 Base the definition and classification of soil in accordance with ASTM D2487 and D2488.

Note 3 All definitions and procedures in accordance with ASTM D2488 and D653.

Note 4 Design loads based on moist conditions for the specified soils at optimum density. Include the weight of the buoyant soil plus hydrostatic pressure for submerged or saturated soil. Pressures are calculated for level backfill for a distance equal to the wall height. If backfill exceeds wall height at a distance equal to or less than the wall height, increase pressures accordingly. If equipment loads are expected or are possible to operate within a distance equal to the wall height behind the wall, use an additional live load soil surcharge equal to 2 feet of backfill for 5,000 pound wheel loads and more or less for other wheel loads, as appropriate.

Note 5 Generally, only washed materials are in this category.

Note 6 Not recommended. Requires special design if used.

Structural Design. Design structures with reinforced concrete, steel, wood, or masonry materials in accordance with NRCS-NEM, Part 536, Structural Engineering. Account for all items that will influence the performance of the structure, including loading assumptions, durability, serviceability, material properties, construction quality, waterstops, pipe penetration, channel penetrations, anchor plates, or other attachments to walls such as fence posts. Ensure that the material used for a fabricated structure is compatible with the waste product to be stored.

Indicate design assumptions and construction requirements on the construction plans. Construct any penetration of the structure to maintain the performance and integrity of the structure.

Tanks may be designed with or without a cover. Design covers, beams, or braces that are integral to structural performance accordingly and indicate their location and design requirements on the construction drawings. Design openings in a covered tank to accommodate equipment for loading, agitating, and emptying. Equip these openings with fencing, grills or secure covers for safety, and for odor and vector control as necessary.

Fabricated structures shall be designed according to the following criteria:

- Steel: Manual of Steel Construction, American Institute of Steel Construction.
- Timber: National Design Specifications for Wood Construction, American Forest and Paper Association.
- Concrete:
  - » Building Code Requirements for Reinforced Concrete, American Concrete Institute (ACI) 318. Concrete design calculations shall use a minimum design compressive strength of 3,500 psi.
  - » Code Requirements of Environmental Engineering Concrete Structures, ACI 350.
  - » Concrete used as part of a structure: WI Construction Specification 4, Concrete.

Separation Distance. Fabricated structures must meet the separation distances listed in the liner standard(s) used; see WI NRCS CPS 520, 521 and 522, as applicable.

Additional Criteria - Stacking Facilities

This criteria applies to stacking the following materials at the animal production area:

- Separated manure solids
- Compost
- Dewatered, recycled sand storage
- Poultry litter (turkey or broiler operations)
- Dry poultry layer manure
- Bedded manure (> 50% solids)
- Waste feed

Criteria for stacking facilities are shown in Table 5. Solids stacking within the animal production area may be done in an impoundment, fabricated structure or stacking slab, when provisions are made to capture seepage and runoff.

A stacking facility may be open, covered, or roofed and is used for wastes which behave primarily as solid. Determine the wall height using the anticipated stacking angle of the waste material. Construct a stacking facility of durable materials such as reinforced concrete, reinforced concrete block, or treated lumber. Design the stacking facility with adequate safety factors to prevent failure due to internal or external pressures, including hydrostatic uplift pressure and imposed surface loads such as equipment which may be used within, on, or adjacent to the structure.

Reduced seepage concrete with waterstop is allowed as a liner in place of the soil requirements of Table 5.

Seepage. All facilities lacking permanent, engineered roofs are considered not roofed for the purposes of this standard. Tarps, plastic coverings, or other temporary measures are considered not roofed. Facilities that are not roofed must have floors sloped to control surface drainage and all leachate and runoff (up to the 25-year, 24-hour storm) must be managed. Prevent influent seepage in amounts that would infringe on designed storage capacity. Seepage control may not be necessary on sites that have a roof or waste material with little seepage potential.

Internal Drainage. Make provisions for drainage of leachate, and rainfall from the stacking areas without a roof. Collect leachate and runoff in a facility suitable for liquid containment (as defined within this standard) or transfer receptacle meeting WI NRCS CPS Waste Transfer (Code 634), until land applied in accordance with WI NRCS CPS Nutrient Management (Code 590), or provide other acceptable treatment.

Poultry Litter Stacking Facility. To reduce the potential for spontaneous combustion damage to wood walled facilities, design the height of the litter stack not to exceed 7 feet, with litter to wood contact limited to 5 feet. Compost facilities should be designed and operated to meet the requirements of WI NRCS CPS Composting Facility (Code 317).

Design facilities to prevent run-on and runoff, and operate them to prevent ponding and significant hydrostatic head. Facilities may commonly be located near the ground surface, but may be above or below ground. Determine the wall height using the anticipated stacking angle of the waste material.

Table 5. Liner Criteria for Permanent Solids Stacking Facilities at the Animal Production Area [Note 1]

	Roofed		Not Roofed	
	Work Surface Note 2	**No Surface** Note 3	**Work Surface** Note 2	**No Surface** Note 3
Soils In-Place Liner [Note 3]				
% Fines	≥ 30%	≥ 30%	≥ 40%	≥ 40%
Plasticity Index (PI)	-	≥ 7	-	≥ 7
Thickness	≥ 2 feet	≥ 2.5 feet	≥ 3 feet	≥ 5 feet
Soils Compacted Liner [Note 3]				
% Fines	≥ 30%	≥ 40%	≥ 40%	≥ 40%
Plasticity Index (PI)	≥ 5	≥ 7	≥ 7	≥ 7
Thickness	≥ 1.5 feet	≥ 2 feet	≥ 2 feet	≥ 3 feet
Compaction	WI Spec 204	WI Spec 204	WI Spec 204	WI Spec 204
Separation Distances				
Sinkholes	≥ 400 feet	≥ 400 feet	≥ 400 feet	≥ 400 feet
Well Distance [Note 4]	≥ 100 feet	≥ 100 feet	≥ 100 feet	≥ 100 feet
Subsurface Saturation	≥ 3 feet	≥ 3 feet	≥ 5 feet	≥ 5 feet
Bedrock	≥ 3 feet	≥ 3 feet	≥ 5 feet	≥ 5 feet
Stacking Area	Stacking area not to exceed 7 acres for unroofed managed compost, 2 acres for sand, 2 acres for roofed facilities, or 1 acre for all other materials.			

[Note 1] Solids and sand stacking facilities, treatment areas and other production area structures and systems may be subject to surface water setbacks and other requirements under state and local rules. MOL requirements do not apply to this Table.

[Note 2] The work surface may be constructed of any of the following: minimum 3 in. for asphalt; minimum 4 in. for concrete; or minimum 8 in. for macadam, and designed for anticipated equipment loads. Refer to industry standard design criteria for each work surface material. The purpose of the work surface is to protect the liner material.

[Note 3] Facilities without a work surface must be operated to minimize rutting and removal of the soil liner. Ruts must be repaired and the soil liner thickness maintained after material handling. Stacking height is not to exceed 10 feet.

[Note 4] Additional separation distances to wells may be necessary on WDNR regulated farms.

CONSIDERATIONS

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

Consider using the companion documents located in Chapter 10 of the NRCS, Agriculture Waste Management Field Handbook (AWMFH).

Consider using the Waste Storage Design spreadsheet located in Chapter 10 of the NRCS AWMFH for design storage volume, liner thicknesses, and other calculations described in this standard.

This standard does not preclude the addition of other off farm organic materials not specifically prohibited by standard, pending approval by the appropriate regulatory authority. During planning, consider discussing the potential for off farm organic material storage with the landowner. Encourage the landowner to investigate the impact of accepting off farm organic material to waste consistency, toxic gas generation, nutrient management, and remaining volume prior to accepting any off farm waste. Incorporate any additional operation or maintenance requirements resulting from these discussions.

Consider implementing erosion control methods on the top half of the inside slopes of earthen impoundments.

Consider adding agitation locations on different sides of the storage facility, or different cardinal directions, allowing the location of agitation to be adjusted if wind direction changes.

Consider adding curbs, structural or visual components to all agitation and pumping locations, which may reduce the risk of accidental entry and damage to the liner during agitation.

When designing impoundment embankments, consider using flatter slopes on the outside embankment slope for better operation access and easier maintenance.

Consider adding an auxiliary spillway, additional embankment height, or both as needed to help protect the embankment, particularly for systems that store large volumes of runoff. Factors such as downstream hazards and receiving waters should be evaluated in this consideration.

Consider adding or including steel reinforcement in slabs that will be scraped; this may prevent vertical displacement at crack locations.

Consider placing a permanent marker to designate the empty level. This consideration is particularly important for operations considering future herd expansion to WPDES permit size (see Figure 1).

Monitoring and leakage collection systems should be considered for larger waste storage facilities, especially where the site assessment indicates the area is sensitive for groundwater impacts. This is particularly important for operations considering future expansion to WPDES permit size. Components of a designed system may include secondary containment (soil or synthetic), leachate collection, leachate recirculation, monitoring sumps, and/or monitoring wells. See Wisconsin Administrative Code, Chapter NR 141 (NR 141) for regulations concerning monitoring wells.

For exposed liners utilizing HDPE or similar materials that are slippery when wet, consider the use of textured liners or addition of features such as tire ladders that would allow for escape from the waste storage facility.

Consider solid/liquid separation of runoff or wastewater entering impoundments to minimize the frequency of accumulated solids removal and to facilitate pumping and application of the stored waste.

Due consideration should be given to environmental concerns, economics, the overall waste management system plan, and safety and health factors.

Since the economics and risks associated with waste storage facilities are quite high, consider providing the operator with the cost to close the facility. Cost should include removal of the planned sludge accumulation volume and the waste stored at the maximum operating volume.

Consider using well construction logs within ½ mile of the proposed facility, available from the Wisconsin Geologic and Natural History Survey and/or the Wisconsin Department of Natural Resources, which promote understanding of water supply aquifers in the area along with area hydrogeology.

Considerations for Improving Air Quality

Liquid manure storage may result in emissions of volatile organic compounds, ammonia, hydrogen sulfide, methane, nitrous oxide, and carbon dioxide. Solid manure storage may result in emissions of particulate matter, volatile organic compounds, ammonia, carbon dioxide, and nitrous oxide.

To reduce emissions of greenhouse gases, ammonia, volatile organic compounds, particulate matter and odor, other WI NRCS CPSs such as Anaerobic Digester (Code 366), Roofs and Covers (Code 367), Waste Treatment (Code 629), Amendments for Treatment of Agricultural Waste (Code 591), and Composting Facility (Code 317) can be added to the waste management system. Additionally, consider adding the following components: siting of livestock housing or feedlots, manure storage, and land application; biofilters; feed ration additives and adjustments; manure additives, disinfectants, or aeration; incorporation of manure when land-applied; moisture and dust control within livestock housing areas; and dead animal disposal plans.

For additional information on odor abatement, see ASABE EP379.54 April 2012, Management of Manure Odors.

Adjusting pH below 7 may reduce ammonia emissions from the waste storage facility but may increase odor when waste is surface applied, see WI NRCS CPS Nutrient Management (Code 590).

Some fabric and organic covers have been shown to be effective in reducing odors.

Maintain appropriate manure moisture content for solid manure storage facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice to achieve its intended use. This should include:

- Plan view of system layout.
- Minimum of two cross sections, perpendicular to each other, for each waste storage facility.
- Structural details of all components, including reinforcing steel, type of materials, thickness, anchorage requirements, and lift thickness, sufficient to clearly show the construction requirements.
- Locations, sizes, and type of pipelines and appurtenances including a profile of the waste transfer system.
- Requirements for foundation and preparation and treatment, including bedrock treatment.
- Surface Drainage/Grading plan.
- Subsurface drainage details.

- Location of soil test pits within 100 feet of the facility footprint on the plan view, and a summary of soil logs plotted on the cross sections or profile, with subsurface saturation and bedrock elevations marked, if encountered.
- Safety features, roof covers, fencing, ladders, and safety signs.
- Construction site erosion control practices.
- Specifications for materials and installation.
- Vegetative requirements.
- Quantity of materials.
- Approximate location of utilities and notification requirements.
- Other site-specific information necessary to construct the waste storage facility.
- Applicable Wisconsin Construction Specifications.
- Signature of the person responsible for the design, their engineering stamp, NRCS Job Approval or WDATCP Agricultural Engineering Practitioner Certification level, the date, and a statement attesting the plans meet the requirements of this standard and appropriate liner standard(s).

The following information should be included only if applicable to the project:

- Details for joining different liner types or new liners to existing liners.
- Waterstop joint layout for slabs and walls.
- References to components supplied by others (pumps, etc.).
- Identification of borrow source location(s).
- Reclamation plans for borrow area.

Engineering Design Documentation. Prepare engineering design documentation in compliance with the Design Deliverables in the WI NRCS Statement of Work for the WI NRCS CPS Waste Storage Facility (Code 313), and demonstrate that the criteria in the NRCS practice standard have been met. Include all substantiating data, assumptions, computations and analyses in design documentation. The design documentation shall include:

- Management assessment,
- Site assessment,
- Operation and maintenance plan,
- Construction plan,
- Construction Quality Assurance Plan,
- Engineering computations, such as runoff, structural (unless using NRCS Standard Drawings), earthwork quantities, and volumetric computations for sizing of waste storage facility.

Construction Quality Assurance Plan

A construction quality assurance plan is required that describes the type and frequency of testing, items requiring observation, and the documentation required. The plan shall be approved by a person with NRCS Job Approval, WDATCP Agricultural Engineering Practitioner Certification, a Wisconsin registered professional engineer, or staff under the direction and control of the person holding the aforementioned credentials. The construction quality assurance plan shall address all the following items:

- Contact information and responsibilities of key parties (including owner, designer, construction observer, and contractor).
- Pre-construction meeting agenda items (including quality assurance plan, construction plans and specifications, design change procedures, and critical project-specific items).
- Observation and construction verification (including items to be verified, sequencing, layout/staking, notification requirements, and on-site materials testing documentation).
- Items to be noted on as-built plans, job diary, and other certification (attesting) documentation.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan that is consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for its design. At a minimum, the plan will contain where appropriate:

Include a narrative describing the purpose of the system or structure and how it is intended to operate. This narrative should include design criteria such as number and type of animals, type of waste, type of bedding, days of storage, method for emptying, vehicle sizes intended to operate within or near the system and other pertinent operational information. Include the operational requirements for emptying the storage facility, including the expected storage period. Also include the requirement that waste be removed from storage and utilized at locations, times, rates, and volume in accordance with the overall waste management system plan and WI NRCS CPS Nutrient Management (Code 590).

Manage the stored waste such that it remains below the maximum operating level during normal operating conditions. Include a contingency plan, which shall be implemented when the maximum operating level is reached. The contingency plan shall include how to handle unexpected volumes of wastewater and/or runoff that could cause the system to overflow or negatively impact the liner before scheduled emptying can occur. The contingency plan shall provide for the safe disposition of waste. Include requirements for location and methods of waste removal and emergency disposal.

For impoundments and other liquid storages include an explanation of the staff gauge or other permanent marker to indicate the maximum operating level. For storages where the contents are not visible and a staff gauge would not be visible, such as below a slatted floor, identify the method for the operator to measure the depth of accumulated waste. Include requirements for monitoring the waste level relative to the permanent maximum operating level markers or indicators.

Include a provision for emergency removal and disposition of liquid waste in the event of an unusual storm event that may cause the waste storage facility to fill to capacity prematurely.

If an observation and pumping port is installed, monitor the discharge in the port for flow depth and pollutants. If pollutants are identified, block the gravity outlet and utilize a pump to remove the polluted liquids until the source is identified and repairs can be completed. Pump pollutants to an appropriate location (e.g. pumped back to the structure or spread per a nutrient management plan).

Describe safety issues and procedures/requirements connected with waste storage facilities, including confined spaces. Include additional measures needed to address the fatal or serious inhalation hazards of gases including, but not limited to, hydrogen sulfide (H2S), carbon dioxide (CO2), methane (CH4), and ammonia (NH3), which may or may not exist where manure gases are generated through the handling of liquid or semi-solid manure through activities such as pumping, mixing, agitating, spreading, or cleaning-out. Agitating open-air manure storage facilities can be especially hazardous when high humidity and low winds may cause hydrogen sulfide gas to reside near the storage.

Include instructions as needed for ventilating confined spaces according to ASABE Standard S607, Venting Manure Storages to Reduce Entry Risk.

Develop an emergency action plan for waste storage facilities where there is a potential for significant impact from breach or accidental release. Include site-specific provisions for emergency actions that will minimize these impacts.

Include a requirement to contact the appropriate regulatory authority for approval prior to storing any off-farm waste material in a waste storage facility that has been constructed using the criteria in this standard.

Include a description of the routine maintenance needed for each component of the facility. Also include provisions for maintenance that may be needed as a result of waste removal or material deterioration and requirements for inspecting and maintaining the structural components and mechanical systems.

Maintain appropriate manure moisture content for solid manure storage facilities. Excessive moisture will increase the potential for air emissions of volatile organic compounds, ammonia, and nitrous oxide, and may lead to anaerobic conditions, which will increase the potential for emissions of methane and hydrogen sulfide. Too little moisture will increase the potential for particulate matter emissions.

REFERENCES

American Society for Testing and Materials. Annual Book of ASTM Standards. Standards D 653, D 698, D 1140, D 1760, D 2487, D 2488, D5084. ASTM, Philadelphia, PA.

American Society of Civil Engineers (ASCE), Minimum Design Loads for Buildings and Other Structures, SEI/ASCE 7-10 or newer version.

American Society of Agricultural and Biological Engineers (ASABE), Standards EP378, EP393, EP379, and EP470.

Manual of Steel Construction, American Institute of Steel Construction.

National Design Specifications for Wood Construction, American Forest and Paper Association.

USDA NRCS. 1992. Agricultural Waste Management Field Handbook. USDA-NRCS, Washington, DC.

USDA NRCS. General Manual. USDA-NRCS, Washington, DC.

USDA NRCS. National Engineering Manual. USDA-NRCS, Washington, DC.

USDA NRCS. National Handbook of Conservation Practices.

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

USDA Soil Conservation Service. 1989. Technical Release Number 74, Lateral Earth Pressures, USDA-SCS, Washington, DC.

Wisconsin Administrative Code, Department of Natural Resources, Chapters NR 141, NR 213, NR 243 and NR 811.

DEFINITIONS

Animal Production Area – Means any part of the livestock operation that is used for the feeding and housing of livestock. This includes the entire animal confinement and feeding area, and any adjacent manure storage areas, raw materials storage areas, and waste containment areas. This does not include pasture and cropland.

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

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

Clean Water – Water that has not been mixed with manure, wastewater or other contaminants

Conduits to Groundwater – Sinkholes, swallets, fractured bedrock at the surface, mine shafts, non-metallic mines, tile inlets discharging to groundwater, quarries, or depressional groundwater recharge areas over shallow fractured bedrock. Wells were intentionally left out of this NR 151 list.

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

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

Control Joints – Control joints, often called contraction joints, are used to control the location of cracks caused by concrete shrinkage during setting and thermal changes. Steel reinforcement is interrupted in control joints with embedded waterstop.

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

Drainage System – Water conveyance measures of specified capacity, location, and material that insure the removal of water to a free outlet.

Effective Height – The difference in elevation between the auxiliary (emergency) spillway crest or the settled top of the embankment if there is no auxiliary spillway and the lowest point in the cross section taken along the centerline of the embankment at existing ground surface.

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

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

Gleyed Soil – A soil condition resulting from prolonged soil saturation, which is manifested by the presence of grayish, bluish or greenish colors through the soil matrix. Gleying occurs under reducing conditions, by which iron is reduced predominantly to the ferrous state.

Impoundment – A waste storage facility constructed of an earthen embankment(s) (which is lined) and/or excavations for the purpose of storing waste. The impoundment, below the existing ground, may be lined or unlined if meeting CPS 313, Table 1 Soils (In Place).

Impoundment depth – Depth is the distance from the bottom of the impoundment up to the maximum operating level (M.O.L.).

In-Place Earth – A waste storage facility impoundment where the entire bottom surface is sited where in-situ soils have sufficiently low hydraulic conductivity to provide waste storage without a constructed liner. The bottom is excavated a minimum depth of one foot into the in-situ soils as measured from the planned floor elevation.

Karst features – Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, network of interconnected fissures, fractures, disappearing streams, closed depressions, blind valleys, caves, and springs. See the companion document in Chapter 10 of the AWMFH for additional discussion of karst features.

Leachate – Concentrated liquid waste which has percolated through or drained by gravity from a pile of manure, manure processing derivative, or animal feed. It contains much higher concentrations of contaminants than Contaminated Runoff.

Liquid Waste Storage Impoundment – A facility where the stored material does not consistently stack and is either a manmade excavation, or diked area formed primarily of earthen materials, such as soil (although the unit may be lined with earthen or manmade materials) .

Manure Processing Derivatives – The by-products and waste components that are produced as a result of treatment and processing practices. These include, but are not limited to, the following waste components: separated sand, separated manure solids, precipitated manure sludges, supernatants, digested liquids, composted biosolids, process waters.

Nutrient Management Plans – A planning document that outlines the requirements for managing the amount, form, placement, and timing of applications of plant nutrients to cropland.

Perched Conditions – A soil moisture condition consisting of limited area including 1) saturated soil 2) depleted, gleyed or reduced matrices or, 3) reduced redoximorphic features, located above or part of a barrier to downward flow. Directly below the barrier to downward flow and above the normal free water elevation a soil moisture condition exists in a soil layer(s) which does not display 1) saturation; 2) depleted, gleyed or reduced matrices; or 3) reduced redoximorphic features.

Percent Fines (% Fines) – Percentage of given sample of soil which passes through a #200 sieve.

Permeability – The coefficient of permeability (K) is a measure of the ability of soil to transmit liquids. It is used to compute the flow rate of liquid through a soil liner for specific conditions of soil thickness and fluid head (e.g., $1x10^{-7}$ cm/s).

Plasticity Index (PI) – A soil property indicating moldability. Measured by ASTM D4318.

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

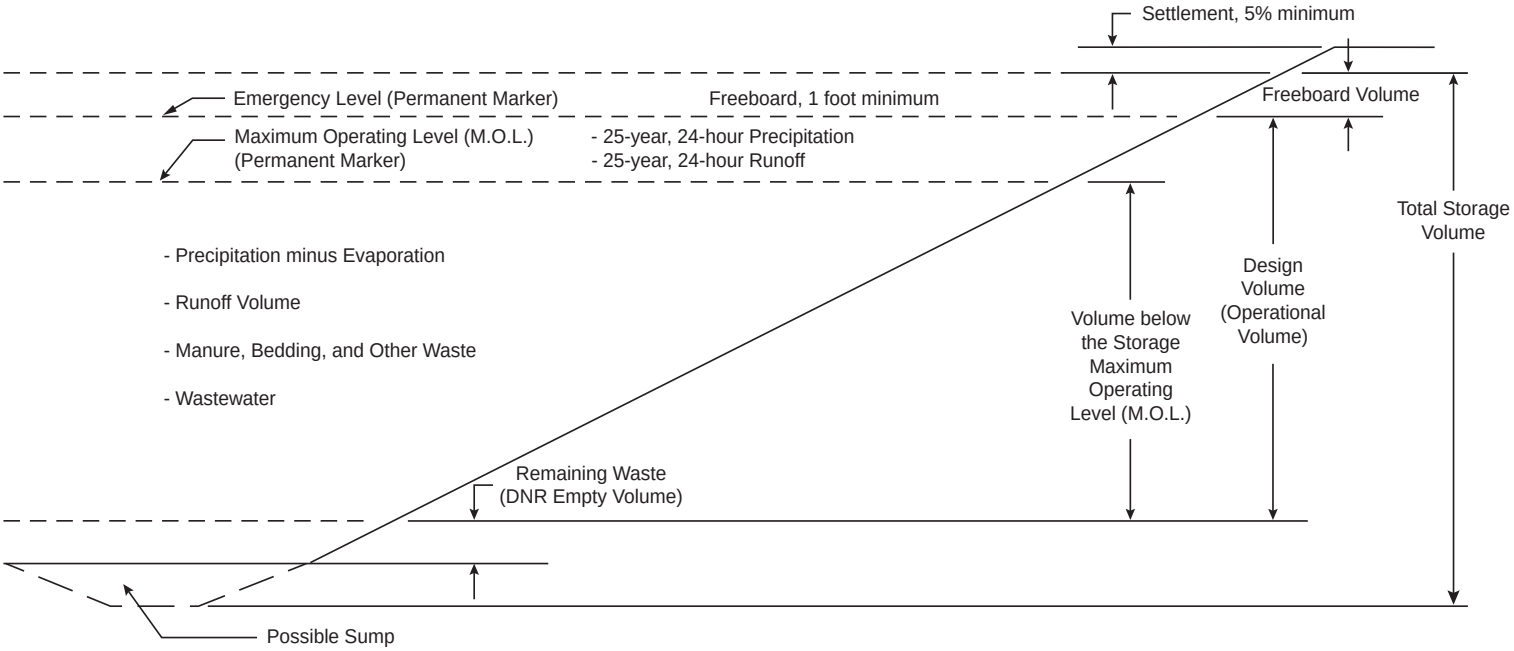
Structure – A waste storage facility consisting of constructed surfaces, tanks, or walls for the purpose of storing waste above or below the ground surface. Structures may be constructed of concrete, steel, wood or other construction materials.

Sub-Liner Soil – The soil directly below the bottom of the liner. This may be placed or in-situ material.

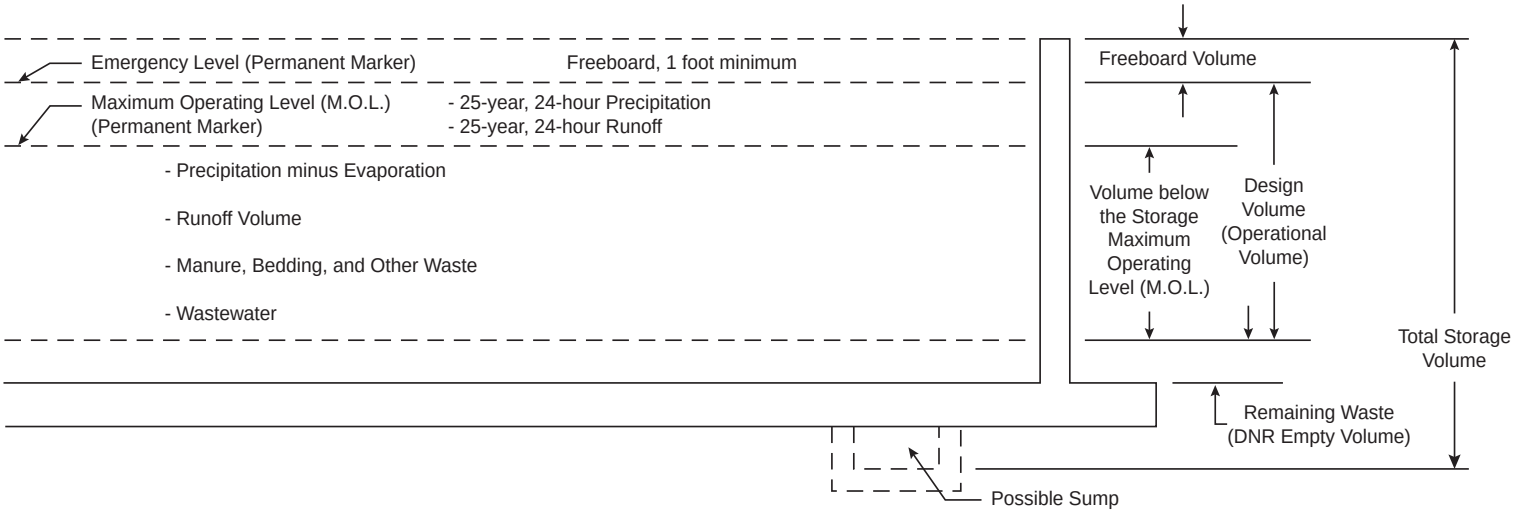
Sub-Soil – The soil directly below the bottom of the liner. This must be in-situ material.

Wastewater – Milking center waste, flush water, leachate from feed holding areas, and similar waste materials generated at the animal production area.

FIGURE 1
Design Storage Volume



IMPOUNDMENT



STRUCTURE

United States Department of Agriculture

CPS 367-1

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	Minimum Thickness Criteria	
Purpose	**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.

REFERENCES

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American Wood Council. 2012. National Design Specifications for Wood Construction. AF&PA, Washington, DC.

American Institute of Steel Construction. Steel Construction Manual, 14th Edition. AISC, Chicago, IL.

American Society for Testing and Materials. Annual Book of ASTM Standards. Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware, A 153. ASTM, Philadelphia, PA.

American Society for Testing and Materials. Annual Book of ASTM Standards. Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process, A 653. ASTM, Philadelphia, PA.

American Society of Agricultural and Biological Engineers. Floor and Suspended Loads on Agricultural Structures Due to Use, ASAE EP378.4. ASABE, St. Joseph, MI.

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American Society of Civil Engineers. Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-10. ASCE, Reston, VA.

American Wood Protection Association. 2014. AWPA Book of Standards. AWPA, Birmingham, AL

International Association of Geosynthetic Installers. HDPE and LLDPE Geomembrane Installation Specification. IAGI, St. Paul, MN.

International Building Code. 2012. International Code Council (ICC). ICC, Whittier, CA.

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Natural Ventilating Systems for livestock housing. Midwest Plan Service, MWPS-33, 1989.

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
⅜" (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
¾" (19.0 mm)	90-100
⅜" (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 be 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 1⅛ to 1½ inches.
- Where 2 inches clear distance is shown between reinforcing steel and forms, allowable clear distance is 1⅝ 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 1⅛ inches.

(ii) Reinforcement Support - Holding steel reinforcement in position with temporary supports is not permitted. Tack welding of bars is not permitted.

- Steel chairs, hangers, spacers; coated steel chairs, hangers, spacers; or plastic chairs may be used as supports.
- Precast concrete chairs may be used as supports providing the chairs are 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		
Top bars	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 superplacticizers.

(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 M. 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 Weather

(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

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

where:

E = evaporation rate, lb. /sq. ft. /hr.
Tc = concrete temperature, °F
Ta = 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 70 percent of the design strength has been attained through compressive strength testing on cylinders that have been cured on-site 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

004-WS EMBEDDED OR EXPANSIVE WATERSTOP

A. 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.

B. 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.

C. 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).

D. 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.

E. 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.

Split forms should firmly hold the waterstop in place to prevent misalignment of the waterstop during concrete placement. A tight fit between the waterstop and the form is also necessary to prevent excessive leakage of concrete paste, which could lead to honeycombing of the concrete.

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.

F. 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.

USDA United States Department of Agriculture
Natural Resources Conservation Service

Roof Structures for Water Quality Practices

Wisconsin Conservation Practice Job Sheet 367

Landowner: _____

County: _____ Address: _____

Design Phase

Conservation practices installed to address water quality resource concerns can benefit from the installation of a roof over the facility. The exclusion of precipitation reduces the volume of liquids to be contained within or treated by the facility. The management of the practice and handling of the materials can also be improved.

The roof and associated structure will be designed and sealed by an engineer or architect registered in Wisconsin. The following are to be provided to the landowner:

- ☐ Necessary foundation investigations (depth of footings)
- ☐ Laboratory testing of soils (if needed) for planning and design of the project (bearing pressure)
- ☐ All computations necessary for the roof
  - Design loadings ASCE-7 (current version)
    - ☐ Wind load (downward and uplift)
    - ☐ Snow load
    - ☐ Dead load
- ☐ All design calculations to support the:
  - ☐ Truss design
  - ☐ Purlin design
  - ☐ Post/truss connection
  - ☐ Post design
  - ☐ Anchoring design
  - ☐ Bracing
  - ☐ Diaphragm analysis
- ☐ References used (hanger loadings and other connections)

Signed and sealed

- ☐ Planning documents
- ☐ Design computations
- ☐ Construction drawings (Trusses, posts, connections, bracing, purlins, and hangers)
- ☐ Specifications

- ☐ A construction quality assurance plan stating the items requiring inspection, documentation requirements, and the qualifications of the personnel performing the inspections.
- ☐ An operation and maintenance plan
- ☐ Cost Estimate.
- ☐ A signed statement similar to the following: “To the best of my professional knowledge, judgment, and belief, this design and these construction plans meet NRCS Standard 367, Roofs and Covers.”

I have received the information listed above for the design phase of the project.

_____ _____

Signature of District Conservationist Date

I have received and accept the design information as meeting NRCS Standard 367, Roofs and Covers.

_____ _____

Signature of staff with Engineering Job Approval Date

Construction Checkout Phase

The following are to be provided to the landowner.

Practice construction documents to include:

- ☐ An as-built plan (showing approved changes from the original plan).
- ☐ All supporting documentation detailed in the construction quality assurance plan.
- ☐ A job diary providing a chronological record of work performed.
- ☐ A signed statement similar to the following: "To the best of my professional knowledge, judgment, and belief, this practice has been installed in accordance with the construction plans and specifications and meets NRCS Standard 367, Roofs and Covers".

I have received the information listed above for the construction phase of the project.

Signature of District Conservationist _____ Date _____

I have received and accept the construction information as meeting NRCS Standard 367, Roofs and Covers.

Signature of staff with Engineering Job Approval _____ Date _____

ONEIDA

DESIGN STANDARDS & CRITERIA

For

ONEIDA NATION

Engineering Department

(Revised: 05/05/17)

TABLE OF CONTENTS

1. PREFACE *Revised: 02/20/12*

1.1. The purpose of this document is to provide criteria for the ongoing planning and design of the ONEIDA NATION's facilities. It contains both generalized issues and specific requirements to be used in the design and construction of new and remodeled facilities.

1.2. The information provided in this document will be the basis upon which the ENGINEERING DEPARTMENT will review design documents to insure that the program requirements are being met and that the ONEIDA NATION's design criteria are being followed.

1.3. The ENGINEERING DEPARTMENT wants to work with outside consulting firms to ensure that valid engineering criteria are applied while developing solutions to the ONEIDA NATION's building requirements.

1.4. The ENGINEERING DEPARTMENT is responsible for and has authority to update/revise these standards and promulgate them to appropriate parties. In addition, the Department has authority to waive any requirement if it deems the waiver beneficial to the Oneida Nation.

1.5. Certain portions of these criteria may not apply to your specific project. Any deviations from these criteria shall be approved in writing by the ENGINEERING DEPARTMENT, prior to their incorporation into the design documents.

1.6. Consultants having any questions relating to these criteria or requiring additional information should contact their project's PROJECT MANAGER at 920-869-1600.

2. GENERAL ISSUES (non-technical)

2.1. CONTRACT DOCUMENTS *Revised: 09/07/12*

2.1.1. PROJECT MANUAL: The manual (specifications) shall be organized utilizing the Construction Specifications Institute MasterFormat 2004 or 2010 edition.

2.1.2. PROPRIETARY SPECIFICATIONS: Proprietary specifications sections will NOT be allowed, unless otherwise approved by the Owner. All sections shall list a minimum of two (2) and a maximum of six (6) separate manufacturers/suppliers. In lieu of the multiple manufacturer listing, the section may be written so as to provide a performance specification.

2.1.2.1. An exception to this requirement is that if the product is covered under the GSA Pricing Schedule it may be proprietary specified. Identification that the Owner is eligible for GSA pricing shall be denoted at the individual specification section for the product.

2.1.3. DOCUMENTS SUPPLIED TO OWNER:

2.1.3.1. To comply with the Oneida Paper Reduction Policy, all documents (except drawings) submitted to Owner shall be printed two-sided.

2.1.3.2. When the final Project Manual is issued, one copy shall be bound in a 3 ring binder.

2.1.3.3. When final CD drawings are issued, two (2) sets of drawings on half size sheets shall be provided.

2.1.4. PROJECT NUMBER: The Engineering Department's Project Number shall be noted on all documents prepared, including: letters, memos, estimates, schedules, specifications, construction documents, invoices, etc.

2.1.5. CONSTRUCTION DOCUMENTS: All documents shall minimize or eliminate the reference to "General Contractor" in notes or specification sections. This GC reference shall be eliminated from the documents if a Construction Manager is involved in the project.

2.1.6. DOCUMENT ISSUE LOG: All sheets in the set of construction documents shall identify the history of the sheet's issuance. For example, if sheet was issued by Owner DD review, Owner Final review, and Issued for Bidding, all of these issues shall be identified on each sheet with a date. This information can be in the revision portion of the title block.

2.1.7. CODE COMPLIANCE DRAWINGS: The set of construction documents shall include:

2.1.7.1. A Code Compliance Plan which delineates: fire rated walls, smoke partitions, and floor & attic smoke compartments, occupant load of rooms, egress path.

2.1.7.2. Code Compliance Data and Schedules which denote: applicable codes used for design, occupancy classification, construction type, sprinklered or non-sprinklered, smoke/fire detection /alarm systems, number of stories, number of streets, allowable area, occupant load, exit width, plumbing fixture calculations, off-street parking, etc.

2.2. DESIGN PROCEDURES *Revised: 12/17/15*

2.2.1. MEETING MINUTES: The A/E shall take minutes of all meetings at which they are present, and distribute to all attendees and other appropriate individuals.

2.2.2. DESIGN REVIEWS: At the END of the following phases all departments listed shall review the documents prepared by the Architect. The Owner's Project Manager shall be responsible to coordinate distributing documents to identified departments. The Engineering Department will review all phases and give instructions to the architect to proceed into the next phase after all approvals are received.

2.2.2.1. Schematic Design Phase (SD)

- DPW – Custodial (Space needs)
- DPW – Facilities (Space needs, DDC Controls, HVAC, electrical)
- DPW – Groundskeeping (Site Maintenance)
- DPW – Plumbing (Plumbing)
- EH&S Division - Conservation (mitigation concerns)
- EH&S Division – Environmental Quality (storm water management, NEPA coord.)
- EH&S Division – Health & Industrial Services (Recycling Space, Safety)
- MIS Department (Space Needs)
- Planning Department (Site Planning issues)
- Utilities Department (fire hydrant, water and sewer main materials and connections)
- Zoning Department (Preliminary Site Plan Review)

2.2.2.2. Design Development Phase (DD)

- DPW – Custodial (Space needs & finish material selections)
- DPW – Facilities (Space needs, DDC Controls, HVAC, electrical)
- DPW – Groundskeeping (Site Maintenance)

- DPW – Plumbing (Plumbing)
- EH&S Division - Conservation (landscape plant materials)
- EH&S Division – Environmental Quality (storm water management, NEPA coord.)
- EH&S Division – Health & Industrial Services (Recycling Space, Safety)
- MIS Department (Space Needs, Kronos, voice & data)
- Planning Department (Site Planning issues)
- Utilities Department (fire hydrant, water and sewer main materials and connections)
- Wells & Septic Department (Preliminary review of systems)
- Zoning Department (Preliminary Site Plan Review)

2.2.2.3. Construction Document Phase (CD)

- Division of Land Management – Real Estate Services (initiate process for easements approval)
- DPW – Custodial (finish material selections)
- DPW – Facilities (DDC Controls, HVAC, electrical)
- DPW – Groundskeeping (Site Maintenance)
- DPW – Plumbing (Plumbing)
- EH&S Division - Conservation (landscape plant materials and planting spec.)
- EH&S Division – Environmental Quality (storm water management, NEPA coord.)
- EH&S Division – Health & Industrial Services (Recycling Space, Safety)
- MIS Department (Kronos, voice & data)
- Planning Department (Site Planning issues)
- Risk Management (Fire Sprinkler System review, Insurance Requirements review)
- Utilities Department (fire hydrant, water and sewer main materials and connections)
- Wells & Septic Department (Review of systems)
- Zoning Department (Preliminary Site Plan Review)

2.2.2.4. Construction Administration (CA)

2.2.2.4.1. Pre-Bid conference:
- Indian Preference Department

2.2.2.4.2. Pre-Construction conference:
- Indian Preference Department
- EH&S Safety Department

2.2.3. CODE ISSUES: All building designs must comply with the Oneida Code of Laws – Chapter 66 – Building Code (*this code adopts the International Building Code and Wisconsin amendments by reference*) and documents shall be submitted for review, following standard Wisconsin procedures.

3. FACILITY & TECHNOLOGY FEATURES

3.1. DESIGN ELEMENTS *Revised: 12/17/15*

3.1.1. Data Rooms: All buildings shall have separate MIS (Management Information Systems) rooms. These functions are not to be combined with mechanical or electrical into one room. MIS room is to contain all telephone and computer network equipment.

3.1.1.1. Walls surrounding these rooms shall extend to underside of structure above and shall be a minimum of one-hour fire rated.

3.1.1.2. Provide 3’-0” clear floor area in front of and behind data rack for access and maintenance. Room dimensions shall comply with Owner’s *Data Room Configuration Standard.*

3.1.1.3. See MEP and Division 27 sections of this document for additional requirements.

3.1.2. Entrance Canopies: Design all canopies over doors to ensure there are no drip lines onto walkways leading to door. Preference is to pitch roof to either side of door.

3.1.3. Kitchens: where project includes a commercial kitchen, the Construction Documents shall denote the requirement that locations of equipment are to be permanently marked on floor per *NFPA 1 – Chapter 50 Commercial Cooking Equipment.*

3.1.4. Knox-Box: Construction Documents shall denote the requirement to provide a Knox-Box key box for the building. Contractor shall coordinate with local fire department to insure compliance with local standards.

3.1.5. Mechanical/Electrical Rooms: All buildings shall have separate mechanical, electrical, and Data rooms. These functions are not to be combined into one room.

3.1.5.1. Walls surrounding these rooms shall extend to underside of structure above and shall be a minimum of one-hour fire rated.

3.1.5.2. See MEP sections of this document for additional requirements.

3.1.6. Parapet Walls: Do not use on Oneida projects, unless approved by Senior Tribal Architect.

3.1.7. Site/Civil: Storm water management systems designed for project shall address water quality concerns in addition to water quantity management.

3.1.8. Toilet Rooms:

3.1.8.1. All multi-fixture toilet doors shall be designed to have the entrance doors swinging out of the room not into room. The out swinging doors limit the spread of bacteria by patrons who do not wash their hands after using the facilities. A patron can exit the facilities without touching the door hardware.

3.1.8.2. All restroom accessories (not in toilet stalls) shall comply with ADA requirements for protruding objects. Accessories protruding more than 4 inches shall be located in corners, alcoves, between other structural elements, or recessed in walls.

3.1.9. Tornado Shelter: All building shall have an area designated as a tornado shelter. The structure in the area of the shelter shall be reinforced to provide a higher level of protection. The shelter does not need to be an additional room not already in the program, using one of the programmed spaces is sufficient.

3.2. SPECIFICATION ELEMENTS *Revised: 02/20/12*

Equipment: where multiple pieces of the same equipment are provided, all pieces must be manufactured within one year of each other. Example: if two boilers are installed on project, manufacture date of each boiler must be within one year of each other.

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 11 00 Invitation to Bid *Revised: 11/18/13*

1. The Oneida Engineering Department shall make a determination of the bid process to be used for each project. The process can be invited bids or public bidding.

2. On projects where an invited bid process will be used, the list of invited bidders shall be derived from the *Oneida Engineering Department Master List of Contractors.*

3. On projects where a public bid process will be used, the Bid Advertisement shall be published in a minimum of the following publications:

    a. Kalihwisaks (Tribal newspaper) – Oneida Project Manager will coordinate submittal.

    b. Green Bay Press-Gazette – Consultant responsible for submittal. Consultant shall ensure the Tribe receives a proof of publication from the Green Bay Press-Gazette.

00 21 00 Instructions to Bidders *Revised: 12/17/15*

2.0 BID INVITATION/ADVERTISEMENT:

A. Bids received by owner at:
Engineering Department
N7332 Water Circle Place
Oneida, WI 54155

B. Bids will be opened privately if invited bid process used, and opened publicly for advertised bid process or if required by funding source.

3.0 BID DOCUMENTS

A. Bid Documents are **NOT** available at the office of the owner.

B. Bid Documents shall be sent to local plan rooms as follows (additional exchanges are at the Architect/Engineer's discretion):

American Indian Chamber of Commerce of Wisconsin – Plan Room 10809 W. Lincoln Ave. West Allis, WI 53227 414-604-2044 414-604-2070 Fax	Builders Exchange of Wisconsin, Inc. - Fox Valley Plan Room W2518 County Road JJ Appleton, WI 54913-9288 920-687-8782 920-687-8705 Fax http://bxwi.com/	

C. Bid Documents may also be made available at on-line websites.

4.0 SITE ASSESSMENT

A. A Prebid Conference shall be scheduled.

5.0 QUALIFICATIONS

A. Contractor shall submit an *AIA A305 Contractor's Qualification Statement* if specifically requested by Owner.

6.0 BID SUBMISSION

A. Submit three copies of bid.

B. Abstract summary of submitted bids will be made available to all bidders following bid opening.

7.0 BID ENCLOSURES / REQUIREMENTS

A. Bid Bond required.

B. Performance & Payment Bonds at owner's discretion, include cost on bid form.

C. See Supplementary Conditions for information regarding taxes.

00 22 00 Supplementary Instructions *Revised: 10/06/06*

1. Include a copy of the Oneida Engineering Department's *Document 00 22 01 - Indian Preference Vendors* in the Project Manual under this section and include listing of Certified Indian Owned Businesses following document.

00 31 00 Available Project Information *Revised: 10/06/06*

1. Include a copy of the Oneida Engineering Department's *Document 00 31 43 - Permit Fee Schedule* in the Project Manual under this section and include Oneida Zoning Department Permit Fee Schedule following document.

00 41 00 Bid Form *Revised: 02/20/12*

1. Performance & Payment Bonds at owner's discretion, include cost on bid form.

2. A subcontractors listing shall be included with bid.

3. Form shall list Contractor's name, address and telephone number, E-Mail address.

4. Within 24 hours of notification, apparent low-bidder will be required to submit the unit costs of products covered by GSA Schedule. Include Oneida Engineering Department's *Document 00 43 10 - Documentation of Special Pricing* in the Project Manual under this section. Architect shall complete the first two columns of form based upon materials selected for project.

00 52 00 Agreement *Revised: 05/05/17*

1. For Building Projects: The form of Agreement shall be *AIA Document A101, Standard Form of Agreement Between Owner and Contractor* and shall include the current *Oneida Nation's AIA Document A101, Modifications* amending the standard document.

2. For Civil Projects: The form of Agreement shall be *EJCDC C-520 Suggested Form of Agreement Between Owner and Contractor for Construction Contract (Stipulated Price)* and shall include the current *Oneida Nation's - Appendix A to: EJCDC C-520 Suggested Form of Agreement Between*

Owner and Contractor for Construction Contract (Stipulated Price) amending the standard document.

3. Other contract formats may be more appropriate for a particular project, confirm contract format with the Senior Tribal Architect.

00 71 00 General Conditions *Revised: 05/05/17*

1. For Building Projects: *AIA Document A201 General Conditions of the Contract for Construction* shall be the General Conditions between the Owner and Contractor.

2. For Civil Projects: *EJCDC Standard General Conditions of the Construction Contract* shall be the General Conditions between Owner and Contractor.

3. Other general conditions may be more appropriate for a particular project, confirm general condition format with the Senior Tribal Architect.

00 73 00 Supplementary Conditions *Revised: 05/05/17*

1. For Building Projects: Use the *Oneida Nation - AIA Supplementary Conditions* modifying AIA Document A201.

2. For Civil Projects: Use the *Oneida Nation - EJCDC Supplementary Conditions* modifying EJCDC C-700.

3. Include a copy of the Oneida Nation's *Indian Preference in Contracting Law (a.k.a Indian Preference Law)* in the Project Manual under this section.

4. Include the appropriate copy of the Oneida Engineering Department's *Document 00 73 43 Wage Rate Determination* in the Project Manual and include the appropriate wage rate determination. The county for Oneida projects will be Brown or Outagamie, verify project location. Wage rates will vary dependent upon specific project requirements:

   A. All projects with federal funding: use Davis-Bacon Wage determination and denote that rates apply to all workers.

   B. All other projects, Wage rates apply to workers hired from the Oneida Skills Bank, workers shall be paid according to the Wage Rate Determination established by the Indian Preference Office.

5. Security Requirements: Denote that Oneida Nation prohibits weapons on its property. Contractor will need to inform their employees and subcontractors. Contractor will also have to post signage prohibiting weapons on Oneida construction sites.

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00 Summary of Work *Revised: 10/18/95*

1. Identify work by Owner, if any.

01 20 10 Special Product Purchasing Procedures *Revised: 10/06/06*

1. Include a copy of the Oneida Engineering Department's *Document 01 20 10 - Special Product Purchasing Procedures* in the Project Manual under this section.

01 23 00 Alternatives *Revised: 10/06/06*

1. Include alternates to allow flexibility in scope adjustments necessary to bring project into budget. There will be no requirement as to the order of the alternate listing or priority of their acceptance.

01 31 19 Project Meetings *Revised: 10/18/95*

1. Identify requirements for having construction meetings and meeting minutes.

01 35 63 Sustainability Certification Project Requirements *Revised: 01/17/14*

1. Include this Section and note the following: "It is a goal of the Oneida Nation to minimize the environmental impact of its building projects consistent with our cultural beliefs to respect nature and conserve natural resources. While we do not intend to pursue a LEED Certification Rating, LEED will be used as a benchmark for evaluating sustainable design features."

    A. Identify any specific requirements or documents that the contractor(s) will need to submit to verify sustainable design features.

01 58 00 Project Identification *Revised: 02/20/12*

1. Provide a temporary project sign with a layout complying with the Owner's *Temporary Project Sign Standard Layout*.

2. Project Identification - the project sign shall identify an after-hours emergency telephone number for both the general contractor and the owner.

01 74 19 Construction Waste Management and Disposal *Revised: 10/06/06*

1. Include requirements for waste management and recycling of project materials under this section. Identify forms required to verify quantities of materials.

    A. WasteCap Wisconsin has sample specifications and forms available for download on their website www.wastecapwi.org

01 78 00 Closeout Submittals *Revised: 12/17/15*

1. Operations and Maintenance manuals shall be provided to Owner.

    A. Owner preference is for manuals to be provided on a CD as a Portable Document File (PDF).

    B. If paper copies are provided:

1. Owner will require three (3) copies.
2. Binder edge must be labeled with:
    a. Project Title
    b. Oneida Project number
    c. Volume number (if multiple volumes)

2. Operations and Maintenance manuals shall include (at a minimum):

A. Subcontractor / Material Supplier Listing. Identify the company name, address, phone, contact name, e-mail address, and identification of scope of work provided by Section number.

B. Warranty Letter from General Contractor identifying the date of Substantial Completion.

C. Specification Sections, identify each specification section in which work was provided, identify the name of subcontractor, included relevant data of materials used and their maintenance requirements.

DIVISION 02 – EXISTING CONDITIONS

DIVISION 03 - CONCRETE

DIVISION 04 - MASONRY

04 05 00 Common Work Results for Masonry *Revised: 10/06/06*

1. Sills:

A. Brick sills are not acceptable (row-lock or other). Sill must be either stone material or metal. Material should not have a joint across width of opening, unless it is a wide opening.

2. Masonry Embedded Flashings:

A. The following flashing materials are NOT ACCEPTABLE and cannot be specified:
    1. PVC Flashing.
    2. Aluminum Flashing.

B. The following flashing materials are acceptable:
    1. Rubberized asphalt.
    2. Copper, stainless steel, etc.

C. Flashings shall be specified and detailed as:
    1. Continuous at corners.
    2. Having end dams at ends of flashing at all openings. End dams shall be detailed on Construction Documents.
    3. Extending flashing as follows:
        a. <u>Multi-Wythe Walls:</u> Extend through back-up wythe to 1 inch from inside face of wall. Turn flashing back over itself a minimum of 1/4 inch to form a water dam.
        b. <u>Single-Wythe Walls:</u> Extend flashing to 1 inch from inside face of wall. Turn flashing back over itself a minimum of 1/4 inch to form a water dam.

c. Masonry walls where covered on interior with another finish material: Extend flashing entirely through masonry. Turn flashing up a minimum of ½ inch on inside face of masonry to form a water dam.

4. Flashing shall have a drip edge where exiting the exterior face of wall. If rubberized asphalt flashing is used, stop flashing short of exterior face of wall and provide a stainless steel drip and adhere flashing to drip.
5. Flashing shall extend a minimum of 6 inches above the "Mortar Net".

3. Masonry Cavity Drainage, Weepholes, and Vents:

A. The following methods for creating weepholes are NOT ACCEPTABLE and cannot be specified:
   1. Rope wick (rope eventually fills with sand and water and turns to cement, preventing the wicking of moisture and does not allow air into cavity).
   2. Oiled rod (hole created by removed rod eventually fills with debris, preventing the wicking of moisture and does not allow air into cavity).
   3. Plastic tubes (tube eventually fills with debris, preventing the wicking of moisture and does not allow air into cavity).

B. The following method is acceptable for creating weepholes:
   1. UV resistant recycled polyester mesh inserted into open head joint.
   2. "Weep Vent" by Mortar Net or equal.

04 27 00 Multiple-Wythe Unit Masonry *Revised: 10/06/06*

1. Cavity Walls:

A. Wall shall have a 2 inch clear drainage cavity.
B. Walls shall contain a "Mortar Net" or other similar product at all thru-wall flashing locations: wall base, lintel, etc.
   1. Full height of cavity with "Cav-A-Clear" or other similar product is acceptable in lieu of "Mortar Net" at wall base and lintels.

DIVISION 05 - METALS

DIVISION 06 - WOOD AND PLASTIC

DIVISION 07 - THERMAL & MOISTURE PROTECTION

07 27 00 Air Barriers *Revised: 02/20/12*

1. Provide air barrier as required by Building Code.

07 50 00 Membrane Roofing *Revised: 10/06/06*

1. Preferred roofing material for Oneida projects is Built-Up Bituminous Roofing. Verify roofing material with Senior Tribal Architect on each project.

DIVISION 08 - OPENINGS

08 70 00 Hardware *Revised: 03/21/14*

1. Doors to receive an access control device (proximity card reader) shall have an electric strike and associated conduit, supplied and installed by the Contractor.

   A. The electric strike shall be 24 volt DC.
   B. Access control system will be by owner under a separate contract (see 28 13 00).

2. On projects for the Tribe's Gaming Division, all locksets shall be specified with a Best Access Systems interchangeable core to match Owner's keying standards.

08 80 00 Glazing *Revised: 02/20/12*

1. Exterior glazing shall have a shading coefficient of 0.45 or lower.

DIVISION 09 – FINISHES

09 06 00 Schedules for Finishes *Revised: 02/20/12*

1. Wood base is not permitted where ceramic tile floors are used.

DIVISION 10 - SPECIALTIES

10 28 00 Toilet, Bath, and Laundry Accessories *Revised: 03/23/05*

2. All of the following items are supplied by Owner, installed by Contractor:

   A. Toilet Tissue Holders
   B. Paper Towel Dispensers
   C. Soap Dispensers (mounting on mirrors is not permitted by our Custodial Dept.)

3. All of the following items are supplied by Owner (no installation required):

   A. Waste Receptacles

10 44 00 Fire Protection Specialties *Revised: 10/18/95*

1. Fire extinguishers are by Owner. Cabinets supplied and installed by Contractor.

DIVISION 11 - EQUIPMENT

DIVISION 12 - FURNISHINGS

DIVISION 13 - SPECIAL CONSTRUCTION

DIVISION 14 - CONVEYING EQUIPMENT

14 20 00 Elevators *Revised: 02/20/12*

1. The following equipment is NOT allowed and cannot be specified on Oneida Nation projects:

   A. Kone Elevators.

DIVISION 21 - FIRE SUPPRESSION

21 00 00 Fire Suppression *Revised: 01/17/14*

1. All newly constructed Oneida Nation building shall have full fire sprinkler system installed.

2. Construction Documents for this system shall identify code, industry, and/or manufacturers required/recommended maintenance clearances as hatched areas around units/equipment.

3. A Clean-Agent Fire-Extinguishing System shall be utilized for fire suppression in the following room types:

   A. Data Centers, Data Rooms (of any size)
   B. Large file/record rooms
   C. Electrical rooms in Gaming facilities

4. “Omega” brand, manufactured by Central Sprinkler Co., Fire Sprinkler Heads by are not allowed and cannot be specified on Oneida Nation projects.

5. Flexible piping used in system:

   A. Braided is acceptable
   B. Corrugated is NOT acceptable

6. System plans and specifications shall comply with the Owner’s insurance carrier (FM Global) requirements.

7. Awarded Fire Suppression Contractor shall submit systems plans and specifications to the Owner (at same time as submitted for state plan review), for review by the Owner’s Risk Management Department and insurance carrier (FM Global).

DIVISION 22 - PLUMBING

22 00 00 Plumbing *Revised: 1/22/16*

1. Construction Documents for this system shall identify code, industry, and/or manufacturers required/recommended maintenance clearances as hatched areas around units/equipment.

2. The following equipment is NOT allowed and cannot be specified on Oneida Nation projects:

   A. Aerco Water Heaters
   B. A.O. Smith Water Heaters
   C. ProFlo fixtures

3. Plumbing, On large toilet rooms, (greater than three water closets), provide a keyed hose bibb connection located under the vanity counter.

4. All toilet room fixtures shall be sensor operated. Sensors shall be electrically powered. If this requirement seems excessive for scope of building verify owner requirements with Owner’s Project Manager.

5. Interior clean-outs on sanitary sewers shall be spaced a maximum of 75 feet on center. Clean-out shall be sized to pipe downstream. Prefer wall to floor clean-outs.

6. Cross connection control shall be provided at or near all mop basins.

7. Cross Connection devices shall comply with the Oneida Plumbing Department standard.

8. If project includes coolers and freezers, coordinate providing heat recovery water heater to use condenser wasted heat with HVAC design. Example manufacturer is “Therma-Stor”.

9. Provide floor drains in all toilet rooms. Verify if self-priming traps are required on project.

10. All water closets shall be installed with a seat height between 17 to 19 inches above floor. This requirement applies to all water closets, not just accessible water closets (exception allowed for fixtures serving child care areas).

11. Pipe size standards:

    A. Serving each water closet – 4” minimum diameter.
    B. Serving each urinal – 3” minimum diameter.
    C. Serving beverage (soda) dispenser – 4” minimum diameter receptor.

DIVISION 23 - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

23 00 00 HVAC *Revised: 12/17/15*

1. Construction Documents for this system shall identify code, industry, and/or manufacturers required/recommended maintenance clearances as hatched areas around units/equipment.

2. The following equipment is NOT allowed and cannot be specified on Oneida Nation projects:

   A. Fulton Pulse Boilers

3. HVAC system shall have a two year warranty.

4. HVAC system redundancy – system shall achieve heating and cooling loads by multiple units (i.e. boiler, chiller, compressor, etc.). Unit size shall provide approximately 50% capability to meet load requirements. Verify with Project Manager if any areas require 100% redundancy.

5. HVAC design shall not allow zoning of ventilation systems to permit service by a single unit for a majority of a given space or facility. If necessary or desired to use large, multi-zone systems, then system shall have multiple fan configurations.

6. HVAC Air Handling Units - Adjustable sheaves are NOT allowed on equipment as part of final installation. Adjustable sheaves may be used temporarily until system is balanced, but shall be replaced with fixed sheaves thereafter.

7. Electric Heaters are not acceptable on Oneida projects and shall not be designed into a heating system. The Engineering Department may approve use of electric heaters under certain circumstances, contact the Project Manager if electric heaters seem to be a viable option on a particular project.

8. Fin tube baseboard heating shall be installed with a shut-off valve at each end of fin pipe in each room to allow removal of section. Each section shall be installed with a drain valve.

9. The following Design Temperatures shall be used on Oneida projects:

		Code:	**Preferred / Design:**
Heating (min.)	Outside	-15 degrees F dry bulb	- 15 Degrees F Dry Bulb
	Inside	67 degrees F	70 degrees F
Cooling (max.)	Outside	87 degrees F	90 degrees F
	Inside	78 degrees F	75 degrees F

10. Refrigerants, HCFC (R-22) are not allowed on Oneida projects because of future EPA phase out and environmental reasons. Alternative refrigerants must be used in lieu of R-22.

11. Design shall not place air intakes near areas where idling vehicles will be parked. Need to avoid drawing vehicle exhaust into building HVAC system.

12. Condensers serving coolers and freezer shall be remotely located, verify maximum run with manufacturer.

    A. Option: provide heat recovery water heater to use condenser wasted heat. Example manufacturer is “Therma-Stor”.

13. Data Rooms shall be provided with an independent HVAC system to maintain an ambient temperature range of 68° to 75°F and an ambient relative humidity level between 45% and 55%.

14. All HVAC equipment shall be permanently labeled to match the HVAC plans.

15. Construction Documents for HVAC system shall identify responsible discipline for providing electrical disconnect switches on HVAC equipment, HVAC or Electrical contractor. Responsible party shall be noted on both HVAC and Electrical Construction Documents.

DIVISION 25 - INTEGRATED AUTOMATION

25 00 00 Integrated Automation *Revised: 11/18/13*

1. Oneida standard manufacturer for Direct Digital Controls is Schneider Electric – SmartStruxure Solution. Controls will be by Owner's standard vendor under a separate contract, unless noted otherwise in project requirements or contract. This section shall denote that HVAC contractor will coordinate with standard vendor.

2. HVAC Designer shall identify a Sequence of Operation so that Owner's control contractor can create a control point listing. HVAC Designer shall coordinate with Oneida DPW – Facilities to coordinate system control issues.

3. Sensor/Thermostats will be supplied and installed by Owner under a separate contract, unless noted otherwise in project requirements or contract. Wall box and conduit for sensor is to be supplied and installed by Electrical Contractor.

DIVISION 26 - ELECTRICAL

26 05 00 Common Work Results for Electrical Systems *Revised: 12/17/15*

1. Construction Documents for this system shall identify code, industry, and/or manufacturers required/recommended maintenance clearances as hatched areas around units/equipment.

2. HVAC Sensor/Thermostats will be supplied and installed by Owner under a separate contract. Wall box and conduit for sensor is to be supplied and installed by Electrical Contractor, note this requirement on electrical drawings.

3. Door Access Controls will be supplied and installed by Owner under a separate contract. Wall box and conduit for electric strike is to be supplied and installed by Electrical Contractor, note this requirement on electrical drawings.

4. Electrical panels/equipment shall not be installed on walls behind doors. Installation at these locations poses a safety hazard for maintenance personnel. No panels/equipment shall be installed within the area defined by ADA for Maneuvering Clearances at doors.

5. Aluminum is not allowed for wire, conductors, bus bars, etc. and cannot be specified on Oneida Nation projects.

6. 10 AWG conductors and smaller are to be stranded not solid.

7. On projects for the Tribe's Gaming Division, provide power receptacles in the toilet rooms to allow drying fans to be used. Coordinate locations with Gaming Facilities Director.

8. Construction Documents for Electrical shall identify responsible discipline for providing electrical disconnect switches for HVAC equipment, HVAC or Electrical contractor. Responsible party shall be noted on both HVAC and Electrical Construction Documents.

9. Conductors for branch circuits shall be sized to prevent a voltage drop exceeding 3% at the farthest outlet of power, heating, lighting and motor loads or combination of such loads.

10. The maximum total voltage drop on both feeds and branch circuits to the farthest outlet shall not exceed 5%.

11. The ground fault protection system shall be performance tested when first installed on site. A written record of the test shall be available to the Authority Having Jurisdiction (AHJ).

12. The ungrounded and grounded circuit conductors of each multi wire branch circuit shall be grouped with cable ties, tape, or similar means within the panel board or other point of origination.

13. A grounding conductor shall be pulled in each raceway. The raceway shall not be used as the grounding means.

14. Direct buried cables or conduits shall have a warning ribbon buried 12 inches above the cables or conduits.

15. Emergency circuits and normal circuits shall not share the same raceways.

16. All service conductors, motor conductors, and feeder conductors larger than # 4 shall have the insulation tested and documented with the date, time, and results and signed by the electrician conducting the test.

17. Raceways, boxes, and conduit bodies shall be of sufficient size to provide free space for the conductors.

26 05 26 Grounding and Bonding for Electrical Systems *Revised: 12/17/15*

1. Building and structures supplied by feeder(s) or branch circuit(s) shall comply with article 250.32 of the NEC.

2. All grounding electrodes as described in the NEC article 250.52(A)(1) through (A)(7) that are present at each building or structure served shall be bonded together to form the grounding electrode system. Where none of these grounding electrodes exist one or more of the grounding electrodes specified in NEC article 250.52(A)(4) through (A)(8) shall be used.

3. A metal underground water pipe shall be supplemented by an additional electrode of the types specified in the NEC article 250.52(A)(2) through (A)(8).

4. An intersystem bonding termination for connecting intersystem bonding conductors required for other systems shall be provided externally to enclosures at the service equipment or the metering equipment enclosure and at the disconnecting means for any additional buildings or structures.

5. Bonding of the piping system and the exposed structural steel shall comply with the NEC article 250.104.

6. Metal raceways shall not be used as equipment grounding conductors.

26 05 33 Raceway and Boxes for Electrical Systems *Revised: 12/17/15*

1. Junction boxes are to be a minimum of 2 1/8" deep, unless limited by stud cavity depth.

2. Boxes shall be independently supported.

3. EMT, IMC, AND RMC conduits shall be supported at intervals not exceeding seven (7) feet.

4. Couplings and connecters shall be steel set screw type (exception where the NEC prohibits this type of raceway fitting).

5. EMT, IMC, and RMC supporting straps shall be of the steel type.

6. MC cable shall not be used for service entrance, feeders or branch circuit wiring (exception when fished between access points through concealed spaces).

7. Where all conduits penetrate fire rated walls and ceilings the openings shall be fire stopped to maintain the rating of the walls and ceilings.

8. Emergency system box covers, fitting covers and enclosures shall be identified as emergency system components.

9. Conduit originating at panels, switch gear and load centers shall not be sized less than ¾ in.

26 05 53 Identification for Electrical Systems *Revised: 12/17/15*

1. Wiring colors shall be per standard NEC Code.

2. The ungrounded conductors of a 1 phase 120/240v and 3 phase 120/208v systems shall be colored coded black, red, and blue.

3. The ungrounded conductors of a 3 phase 277/480v system shall be color coded brown, orange, yellow.

4. Switch gear, motor control centers, and panels shall have name tag information labels on the equipment such as the voltage, amperage, phase, and location of source.

5. Disconnects shall have name tag information labels on them such as voltage, amperage of the overcurrent protection, phase and location of the source, and purpose of the disconnect if not evident.

6. Emergency system equipment such as switch gear, panels, generators and transfer switches shall be permanently marked so they will be identified as emergency equipment.

26 05 73 Overcurrent Protective Device Coordination Study *Revised: 12/17/15*

1. Electrical system coordination is required for short circuit protection where an orderly shut- down is needed to minimize the hazards to personnel and equipment.

26 06 20 Schedules for Electrical Distribution *Revised: 12/17/15*

1. Switch gear and panels shall have a circuit directory or circuit identification.

2. Feeders and branch circuits shall be identified with the panel label and circuit number at the source and the outlet(s) or equipment.

3. All conductors at termination and splice points shall be labeled with the panel and circuit number. Labels shall not be hand written.

26 24 00 Switchboards and Panelboards *Revised: 12/17/15*

1. Commercial grade equipment shall be used. Preferred manufacturer is Square D.

2. Aluminum is not allowed for bus bars and cannot be specified on Oneida Nation projects.

3. On projects for the Tribe’s Gaming Division, provide dedicated service panel(s) within observation and/or security areas.

4. Ground- fault protection of equipment shall be provided for solidly grounded wye electrical services of more than 150 volts to ground but not exceeding 600 volts phase to phase for each service disconnect rated 1000 amps or more.

5. Available fault-current for the service equipment other than dwelling units shall be legibly marked in the field with the maximum available fault current. The field markings shall include the date the fault current calculation was performed and be sufficient durability to with stand the environment involved.

6. All working space for electrical equipment per NEC article 110.26 shall be maintained.

7. Service equipment rated 1200 amps or more shall have disconnecting means remote from the service equipment. This shall be discussed and determined if feasible per project.

26 43 00 Transient Voltage Suppression *Revised: 12/17/15*

1. TVSS protection shall be installed remote from the electrical equipment it is protecting.

26 51 00 Interior Lighting *Revised: 12/17/15*

1. All lighting fixtures requiring ballast, shall have electronic ballasts specified.

   A. Owner's preferred ballast manufacturers are: Advance and Osram Sylvania.

2. 2 x 4 lay-in fixtures shall have split ballast to allow multiple lighting levels.

3. Dimmable ballasts are not allowed.

4. Suggested light fixtures shall be reviewed by Oneida DPW – Electrical Department.

5. Halogen lamps are not allowed in light fixtures.

6. 2 x 2 lay-in fluorescent fixtures are not allowed.

7. Light Switching:

   A. Provide wall or ceiling mount occupancy sensors at the following rooms (review specific locations with project team):
      1. Offices
      2. Small storage rooms
      3. Conference rooms
      4. Toilet rooms

   B. Occupancy sensors are NOT to be installed in Mechanical and electrical rooms.

26 52 00 Emergency Lighting *Revised: 12/17/15*

1. Mechanical rooms and electrical rooms shall have at least one battery backup emergency fixture. The emergency fixture shall share the same circuit as the normal lighting in these rooms.

2. Commercial building exits shall have emergency outdoor egress lights. Exception : where emergency outdoor egress lights at exits are not required by SPS 316 and NFPA 70.

26 53 00 Exit Signs *Revised: 12/17/15*

1. Exit lights shall be L.E.D.

26 56 00 Exterior Lighting *Revised: 12/17/15*

1. Lamps - reviewed options with Oneida DPW – Electrical Department.

2. Photo cell control in groups is acceptable.

3. Review requirements for receptacles at poles with project team.

4. Commercial building outdoor lighting shall be controlled by the Building Automation Direct Digital Control System (BAS DDC System).

DIVISION 27 - COMMUNICATIONS

27 00 00 Communications *Revised: 12/17/15*

1. Construction Documents shall require the Electrical Contractor to provide conduit and box roughed out to above ceiling for Owner voice and data outlets. Provide at all offices and other rooms as designated by Owner during design phases.

2. All rooms to receive voice and data outlets, shall have a minimum of two (2) voice and data outlets located so as to provide the most flexible arrangement of furniture in each room.

3. System design shall be compliant with the current edition of the *Oneida Casino Network Standards*.

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 13 00 Access Control *Revised: 11/18/13*

1. Oneida standard manufacturer for door access controls is Schneider Electric – SmartStruxure Solution. Controls will be by Owner's standard vendor under a separate contract, unless noted otherwise in project requirements or contract. This section shall denote that Electrical contractor will coordinate with standard vendor.

2. Construction Documents shall require the Electrical Contractor to provide conduit and box roughed out to above ceiling for Owner Access Control system.

28 16 00 Intrusion Detection *Revised: 10/12/06*

1. Owner will be incorporating a security system into project. System and monitoring will be by Owner's standard vendor under a separate contract. Coordinate equipment utility requirements with standard vendor.

28 31 00 Fire Detection and Alarm *Revised: 11/18/13*

1. Owner requires complete fire alarm system installation. Manufacturer: UTC Fire and Security.

   A. If this requirement seems excessive for scope of building verify owner requirements with Owner's Project Manager.

2. System plans and specifications shall comply with the Owner's insurance carrier (FM Global) requirements.

3. Awarded Fire Alarm Contractor shall submit systems plans and specifications to the Owner (at same time as submitted for state plan review), for review by the Owner's Risk Management Department and insurance carrier (FM Global).

4. Fire alarm system monitoring will be by Owner's standard vendor, unless noted otherwise in project requirements or contract. Coordinate equipment installation with standard vendor.

DIVISION 31 - EARTHWORK

31 09 00 Geotechnical Instrumentation and Monitoring of Earthwork *Revised: 10/06/06*

1. The following wording shall be added to all appropriate site preparation and earthwork sections:

   A. "An Oneida Archaeological Site Monitor is required to be on the project site during all ground breaking and earth moving activities. The Contractor is to give the Oneida Project Manager adequate notification as to when these activities are scheduled and the Oneida Project Manager will make arrangements to have a monitor available during these activities. Particular care is to be given when ground breaking begins and at any time during the earth moving process. If at any time during the process artifacts or human remains are uncovered/discovered, construction is to cease immediately and the Oneida Project Manager is to be contacted. The Oneida Project Manager will in turn contact the Oneida Tribal Historic Preservation Office for proper handling and care of these finds -- BEFORE REMOVAL FROM THE EARTH!"

31 10 00 Site Clearing *Revised: 05/05/17*

1. Clearing and Grubbing Construction Documents shall denote:

   A. Contractor will be required to obtain a Tree Cutting Permit from the Oneida Conservation Department.
   B. Removed trees (5" caliper and larger) are the property of the Oneida Nation and shall be returned to the Tribe.
   C. Limb and cut trees into 8'4" lengths and deliver to Oneida Conservation Department.
   D. Properly dispose of stumps, brush, branches and other debris off site.

   E. Oneida Conservation Department – Compost Yard
   N8085 County Road U
   Oneida, WI 54155
   920-869-1450

2. Earthwork sections shall denote that excess top soil and sub-soil is the property of the Owner and shall be delivered to a site determined by Owner.

   A. Identify the address of the owner's property where material will be stock piled with Owner's Project Manager, and include in Construction Documents.

31 20 00 Earth Moving *Revised: 12/17/15*

1. Civil Engineer shall determine if Oneida has stock piled soils available to meet the fill requirements of the project. Coordinate with the Oneida Material Team to confirm available soil types and quantities. If stockpiled material meets the project needs, earthwork sections shall denote location and use of material. No imported material will be allowed if sufficient stockpile material is available. Identify the address of the owner's property where material will be loaded for delivery to project site.

   A. Material Team contact: Mary Jo Nash, 920-869-1690 ext. 6612, mnash@oneidanation.org

2. Construction Documents must denote the requirements for truck routes to and from the stock pile location. Routes shall maximize utilization of use state highway, followed by county highways, then municipal roads. Routes over municipal roads shall be minimized to the greatest extent possible.

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 10 00 Bases, Ballasts, and Paving *Revised: 02/20/12*

1. Parking, in addition to the required amount of handicap parking spaces provide "Elder Parking" spaces in a quantity to match 50% of the quantity of handicap spaces, but no less than two.

   A. Size of spaces shall be standard parking stall.

32 80 00 Irrigation *Revised: 10/06/06*

1. Irrigation systems are not allowed on Oneida projects. Landscaping is NOT to be irrigated.

32 90 00 Planting *Revised: 10/06/06*

1. To the maximum extent possible, plant materials should be indigenous to Wisconsin, and drought tolerant.

2. At sloped roof drip lines, provide ground cover to protect exterior building wall from splash stains.

DIVISION 33 - UTILITIES

DIVISION 34 - TRANSPORTATION

DIVISION 35 - WATERWAY AND MARINE CONSTRUCTION

APPENDIX A

REFERENCED DOCUMENTS LISTING: *Revised: 05/05/17*

A.1 *Oneida Engineering Department Master List of Contractors*

A.2 *Oneida Nation's AIA Document A101, Modifications*

A.3 *Oneida Nation's - Appendix A to: EJCDC C-520 Suggested Form of Agreement Between Owner and Contractor for Construction Contract (Stipulated Price)*

A.4 *Oneida Nation's Indian Preference in Contracting Law (a.k.a Indian Preference Law)*

A.5 *Oneida Nation - AIA Supplementary Conditions*

A.6 *Oneida Nation - EJCDC Supplementary Conditions*

A.7 *Oneida Engineering Department's Document 00 22 01 - Indian Preference Vendors*

A.8 *Oneida Engineering Department's Document 00 31 43 - Permit Fee Schedule*

A.9 *Oneida Engineering Department's Document 00 43 10 - Documentation of Special Pricing*

A.10 *Oneida Engineering Department's Document 00 73 43 Wage Rate Determination*

A.11 *Oneida Engineering Department's Document 01 20 10 - Special Product Purchasing Procedures*

A.12 *Oneida Nation - Temporary Project Sign Standard Layout*

A.13 *Oneida Nation – Data Room Configuration Standard*

A.14 *Oneida Casino Network Standards*