

TOWN OF BYRON

BOARD OF APPEALS

APPLICATION FOR VARIANCE FROM ZONING ORDINANCE

OR GRANTING OF SPECIAL USE

NAME: Fond du Lac Stone Development, LLC, Dennis Buechel

ADDRESS: N4224 State Road 175 Fond du Lac, WI 54937-9204

PHONE: 920.921.8280

DATE: March 12, 2026

REASON FOR REQUESTING VARIANCE OR SPECIAL USE:

Non Metallic Mining is a Special Use under Article VII (Farmland Preservation District) 7.47

LEGAL DESCRIPTION OF PROPERTY WHERE VARIANCE OR SPECIAL USE IS REQUESTED:

•T041417150300100 (40.00 Acres)

•T041417150400100 (32.42 Acres)

•T041417151400100(40.00 Acres)

DRAWING OR MAP SHOWING SET BACK DISTANCE FROM ROADS, LOT LINE, WELL, SEPTIC LOCATION AND OTHER BUILDINGS. SHOW ON DRAWING LOCATION WHERE VARIANCE IS REQUESTED.

FEE FOR VARIANCE OR SPECIAL USE REQUEST IS: \$750.00 PLUS ANY ATTORNEYS FEES ABOVE AND BEYOND PREPARATION OF LEGAL NOTICES. (AS PER SEC 14.2 OF THE TOWN OF BYRON ZONING ORDINANCE) IF ATTORNEY OR OTHER PROFESSIONAL WITNESSES OR SERVICES ARE REQUIRED, APPLICANT WILL BE CHARGED FOR THEIR SERVICE AT THEIR CUSTOMARY HOURLY RATE. IN THE EVENT THE ATTORNEY CHARGES DO NOT EXCEED \$750, THE DIFFERENCE WILL BE REIMBURSED TO THE APPLICANT.**NO MEETING SHALL LAST BEYOND 3 HOURS. MAKE CHECK PAYABLE TO TOWN OF BYRON.**

APPLICANT MUST BE AT THE PUBLIC HEARING TO ANSWER ANY QUESTIONS THE BOARD MAY HAVE.

RETURN 5 COPIES OF ALL DOCUMENTS, OR HAVE DOCUMENTS AVAILABLE FOR THE USE OF APPEAL BOARD MEMBERS AT THE PUBLIC HEARING. YOU WILL BE NOTIFIED BY MAIL OF THE DATE OF THE PUBLIC HEARING.

RETURN TO: KATIE TREWIN
TOWN OF BYRON CLERK
W5232 BROOKSIDE RD
FOND DU LAC, WI 54937

**Fond du Lac Stone
Development, LLC**

Operation, Erosion Control
Implementation Plan and
Environmental Control
Plan

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INTRODUCTION

Fond du Lac Stone Development, LLC , (hereafter referred to as “FDL Stone”) is applying for approval to open a nonmetallic mine site in part of the east half of Section 15 in the Town of Byron (TWP 14N, RNG 17E), Fond du Lac County. FDL Stone owns three parcels with a total acreage of 112.42 acres. The products that will be produced from the limestone, include sand and gravel of various sizes and dimensional stone which will be used for state, residential and commercial projects.

Parcel Numbers:

- T041417150300100 (40.00 Acres)
- T041417150400100 (32.42 Acres)
- T041417151400100(40.00 Acres)

Estimated Extent of Mining

The extent of mining is designed to meet the applicable requirements as established in the Town of Byron’s Zoning Ordinance. The initial extraction area will consist of approximately 28 acres and will be operated in two phases. An Operation & Phasing Figure is provided to illustrate the estimated extraction area, along with the operational phasing.

Contact Information

Dennis Buechel
Fond du Lac Stone Development, LLC
N4224 State Road 175
Fond du Lac, WI 54937-9204
(920) 921-8280

OPERATION PLAN

Topsoil will be stripped and stockpiled as berms around the extraction area. The length and size of the berms will be dependent on the amount of topsoil stripped on site. However, they will be a minimum of ten feet high. Berms will provide noise abatement, dust control, and visual aesthetics as well as for future reclamation.

Operations will generally progress from the South to the North. Portable crushing, washing, and screening equipment will be brought in as needed for the processing of material. The result will be a variety of construction materials for use on projects in the surrounding communities. All processing and warehousing of stockpiles will be located within the operational area. No shed or manufacturing building will be erected onsite for processing dimensional stone. All dimensional stone will be transported to the existing facility at 4209 State Highway 175.

See the table below for the typical list of equipment used for this site.

Equipment List

<i>Crushing/Washing Equipment</i>	<i>Highway</i>
Primary crusher	Dump trucks
Secondary crusher	Graders
Screening plant	Roller
Wash plant	Loader
Surge bin	Water truck
Stacking conveyor	Broom tractor
Quarry trucks	Portable truck scale and scale house
Bulldozer	
Front end loader	
Miscellaneous trailers	
generators	

Travel Routes

All the traffic will be entering and exiting onto State Hwy 175.

Operating Hours

Weekdays: 6:00 a.m. to 6:00 p.m.

Saturdays: 6:00 a.m. to 2:00 p.m.

Blasting Hours

Monday – Friday: 7:30 a.m. to 4:30 p.m.

Drilling Hours

Monday – Friday: 7:30 a.m. to 5:00 p.m.

No operational hours for Sundays or legal holidays.

Repairs or maintenance may have to be performed after operating hours.

**Extended hours may be required due to WISDOT requirements*

SAFETY AND ENVIRONMENTAL CONTROLS

As with any industry, nonmetallic mineral extraction is regulated by the Department of Commerce (DCOMM), Mining Safety and Health Administration (MSHA) and the Department of Natural Resources (DNR). DCOMM regulates safety issues, MSHA regulates on-site safety practices, noise, and dust, and DNR regulates activities with potential impacts to air, water or land. Site-specific approvals from the appropriate regulators will be obtained after local approvals have been granted.

Safety Controls

Working berms will be an integral part of the Safety and Environmental Control Plan. The berms will create a buffer zone between the project area and neighboring landowners. A locking gate will be placed at the entrance and will continue to be used as long as the pit is operational.

Fugitive Dust Control

At nonmetallic mining operations or any construction sites, small particulates less than 30 microns in size (One micron equals one millionth of a meter) become airborne through wind and/or equipment movement. Factors affecting emissions include the amount of crushing and hauling activity at the site, processed material type and associated moisture content, topographical and climatic factors, equipment type, and operating practices.

Dust control measures are employed during periods of active operation in concentrated areas of fugitive dust. Areas containing higher concentrations of fugitive dust typically include haul roads and areas encompassing the crushing equipment. Therefore, it is generally these areas that receive the most aggressive dust control measures. The most efficient forms of dust suppression include the application of water to haul areas by specialized water trucks equipped with spray bars, as well as sprayer equipped crushing equipment. A power broom will also be used on an as needed basis to keep roadways at ingress and egress free from debris.

Surface Water and Ground Water Protection

Measures to minimize erosion and limit off-site storm water runoff may include vegetative cover, erosion hay bales, silt fencing and rip-rap, as necessary. FDL Stone' erosion control practices mirror those found in the "Wisconsin Construction Site Best Management Practices" handbook (DNR Pub. WR-222-89). FDL Stone currently holds a Wisconsin Pollution Discharge Elimination System Permit (WPDES) for the management of storm and wastewater generated at the site.

Small amounts of fuel and oil may be stored at the site for equipment operation purposes. Proper handling and containment procedures will be followed to keep the project area free of contaminants. For minor spills, emergency response kits will be maintained on-site and to prevent spills due to vandalism, petroleum products will be secured each night in locked trailers. In the event of an accidental spill, an emergency hazardous materials response team will be on call 24 hours per day to facilitate cleanup.

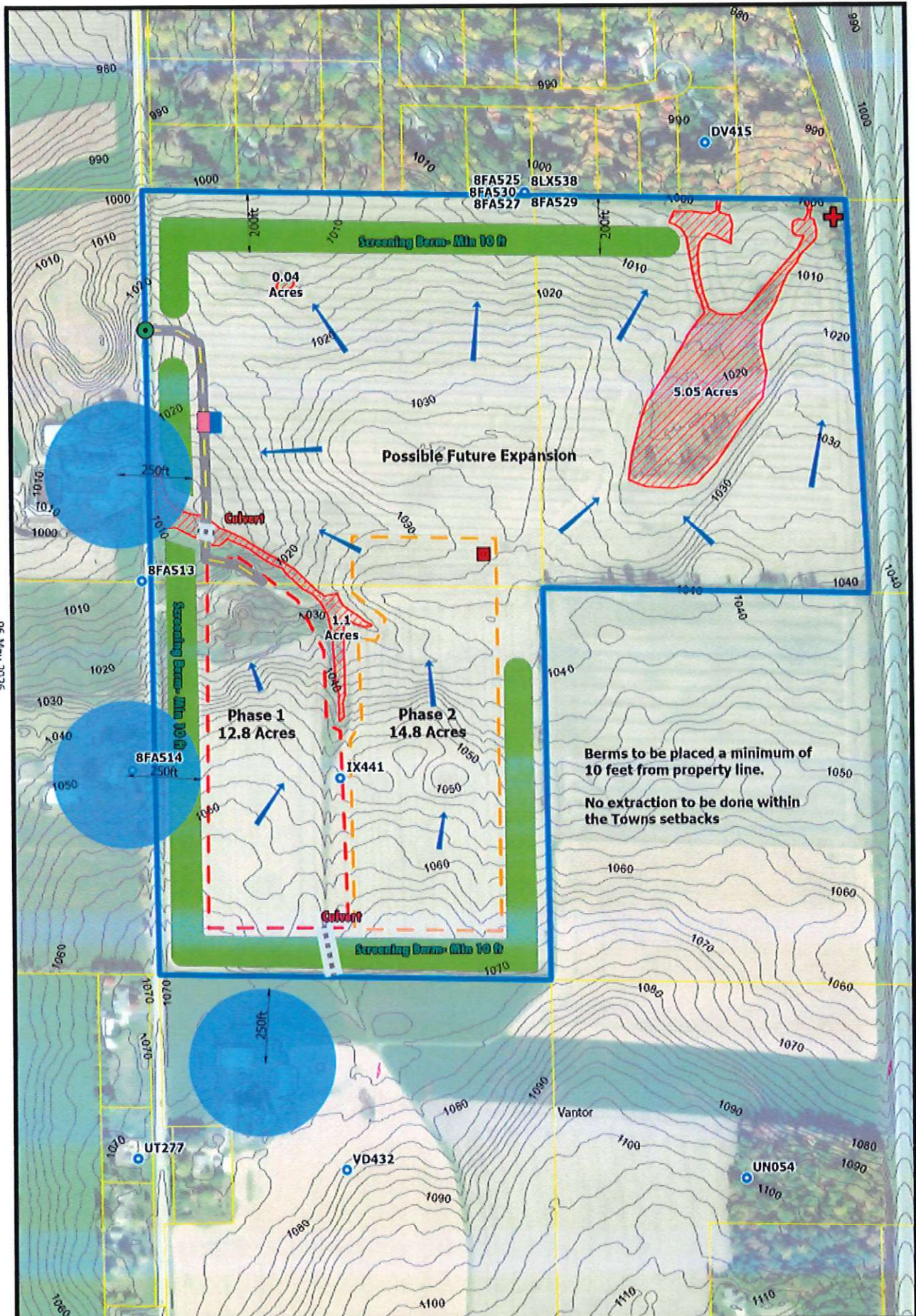
Land Reclamation

When the site is depleted of the aggregate resource the land use will remain agricultural with a 23 acre lake with passive recreation around the outside. The remaining 85+ acres will be actively farmed. Nonmetallic mining reclamation is governed by Fond du Lac County's Nonmetallic Mining Requirements.

APPENDIX A

❖ Operations & Phasing Plan

06 May 2026



Operations Plan



Legend

- Well Location
- Outfalls
- Berm
- Drainage
- Entrance
- Study Horne
- Scale
- Well Unopen
- Well ID
- Application
- Extant
- Acquired
- Delisted
- Wetland
- Links

Operations Plan

Town of Byron, Fond Du Lac, WI Sec 15

Fond du Lac Stone Development, LLC



RECEIPT

DATE

5/14/24

No.

054040

RECEIVED FROM

~~For~~ ^{Natural} Stone Development

\$1,000

one thousand and 0/100

DOLLARS

FOR RENT

FOR New Permit Review

1173

ACCOUNT

☐ CASH

PAYMENT

☒ CHECK

BAL. DUE

☐ MONEY ORDER

☐ CREDIT CARD

FROM

TO

By *James Kuegel*

Fond du Lac County Nonmetallic Mining Reclamation
Code Enforcement Office, 160 S. Macy St., Fond du Lac, WI 54935
Phone: (920) 929-3139 Fax (920) 929-7655

**Reclamation Permit Application for
New or Re-Opened Mine Sites**

Fond du Lac County Use Only

Permit No. **MX-**

Use of this form is required by the Fond du Lac County Code Enforcement Office for any nonmetallic mining reclamation permit application filed pursuant to Section 36.31 of the Fond du Lac County Nonmetallic Mining Ordinance and s. NR 135.18(2), Wisconsin Administrative Code. Please complete this form in its entirety and submit to Fond du Lac County along with **two** complete copies of the reclamation plan which meets the requirements set forth in NR135.06.15. In addition, a **nonrefundable permit application fee** is due at the time of application. The annual fee payment will be determined after the submittal of application, but prior to approval. Payment of annual fee will be required prior to permit issuance.

1. Applicant/Operator Fond du Lac Stone Development, LLC	2. Property Owners/Lessors (if different from Applicant/Operator) (Submit additional owner/lessor on separate sheet)* same
Street Address N3895 STATE ROAD 175	Street Address same
City, State, Zip FOND DU LAC, WI 54937	City, State, Zip same
Telephone Number (include area code) 920.921.8280	Telephone Number (include area code) same
Email Address dennisb@fdlstone.com	Email Address same

*If there are additional persons who hold title to the property, provide information on an attached sheet.

3. Property Description: Provide the complete legal description of the property on which the mine is located, as found on the property deed. Example: N ½ NE 1/4, Section 3, T29N, R6E SE ¼ NE ¼, Section 15, T 14 N., R 17 E.	
Town/City/Village of Town of Byron	
Tax Parcel Number(s) •T041417150300100 (40.00 Acres) •T041417150400100 (32.42 Acres) •T041417151400100(40.00 Acres)	Total Site Acreage 112.42
*If there are additional contiguous parcels, provide information on an attached sheet.	
Current Zoning (If known) Farmland Preservation District	

Fond du Lac County Nonmetallic Mining Reclamation
Code Enforcement Office, 160 S. Macy St., Fond du Lac, WI 54935
Phone: (920) 929-3139 Fax (920) 929-7655

4. Project Information:

Provide a description of the current and surrounding land use:

The parcels are currently used for agriculture purposes. The surrounded land is primarily agriculture, with a small subdivision to the north.

What type of material will be mined?

The material to be mined will be limestone/dolomite. Both aggregate and dimensional stone products will be generated.

Wetland Protection: Are you aware of any wetlands at the nonmetallic mining site?

☒ Yes ☐ No If "Yes", attach documentation of wetlands.

Note: The nonmetallic mining project must water quality standards as required by NR-103. The presence of wetlands may affect certain aspects of the nonmetallic mining site.

Cultural or Historical Resources: Are you aware of any listed cultural or historical resources at the nonmetallic mining site? ☐ Yes ☒ No

If "Yes", attach documentation of the cultural or historical resource.

Note: The regulatory authority will consult with the State Historic Preservation Officer on whether approval of this permit will affect a listed historical or cultural resource. The presence of a historical or cultural resource may affect certain aspects of the nonmetallic mining site.

Threatened or Endangered Species: Are you aware of any listed threatened or endangered species at the nonmetallic mining site?

☐ Yes ☒ No If "Yes", attach documentation of the threatened or endangered species.

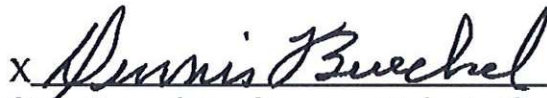
Note: The regulatory authority will consult with the Bureau of Endangered Resources on whether approval of this permit may affect a listed threatened or endangered species. The presence of a listed threatened or endangered species may affect certain aspects of the nonmetallic mining site under the requirements of this statute.

Fond du Lac County Nonmetallic Mining Reclamation
Code Enforcement Office, 160 S. Macy St., Fond du Lac, WI 54935
Phone: (920) 929-3139 Fax (920) 929-7655

5. Reclamation Plan Submittal, Plan Review Fee & Financial Assurance

- ▶ Submit two (2) copies of a complete reclamation plan which meets the requirements of the Fond du Lac County Nonmetallic Mining Ordinance Chapter 36 and Wis. Adm. Code NR 135.19, including any previous approvals (if applicable).
- ▶ Certify that the operator will provide financial assurance upon granting of the permit.
- ▶ The landowner or lessee, if different from the operator, must also provide signed certification that they concur with the reclamation plan and will allow its implementation.
- ▶ The applicant will be required to post an appropriate amount of **financial assurance** (to be calculated and agreed upon by Fond du Lac County) as required by NR 135.40 **no later than 15 days prior** to approval and issuance of the Reclamation Permit.

I hereby certify, as a duly authorized representative or agent that the applicant/operator listed above will comply with the Fond du Lac County Nonmetallic Mining Reclamation Ordinance. Furthermore, I hereby certify that: 1) A completed reclamation plan shall be submitted to the Fond du Lac County Code Enforcement Officer and 2) Financial assurance shall be submitted prior to the approval of the nonmetallic reclamation plan.

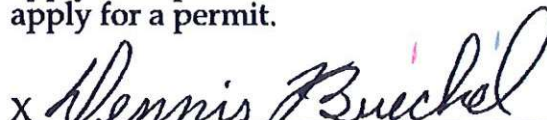
x 
Signature of Applicant or Duly Authorized Agent

x 5/8/26
Date Signed

A nonrefundable plan review fee of \$1000.00 is due at time of application submittal.

6. Permit Certification

I hereby certify that the information contained herein is true and accurate. I also certify that I am entitled to apply for a permit, or that I am the duly authorized representative or agent of an applicant who is entitled to apply for a permit.

x 
Signature of Applicant or Duly Authorized Representative

x 5/8/26
Date Signed

Fond du Lac County Nonmetallic Mining Reclamation
Code Enforcement Office, 160 S. Macy St., Fond du Lac, WI 54935
Phone: (920) 929-3139 Fax (920) 929-7655

LEAVE BLANK - FOR DEPARTMENT USE ONLY

Received By:	Fee Amount Received:	Date Application & Fee Received:
Verification/inspection by:	Date Verification was Complete:	
Comments:		

Public Notice Publication Date:	
Public Hearing Date: (If required)	
Assigned Permit No. (Site ID No.)	Date Permit Issued:
Site Inspected by:	Site Inspection Date:
Comments:	



Fond Du Lac Stone Development, LLC Reclamation Plan

May 12, 2026



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PROJECT SUMMARY

Fond du Lac Stone Development, LLC , (hereafter referred to as “FDL Stone”) is applying for approval to open a nonmetallic mine site in part of the east half of Section 15 in the Town of Byron (TWP 14N, RNG 17E), Fond du Lac County. FDL Stone owns three parcels with a total acreage of 112.42 acres. The products that will be produced from the limestone, include sand and gravel of various sizes and dimensional stone which will be used for state, residential and commercial projects.

Elements critical to the ultimate success of non-metallic mining reclamation are active communication and the resultant consensus between owner, operator, and regulator. The following narrative is based upon information made available to FDL Stone from a variety of sources, including proprietary records, local government, regional planning authorities and published surface mine reclamation research.

This document should be recognized as a physical planning tool for the quarry and should be used as a guide for reclamation. While extensive research has been conducted the limestone may not have been deposited in a consistent manner. When processing begins the reclamation plan may need to be revised according to the geology of the deposited layers.

REGULATORY SETTING

In accordance with the requirements set forth in the Fond du Lac County Non-metallic Mining Reclamation Ordinance and Chapter NR135 of the Wisconsin Administrative Code (NR135) FDL Stone is providing Fond du Lac County with a site-specific non-metallic mining reclamation plan.

All activities conducted by FDL Stone will comply with all other applicable federal, state and local laws including those related to environmental protection, zoning and land use.

GENERAL INFORMATION

CONTACT INFORMATION

Property Owner	Operator
Fond du Lac Stone Development, LLC N4224 State Road 175 Fond du Lac, WI 54937-9204	Dennis Buechel Fond du Lac Stone Development, LLC N4224 State Road 175 Fond du Lac, WI 54937-9204

PROPERTY INFORMATION

In total, the Site now consists of three parcels with a total of 112.42 acres located in the Town of Byron, Fond du Lac County, Wisconsin. The Site is located off State Highway 175 in the East half of Section 15 in the Town of Byron (TWP 14N, RNG 17E), Fond du Lac County. Quality marketable materials were discovered when soil borings were drilled throughout the Site.

Parcel Numbers:

- T041417150300100 (40.00 Acres)
- T041417150400100 (32.42 Acres)
- T041417151400100 (40.00 Acres)

All buildings were razed on site, and the well was also abandoned.

LAND USE AND ZONING

The parcels currently owned by FDL Stone are used for agriculture purposes, and are surrounded by agriculture, rural residential and a small subdivision to the north. Parcels are located in the Farmland Preservation District as established by the Town of Byron. The Town of Byron allows, for non-metallic mining extraction as a Special Use.

TOPOGRAPHY

The Site is located within an area characterized by gently rolling to moderately undulating topography formed by glacial processes. The landscape consists primarily of low-relief uplands interspersed with shallow depressions, drumlinized terrain, and areas of glacial till plains. Regional elevations generally range from approximately 800 to 1,000 feet above mean sea level, with gradual slopes and no significant relief features aside from localized ridges or depressional areas associated with glacial landforms.

Surface drainage is typically poorly to moderately defined, with water movement influenced by subtle topographic gradients, shallow swales, and intermittent drainageways. In portions of Fond du Lac County, particularly near the Niagara Escarpment, local relief may increase slightly where bedrock is nearer the surface; however, within the Town of Byron, overall relief remains modest. The topography reflects glacial deposition and erosion during the late Wisconsin glaciation and plays a significant role in surface water runoff, infiltration potential, and reclamation design considerations

The existing conditions at the Site are depicted on Figure 3.

EXTRACTION METHODS

The extraction process will include the use of bulldozers, front-end loaders or backhoes to remove marketable material above the water table. When groundwater is encountered, typically either the material is dredged or the groundwater is pumped to expose the marketable material.

Within the property, groundwater is encountered at approximately 1005-1015 feet. The bottom extraction elevation will be at approximately 975 feet. Additional information is provided in the Reclamation Methodology section.

Topsoil and overburden will be stripped and stockpiled on site in berms, which will be used for reclamation. The berms are located on the outer edge of the extraction area and were created from past mining operations.

To minimize the effects of erosion, only active areas will be removed of vegetation and stripped of topsoil and overburden. Seeding, mulching, and use of sediment barriers such as Silt fencing will be used to help prevent soil erosion and to allow for the berms to re-vegetate.

The operational area consists of haul roads, stockpiles, berms, and an extraction area. Manmade structures will be a scale and scale house. Traffic entering and exiting the Site will do so from State Highway 175. After extraction is complete, the pit perimeters will be rough graded with overburden to match the proposed final topography.

NATURAL RESOURCES

LOCAL SOILS

Figure 5 shows the soils mapping units occurring on and adjacent to the site, which was first identified in Soil Survey of Fond du Lac County (1973). Topsoil is approximately 12 inches thick and the subsurface layer of various thickness. Soils mapping units within the extraction area include:

- ❖ Beecher Silt Loam, 0-2
- ❖ Beecher Silt Loam 2-6%
- ❖ Casco Loam, 12-20%, Eroded
- ❖ Milton Silt Loam, 0-2%
- ❖ Milton Silt Loam, 6-20%
- ❖ Morley SILT Loam, 2-6%
- ❖ Ashkum Silt Clay Loam, 0-3%
- ❖ Washtenaw Silt Loam, 0-2%

LOCAL GEOLOGY

The Site is in the eastern Wisconsin portion of the Niagara Escarpment physiographic region. The local geology is characterized by a thin to moderately thick mantle of Quaternary glacial deposits overlying carbonate bedrock. These unconsolidated materials consist primarily of glacial till, with localized lenses of sand and gravel and minor lacustrine sediments deposited during the last glaciation.

Across Fond du Lac County, these surficial deposits range from less than 5 feet to over 300 feet in thickness, although thinner sections are common in the Town of Byron. Underlying these materials is Silurian-age dolostone bedrock, including formations equivalent to the Mayville Formation and associated Niagara Escarpment units. These dolostones are generally light gray, fractured, and locally cherty, and represent the dominant bedrock lithology in the area.

Depth to bedrock within the Town of Byron is highly variable but typically shallow, with bedrock commonly encountered at depths of approximately 0 to 20 feet, and more frequently within 20 to 50 feet of the ground surface, with localized areas exceeding 50 feet where thicker glacial deposits are present. The shallow, fractured nature of the dolomite bedrock results in relatively direct hydraulic connectivity between surface and groundwater systems, an important consideration for both mining operations and reclamation planning

GROUNDWATER AND SURFACE WATER DRAINAGE PATTERNS

Groundwater and surface water conditions within the eastern half of Section 15, Town of Byron, are controlled by shallow glacial deposits overlying fractured Silurian dolomite bedrock. Groundwater occurs in both the unconsolidated overburden and underlying carbonate bedrock, with vertical and horizontal movement facilitated by the thin soil cover and secondary permeability of fractures and joints. Recharge is derived primarily from local precipitation, with groundwater flow direction generally following site-scale topographic gradients toward adjacent low areas, wetlands, and drainage features.

Surface water drainage is characterized by diffuse overland flow across gently sloping terrain, with runoff conveyed through shallow swales and intermittent drainageways rather than well-defined perennial channels. Drainage patterns are influenced by subtle elevation changes and glacial landforms, and no major surface water features are present within the immediate site area. The relatively permeable surficial materials and shallow bedrock promote infiltration and hydraulic connectivity between surface water and groundwater systems, consistent with regional hydrogeologic conditions

Site Location, Figure 1, and the Existing Conditions, Figure 3 provide additional details on local drainage.

Well Summary

Well reports below are available for review on the DNR website. Many of them don't have a specific location. However, the majority of them are likely in the subdivision to the north.

<https://apps.dnr.wi.gov/wellconstructionpub/#!/PublicSearch/Index>

Unique Well No	Well Completion Date	Static Water Level (ft)	Casing Depth (ft)	Well Depth (ft)
IX441	No Information	No Information	No Information	No Information
8FA513**	1964	Artesian	42	71
8FA514	1949	82	18	168
DV415	1991	14	55	160
8FA538	1965	12	46	78

8FA539	1964	10	41	65
TC252	2005	15	65	165
VD432	2010	84	134	202
UT277	2009	95	120	202
UN054	2008	85	72	205
8FA524	1979	12	58	127
8FA525	1976	29	42	102
8FA526	1976	12	43	62
8FA527	1976	12	42	80
8FA528	1977	29	43	102
8FA529	1977	22	61	102
8FA530	1974	5	40	84
8FA531	1977	32	57	57
8FA532	1974	20	58	100
8FA533	1972	15	41	102
8FA534	1973	15	41	102
8FA535	1973	21	44	122
8FA536	1973	8	40	100
8FA537	1971	30	49	124
		30	54	117

**The existing well on the property has been abandoned. Based on the information available we believe the well that was abandoned was 8FA513.

In accordance with Chapters NR102-105 and NR140 of the Wisconsin Administrative Code, all necessary measures will be taken to prevent negative impacts to waters of the State. No appreciable impact on surface waters or groundwater is expected during the operation and reclamation process.

BIOLOGICAL INFORMATION

Biological resources consisting primarily of cultivated cropland, managed grasslands, and scattered pasture, interspersed with small woodland patches and hedgerows. Native vegetation in undisturbed areas is typically dominated by cool-season grasses, forbs, and early successional species, with localized areas of deciduous woodland composed of species such as oak, maple, and ash where soils and moisture conditions are suitable.

Wildlife use in the area is consistent with these habitat types and may include common species such as white-tailed deer, small mammals, game birds, songbirds, and amphibians associated with nearby wetlands or lowland areas. Due to the predominance of agricultural land use and

fragmented habitat, the site provides limited high-quality native habitat, although edge environments and drainage features may support localized biodiversity.

No known unique, rare, or critical habitat features have been identified within the immediate site area based on available regional data; however, seasonal use by mobile wildlife species may occur. Biological conditions are typical of the region and do not present significant constraints to reclamation, provided that post-mining revegetation is conducted in accordance with NR 135 standards to reestablish vegetative cover and site stability.

RECLAMATION METHODOLOGY

POST MINING LAND USE

The Town of Byron zoning map shows all three parcels of the nonmetallic mining operation to be within the Farmland Preservation District. Prior approved reclamation plans for this site called for agricultural production and open space wildlife ponds as the land use after the site is reclaimed. Agricultural will be the primary use which is required by Wisconsin State Statute (Chapter 91 Farmland Preservation). Passive recreation may occur on the site however they will remain incidental and will not interfere or preclude agricultural production.

MATERIAL ACCEPTANCE

The site will accept off-site material to facilitate efficient and stable reclamation. Acceptable materials include but are not limited to excess soil and earthen material generated from construction activities, including surplus topsoil from commercial developments and soils excavated during building foundation work, provided such materials are clean, non-contaminated, and suitable for reclamation use.

In certain cases, clean construction debris, as defined by the Wisconsin Department of Natural Resources, may also be accepted where its use is specifically authorized and demonstrated to be compatible with the approved reclamation plan. All imported materials shall be used to regrade the site, reduce or eliminate steep slopes, and restore appropriate landforms that support the designated post-mining land use, including agricultural capability where required.

GRADING

To optimize land use following extraction, the site's reclamation plan ensures that the post-mining landform, drainage and vegetation associations will be stable, self-sustaining, visually compatible with the surrounding land, and will meet the community needs. Creation of finished surface contours will be accomplished through utilization of the ample source of on-site soil.

Property boundaries will be graded to match adjacent property elevations. No slope will lie greater than 3-foot horizontal to 1-foot vertical (3:1). In the areas where an auxiliary agricultural pond will be established FDL Stone will follow the Natural Resource Conservation Service (NRCS) Code 378, Standard Practice for Ponds. Pond depth is expected to be approximately 30-35 feet and 3:1 slope will continue to below water line to a depth of at least 6 feet.

The slope surrounding the ponds will not be greater than 3-foot horizontal to 1-foot vertical (3:1) for safe pond access and egress. Figure 6 which illustrates the anticipated grades after final shaping is completed.

If ample material is available, the site will be graded so there is no surface water. As stated, if that were to occur the pond will be filled in and no slope greater than 3:1 will remain.

TOPSOIL REDISTRIBUTION

Prior to re-application of topsoil and subsoils, all sub-surface areas will be prepared (via scarification) to promote optimal bonding. Topsoil and subsoil stockpiles stored adjacent to disturbed areas will be redistributed in uniform thickness and all clods and lumps will be broken down prior to seeding.

The post-mining topsoil and subsoil volume necessary for successful site reclamation on the six upland acres is approximately 9,700 yds³ (based on 6 inches of topsoil and 6 inches of subsoil). Leftover topsoil will be used for the pond beds and edges to promote vegetative growth. Ample soil is available on site in berms to achieve the described success criteria.

RE-VEGETATION

Much of the area where active extraction took place will be converted to an auxiliary agricultural pond that will have the immediate upland area revegetated as passive recreational. That area will be stabilized with perennial grasses or compatible vegetative cover that does not preclude agricultural capability.

Upon completion of site grading and topsoil distribution of the active extraction area the remaining acreage will restore areas will be made available for agricultural production through lease agreements with a qualified operator. The site does maintain an active agricultural lease and is actively being farmed. As additional portions of the site are progressively reclaimed the lessee shall determine and implement appropriate crops, fertilizer, soil amendments or rotations consistent with standard agricultural practices, site conditions, and operational goals.

Crop selection may include row crops, forage, or pasture, and may vary over time based on soil characteristics, drainage, and market considerations. This approach ensures that reclaimed lands are actively returned to productive agricultural use while allowing flexibility for adaptive management and continued improvement of soil productivity and field conditions.

EROSION CONTROL

Potential erosion concerns at the site include sheet erosion from exposed soils, rill and gully formation on sloped areas, and localized sediment transport resulting from concentrated runoff following precipitation events. These risks are minimized through implementation of final grading that reduces slope length and steepness, establishment of stable drainage patterns to prevent concentrated flow, and timely placement of topsoil to promote vegetative growth.

Disturbed areas will be stabilized through the establishment of vegetative cover or managed agricultural cover sufficient to protect the soil surface from erosion forces. Where necessary, temporary erosion control measures such as mulching, cover crops, or other best management practices will be used until permanent stabilization is achieved.

FOLLOW-UP INSPECTIONS AND NECESSARY SITE MAINTENANCE

During reclamation, personnel authorized by the operator will inspect the site on a regular basis for areas of erosion or stressed vegetation. If soil erosion is noted, the area will be repaired, and precautions will be taken to prevent further erosion. If areas of stressed or dead vegetation are noted, the area will be mowed, scarified and replanted as described. Fertilizers may then be applied to facilitate regrowth. All reclamation activities will continue until the success criteria described in the subsequent section are achieved.

As part of maintenance of the reclaimed site, FDL Stone will perform any necessary weed and/or pest control maintenance to assist with the growth and survival of vegetation. Exotic species that occur on the site will be promptly controlled through fire, mechanical means or with herbicides.

SITE SAFETY

The reclaimed site shall be maintained in a condition that is safe for its approved post-mining land use of agricultural and/or passive recreational purposes. Site access shall be controlled through a gate at the primary access point. Final reclaimed slopes shall not exceed a gradient of 3:1 (horizontal to vertical) unless otherwise approved, to ensure long-term stability and safe use.

Following completion of reclamation, the site shall not contain hazardous features such as steep highwalls, open pits, or unsafe structures. Signage, fencing, or other physical barriers, if utilized, shall be consistent in type, frequency, and placement with those commonly found on neighboring properties with similar agricultural or passive recreational land uses.

STRUCTURES

Upon completion of mining operations, all aboveground structures and associated improvements related to the nonmetallic mining activity shall be removed from the site. This includes, but is not limited to, the scale house, truck scale, foundations, and utility connections.

All disturbed areas resulting from structure removal shall be graded and restored in accordance with the final reclamation plan, including placement of topsoil and stabilization to support the approved post-mining land use. Following reclamation, the only remaining improvement shall be a stabilized access road and the security gate, which shall be maintained solely to support agricultural operations or passive recreational access, as applicable to the approved post-mining land use.

SUCCESS CRITERIA

Reclamation success for the site shall be evaluated based on performance standards consistent with NR 135 and the approved post-mining land use of agricultural and/or passive recreational purposes. Success shall be demonstrated through the establishment of stable landforms, adequate soil resource reconstruction, effective erosion control, and the restoration of site conditions

capable of supporting the intended long-term land use. These criteria are intended to be measurable and field-verifiable through inspection and documentation, focusing on physical site conditions and functional land capability rather than economic productivity.

- Final grading is completed in accordance with the approved reclamation plan, and slopes do not exceed 3:1 unless otherwise approved.
- A minimum of four inches of topsoil or approved soil material has been redistributed over all designated areas to support the approved post-mining land use.
- The site is free of structures, foundations, and debris associated with mining operations, except for an access road retained for post-mining use.
- A vegetative cover, managed ground cover, or agricultural crops are established to a minimum height of six inches across the site sufficient to stabilize soils.
- Surface drainage is established such that no chronic ponding or uncontrolled runoff impairs the approved land use.
- The site supports safe and functional access consistent with agricultural or passive recreational use.
- Where agricultural use is implemented, the site has been actively farmed as documented by lease, operator statement, or observation of agricultural activity.
- The site is in a condition consistent with surrounding properties of similar post-mining land use.

Reclamation shall be carried out in accordance with the approved site reclamation plan, the Fond du Lac County non-metallic mining reclamation requirements and NR 135. Once reclamation is complete, Fond du Lac County will be notified for review. Once final reclamation is approved by the County, the release of the financial assurance will be requested.

FINANCIAL ASSURANCE

RECLAMATION COSTS

Per NR135, the amount of financial assurance shall equal as closely as possible to the costs the regulatory authority would incur if they hired a contractor to complete either final reclamation or progressive reclamation according to the approved reclamation plan. Therefore, the amount of financial assurance only needs to cover costs to reclaim the currently active acreage.

Reclamation costs refer to those direct and indirect costs associated with establishing vegetation. These costs include, grading, structure removal, equipment and man-hour usage, grading, seeding, and maintenance.

It is estimated that outsourcing for grading, topsoil application and preparation, seeding and maintenance within the project area would equal \$6,031.37 per acre. A detailed summary of financial assurance calculations is included in Table 1. Financial assurance will be submitted in the form of a performance surety bond with an emphasis on restoration.

CALCULATION ASSUMPTIONS

The amount of financial assurance required would equal the average per acre cost \$6,031.37 multiplied by the active area minus any pond area plus the one-time fee of \$1,200. The largest area of actively disturbed are will not exceed 28 acres. The maximum financial assurance is shown in the following Table. See Proposed Reclamation Map in the Figures section which identifies the seeded areas where vegetation will be grown.

FA Table: Estimated Reclamation Cost Summary (per acre and totals)

Reclamation Items(* Only the area above the low water elevation will require grading and revegetation)	Cost/Unit	Unit Type	# Units	Amount/acre
<u>Earthwork and Grading</u> -Final grading and slope stabilization -Minimum of 6" topsoil and 6" subsoil (salvage) (Salvage Topsoil Wis DOT 625.0500)	\$0.80	Sq. yd.	4,840	\$3,872.00
<u>***Revegetation Plan (Return to Agricultural)</u> -Corn (Silage or Grain) with cover crop based on farmers (20-25 lbs/acre)	\$15.00	lbs.	80	\$1,200***
<u>Revegetation Plan (Passive Recreation Option)</u> -WI DOT No. 20 seed mixture (Wis DOT 630.0120) (5 lbs./1,000 sq. ft. is 217.8 lbs./ac)	\$7.95	lbs.	217.8	\$1,731.51
<u>Erosion Control: Stabilization of Soil Conditions</u> To include any of the following: matting, straw bales, Silt fences, sediment ponds, swales, etc. (Wis DOT 628.1504)	\$2.05	L.F.	208.71	\$427.86
<u>Maintenance and Monitoring Prior to Release of FA to COC</u> Covers period until Declaration of Completion (DOC): Maintenance and monitoring (photos, data collection, reports, etc. one-time fees)	\$100	Per Visit	2	\$200.00
<u>Management of Refuse (one-time fee)</u> - Temp Scale building and scale removal	\$500.00	Lump sum One-time	1	\$500.00
<u>Other Reclamation Activities (one-time fee)</u> - install/removal fence, electric, etc.	\$500.00	Lump sum One-time	1	\$500.00
TOTAL (per acre)		Total	Acre	\$6,031.37
***Use Passive Recreation revegetation cost because they are higher than cost to return to agricultural				
TOTAL Upland Area (28ac)		Total	47 acres	\$168,878.36
TOTAL (Lump Sum and/or one-time fees)		Total		\$1,200.00
Grand Total				\$170,078.36

* 43,560 sq. ft./acre = 4,840 sq. yd./acre = 1,613 cu. yds./acre

* Unit cost: 2024 WIS DOT Standard Spec (Average Unit Price List)

* Pricing also from Reinders Inc. for seed and fertilizer products

CERTIFICATION of the RECLAMATION PLAN

I hereby certify, as a duly authorized representative or agent, that FDL Stone will comply with the provisions of this reclamation plan as well as the statewide nonmetallic mining reclamation standards established in ss. NR 135.05 through NR 135.15, Wis. Adm. Code.

Property Owners:

Dennis Buechel
Fond du Lac Stone Development, LLC
N4224 State Road 175
Fond du Lac, WI 54937-9204

Tax Parcel Numbers

- T041417150300100 (40.00 Acres)
- T041417150400100 (32.42 Acres)
- T041417151400100(40.00 Acres)

General Operator:

Fond du Lac Stone Development, LLC
N4224 State Road 175
Fond du Lac, WI 54937-9204

Dennis Buechel

Date

(Signature of Applicant or Duly Authorized Agent)

May 12, 2026

REFERENCES

- Bedrock Geology of Wisconsin, Ostrom M, April 1981 (revised 1995)
- Fond du Lac County 2010 LIDAR data
- Glaciation of Wisconsin, Clayton L, J.W. Attig, D. Mickelson – Educational Series 36, 1991 (revised 1992)
- Reinders Inc. seed and fertilizer products 2025
- Natural Heritage Inventory, Aug 30, 2012 <http://dnr.wi.gov/topic/NHI/CountyData.html>
- Natural Resource Conservation Service, Web Soil Survey.
- Natural Resources Conservation Service, Conservation Practice Standard, “Critical Area Planting” (Code 342), 2002
- Natural Resources Conservation Service, Conservation Practice Standard, “Nutrient Management” (Code 590), 2002
- Soil Survey of Fond du Lac County, 1973
- State of Wisconsin, Department of Transportation, Standard Specifications for Highway and Structure Construction, 2009
- Surface Water Quality Criteria and Secondary Values for Toxic Substances, Wisconsin Legislature: Chapter NR105
- Thickness of Unconsolidated Material in Wisconsin, Ostrom M, 1983 Water Resources of Wisconsin Pond Michigan Basin-HA - 432
- United States Geological Survey, St Cloud, Wisconsin 7.5 Minute Quadrangle, 1974.
- USDA Custom Rate Guide 2010
- Water Quality Standards for Wisconsin Surface Waters, Wisconsin Legislature: Chapter NR102
- Wisconsin Department of Natural Resources, Nonmetallic Mining Reclamation, Wisconsin Administrative Code, Chapter NR 135.
- Wisconsin Department of Natural Resources, A Guide to Developing Reclamation Plans for Nonmetallic Mining Sites in Wisconsin, PUBL-WA-8342002, February 2002.
- Wisconsin Department of Natural Resources, Bureau of Water Resources Management, Nonpoint Source and Land Management Section, Wisconsin Construction Site Best Management Practice Handbook, PUBL-WR-222 93 Rev., Sixth Printing, April 1994.
- Wisconsin Department of Natural Resources, Groundwater Quality, Wisconsin Administrative Code, Chapter NR 140
- Wisconsin Department of Natural Resources 2008, Ecological Landscapes web reference, <http://dnr.wi.gov/landscapes/index.asp?mode=detail&Landscape=9>
- Wisconsin Geological and Natural History Survey, Electronic Records of Well Construction Reports

FIGURES

- ✓ **Figure 1: Site Location Map**
- ✓ **Figure 2: Parcel Map**
- ✓ **Figure 3: Existing Site**
- ✓ **Figure 4: Zoning Map**
- ✓ **Figure 5: Soils Map**
- ✓ **Figure 6: Proposed Reclamation Plan**

06 May 2026

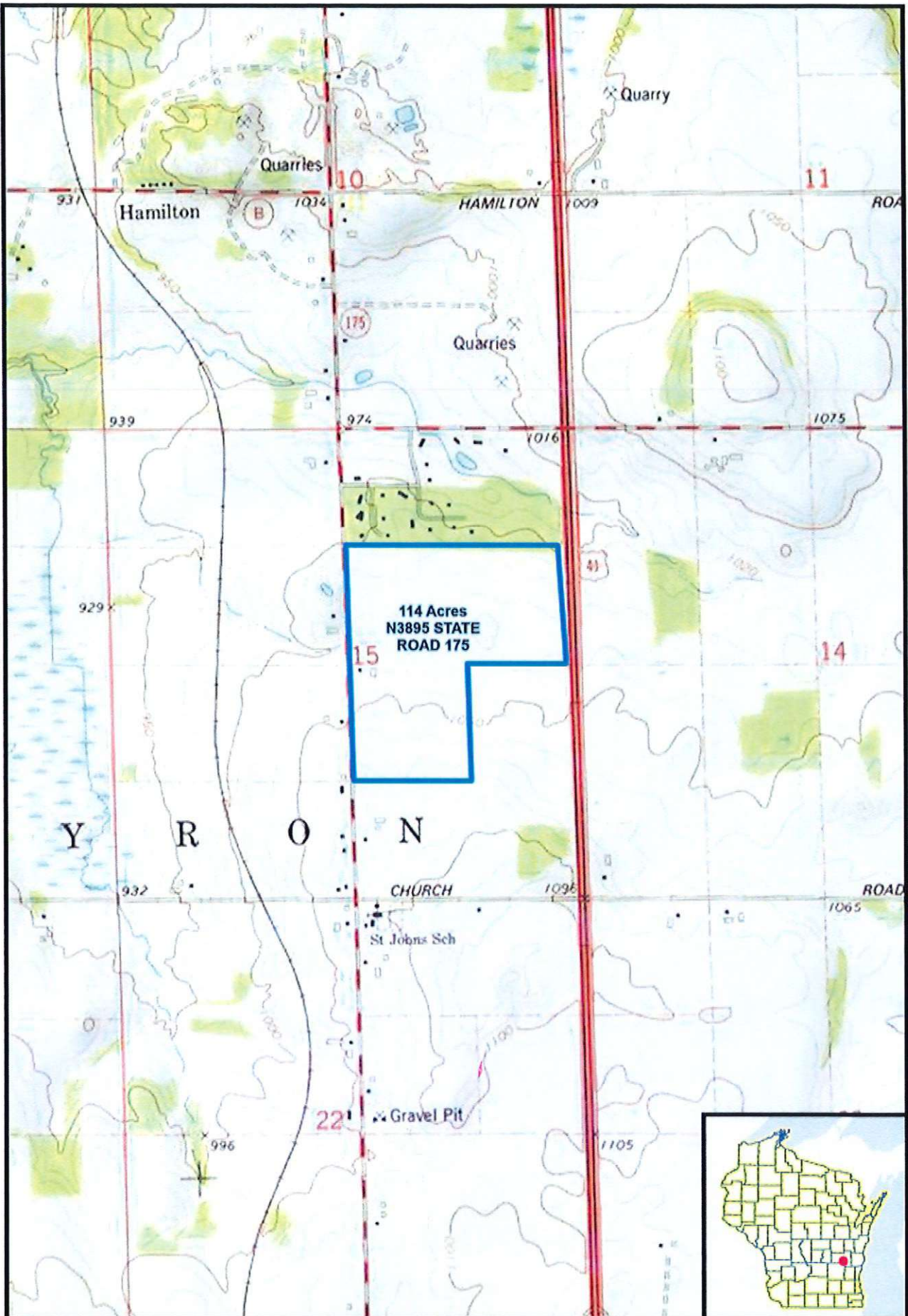


Figure 1
Site Location

1 inch equals 1,000 feet
0 1,000

Legend

 Application Extent

Site Location

Town of Byron, Fond Du Lac, WI Sec 15

Fond du Lac Stone Development, LLC



[illegible]

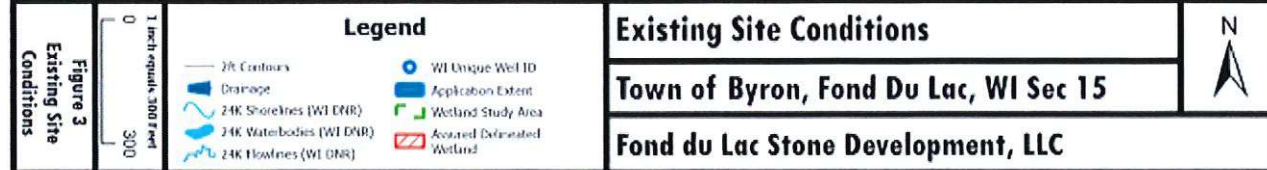
1 inch equals 300 feet

0 300

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WI Tax Parcels 2025
Application Extent

Fond du Lac Stone Development, LLC



06 May 2026



Figure 5
Soils

0
1 inch equals 300 feet
300

Legend

- Soils Map Units
- Application Extent

Soils

Town of Byron, Fond Du Lac, WI Sec 15

Fond du Lac Stone Development, LLC





Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

Critical Area Planting

Code 342

(Ac)

DEFINITION

Establishing permanent vegetation on sites that have, or are expected to have, high erosion rates, and on sites that have physical, chemical, or biological conditions that prevent the establishment of vegetation with normal seeding/planting methods.

PURPOSE

- Stabilize areas with existing or expected high rates of soil erosion by wind or water.
- Stabilize stream and channel banks, pond and other shorelines, earthen features of structural conservation practices.
- Stabilize areas such as sand dunes and riparian areas.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to highly disturbed areas such as—

- Active or abandoned mined lands.
- Urban restoration sites.
- Construction areas.
- Conservation practice construction sites.
- Areas needing stabilization before or after natural disasters such as floods, hurricanes, tornados, and wildfires.
- Eroded banks of natural channels, banks of newly constructed channels, and lake shorelines.
- Other areas degraded by human activities or natural events.

CRITERIA

General Criteria Applicable to All Purposes

Site preparation. Conduct a site investigation to identify any physical, chemical, or biological conditions that could affect the successful establishment of vegetation.

Clear areas to be planted of unwanted materials and smooth or shape, if needed, to meet planting purpose(s).

Prepare a suitable seedbed for all seeded species. Rip compacted layers and re-firm the soil prior to seedbed preparation, as needed.

As site conditions dictate, when grading slopes, stockpile topsoil to be redistributed over area to be planted.

Species selection. Select species for seeding or planting that are suited to local site conditions and intended uses, and common to the site or location.

Selected species will have the capacity to achieve adequate density and vigor to stabilize the site within an appropriate period.

Establishment of vegetation. Plant seeds using the method or methods best suited to site and soil conditions.

Limit sod placement to areas that can naturally supply needed moisture or sites that can be irrigated during the establishment period. Place and anchor sod using techniques to ensure that it remains in place until established.

Specify species, rates of seeding or planting, legume inoculation, minimum quality of planting stock (e.g., pure live seed (PLS) or stem caliper), method of seedbed preparation, and method of establishment before application. Use only viable, high-quality seed or planting stock.

Seed or plant at a time and in a manner that best ensures establishment and growth of the selected species.

Plant during approved times for the species to be used.

Apply soil amendments (e.g., lime, fertilizer, compost) according to the requirements in the local Field Office Technical Guide.

Mulch or otherwise stabilize (e.g., polyacrylamide (PAM)) plantings as necessary to ensure successful establishment.

Additional Criteria to Stabilize Stream and Channel Banks, Pond and Other Shorelines, Earthen Features of Structural Conservation Practices

Bank and channel slopes. Shape channel side slopes so that they are stable and allow establishment and maintenance of desired vegetation.

A combination of vegetative and structural measures may be necessary on slopes steeper than 3:1 to ensure adequate stability.

Species selection. Plant material used for this purpose must—

- Be adapted to the hydrologic zone into which they will be planted.
- Be adapted and proven in the regions in which they will be used.
- Be compatible with existing vegetation in the area.
- Protect the channel banks but not restrict channel capacity.

Establishment of vegetation. Specify species, planting rates, spacing, methods and dates of planting based on local planting guides or technical notes.

Identify and protect desirable existing vegetation during practice installation.

Use a combination of vegetative and structural practices with living and inert material when flow velocities, soils, and bank stability preclude stabilization by vegetative establishment alone. Use Conservation Practice Standard (CPS) Streambank Stabilization (Code 580) for the structural measures.

Control existing vegetation on a site that will compete with species to be established vegetatively (e.g., bare-root, containerized, ball-and-burlap, potted) to ensure successful establishment of the planted species.

Plant streambank stabilization vegetation in accordance with the NRCS Engineering Field Handbook Part 650, Chapter 16, "Streambank and Shoreline Protection," and Chapter 18, "Soil Bioengineering for Upland Slope Protection & Erosion Reduction."

Site protection and access control. Restrict access to planted areas until fully established.

Additional Criteria to Stabilize Areas Such As Sand Dunes and Riparian Areas

Plants for sand dunes and coastal sites must be able to survive being buried by blowing sand, sand blasting, salt spray, salt water flooding, drought, heat, and low nutrient supply.

Include sand trapping devices such as sand fences or brush matting in the revegetation/stabilization plans where applicable.

CONSIDERATIONS

Species or diverse mixes that are adapted to the site and have multiple benefits should be considered. Native species may be used when appropriate for the site.

To benefit pollinators and other wildlife, flowering shrubs and wildflowers with resilient root systems and good soil-holding capacity also should be considered for incorporation as a small percentage of a larger grass-dominated planting. Where appropriate consider a diverse mixture of forbs to support pollinator habitat.

Planning and installation of other CPSs such as Diversion (Code 362), Obstruction Removal (Code 500), Subsurface Drain (Code 606), Underground Outlet (Code 620), or Anionic Polyacrylamide Application (Code 450) may be necessary to prepare the area or ensure vegetative establishment.

Areas of vegetation established with this practice can create habitat for various type of wildlife. Maintenance activities, such as mowing or spraying, can have detrimental effects on certain species. Perform management activities at the times and in a manner that causes the least disruption to wildlife.

PLANS AND SPECIFICATIONS

Prepare plans and specifications for each field or management unit according to the criteria and operation and maintenance sections of this standard. Record practice specifications using approved Implementation Requirements document.

Address the following elements in the plan, as applicable, to meet the intended purpose(s):

- Practice purpose(s)
- Site preparation
- Topsoil requirements
- Fertilizer application
- Seedbed/planting area preparation
- Timing and method of seeding/planting
- Selection of species
- Seed/plant source
- Seed analysis/pure live seed (PLS)
- Seeding rate/plant spacing
- Mulching, PAM, or other stabilizing materials
- Supplemental water needed for establishment
- Protection of plantings
- Describe successful establishment (e.g., minimum percent ground/canopy cover, percent survival, stand density)

OPERATION AND MAINTENANCE

- Control access to the area to ensure the site remains stable.
- Protect plantings shall be protected from pests (e.g., weeds, insects, diseases, livestock, or wildlife) as necessary to ensure long-term survival.
- Inspections, reseeding or replanting, and fertilization may be needed to ensure that this practice functions as intended throughout its expected life.
- Observe establishment progress and success at regular intervals until the practice has met the criteria for successful establishment and implementation.
- Description of successful establishment (e.g., minimum percent ground/canopy cover, percent survival, stand density).

REFERENCES

Federal Interagency Stream Restoration Working Group. 1998. Stream corridor restoration: principles, processes, and practices. USDA NRCS National Engineering Handbook, Part 653.

USDA NRCS. 2007. National Engineering Handbook, Part 654. Stream restoration guide.

USDA NRCS. 2015. The PLANTS Database (<http://plants.usda.gov>, 8 December 2015). National Plant Data Team, Greensboro, NC.



Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

POND

CODE 378

(no)

DEFINITION

A pond is a water impoundment made by constructing an embankment, by excavating a dugout, or by a combination of both.

In this standard, NRCS defines ponds constructed by the first method as embankment ponds, and those constructed by the second method as excavated ponds. Ponds constructed by both the excavation and the embankment methods are classified as embankment ponds if the depth of water impounded against the embankment at the auxiliary spillway elevation is 3 feet or more above the lowest original ground along the centerline of the embankment.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Store water for livestock
- Store water for fish and wildlife
- Store water for recreation
- Store water for fire control
- Store water for erosion control
- Store water for flow detention
- Improve water quality

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all excavated ponds. It also applies to embankment ponds that meet all of the criteria for low-hazard dams as listed below:

- The failure of the dam will not result in loss of life, damage to homes, commercial or industrial buildings, main highways, or railroads, or in interruption of the use or service of public utilities.
- The product of the storage times the effective height of the dam is less than 3,000.
- The effective height of the dam is 35 feet or less.

This standard does not apply to ponds with the primary purpose of controlling solids loading and attached pollutants. Such ponds shall meet the criteria set forth in Wisconsin Department of Natural Resources (DNR) Standard for Wet Detention Basin (1001).

CRITERIA

General Criteria Applicable to All Purposes

Plan, design, and construct this practice to comply with all Federal, State, and local regulations. The owner and/or operator is responsible for securing required permits. Permitting authorities should be contacted during the planning phase of the project. This standard does not contain the text of the federal, tribal, state or local laws.

A site assessment shall be conducted, documented, and incorporated into the design. The assessment shall be performed to determine physical site characteristics that will influence the placement, construction, maintenance, and environmental integrity of a proposed pond. The assessment shall include input from the owner/operator. The site assessment shall include:

1. Locations and elevations of buildings, roads, lanes, soil test pits, property lines, setbacks, easements, springs, wells, floodplains, surface drains, drain tile, utilities, overhead lines, cultural resources, wetlands, and potential contamination sources.
2. Geological investigations. Use pits, trenches, borings, reviews of existing data, or other suitable means of investigation to characterize materials within the embankment foundation, auxiliary spillway, and borrow areas. Classify soil materials using the Unified Soil Classification System (ASTM D2487). Test pits or test holes shall be recorded to include:
 - a. The number and distribution needed to characterize the subsurface.
 - b. The elevation of bedrock and bedrock type, if encountered, such as sandstone, limestone, dolomite, or granite.
 - c. Saturation indicators, if encountered, such as seepage from sand and gravel lenses, lens thickness, and elevation. Groundwater maps and well construction logs may be included when available and applicable.
 - d. Soil test results.
3. Locations and elevations of sinkholes and other karst features within 500 feet of the pond.
4. Locations and elevations, soil volumes, soil samples, and reclamation plans of any borrow areas.
5. Identification of potential impacts from failure of the embankments, liners, or structures. Document hazard potential classification.
6. An estimate or measurement of the base flow rate, when present.
7. Identification of potential navigability, water quality and wetland issues that may require permits.
8. Community wells, existing or proposed private wells, ponds, or springs

The pond owner must have ownership or legal control of the pond site and impoundment including the right to flood all land in the impoundment up to the 1% flood event. Legal control is usually obtained through permanent easements recorded on the deed of the affected property.

A pond may not be constructed with a horizontal separation distance less than 25 feet to an existing or proposed private well, pond, or spring OR 400 feet of an existing or proposed community well. This distance is measured from the edge of the pond formed during the 1% flood event, unless the well is properly decommissioned in accordance with Wisconsin Administrative Code Chapter NR 812 and Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), Well Decommissioning (Code 351).

Design a minimum sediment storage capacity equal to the design life of the structure, or provide for periodic cleanout. Protect the drainage area above the pond to prevent sedimentation from adversely affecting the design life.

Design measures necessary to prevent serious injury or loss of life in accordance with requirements of NRCS National Engineering Manual (NEM), Part 503, Safety. Appropriate safety measures such as warning signs, rescue facilities, visual barriers, safety shelf, and other applicable features shall be incorporated as appropriate for the site.

Construction operations shall be carried out in such a manner and sequence that erosion and water pollution will be minimized. Sources for acceptable construction site erosion/sediment control practices can be found in NRCS FOTG Section IV, NRCS Wisconsin Standard Detail Drawings for Conservation Practices, DNR Construction Site Erosion Control Best

Management Practices (BMPs), and Chapter 10 of the Department of Transportation (DOT) Facility Development Manual.

Seed or sod the exposed surfaces of earthen embankments, earth spillways, borrow areas, and other areas disturbed during construction in accordance with the criteria in WI NRCS CPS, Critical Area Planting (Code 342). When necessary to provide surface protection where climatic conditions preclude the use of seed or sod, use the criteria in WI NRCS CPS, Mulching (Code 484), to install inorganic cover material such as gravel.

Cultural resources. Evaluate the existence of cultural resources in the project area and any project impacts on such resources. Provide conservation and stabilization of archaeological, historic, structural, and traditional cultural properties when appropriate.

Site conditions. Select or modify the site to allow runoff from the design storm to safely pass through (1) a natural or constructed auxiliary spillway, (2) a combination of a principal spillway and an auxiliary spillway, or (3) a principal spillway.

Select a site that has an adequate supply of water for the intended purpose via surface runoff, groundwater, or a supplemental water source. Water quality must be suitable for its intended use.

Reservoir. Provide adequate storage volume to meet user demands for all intended purposes. Account for sedimentation, season of use, evaporation loss, and seepage loss when computing the storage volume.

When seepage losses from the pond area are expected to compromise the intended use, the pond area shall be sealed. Acceptable methods are included in WI NRCS CPS, Pond Sealing or Lining, Compacted Soil Treatment (Code 520), Pond Sealing or Lining, Geomembrane or Geosynthetic Clay Liner (Code 521), or Pond Sealing or Lining, Concrete (Code 522).

Criteria Applicable to Embankment Ponds

The area under the footprint of the embankment shall be cleared of all sod, roots, vegetation, organic matter, and other undesirable materials.

Soils should be suitable for construction and water retention. Soils should not contain any hazardous or toxic substances.

Foundation Cutoff

Design a cutoff of relatively impervious material under the dam and up the abutments as required for preventing seepage. Locate the cutoff at, or upstream from, the centerline of the dam. Extend the cutoff deep enough to intercept flow and connect with a relatively impervious layer. Combine seepage control with the cutoff as needed. Use a cutoff bottom width adequate to accommodate the equipment used for excavation, backfill, and compaction operations. Design cutoff side slopes no steeper than one horizontal to one vertical.

Seepage Control

Include seepage control if (1) foundation cutoff does not intercept pervious layers, (2) seepage could create undesired wet areas, (3) embankment stability requires seepage control, or (4) special problems require drainage for a stable dam. Control seepage by foundation, abutment, or embankment filters and drains; (2) reservoir blanketing; or (3) a combination of these measures.

Top Width

Table 1 provides the minimum top widths for dams of various total heights.

Design a minimum width of 16 feet for one-way traffic and 26 feet for two-way traffic for the top of dams used as public roads. Design guardrails or other safety measures where necessary and follow the requirements of the responsible road authority. For dams less than 20 feet in total height, maintenance considerations or construction equipment limitations may require increased top widths from the minimum shown in Table 1.

Table 1. Minimum top width for dams

Design Fill Height of Dam (feet)	Top Width (feet)
Less than 10	6
10-14.9	8
15-19.9	10
20-24.9	12
25-34.9	14
35 or more	15

Side Slopes

Design each side slope with a ratio of two horizontal to one vertical or flatter. Design the sum of the upstream- and downstream-side slopes with a ratio of five horizontal to one vertical or flatter. As required, design benches or flatten side slopes to assure stability of all slopes for all loading conditions.

Slope Protection

Design special measures such as berms, rock riprap, sand-gravel, soil cement, or special vegetation as needed to protect the slopes of the dam from erosion. Use NRCS Engineering Technical Release (TR) 210-56, A Guide for Design and Layout of Vegetative Wave Protection for Earth Dam Embankments, and TR-210-69, Riprap for Slope Protection against Wave Action, as applicable.

A berm at least 6 feet wide shall be constructed across the embankment at normal pool elevation on the upstream side and extend to the abutments on all dams with a permanent pond area of more than 2 acres or when the pond has an exposure of more than 500 feet of fetch.

A semicircular berm at normal pool elevation extending not less than 5 feet from the edge of any pipe inlet shall be installed on all dams not covered by the preceding paragraph to protect the inlet from damage by ice or floating debris.

Freeboard

This criteria applies to boxes a, c, and e of Table 3. Design a minimum of 1.0 feet of freeboard between design high-water-flow elevation in the auxiliary spillway and the top of the settled embankment. Design a minimum 2.0 feet of elevation difference between the crest of the auxiliary spillway and the top of the settled embankment when the dam has more than a 20-acre drainage area or more than 20 feet in effective height. Design a minimum of 1.0 feet of freeboard above the peak elevation of the routed design hydrograph to the top of the settled embankment, when the pond has no auxiliary spillway.

For ponds that meet the criteria in box b or d of Table 3, the freeboard shall be a minimum of 0.3 feet.

Settlement

Increase the height of the dam by the amount needed to ensure that the settled top elevation of the dam equals or exceeds the design top elevation. Design a minimum of 5 percent of the design fill height of the dam associated with each dam cross section, except where detailed soil testing and laboratory analyses or experience in the area shows that a lesser amount is adequate.

Principal Spillway and Pipe Conduit through the Embankment

Design a pipe conduit with needed appurtenances through the dam, except where rock, concrete, or other types of lined spillways are used, or where a vegetated or earth spillway can safely handle the rate and duration of base flow.

Design a minimum of 0.5-foot difference between the crest elevation of the auxiliary spillway and the crest elevation of the principal spillway when the dam has a drainage area of 20 acres or less. Design a minimum of 1.0-foot difference when the dam has a drainage area of over 20 acres.

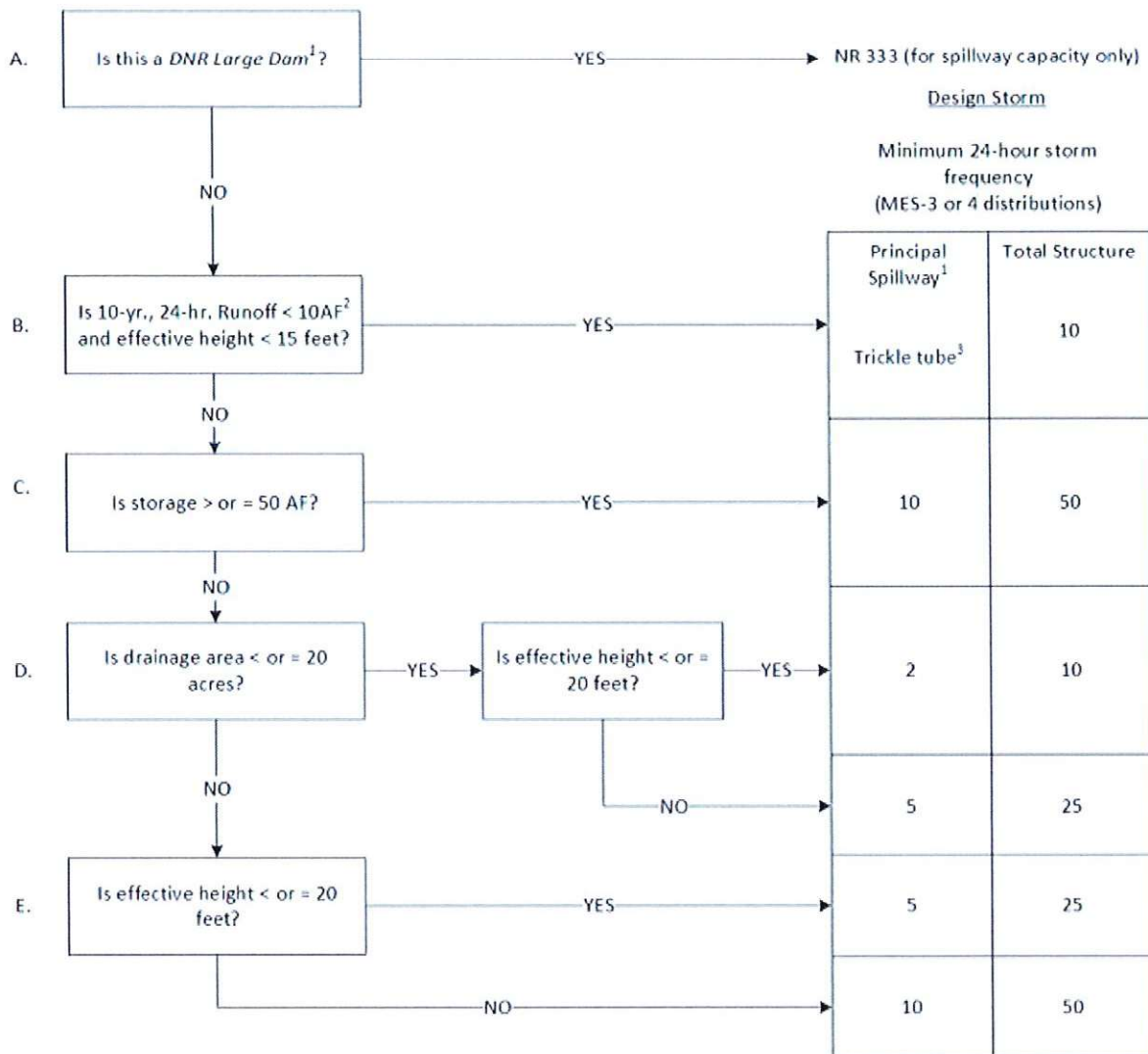
Polyethylene or plastic in-line water level control structures, typically used in drainage water management, may be used for wetland restoration principal spillways when their manufactured depth 6 feet or less.

Table 2. Trickle Tube Separation

Height Effective (feet)	Separation Distance (feet)
≥ 10	2
6-9.9	1.5
≤ 5.9	1

For designs without a principal spillway but with a trickle tube, see Table 2 for the separation distance between the trickle tube invert elevation and the auxiliary spillway elevation, or the top of dam if there is no auxiliary spillway. An armored auxiliary spillway capable of handling the expected rate and duration of flow may be used in lieu of a trickle tube for designs without a principal spillway.

Table 3. Minimum Spillway Capacity



¹ Consideration should be given to increasing principal spillway design storm frequency to reduce the frequency of the auxiliary spillway's use.

² AF = acre-feet

³ Trickle tube or other type of principal spillway required. If another type of principal spillway is used, it shall meet the separation distances required for a trickle tube. If a trickle tube is used, it shall be a 4-inch diameter minimum conduit, or the size required to pass 2 times the base flow. Trickle tube material shall meet the requirements of WI NRCS CPS, Underground Outlet (Code 620)

The minimum capacity of the principal spillway shall be that required to pass the peak discharge from the design storms (Table 3) less any reduction creditable to detention storage between the crest of the principal spillway and the crest of the auxiliary spillway. Flood-routing methods are in NRCS NEH Part 650, EFH Chapter 11, NRCS NEH Part 630, Hydrology, and in NRCS Technical Releases 20 (TR-20) or 55 (TR-55).

When design discharge of the principal spillway is considered in calculating peak outflow through the auxiliary spillway, the crest elevation of the inlet shall be such that the full flow will be generated in the conduit before there is discharge through the auxiliary spillway. The inlets and outlets shall be designed to function satisfactorily for the full range of flow and hydraulic head anticipated.

Design adequate pipe conduit capacity to discharge long-duration, continuous, or frequent flows without causing flow through the auxiliary spillway. Design a principal spillway pipe with a minimum inside diameter of 4 inches.

If the pipe conduit diameter is 10 inches or greater, its design discharge may be considered when calculating the peak outflow rate through the auxiliary spillway.

Design and install pipe conduits to withstand all external and internal loads without yielding, buckling, or cracking. Design rigid pipe for a positive projecting condition. Design flexible pipe conduits in accordance with the requirements of NRCS National Engineering Handbook (NEH), Part 636, Chapter 52, Structural Design of Flexible Conduits. Flexible pipe strength shall not be less than that necessary to support the design load with a maximum of 5 percent deflection. The modulus of elasticity for plastic pipe shall be assumed as one-third of the amount designated by the compound cell classification to account for long-term reduction in modulus of elasticity values for the pipe. The minimum thickness of flexible pipe shall be SDR 26, Schedule 40, Class 100, or 16 gage as appropriate for the particular pipe material.

Hood and canopy inlets shall have a minimum vertical distance between the invert of the inlet and the crest of the auxiliary spillway of 1.8 times the diameter of the pipe. The minimum size for box drop inlets in combination with hood inlets shall be two times the diameter of the pipe in both directions if square, or two times the diameter if circular. The minimum depth of the box will be 1.25 times the diameter of the pipe. An anti-vortex device shall be attached.

The minimum diameter of a riser pipe shall be at least 1.25 times the diameter of the conduit.

Design connections of flexible pipe to rigid pipe or other structures to accommodate differential movements and stress concentrations. Design and install all pipe conduits to be watertight using couplings, gaskets, caulking, water stops, or welding. Design joints to remain watertight under all internal and external loading including pipe elongation due to foundation settlement.

Provide an anti-vortex device for a pipe conduit designed for pressure flow. Design the inlet and outlet to function for the full range of flow and hydraulic head anticipated.

Design a concrete cradle or bedding for pipe conduits if needed to reduce or limit structural loading on pipe and improve support of the pipe.

Design outlet structures, such as cantilever pipe outlet sections and impact basins, to dissipate energy as needed.

Materials

For dams 20 feet or less in effective height, acceptable pipe materials are corrugated steel or aluminum, pre-cast simple or reinforced concrete, Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE) ASTM D3350, and cast-in-place reinforced concrete.

For dams more than 20 feet in effective height, conduits shall be corrugated steel or aluminum, pre-cast reinforced concrete, PVC, or cast-in-place reinforced concrete.

Concrete pipe shall be laid in a concrete bedding or have a concrete cradle, if required. A detailed structural analysis is required if concrete pipe is used.

All annular corrugated metal pipe (CMP) shall be caulk seamed and close riveted.

The inlets and outlets shall be structurally sound and made of materials compatible with those of the pipe.

The maximum height of fill over any principal spillway corrugated steel or corrugated aluminum pipe must not exceed 25 feet.

Specifications in Tables 4 and 5 are to be followed for PVC, corrugated steel, and corrugated aluminum pipe. Specifications in Table 6 are to be followed for HDPE pipe.

Outlets

The outlet section of all CMP conduits flowing under pressure and over 10 inches in diameter shall have a minimum length of 20 feet. The minimum length of the outlet section of PVC pipe shall be 10 feet for pipe that has cemented couplings and 20 feet for gasket-type couplings. The slope of the outlet section of pipe conduits over 12 inches in diameter shall not exceed 5 percent.

Cantilever outlet sections, if used, shall be designed to withstand the cantilever load. Pipe supports shall be provided when needed. Other suitable devices such as a Saint Anthony Falls stilling basin or an impact basin may be used to provide a safe outlet, see NRCS Technical Release 54 (TR-54), Structural Design of Saint Anthony Falls Stilling Basins.

For non-plastic cantilever outlets, pipe supports shall be provided for all conduits 18 inches in diameter or larger. Pipe supports for smaller diameters will be provided if required for stability. The outlet end of pipe conduits shall extend a minimum distance of 5 feet downstream from the point where the flow line of the downstream channel and the back slope of the embankment intersect or from the pipe support if used. This distance shall be increased to 8 feet for outlet pipes larger than 18 inches in diameter.

For cantilever outlets of plastic conduits, the outlet end of plastic conduits shall extend a minimum of 5 feet downstream from the point where the flow line of the downstream channel and the back slope of the embankment intersect. A pipe support located a maximum of 3 feet from the end of the pipe shall be provided. The pipe support may be constructed by using an earthfill or gravel-fill pad, wood, wood-metal combinations, or CMP to encase the plastic conduit.

Corrosion Protection

Provide protective coatings for all steel pipe and couplings in areas that have traditionally experienced pipe corrosion or in embankments with saturated soil resistivity less than 4,000 Ohm-cm or soil pH less than 5. Protective coatings may include asphalt, polymer over galvanizing, aluminized coating, or coal tar enamel.

Ultraviolet protection

Use ultraviolet-resistant materials for all plastic pipe or provide coating or shielding to protect plastic pipe exposed to direct sunlight.

Cathodic protection

Provide cathodic protection for coated welded steel and galvanized corrugated metal pipe where soil and resistivity studies indicate that the pipe needs a protective coating and where the need and importance of the structure warrant additional protection and longevity. If the original design and installation did not include cathodic protection, consider establishing electrical continuity in the form of joint-bridging straps on pipes that have protective coatings. Add cathodic protection later if monitoring indicates the need.

Filter diaphragms

When the effective height of the dam is 15 feet or greater and the effective storage of the dam is 50 acre-ft. or more, provide filter diaphragms to control seepage on all pipes extending through the embankment. Design filter diaphragms or alternative measures (Anti-seep collars) as needed to control seepage on pipes extending through all other embankments.

Design the filter diaphragm in accordance with the requirements of NEH, Part 628, Chapter 45, Filter Diaphragms. Locate the filter diaphragm immediately downstream of the cutoff trench, but downstream of the centerline of the dam if the foundation cutoff is upstream of the centerline or if there is no cutoff trench.

To improve filter diaphragm performance, provide a drain outlet for the filter diaphragm at the downstream toe of the embankment. Protect the outlet from surface erosion and animal intrusion.

Ensure filter diaphragm functions both as a filter for adjacent base soils and as a drain for seepage that it intercepts. Materials for the filter diaphragm shall meet the requirements of NEH Part 628, Chapter 45, Filter Diaphragms, Section 628.4503(d), Filter and Drain Gradation.

When using anti-seep collars in lieu of a filter diaphragm, ensure a watertight connection to the pipe. Limit the maximum spacing of the anti-seep collars to 14 times the minimum projection of the collar measured perpendicular to the pipe, or 25 feet, whichever is less. Locate anti-seep collars no closer than 10 feet apart. Use a collar material that is compatible with the pipe material.

When using anti-seep collars, design the collars to increase the seepage path along the pipe within the fill by at least 15 percent.

Trash guard

Install a trash guard at the riser or inlet to prevent clogging of the conduit, unless the watershed does not contain trash or debris that could clog the conduit.

Pool Drain

Provide a pipe with a suitable valve to drain the pool area if needed for proper pond management or if required by State law. The designer may use the principal spillway conduit as a pond drain if it is located where it can perform this function.

Auxiliary spillways

A dam must have an open channel auxiliary spillway, unless the principal spillway is large enough to pass the peak discharge from the routed design hydrograph and the trash that comes to it without overtopping the dam. The minimum criteria for acceptable use of a closed conduit principal spillway without an auxiliary spillway consist of a conduit with a cross-sectional area of 3 feet² or more, an inlet that will not clog, and an elbow designed to facilitate the passage of trash. (This criteria applies to Table 3 boxes a, c, and e) (A conduit with a minimum diameter of 4 inches is required for Table 3 boxes b and d. without an auxiliary spillway) Design the minimum capacity of a natural or constructed auxiliary spillway to pass the peak flow expected from a total design storm of the frequency and duration shown in Table 3, less any reduction creditable to the conduit discharge and detention storage.

Design the auxiliary spillway to safely pass the peak flow through the auxiliary spillway, or route the storm runoff through the reservoir. Start the routing either with the water surface at the elevation of the crest of the principal spillway or at the water surface after 10 days drawdown, whichever is higher. Compute the 10-day drawdown from the crest of the auxiliary spillway or from the elevation attained from impounding the entire design storm, whichever is lower. Design the auxiliary spillway to pass the design flow at a safe velocity to a point downstream where the flow will not endanger the dam.

A constructed auxiliary spillway consists of an inlet channel, a control section, and an exit channel. Design the auxiliary spillway with a trapezoidal cross section. Locate the auxiliary spillway in undisturbed or compacted earth or in-situ rock. Design for stable side slopes for the material in which the spillway is to be constructed. Design a minimum bottom width of 10 feet for dams having an effective height of 20 feet or more.

Design a level inlet channel upstream from the control section for the distance needed to protect and maintain the crest elevation of the spillway. The minimum length of the level section shall be 20 feet. If necessary, curve the inlet channel upstream of the level section to fit existing topography. Design the exit channel grade in accordance with NEH Part 628, Chapter 50, Earth Spillway Design, or with equivalent procedures. The exit channel shall be straight until at least as far as the downstream toe of the embankment.

Natural auxiliary spillways may be used wherever there is a good vegetative cover in the spillway area and the topography is suitable. Natural or earth spillways must be designed by using the procedure described in NRCS NEH Part 650, EFH Chapter 11.

If an access road crosses the auxiliary spillway, the downstream edge of the road shall be located upstream of the level section but need not be greater than 30 feet upstream of the control section.

Structural auxiliary spillways

When used for principal spillways or auxiliary spillways, design chute spillways or drop spillways according to the principles set forth in NEH, Part 650, Engineering Field Handbook; and NEH, Section 5, Hydraulics; Section 11, Drop Spillways; and Section 14, Chute Spillways. Design a structural spillway with the minimum capacity required to pass the peak flow expected from a total design storm of the frequency and duration shown in Table 3, less any reduction creditable to the conduit discharge and detention storage.

Criteria for Excavated Ponds

Runoff

Design a minimum of 1.0 feet of freeboard above the peak elevation of the routed design hydrograph. Design a pipe and auxiliary spillway that will meet the capacity requirements of Table 3. Consider runoff flow patterns when locating the excavated pond and placing the spoil.

Side Slopes

Design stable side slopes in the excavated area. The maximum slope for various soil materials shall be as follows:

- Sand: 3 horizontal to 1 vertical
- Peat: 1 horizontal to 1 vertical
- Muck and other: 2 horizontal to 1 vertical

Wildlife ponds shall have at least 50 percent of the side slopes 5 horizontal to 1 vertical, or flatter and have at least 40 percent of the perimeter less than 5 feet deep.

Watering Ramp

When wildlife or livestock need access to stored water, use the criteria in WI NRCS CPS, Watering Facility (Code 614), to design a watering ramp.

Inlet Protection

Protect the side slopes from erosion where surface water enters the pond in a natural or excavated channel.

Excavated Material

Place the material excavated from the pond so that its weight does not endanger the stability of the pond side slopes and so that the soil will not wash back into the pond by rainfall. Dispose of excavated material in one of the following ways:

- Uniformly spread to a height that does not exceed 3 feet, with the top graded to a continuous slope away from the pond.
- Uniformly place or shape reasonably well, with side slopes assuming a natural angle of repose. Place excavated material at a distance equal to the depth of the pond, but not less than 12 feet from the edge of the pond.
- Shape to a designed form that blends visually with the landscape.
- Provide for low embankment construction and leveling of surrounding landscape.
- Haul material off-site.

Table 4. Acceptable PVC Pipe For Use in Earth Dams

Normal Pipe Size (in.)	Schedule or Standard Dimension Ratio (SDR)	Maximum Depth of Fill Over Pipe (ft.)
4 or smaller	SDR 26	15
4 or smaller	Sch 40, 80 or SDR 17, 21	20
6 or 8	Sch 40 or SDR 21, 26	14
6 or 8	Sch 80 or SDR 17	20
10, 12 or 16	Sch 40	12
10, 12 or 16	SDR 21, 26	15
10, 12 or 16	Sch 80 or SDR 17	20

¹Polyvinyl chloride pipe, PVC 1120 or PVC 1220, conforming to ASTM D 1785 or ASTM D 2241.

²Unit weight of soil = 120 lb/ft³ and wheel loading = 16,000 lbs (H20)

Table 5. Minimum Gages¹ for Corrugated Metal Pipe

Fill Height (ft.)	Minimum Gage for Steel Pipe (2 2/3 in. x 1/2 in. corrugations) ² with Diameter (in.) of:						Minimum Gage for Steel Pipe (3 in. x 1 in. corrugations) ² With Diameter (in.) of:						Minimum Thickness (in.) of Aluminum Pipe ³ (2 2/3 in. x 1/2 in. corrugations) ² With Diameter (in.) of:			
	≤ 21	24	30	36	42	48	36	42	48	54	60	66	≤ 21	24	30	36
1-15	16	16	16	14	12	10	16	16	16	16	16	16	0.06	0.06	0.075	0.075
15-20	16	16	16	14	12	10	16	16	16	16	14	14	0.06	0.075	0.105	0.105
20-25	16	14	12	10	8	4	16	16	14	12	10	8	0.06	0.105	0.135	— ⁴

¹16-gage pipe - thickness of 0.064 inch

¹14-gage pipe - thickness of 0.079 inch

¹12-gage pipe - thickness of 0.109 inch

¹10-gage pipe - thickness of 0.138 inch

²Pipes with diameters of 6, 8, and 10 in. have 1 1/2 in. x 1/4 in. corrugations

³Riveted or helical fabrication

⁴Not permitted

Table 6. Acceptable HDPE Pipe for Use in Earth Dams¹

Pipe Values	Maximum Height of Fill Over the Top of Pipe ² (feet)
SDR 21-32.5	10
SR 17	11.5

¹High density polyethylene pipe, ASTM-D3350 flexural modulus cell class 4 or greater, conforming to ASTM F714. These materials will typically have standard dimension ration (SDR) values ranging from 32.5 to 21 or pipe stiffness (PS) values ranging from 34 to 100 psi respectively.

²The maximum height of fill over top of the pipe. This is based on 0 degree bedding (line support at the invert only). Backfill is assumed to be at 85 to 95% of maximum standard proctor density.

Specific Use-based Criteria**1. Fish and Wildlife**

Management potential of cold and warm water fishponds vary widely according to available water quality and quantity and land resource area. Similarly, various design features including size, depth, side slopes, spacing, and site selection affect the management potential of wildlife ponds. Minimum surface area of the pond varies from 0.1 to 1.0 acre, depending on the design purpose. Additional planning and design criteria are contained in WI NRCS CPS, Fishpond Management (Code 399), Wildlife Wetland Habitat Management (Code 644), and Wetland Restoration (Code 657).

2. Crop and Orchard Spraying

If the pond will be used as a water supply for field or orchard spraying the following minimum amounts of water will be needed per application:

- 100 gal/acre for field spraying
- 1000 gal/acre for orchard spraying

3. Recreation

If the pond will be used for recreation, basic criteria can be found in Corps of Engineers Engineering Manual 1110-1-400 and DNR Design Standards Handbook, Chapter 20 (Swimming Beaches).

4. Fire Control

If the pond will be used as a water supply for fire control, basic criteria can be found in the National Fire Protection Association (NFPA) Standard 1142. Some factors that can affect the suitability of a site can include: distance to structures to be protected; accessibility for fire control equipment to the water, such as ingress and egress to the pond, adequate surfacing of the loading site, location of the pump within 20 feet of the static elevation of the anticipated drought water level, and compatibility of dry hydrant requirements; drought conditions; and dependability of water supply. Contact the local Fire Chief to clarify local design requirements.

CONSIDERATIONS**General Considerations****Visual resource design**

Carefully consider the visual design of ponds in areas of high public visibility and those associated with recreation. The shape and form of ponds, excavated material, and plantings are to relate visually to their surroundings and to their function.

Shape the embankment to blend with the natural topography. Shape the edge of the pond so that it is generally curvilinear rather than rectangular. Shape excavated material so that the final form is smooth, flowing, and fitting to the adjacent landscape rather than angular geometric mounds.

Fish and wildlife

Locate and construct ponds to minimize the impacts to existing fish and wildlife habitat.

When feasible, retain structures such as trees in the upper reaches of the pond and stumps in the pool area. Shape upper reaches of the pond to provide shallow areas and wetland habitat.

If operations include stocking fish, use WI NRCS CPS, Fishpond Management (Code 399).

Vegetation

Stockpile topsoil for placement on disturbed areas to facilitate revegetation.

Consider selecting and placing vegetation to improve fish habitat, wildlife habitat and species diversity.

Water quantity

Consider effects upon components of the water budget, especially:

- Effects on volumes and rates of runoff, infiltration, evaporation, transpiration, deep percolation, and groundwater recharge.
- Variability of effects caused by seasonal or climatic changes.
- Effects on downstream flows and impacts to environment such as wetlands, aquifers, and social and economic impacts to downstream uses or users.

Water quality

Consider the effects of:

- Erosion and the movement of sediment, pathogens, and soluble and sediment-attached substances that runoff carries.
- Short-term and construction-related effects of this practice on the quality of downstream watercourses.
- Water-level control on the temperatures of downstream water to prevent undesired effects on aquatic and wildlife communities.
- Wetlands and water-related wildlife habitats.
- Water levels on soil nutrient processes such as plant nitrogen use or denitrification.
- Soil water level control on the salinity of soils, soil water, or downstream water.
- Potential for earth moving to uncover or redistribute toxic materials.
- Livestock grazing adjacent to the pond. Consider fencing to keep livestock activities out of direct contact with the pond and dam.

PLANS AND SPECIFICATIONS

Prepare plans and specifications that describe the requirements for applying the practice according to this standard. This should include the following items:

- Location map
- Site plan view with existing contours, dam layout, dimensions, and appurtenant features
- Benchmark descriptions and elevations
- Typical profiles and cross sections along centerline of dam, principal spillway (or maximum cross section if no principal spillway), auxiliary spillway, and appurtenant features
- Soil boring symbol logs
- Elevations of inlet and outlet of conduit and other appurtenant features
- Structural drawings adequate to describe the construction requirements
- Site-specific construction and material requirements
- Construction site pollution control measures
- Reclamation plans of any borrow areas.
- Requirements for vegetative establishment and/or mulching, as needed
- Safety features

OPERATION AND MAINTENANCE

Prepare an operation and maintenance plan for the operator.

As a minimum, include the following items in the operation and maintenance plan:

- Periodic inspections of all structures, earthen embankments, spillways, and other significant appurtenance

- Prompt repair or replacement of damaged components
- Prompt removal of sediment when it reaches predetermined storage elevations
- Periodic removal of trees, brush, and undesirable species
- Periodic inspection of safety components and immediate repair if necessary
- Maintenance of vegetative protection and immediate seeding of bare areas as needed

REFERENCES

American Society for Testing and Materials, Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes, ASTM Standard D 420.

American Society for Testing and Materials. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), ASTM D2487. West Conshohocken, PA.

USDA NRCS. Engineering Technical Releases, TR-210-60, Earth Dams and Reservoirs. Washington, DC.

USDA NRCS. National Engineering Handbook (NEH), Part 628, Dams. Washington, DC. USDA NRCS. NEH, Part 633, Soil Engineering. Washington, DC.

USDA NRCS. NEH, Part 636, Structural Engineering. Washington, DC. USDA NRCS. NEH, Part 650, Engineering Field Handbook. Washington, DC.

National Fire Protection Association, Water Supplies for Suburban and Rural Fire Fighting, Standard 1142.378-15 NRCS, WI 7/11

United States Department of Agriculture – Natural Resources Conservation Service, Agriculture Handbook Number 590 (Ponds – Planning, Design, Construction).

Wisconsin NRCS Home Page www.wi.nrcs.usda.gov

United States Department of Agriculture – Natural Resources Conservation Service, Wisconsin Standard Detail Drawings For Conservation Practices.

Wisconsin Department of Natural Resources, A Guide to Planning and Installing Dry Fire Hydrants.

Wisconsin Department of Natural Resources, Wisconsin Construction Site Best Management Practice Handbook, Publication WR-222 92 Rev, 1992.

Wisconsin Department of Transportation, Facilities Development Manual, Chapter 10 (Erosion Control and Storm Water Quality), 1997.

DEFINITIONS

1% flood event. A flood determined to be representative of large floods, which in any given year has a 1% chance of occurring or being exceeded. The 1% flood is based on a statistical analysis of lake level or streamflow records available for the watershed or an analysis of rainfall and runoff characteristics in the watershed, or both. This is commonly referred to as the 100 year event or regional flood.

Allowance for settlement. The product of the design fill height and the settlement factor. See Figure 1.

Auxiliary spillway. The auxiliary spillway is the spillway designed to convey excess water through, over, or around a dam. This has been commonly referred to as an "emergency spillway".

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.

Constructed Elevation. The sum of the design elevation and the allowance for settlement. See Figure 1.

Control section. The control section of an open channel spillway where accelerated flow passes through critical depth.

Design elevation. Design elevation is the required top elevation of the embankment along the centerline before allowance for settlement has been added. See Figure 1.

Design Fill Height (Table 1). The difference in elevation between the design elevation and foundation elevation after stripping along the centerline of embankment. See Figure 1.

DNR Large Dam (Table 3). Any dam with a structural height of more than 6 feet and impounds 50 acre-feet or more of water at the design elevation or has a structural height of 25 feet or more and impounds more than 15 acre-feet of water at the design elevation. See Figure 1. Structures meeting this definition must be designed in accordance with the standards of Wisconsin Administrative Code NR 333.

Earth spillway. An earth spillway is an open channel spillway in earth materials without vegetation.

Effective height. The effective height of the dam is the difference in elevation, in feet, between the lowest open channel auxiliary spillway crest and the lowest point in the original cross section taken on the centerline of the dam prior to stripping. If there is no open channel auxiliary spillway, the design elevation for the top of the dam is the upper limit. See Figure 1.

Exit channel. The exit channel of an open channel spillway is the portion downstream from the control section which conducts the flow to a point where it may be released without jeopardizing the dam.

Fetch. The longest distance that wind can blow across a body of water to the embankment.

Freeboard. Freeboard is the additional depth or elevation required above computed design requirements.

High hazard potential. Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life.

Inlet channel. The inlet channel of an open channel spillway is the portion upstream from the control section.

Karst. Refers to areas of land underlain by carbonate bedrock (limestone or dolomite). Typical land features in karst areas include sinkholes, disappearing streams, closed depressions, blind valleys, caves, and springs.

Low hazard potential. Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are primarily limited to the owner's property.

Principal spillway (Table 3). The principal spillway is the lowest ungated spillway designed to convey water from the reservoir (pond) at predetermined release rates.

Significant hazard potential. Dams assigned the significant hazard potential classification are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss, environmental damage, disruption of lifeline facilities, or can impact other concerns. Significant hazard potential classification dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

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

Spillway (Auxiliary Spillway). A spillway is an open or closed channel, conduit, or drop structure used to convey water from a reservoir. It may contain gates, either manually or automatically controlled, to regulate the discharge of water.

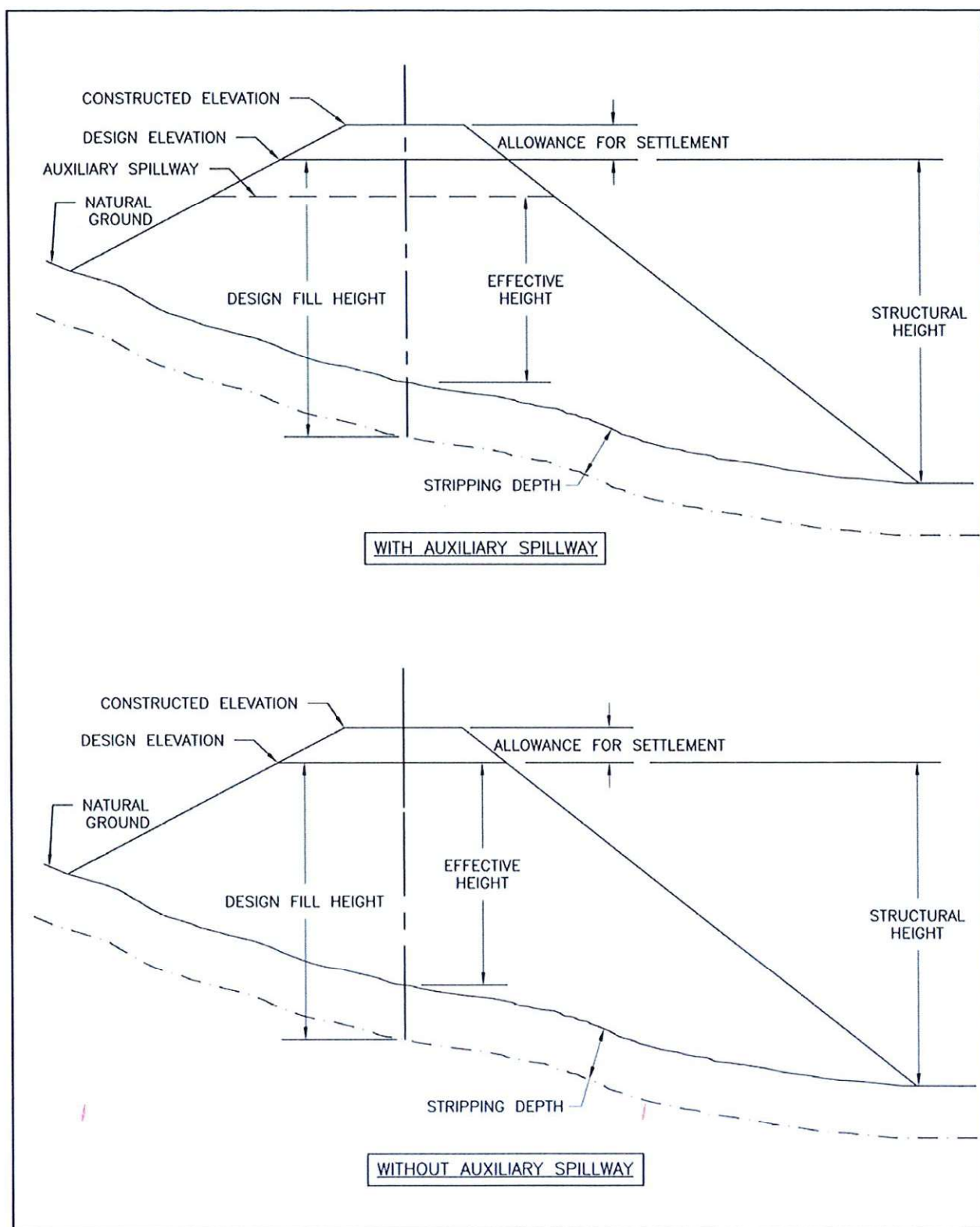
Storage. Storage is the capacity of the reservoir in acre-feet below the elevation of the crest of the lowest auxiliary spillway or the elevation of the top of the dam if there is no open channel auxiliary spillway.

Structural height (DNR Large Dam). The difference in the elevation between the design elevation and the lowest elevation of the natural stream or lake bed at the downstream toe of the embankment. See Figure 1.

Trickle tube (Table 3). A trickle tube is a minimum 4 inch diameter conduit intended to draw down the pool to a level below the auxiliary spillway. The Trickle tube discharge is not credited in the design, nor is it considered the principal spillway.

Vegetated spillway. A vegetated spillway is a vegetated open channel spillway in earth materials.

Figure 1





Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

CODE 590

(ac)

DEFINITION

Manage rate, source, placement, and timing of plant nutrients and soil amendments while reducing environmental impacts.

PURPOSE

This practice is used to accomplish one or more of the following purposes:

- Improve plant health and productivity.
- Reduce excess nutrients in surface and ground water.
- Reduce emissions of objectionable odors.
- Reduce emissions of particulate matter (PM) and PM precursors.
- Reduce emissions of greenhouse gases (GHG).
- Reduce emissions of ozone precursors.
- Reduce the risk of potential pathogens from manure, biosolids, or compost application from reaching surface and ground water.
- Improve or maintain soil organic matter.

CONDITIONS WHERE PRACTICE APPLIES

All fields where plant nutrients and soil amendments are applied. Does not apply to one-time nutrient applications at establishment of permanent vegetation.

CRITERIA

General Criteria Applicable to All Purposes

Develop a nutrient management plan for nitrogen (N), phosphorus (P), and potassium (K), which accounts for all known measurable sources and removal of these nutrients.

Sources of nutrients include, but are not limited to, commercial fertilizers (including starter and in-furrow starter/pop-up fertilizer), animal manures, legume fixation credits, green manures, plant or crop residues, compost, organic by-products, municipal and industrial biosolids, wastewater, organic materials, estimated plant available soil nutrients, and irrigation water.

When irrigating, apply irrigation water in a manner that reduces the risk of nutrient loss to surface and ground water.

Follow all applicable State requirements and regulations when applying nutrients near areas prone to contamination, such as designated water quality sensitive areas, (e.g., lakes, ponds, rivers and streams,

sinkholes, wellheads, classic gullies, ditches, or surface inlets) that run unmitigated to surface or groundwater.

Soil and tissue testing and analysis

Base the nutrient management plan on current soil test results in accordance with land grant university (LGU) guidance, or industry practice when recognized by the LGU. Use soil tests no older than 2 years when developing new nutrient management plans. Use tissue testing, when applicable, for monitoring or adjusting the nutrient management plan in accordance with LGU guidance, or industry practice when recognized by the LGU.

For nutrient management plan revisions and maintenance, take soil tests on an interval recommended by the LGU or as required by local rules and regulations.

Collect, prepare, store, and ship all soil and tissue samples following LGU guidance or industry practice. The test analyses must include pertinent information for monitoring or amending the annual nutrient plan. Follow LGU guidelines regarding required analyses and test interpretations.

For soil test analyses, use laboratories successfully meeting the requirements and performance standards of the North American Proficiency Testing Program under the auspices of the Soil Science Society of America and NRCS or use an alternative NRCS- or State-approved certification program that considers laboratory performance and proficiency to assure accuracy of soil test results. Alternative certification programs must have solid stakeholder support (e.g., State department of agriculture, LGU, water quality control entity, NRCS State staff, growers, and others) and be State or regional in scope.

Maintain soil pH within ranges which enhance the adequate level for plant or crop nutrient availability and utilization. Refer to State LGU documentation for guidance.

Manure, organic by-product, and biosolids testing and analysis

Collect, prepare, store, and ship all manure, organic by-products, and biosolids following LGU guidance or industry practice when recognized by the LGU. In the absence of such guidance, test at least annually, or more frequently if needed to account for operational changes (e.g., feed management, animal type, manure handling strategy, etc.) impacting manure nutrient concentrations. If no operational changes occur and operations can document a stable level of nutrient concentrations for the preceding 3 consecutive years, manure may be tested less frequently, unless Federal, State, or local regulations require more frequent testing. Follow LGU guidelines regarding required analyses and test interpretations. Analyze, as a minimum, total N, total P or P_2O_5 , total K or K_2O , and percent solids.

When planning for new or modified livestock operations, and manure tests are not available yet, use the output and analyses from similar operations in the geographical area if they accurately estimate nutrient output from the proposed operation or use "book values" recognized by the NRCS (e.g., NRCS Agricultural Waste Management Field Handbook) and the LGU.

For manure analyses, use laboratories successfully meeting the requirements and performance standards of the Manure Testing Laboratory Certification program under the auspices of the Minnesota Department of Agriculture or other NRCS-approved program that considers laboratory performance and proficiency to assure accurate manure test results.

For nutrient management plans developed as a component of a comprehensive nutrient management plan for an animal feeding operation (AFO) follow policy in NRCS directive General Manual (GM) 190, Part 405, "Comprehensive Nutrient Management Plans." These plans must include documentation of all nutrient imports, exports, and on-farm transfers.

Nutrient loss risk assessments

Use current NRCS-approved nitrogen, phosphorus, and soil erosion risk assessment tools to assess the site-specific risk of nutrient and soil loss.

Complete an NRCS-approved nutrient risk assessment for N on all fields where nutrient management is planned unless the State NRCS, in cooperation with State water quality control authorities, has determined specific conditions where N leaching is not a risk to water quality, including drinking water.

Complete an NRCS-approved nutrient risk assessment for P when any of the following conditions are met—

- P application rate exceeds LGU fertility rate guidelines for the planned crop(s).
- The planned area is within a P-impaired watershed.
- The site-specific conditions equating to low risk of P loss have not been determined by the NRCS in cooperation with the State water quality control authority.

Any fields excluded from a P risk assessment must have a documented agronomic need for P, based on soil test P and LGU nutrient recommendations.

For fields receiving manure, where P risk assessment results equate to—

- LOW risk.—Manure can be applied at rates to supply P at greater than crop requirement not to exceed the N requirement for the succeeding crop.
- MODERATE risk.—Manure can be applied at rates not to exceed crop P removal rate or the soil test P recommended rate for the planned crops in rotation.
- HIGH risk.—Manure can be applied at rates not to exceed crop P removal rate if the following requirements are met:
 - A soil P drawdown strategy has been developed, documented, and implemented for the crop rotation.
 - Implementation of all mitigation practices determined to be needed by site-specific assessments for nutrients and soil loss to protect water quality.
 - Any deviation from these high-risk requirements that would increase the risk of P runoff requires the approval of the Chief of the NRCS.

The 4Rs of nutrient stewardship

Manage nutrients based on the 4Rs of nutrient stewardship—apply the right nutrient source at the right rate at the right time in the right place—to improve nutrient use efficiency by the crop and to reduce nutrient losses to surface and groundwater and to the atmosphere.

Nutrient source

Choose nutrient sources compatible with application timing, tillage and planting system, soil properties, crop, crop rotation, soil organic content, and local climate to minimize risk to the environment.

Determine nutrient values of all nutrient sources (e.g. commercial fertilizers, manure, organic by-products, biosolids) prior to land application.

Determine nutrient contribution of cover crops, previous crop residues, and soil organic matter.

For operations following USDA's National Organic Program, apply and manage nutrient sources according to program regulations.

For enhanced efficiency fertilizer (EEF) products, use products defined by the Association of American Plant Food Control Officials as EEF and recommended for use by the State LGU.

In areas where salinity is a concern, select nutrient sources that limit the buildup of soil salts. When manures are applied, and soil salinity is a concern, monitor salt concentrations to prevent potential plant or crop damage and reduced soil quality.

Apply manure or organic by-products on legumes at rates no greater than the LGU estimated N removal rates in harvested plant biomass, not to exceed P risk assessment limitations.

For any single application of nutrients applied as liquid (e.g., liquid manure, nutrients in irrigation water, fertigation)—

- Do not exceed the soil's infiltration rate or water holding capacity.
- Apply so that nutrients move no deeper than the current crop rooting depth.
- Avoid runoff or loss to subsurface tile drains.

Nutrient rate

Plan nutrient application rates for N, P, and K using LGU recommendations or industry practices when recognized by the LGU. Lower-than-recommended nutrient application rates are permissible if the client's objectives are met.

At a minimum, determine the rate based on crop/cropping sequence, current soil test results, and NRCS-approved nutrient risk assessments. Where applicable, use realistic yield goals.

For new crops or varieties where LGU guidance is unavailable, industry-demonstrated yield and nutrient uptake information may be used.

Estimate realistic yield potentials or realistic yield goals using LGU procedures or based on historical yield or growth data, soil productivity information, climatic conditions, nutrient test results, level of management, and/or local research results considering comparable management and production conditions.

Nutrient application timing and placement

Consider the nutrient source, management and production system limitations, soil properties, weather conditions, drainage system, soil biology, and nutrient risk assessment to develop optimal timing of nutrients. For N, time the application as closely as practical with plant and crop uptake. For P, time planned surface application when runoff potential is low. Time the application of all nutrients to minimize potential for soil compaction.

For crop rotations or multiple crops grown in one year, do not apply additional P if it was already added in an amount sufficient to supply all crop nutrient needs.

To avoid salt damage, follow LGU recommendations for the timing, placement, and rate of applied N and K in starter fertilizer or follow industry practice recognized by the LGU.

Do not surface apply nutrients when there is a risk of runoff, including when—

- Soils are frozen.
- Soils are snow-covered.
- The top 2 inches of soil are saturated.

Exceptions for the above criteria related to surface-applied nutrients when there is a risk of runoff can be made when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. NRCS, in cooperation with the State water quality control authority, will define adequate treatment levels and specified conditions for applications of manure if soils are frozen and/or snow covered or the top 2 inches of soil are saturated. At a minimum, must consider the following site and management factors:

- Climate (long-term)
- Weather (short-term)
- Soil characteristics
- Slope

- Areas of concentrated flow
- Organic residue and living covers
- Amount and source of nutrients to be applied
- Setback distances to protect local water quality

Additional Criteria to Minimize Agricultural Nonpoint Source Pollution of Surface and Groundwater

Apply conservation practices to avoid nutrient loss and control and trap nutrients before they can leave the field(s) by surface, leaching, or subsurface drainage (e.g., tile, karst) when there is a significant risk of transport of nutrients.

Additional Criteria to Reduce the Risk of Potential Pathogens From Manure, Biosolids, or Compost Application From Reaching Surface and Groundwater

When applicable, follow proper biosecurity measures as provided in NRCS directives GM-130, Part 403, Subpart H, "Biosecurity Preparedness and Response."

Follow all applicable Federal, Tribal, State, and local laws and policies concerning the application of manure, biosolids, or compost in the production of fresh, edible crops.

Apply manure, biosolids, or compost with minimal soil disturbance or by injection into the soil unless it is being applied to an actively growing crop, a minimum of 30 percent residue exists, or there is a living cover that has a fibrous root system with 75 percent or more cover. Do not surface apply manure if a storm event is forecast within 24 hours.

Additional Criteria to Reduce Emissions of Objectionable Odors, PM and PM Precursors, and GHG and Ozone Precursors

To address air quality concerns caused by odor, N, sulfur, and particulate emissions; adjust the source, timing, amount, and placement of nutrients to reduce the negative impact of these emissions on the environment and human health.

Do not surface apply solid nutrient sources, including commercial fertilizers, manure, or organic by-products of similar dryness/density when there is a high probability that wind will blow the material and emissions offsite. Do not surface apply liquid nutrient sources when there is a high probability that wind will blow the liquid droplets applied from sprinklers or other applicable methods offsite.

Reduce the potential for volatilization by applying sources subject to volatilization during cooler, higher humidity conditions or by placement that minimizes vulnerability to volatilization.

Additional Criteria to Improve or Maintain Organic Matter

Design the plant or crop management systems so the soil conditioning index (SCI) organic matter subfactor is positive.

Apply manure, compost, or other organic nutrient sources at a rate and with minimal disturbance that will improve soil organic matter without exceeding acceptable risk of N or P loss.

For low residue plant or cropping systems, apply adequate nutrients to optimize plant or crop residue production to maintain or increase soil organic matter.

CONSIDERATIONS

General Considerations

Consider development of nutrient management plans by conservation management unit (CMU). A CMU is a field, group of fields, or other land units of the same land use and having similar treatment needs and planned management. A CMU is a grouping by the planner to simplify planning activities and facilitate development of conservation management systems. A CMU has definitive boundaries such as fencing, drainage, vegetation, topography, or soil lines.

Develop site-specific yield maps using a yield monitoring system, multispectral imagery or other methods. Use the data to further delineate low- and high-yield areas, or zones, and make the necessary management changes. Use variable rate nutrient application based on site-specific factor variability. See NRCS directive Agronomy Technical Note (TN) 190, AGR.3, "Precision Nutrient Management Planning."

Use the adaptive nutrient management learning process to improve nutrient use efficiency on farms as outlined in NRCS' national nutrient policy in GM-190, Part 402, "Nutrient Management." Consider using an adaptive approach to adjust nutrient rate, timing, form, and placement as soil biologic functions and soil organic matter changes over time. See NRCS directive Agronomy Technical Note (TN) 190, AGR.7, "Adaptive Nutrient Management Process."

When developing new nutrient management plans, consider using soil test information no older than 1 year rather than 2 years.

Develop a whole farm nutrient budget (nutrient mass balance), including all imported and exported nutrients. Imports may include feed, fertilizer, animals and bedding, while exports may include crop removal, animal products, animal sales, manure, and compost.

Modify animal feed diets to reduce the nutrient content of manure following guidance contained in Conservation Practice Standard (CPS) Feed Management (Code 592).

Provide a nutrient analysis of all nutrient source exports (manure or other materials).

Excessive levels of some nutrients can cause induced deficiencies of other nutrients, (e.g., high soil test P levels can result in zinc deficiency in corn).

Use soil tests, plant tissue analyses, and field observations to check for secondary plant nutrient deficiencies or toxicity that may impact plant growth or availability of the primary nutrients.

Do not apply K in situations where an excess (greater than soil test K recommendation) causes nutrient imbalances in crops or forages.

Use bioreactors and multistage drainage strategies to mitigate nutrient loss pathways, as applicable.

Use legume crops and cover crops to provide N through biological fixation. Cover crops with a carbon to nitrogen ratio below 20:1 can release a large amount of soluble N after being plowed or tilled into the soil when an actively growing crop is not present to take up nutrients, leading to increased risks of nitrate movement and nitrous oxide emissions. The nitrous oxide emissions often occur in high soil moisture conditions, such as when a legume cover crop is plowed down in fall or early spring. To avoid these losses, use grass-legume or grass-legume-forbs mixtures with a more balanced carbon to nitrogen ratio.

Use winter hardy grass cover crops to take up excess N after the cash crop growing season and promote contribution of the nitrogen to next plant or crop.

Use conservation practices that slow runoff, reduce erosion, and increase infiltration (e.g., filter strip, contour farming, or contour buffer strips).

Use application methods, timing, technologies or strategies to reduce the risk of nutrient movement or loss, such as—

- Split nutrient applications.
- Banded applications.
- Injection of nutrients below the soil surface.
- Incorporate surface-applied nutrient sources when precipitation capable of producing runoff or erosion is forecast within the time of a planned application.
- High-efficiency irrigation systems and technology.

- Enhanced efficiency fertilizers
 - Slow or controlled release fertilizers
 - Nitrification inhibitors
 - Urease inhibitors.
- Drainage water management.
- Tissue testing, chlorophyll meters, or real-time sensors.
- Pathogen management considerations.

When a recycled product (e.g., compost) is to be used as a nutrient source on food crops or as food for humans or animals, make sure that pathogen levels have been reduced to acceptable levels (reference the Food and Drug Administration's Food Safety Modernization Act at www.fda.gov/FSMA). When the recycled product has come from another farming operation, implement biosecurity measures and evaluate the risk of pathogen transfer that could cause plant or animal diseases.

Use manure treatment systems that reduce pathogen content from manure.

Implementing a soil health management system that reduces tillage or other soil disturbance, includes a diverse rotation of crops and cover crops, keeps roots growing throughout the year, and keeps the soils covered to reduce nutrient losses, and improves—

- Nutrient use efficiency, rooting depth, and availability of nutrients.
- Soil organic matter levels.
- Availability of nutrients from organic sources.
- Aggregate stability and soil structure.
- Infiltration, drainage, and aeration of the soil profile.
- Soil biological activity.
- Water use efficiency and available moisture.

Use targeted or prescribed livestock grazing to enhance nutrient cycling and improve soil nutrient cycling functions.

Elevated soil test P levels may lead to reduced mycorrhizal fungal associations and immobilize some micronutrients, such as iron, zinc, and copper.

Apply manure, compost, or other nutrient sources with minimal soil disturbance and at a rate that will improve soil organic matter without exceeding acceptable risk of N or P loss.

PLANS AND SPECIFICATIONS

In the nutrient management plan, document—

- Aerial site photograph(s), imagery, topography, or site map(s).
- Soil survey map of the site.
- Soil information including: soil type, surface texture, drainage class, permeability, available water capacity, depth to water table, restrictive features, and flooding and ponding frequency.
- Location of designated sensitive areas and the associated nutrient application restrictions and setbacks.
- Location of nearby residences, or other locations where humans may be present on a regular basis, that may be impacted if odors or PM are transported to those locations.
- Results of approved risk assessment tools for N, P, and erosion losses.
- Documentation establishing the application site presents a low risk for P transport to local water if P is applied in excess of crop requirement.

- Current and planned plant production sequence or crop rotation.
- All available test results (e.g. soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient budget and management plan are based.
- When soil P levels are increasing above an agronomic level, include a discussion of the risk associated with P accumulation and a proposed P draw-down strategy.
- Realistic yield goals for the crops (where applicable for developing the nutrient management plan).
- Nutrient recommendations for N, P, and K for the entire plant production sequence or crop rotation.
- Listing, quantification, application method and timing for all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports, and onsite transfers.
- Guidance for implementation, operation and maintenance, and recordkeeping.

For variable rate nutrient management plans, also include—

- Geo-referenced field boundary and data collected that was processed and analyzed as a GIS layer or layers to generate nutrient or soil amendment recommendations per management zone. Must include site-specific yield maps using soils data, current soil test results, and a yield monitoring system with GPS receiver to correlate field location with yield.
- Nutrient recommendation guidance and recommendation equations used to convert the GIS base data layer or layers to a nutrient source material recommendation GIS layer or layers.
- After implementation, provide application records per management zone or as applied map within individual field boundaries (or electronic records) documenting source, timing, method, and rate of all nutrient or soil amendment applications.

If increases in soil P levels are expected above an agronomic level (i.e., when N-based rates are used), document—

- Soil P levels at which it is desirable to convert to P-based planning.
- A long-term strategy and proposed implementation timeline for soil test P drawdown from the production and harvesting of crops.
- Management activities or techniques used to reduce the potential for P transport and loss.
- For AFOs, a quantification of manure produced in excess of crop nutrient requirements.

OPERATION AND MAINTENANCE

Review or revise plans periodically to determine if adjustments or modifications are needed. At a minimum, review and revise plans as needed with each soil test cycle, changes in manure management, volume or analysis, plants and crops, or plant and crop management.

Monitor fields receiving animal manures and biosolids for the accumulation of heavy metals and P in accordance with LGU guidance and State law.

For animal feeding operation, significant changes in animal numbers, management, and feed management will necessitate additional manure analyses to establish a revised average nutrient content.

Calibrate application equipment to ensure accurate distribution of material at planned rates. For products too dangerous to calibrate, follow LGU or equipment manufacturer guidance on proper equipment design, plumbing, and maintenance.

Document the nutrient application rate. When the applied rate differs from the planned rate, provide appropriate documentation to explain the difference.

Protect workers from and avoid unnecessary contact with nutrient sources. Take extra caution when handling anhydrous ammonia or when managing organic wastes stored in unventilated tanks, impoundments, or other enclosures.

Use material generated from cleaning nutrient application equipment in an environmentally safe manner. Collect, store, or field apply excess material in an appropriate manner.

Recycle or dispose of nutrient containers in compliance with State and local guidelines or regulations.

Maintain records for at least 5 years to document plan implementation and maintenance. Records must include—

- All test results (soil, water, compost, manure, organic by-product, and plant tissue sample analyses) upon which the nutrient management plan is based.
- Listing and quantification of all nutrient sources (including all enhanced efficiency fertilizer products) that are planned for use and documentation of all nutrient imports, exports and onsite transfers.
- Date(s), method(s), and location(s) of all nutrient applications.
- Weather conditions and soil moisture at the time of application, elapsed time from manure application to rainfall or irrigation event(s).
- Plants and crops planted, planting and harvest dates, yields, nutrient analyses of harvested biomass, and plant or crop residues removed.
- Dates of plan review, name of reviewer, and recommended adjustments resulting from the review.

For variable rate nutrient management plans, also include—

- Maps identifying the variable application location, source, timing, amount, and placement of all plant and crop nutrients applied.
- GPS-based yield maps for crops where yields can be digitally collected.

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