Water Quality Trading Plan

BC Organics Wastewater Facility

Town of Holland | Brown County, Wisconsin

Prepared For

BC ORGANICS, LLC

MARCH 27, 2019

McM. No. D0992-9-18-00618.02

NAV:gmh:car

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TABLE OF CONTENTS

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I. EXECUTIVE SUMMARY

BC Organics, LLC plans to use water quality trading to comply with its Water Quality Based Effluent Limits (WQBELs) for the new BC Organics wastewater facility located at the southwest corner of Lamers Clancy Road and Old 57 Road, Town of Holland, Brown County, Wisconsin. The location of the BC Organics facility is depicted in Appendix A. BC Organics, LLC plans to use water quality trading for Total Phosphorus (TP) and Total Suspended Solids (TSS) WQBELs pursuant to Wisconsin Pollution Discharge Elimination System (WPDES) permit WI-0066303-01.

The purpose of the BC Organics facility is to process manure from the Wiese Brothers Dairy, Country Aire Farms, Rueden Beef, Thompson's Gold Dust Dairy, New Horizons Dairy, Brickstead Dairy, and Wall Dairy facilities producing biogas, soil amendments, and fertilizers. BC Organics also intends to implement technology at the facility to treat liquids from the manure before discharging wastewater into the adjacent unnamed tributary of the East River. The new wastewater facility is planned to have a maximum TP effluent discharge of 18.3 pounds per year and a maximum TSS effluent discharge of 1,827 pounds of per year.

BC Organics, LLC has submitted application materials to obtain a new WPDES permit for discharge of treated wastewater. BC Organics plans to convert 15 acres of cropland into prairie grassland to comply with its TP and TSS discharge limits for the new BC Organics wastewater facility. Within the 15 acre site, McMahon Associates, Inc. (McMAHON) evaluated TP and TSS discharges for both the cropland condition and the proposed prairie grassland condition. Using a trade ratio of 1.2:1 and a Credit Threshold of 0.5 pounds/acre/year for TP and 0.26 pounds/acre/year for TSS, McMAHON calculated the annual interim and long-term water quality trading credits associated with conversion of 15 acres of cropland to native prairie grassland. In addition to the prairie credits, McMAHON evaluated the long-term trading credits associated with construction of the wet detention ponds for the proposed wastewater facility. The prairie grassland and wet detention pond locations are depicted in Appendix A. The trading credits are

summarized in Table 1. BC Organics will use the interim TP and TSS credits to assist with its WPDES Permit compliance during the initial 5-year permit term. The long-term TP and TSS credits will be held in reserve for future use.

Table 1

Average Interim & Long-Term Total Phosphorus & Total Suspended Solids Trading Credits

	Total Phosphorus (TP) (Pounds per Year)	Total Suspended Solids (TSS) (Pounds per Year)
Interim Credits – 5 Year (15 ac prairie)	69	1,264
Interim Credits – 5 Year (wet pond)	4.5	2,227
Long-term Credits (15 ac prairie)	12	1,244
Long-term Credits (wet pond)	0.5	327

II. PROJECT HISTORY & BACKGROUND

A. Project Site

The BC Organics wastewater facility will process manure from the Wiese Brothers Dairy, Country Aire Farms, Rueden Beef, Thompson's Gold Dust Dairy, New Horizons Dairy, Brickstead Dairy, and Wall Dairy facilities. Force mains will deliver manure from Wiese Brothers Dairy and Country Aire Farms to the BC Organics wastewater facility. Liquid manure from the other farms will be trucked to the wastewater facility and unloaded in an enclosed Receiving Building. The manure will be digested, dried, and treated before most of the by-products are sent to be used as soil amendment products and liquid organic nitrogen and potassium fertilizer. All fields receiving sludge byproduct will report the sludge application in their nutrient management plan. Wastewater will be discharged from the wastewater facility into an unnamed stream of the East River. No shifting of nutrients will occur to other lands due to the proposed prairie area being taken out of production.

The BC Organics wastewater facility is located within the East River Sub-Basin and the larger Lower Fox River Basin. A Total Maximum Daily Load (TMDL) for TP and TSS was developed for the Lower Fox River Basin and Green Bay Area of Concern, which includes the East River. The BC Organics wastewater facility will help accomplish the goal of reducing phosphorus discharges into the East River waterways and the larger Lower Fox River. The facility will also assist in protecting groundwater in areas with shallow soils or fractured bedrock.

B. Purpose of Water Quality Trading Plan

The purpose of this Water Quality Trading Plan is to demonstrate how BC Organics will utilize water quality trading to comply with the TP and TSS discharge limits for WPDES Permit WI-0066303-01. The total area of prairie that will be used for phosphorus and TSS trading is 15 acres. The interim TP and TSS water quality trading credits associated with converting these cropland areas into native prairie grassland will be used by BC Organics, LLC for WPDES Permit compliance during the initial 5-year permit period. The long-term credits associated within the prairie will be held in reserve for potential future use. Prairie site preparation and spraying is scheduled to begin in spring of 2019 and continue through summer of 2019. Prairie seeding is scheduled for the fall of 2019.

In addition, BC Organics will construct two wet detention ponds for the post-construction site that is associated with the proposed wastewater facility. The long-term TP and TSS water quality trading credits associated within these wet detention ponds will be held in reserve for potential future use. Completion of post-construction site construction is scheduled for the spring of 2020, including the wet ponds.

C. Total Phosphorus & Total Suspended Solids Permit Requirements

BC Organics is the operating company that is seeking a WPDES Permit WI-0066303-01 in order to discharge clean effluent from the wastewater treatment facility to an unnamed tributary of the East River. The proposed wastewater facility is planned to have a maximum TP effluent discharge of 18.3 pounds per year and a maximum TSS effluent discharge of 1,827 pounds of per year. Total waste load allocation for TP and TSS are zero for the project. If sufficient TP and TSS water quality trading credits are not available to allow discharge into the unnamed tributary, then all effluent discharge from the wastewater facility will be directed to existing storage lagoons at Wiese Brothers Dairy and Country Aire Farms and handled according to the land spreading conditions set forth in WPDES Permit WI-0066303-01.

III. PROJECT & CREDIT LOCATIONS

A. Project Location

The location of the BC Organics wastewater facility and Outfall 1 are depicted in Appendix A. Outfall 1 is located at approximate latitude of 44.280809 and longitude of -88.115350. Outfall 1 is proposed to discharge into the adjacent unnamed tributary stream which then discharges into the East River. The East River is a 303(d) impaired water body that is listed for TP, TSS, and unspecified metals. The BC Organics wastewater facility and Outfall 1 are located within Hydrologic Unit Code (HUC) 12 Sub-Watershed #040302040301, which is also known as the Upper East River Sub-watershed.

B. Practice/Credit Locations

The prairie grassland and wet detention pond practices that generate TP and TSS credits are located within the same parcel as the BC Organics wastewater facility, which is owned by the Brown County Port & Resource Recovery. BC Organics, LLC will enter into a water quality trading agreement with the Brown County Port & Resource Recovery for the proposed prairie grassland practice. BC Organics will implement the native prairie grassland and construct the wet detention ponds. Appendix A, Figure 1 depicts the proposed prairie location, including its proximity to the BC Organics wastewater facility, Outfall 1, and the wet detention ponds.

IV. CREDIT BROKER REQUIREMENTS

A credit broker is not needed since BC Organics will be executing a water quality trading agreement directly with the landowner, which is the Brown County Port & Resource Recovery for the initial 5 year WPDES Permit period and potentially longer. For future 5 year WPDES Permit periods, BC Organics will likely be executing water quality trading agreements directly with other project partners or crop producers, such as Wiese Brothers Dairy, Country Aire Farms, Rueden Beef, Thompson's Gold Dust Dairy, New Horizons Dairy, Brickstead Dairy, and Wall Dairy.

V. PRACTICE IMPLEMENTATION

A. Prairie Grassland Description & Practice Standard

BC Organics or a designee will oversee the establishment, operation and maintenance of the native prairie grassland in accordance with the criteria contained within NRCS Technical Standard Code 327 (Appendix B). BC Organics or a designee will be responsible for the site preparation and planting of the native prairie grassland as described in NRCS Technical Note 5 (Appendix B). If any drain tile serves proposed prairie area, it is to be abandoned before seeds can be established. BC Organics or a designee will be responsible for monthly maintenance and inspections, and a professional prairie consultant will be responsible for annual inspections. Inspections should document established species, percent cover, maintenance issues, and pictures should be taken capturing inspection notes and a general prairie overview. Practices are required to be certified monthly by BC Organics in their Discharge Monitoring Reports, and all reporting of phosphorus credits will be completed monthly. It is recommended that at the beginning of the establishment period inspection occur weekly or bi-weekly to ensure adequate germination and coverage of native species early on, and to remove competitive volunteer species.

1. Establishment Plan

The Prairie Establishment Plan can be found in Appendix C. Prairie establishment will be performed in accordance with the following:

- Site map identifying where the prairie is to be planted (Appendix A, Figure 1).
- Effective tillage and herbicide applications to weeds in the growing season just prior to planting, as well as assurance that herbicide used will not have residual impacts on the planted seed (Appendix B).
- Prairie grass seeding that contains the recommended seed types and amounts as well as appropriate seeding dates (Appendix B).
- Costs can be estimated using NRCS's prairie seed calculator (Appendix D). Prairie establishment will be performed using actual costs.

Established practices are subject to inspection by the Wisconsin Department of Natural Resources (WDNR) or its agents at any time upon giving reasonable notice to BC Organics. In addition, annual reporting to the WDNR is required for compliance with the WQT Plan.

2. Operation & Maintenance Plan

Operation and maintenance activities will be performed as outlined in Technical Standard Code 327 (Appendix B). Some of the requirements included in Code 327 are mowing or herbicide applications to control competitive weeds, mowing heights, and watering for plant establishment.

B. Wet Detention Pond Description & Practice Standard

BC Organics or a designee will oversee the establishment, operation and maintenance of the wet detention ponds in accordance with the criteria contained within WDNR Technical Standard Code 1001 (Appendix E). BC Organics or a designee will be responsible for the continued operation and maintenance of the wet detention ponds for duration of the water quality trading credits. A professional engineer will be responsible for annual inspections of the pond. Practices are required to be certified monthly by BC Organics in their Discharge Monitoring Reports, and all reporting of phosphorus credits will be completed monthly.

1. Establishment Plan

The pond establishment will be performed in accordance with the following:

- Site map identifying where wet ponds are to be constructed (Appendix A).
- The Stormwater Management Plan for BC Organics, LLC (dated October 23, 2018) and wet ponds depicted on plans approved as part of NOI Permit. A copy of October 23, 2018 Stormwater Management Plan report and plans approved as part of NOI Permit are available upon request.
- WDNR Wet Detention Pond Technical Standard Code 1001 (Appendix E)

Established practices are subject to inspection by WDNR or its agents at any time upon giving reasonable notice to BC Organics. In addition, annual reporting to the WDNR is required for compliance with the WQT Plan.

2. Operation & Maintenance Plan

Operation and maintenance activities will be performed as outlined in Technical Standard Code 1001 (Appendix E). In addition, activities will be performed as outlined in the Operation & Maintenance Plan for BC Organics, LLC (dated October 23, 2018). A copy of October 23, 2018 Operation & Maintenance Plan report is located in Appendix F.

VI. QUANTIFYING PHOSPHORUS & TOTAL SUSPENDED SOLIDS REDUCTIONS

The quantification of phosphorus and total suspended solids was performed using SNAP Plus modeling software. A preliminary analysis looked at achieving credits through various management and structural BMPs including cover crops, no till, and filter strips. The results ranged from 5% to 70% reduction in phosphorus from the baseline condition, however, none of the practices that allowed cropland to remain in production met the credit threshold of 0.5 pounds per acre per year TP, which needs to be satisfied in order to generate interim credits. As such, it was determined that the only way to produce interim credits on cropland was through conversion of cropland to prairie grassland.

The SNAP database used to prepare the most recent nutrient management plan was obtained from the producer's agronomist, Tilth Agronomy. For accuracy, McMAHON verbally verified with Tilth Agronomy the recent cropping, tillage, and nutrient applications contained within SNAP database. According to page 48 of the *A Water Quality Trading How To Manual*, a minimum of 3 years of existing verified cropping data is required in order to establish a baseline. From 2015 to 2018 (4 years), the field associated with the proposed prairie restoration was planted in corn silage, winter wheat to annual cover, corn silage, and soybeans. Verification of these crops can be found in the FSA cropping records located in Appendix G. Results from the SNAP Plus modeling are summarized in the trading reports provided in Appendix H.

The proposed wet detention ponds and associated WinSLAMM modeling are summarized in the Stormwater Management Plan for BC Organics, LLC (dated October 23, 2018). A copy of October 23, 2018 Stormwater Management Plan report is available upon request.

VII. TRADE RATIO CALCULATIONS

A. Calculation Factors

1. Delivery Factor (DF)

According to the WDNR Water Quality Trading Guidance "2.11.1 Delivery Factor – When TMDLs do not include fate and transport, pollutant loads are assumed to move through the system in a conservative fashion with no losses due to settling of other processes. This results in downstream allocations being lower with an implicit margin of safety because there are no pollutant losses assumed to have occurred in the system." The Lower Fox River/ Lower Green Bay TMDL does not have fate and transport factors. Therefore, there is no delivery factor that needs to be accounted for in the trade ratio calculation.

2. Downstream Factor (DSF)

The prairie will be located downstream of the point of discharge from the wastewater facility. Table 3 summarizes the PRESTO model that was used to calculate the percent difference between the credit user's load and the load at the point of discharge. Based on the chart in section 2.11.2 of the WQT Guidance, a contribution of less than 25% results in a downstream factor of 0.1. Figure 2 in Appendix A shows the watershed boundary produced by PRESTO used to calculate the non-point source load.

Table 2
PRESTO Downstream Factor Results

	Area (sq mi)	Point Load (lbs)	Nonpoint Load	Point to Nonpoint Ratio
Upstream Watershed	1.47	18.3	485.5	4:96

3. Equivalency Factor (EF)

As stated in the WDNR's Guidance for Implementing Water Quality Trading in WPDES Permits, an equivalency factor of 0 is used for total phosphorus and total suspended solids pollutants.

4. Uncertainty Factor (UF)

Based on WDNR's How To Manual for Water Quality Trading (Table 16, Appendix A), an uncertainty factor of 1 is used for prairie grass when the land will be returned to perennial vegetation. An uncertainty factor of 2 is used for the wet detention ponds.

5. Habitat Adjustment (HA)

No habitat adjustment will be used in establishing the trade ratio.

B. Calculations

Trade Ratio Calculation= (DF + DSF + EF + UF - HA):1

Prairie Trade Ratio = (0 + 0.1 + 0 + 1 - 0):1 = **1.1:1**

Wet Detention Pond Trade Ratio = (0 + 0 + 0 + 2 - 0):1 = **2.1:1**

BC Organics will use the minimum allowable trade ratio of **1.2:1** in calculating TP and TSS credits as a result of installing the prairie grassland.

VIII. CREDIT GENERATION

The associated TP and TSS credits that can be used for WPDES Permit WI-0066303-01 compliance are calculated by dividing the TP and TSS reductions by the trade ratio results. According to WDNR WQT guidance Section 2.8, "NPS (nonpoint source) credit generators that are located in a watershed with an approved TMDL may generate two types of credits; interim credits and long-term credits. Interim credits are generated by load reduction that achieve the credit threshold and therefore, can be generated only when the current pollutant load excess the applicable LA (load allocation). Long-term credits are generated by load reductions obtained below the LA credit threshold. The durations of interim credits equals the lifespan of the management practice employed to reduce pollutant loads, or 5 year, whichever is shorter."

Credit Generation = H / K

H = Phosphorus Reduction (pounds/year)
K = Trade Ratio

Beyond the minimum 80% TSS reduction and 60% TP reduction for post-construction sites, an additional 9 pounds per year of TP and 4,453 pounds per year of TSS will be reduced by the wet detention ponds within the 38.5 acre post-construction site. The associated TP and TSS credits that can be used for WPDES Permit WI-0066303-01 compliance are calculated by dividing the TP and TSS reductions by the trade ratio results. Using a trade ratio of 2.1:1, a total of **0.7 pounds per year of TP and 329 pounds per year of TSS** are available to be used as long-term water quality trading credit.

IX. POLLUTANT REDUCTION CREDIT THRESHOLD

A. Credit Threshold Criteria

Since Outfall 1 is located within the TMDL's East River Sub-Watershed, a Credit Threshold will need to be applied. As described in *Wisconsin DNR Guidance for Implementing Water Quality Trading in WPDES Permits,* the credit threshold is the pollutant loading from a point source or nonpoint source below which reductions can generate credits.

B. Lower Fox TMDL Credit Thresholds

Conversations with the WDNR based on site specific conditions resulted in a slightly elevated phosphorus threshold for the project. The agriculture threshold from the baseline condition is 0.5 pounds per acre per year for TP and 0.26 tons per acre per year for TSS. As such, TP reductions that are lower than 0.5 satisfy the credit threshold. Interim credits are generated for the full amount of phosphorus reduction, divided by the trade ratio, only after the 0.5 pounds per acre per year is satisfied. Long-term credits begin generating only after the 0.5 threshold. Similar credit threshold procedures need to also be followed for TSS reductions.

C. NR 151 Post-Construction Site Credit Thresholds

Based on NR 151.121, the percent reduction that is required for a post-construction site from the baseline condition is 60.0% for TP (verbal communication with WDNR) and 80.0% for TSS. As such, TP percent reductions that are higher than 60.0% exceed the credit threshold for post-construction site best management practices. Interim credits are generated for TP reductions above the threshold. Long-term credits are generated for TP reductions above the threshold. Similar credit threshold procedures need to also be followed for TSS percent reductions.

X. INTERIM & LONG-TERM CREDITS

A. Interim Credits

Interim TP and TSS credits will be available for the first permit term (5 years) of WPDES Permit WI-0066303-01. As shown in Table 3 and 4, year 2020 and beyond satisfy the 0.5 pounds per acre per year threshold, while TSS satisfies the 0.26 tons per acre per year threshold in all years with the installation of a prairie grassland.

Table 3

SNAP Plus Phosphorus Trading Reports Results

		Prairie						
Scenario	**Acres**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
PTP Assuming Crop Rotation Continues (lbs TP/year)	15	82	128	95	63	89	71	87
PTP Assuming Permanent Vegetative Cover (lbs TP/year)	15	11	8	7	6	6	6	6
BMP Reduction (lbs TP/year)		71	120	88	57	83	65	81
lbs TP/acre/year		0.73	0.50	0.44	0.41	0.40	0.39	0.39
Trade Ratio		1.2	1.2	1.2	1.2	1.2	1.2	1.2
Intermediate Credits (lbs/yr)		-	100	74	47	69	54	68

Table 4

SNAP Plus TSS Trading Reports Results

Scenario	Acres	Prairie						
		2019	2020	2021	2022	2023	2024	2025
TSS Assuming Crop Rotation Continues & 10% Delivery (tons TSS/year)	15	0.97	1.04	1.04	0.73	0.30	0.29	0.97
TSS Assuming Permanent Vegetative Cover & 10% Delivery (tons TSS/year)	15	0.016	0.010	0.004	0.002	0.001	0.001	0.001
BMP Reduction		0.95	1.03	1.04	0.73	0.30	0.29	0.97
tons TSS/acre/year		0.0011	0.0007	0.0003	0.0001	0.0001	0.0001	0.0001
Trade Ratio		1.2	1.2	1.2	1.2	1.2	1.2	1.2
Intermediate Credits (lbs/yr)		1590	1715	1733	1220	492	483	1615

Based on WinSLAMM modeling, the proposed wet detention ponds associated with the 38.5 acre post-construction site for the BC Organics wastewater facility will achieve a 71.9% TP reduction, which exceeds the 60.0% TP credit generation threshold. In addition, the wet detention ponds will achieve a 94.7% TSS reduction, which exceeds the 80.0% TSS credit reduction threshold. As such, the proposed wet detention ponds generate 2,227 pounds per year of interim TSS credits and 4.5 pounds per year of interim TP credits. Table 5 summarizes these findings.

Table 5

Wet Pond Interim Credits

Credit Generator	Discharge (lbs/yr)	Req. NR 151 % Reduced	BMP % Reduced	Reduced (lbs/yr)	Trade Ratio*	Interim Credit (lbs/yr)
TSS	4,704	80.0%	94.7%	4,453	2.0	2,227
TP	12.6	60.0%	71.9%	9.0	2.0	4.5

Total interim credits for the study area based on a crop rotational average plus the wet detention pond are 73 lbs/year TP, and 3,491 lbs/year TSS.

B. Long-Term Credits

SNAP Plus modeling indicates that the 15 acres of prairie grassland will generate an average of 12 pounds per year of long-term TP credits and 1,244 pounds per year of long-term TSS credits. These credits can be applied once the interim credits are exhausted during the first five years of facility operation. Tables 6 and 7 summarize the long term credits produced from 2020 to 2025.

Table 6

SNAP Plus Phosphorus Trading Reports Results

		Prairie						
Scenario	**Acres**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
PTP Assuming Crop Rotation Continues (lbs TP/year)	15	82	128	95	63	89	71	87
PTP Assuming Permanent Vegetative Cover (lbs TP/year)	15	11	8	7	6	6	6	6
BMP Reduction (lbs TP/year)		71	120	88	57	83	65	81
lbs P/acre/year		0.73	0.50	0.44	0.41	0.40	0.39	0.39
Trade Ratio		1.2	1.2	1.2	1.2	1.2	1.2	1.2
Long Term Credits		-	-	8.9	8.6	14.1	11.6	15.0

Table 7

SNAP Plus TSS Trading Reports Results

		Prairie						
Scenario	**Acres**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
TSS Assuming Crop Rotation Continues & 10% Delivery (tons TSS/year)	15	0.97	1.04	1.04	0.73	0.30	0.29	0.97
TSS Assuming Permanent Vegetative Cover & 10% Delivery (tons TSS/year)	15	0.016	0.010	0.004	0.002	0.001	0.001	0.001
BMP Reduction		0.95	1.03	1.04	0.73	0.30	0.29	0.97
tons TSS/acre/year		0.0011	0.0007	0.0003	0.0001	0.0001	0.0001	0.0001
Trade Ratio		1.2	1.2	1.2	1.2	1.2	1.2	1.2
Long Term Credits (lbs/yr)		1525	1671	1716	1214	490	482	1610

Based on WinSLAMM modeling, the proposed wet detention ponds associated with the 38.5 acre post-construction site for the BC Organics wastewater facility will achieve a 71.9% TP reduction, which exceeds the 60.0% TP credit generation threshold. In addition, the wet detention ponds will achieve a 94.7% TSS reduction, which exceeds the 80.0% TSS credit reduction threshold. As such, the proposed wet detention ponds generate 0.5 pounds per year of long-term TP credits and 327 pounds per year of long-term TSS credits, both of which fall well short of the total wastewater facility needs. As such, at this time, BC Organics plans to reserve the following long-term wet detention pond credits for potential future use.

Table 8

Wet Pond Long Term Credits

Credit Generator	Discharge (lbs/yr)	Req. NR 151 % Reduced	BMP % Reduced	Reduced (lbs/yr)	Trade Ratio*	Long Term Credit (lbs/yr)
TSS	4,704	80.0%	94.7%	4,453	2.0	327
TP	12.6	60.0%	71.9%	9.0	2.0	0.5

Total long-term credits for the study area based on a crop rotational average plus the wet detention pond are 12.5 pounds per year TP, and 1,571 pounds per year TSS.

XI. TIMELINE

A. Wastewater Facility Construction Timeline

The wastewater facility construction will likely be completed in the spring of 2020. The filtration portion of the wastewater facility is anticipated to begin operation by January 1, 2021. The wastewater plant will slowly increase to 100% capacity by July 1, 2021.

B. Practice & Credit Generation Timeline

The prairie will be seeded in the fall of 2019 to allow time to prepare the soil through tillage and herbicide. The wet pond construction is scheduled for completion by end of 2019. BC Organics will work to ensure the prairie and pond are established according to standards and specifications, but specific planting dates depend upon weather. It's projected that the prairie and wet ponds will begin generating credits by July 1, 2020. No wastewater discharge into the stream will occur until July 1, 2020. If the wastewater facility is operating but insufficient credits are generated, the discharge water will be returned to existing storage lagoons at Wiese Brothers Dairy and Country Aire Farms.

XII. INSPECTIONS & REPORTING

A. Practice Registration

Before the prairie is planted or the wet detention pond is constructed, BC Organics will file a completed Registration Form 3400-207 (Appendix J) for Water Quality Trading Management Practice Registration with the WDNR.

B. Certification

Certification that the prairie is being maintained will be conducted by BC Organics or a designee on an annual basis. A letter will be included in BC Organic's Annual Trading Reporting certifying compliance.

C. Inspections/Verification

BC Organics will inspect and verify on an annual basis that the prairie and wet detention ponds that are generating Phosphorus Credits as part of this Water Quality Trading Plan are being maintained according to the Operation and Maintenance Plan. Inspection reports will be included in the Annual Certification Letter. Inspection reports will include:

- Date of inspection.
- Statement of finding indicating that the prairie or wet detention ponds are being maintained according to the operation and maintenance plan.
- Any deficient items identified in the Operation and Maintenance Plan if applicable.
- Remedies as to how, who, and in what timeframe corrections will be made for identified deficient items.

D. Annual Trading Report

BC Organics will report to WDNR by January 31 of each year the following:

- The number of TP and TSS reduction credits (pounds/year) used for the previous year to demonstrate compliance.
- Inspection reports and certification letters for the prairie and wet detention ponds that generated the TP and TSS credits used to demonstrate compliance.
- Identification of noncompliance or failure to implement any terms or conditions of WPDES Permit WI-0066303-01 with respect to water quality trading that have not been reported in discharge reports.

E. Notification of Practice Failure

BC Organics will verbally notify the WDNR regional wastewater compliance engineer by phone within 24 hours, and written notification within 7 days, after becoming aware that TP and/or TSS credits used or intended to be used for compliance with WPDES Permit WI-0066303-01 are not being implemented or generated as a set forth in this Water Quality Trading Plan. Both should include the issue to be addressed, how the issue will be addressed, and the appropriate timeline to address the issues.

XIII. COMPLIANCE WITH WATER QUALITY TRADING CHECKLIST

This Water Quality Trading Plan complies with the Water Quality Trading Checklist contained within the WDNR Guidance for Implementing Water Quality Trading in WPDES Permits (Table 8 page 37). This plan complies with the requirements for Credit Source (item e) in Table 8. Credit Source includes sources where "Credits are obtained from either the WDNR or a local governmental unit acting as a broker."

Below is a table identifying the required elements for this Water Quality Trading Plan. Corresponding page numbers are also provided in Table 9.

Table 9

Water Quality Trading Checklist

WI DNR Content of Water Quality Trading Plan (Table 8 item (e) of WI DNR Water Quality Trading Guidance)	Page Number
Permittee's/ Credit User's WPDES Permit Number	1
Permittee's/Credit User's Contact Information	15
Pollutant(s) For Which Credits Will Be Generated	1
Amount Of Credits Available From Each Location/Management Practice/Local Government	9-12
Certification That The Content Of The Trading Application Is Accurate & Correct	15
Signature & Date Of Signature Of Permittee's/Credit User's Authorized Representative	15
Location Where Credits Will Be Generated	Appendix A
Identification Of Management Practices That Will Be Used To Generate Credit	4-6
Duration Of Agreement With Each Credit Generator	9-10
Schedule For Installation Of Each Management Practice	12
Operation & Maintenance Plan For Each Credit Generating Practice	5-6
Date When Credits Become Available For Each Management Practice	9-12
Model(s) Used To Derive The Amount Of Credits	6
The Application Trade Ratio For Each Management Practice	7-8

XIV. CERTIFICATION OF WATER QUALITY TRADING PLAN

The undersigned hereby certifies that this Water Quality Trading Plan is to the best of his/her knowledge accurate and correct, and that all operators, present and future, are aware of the Water Quality Trading Plan requirements.

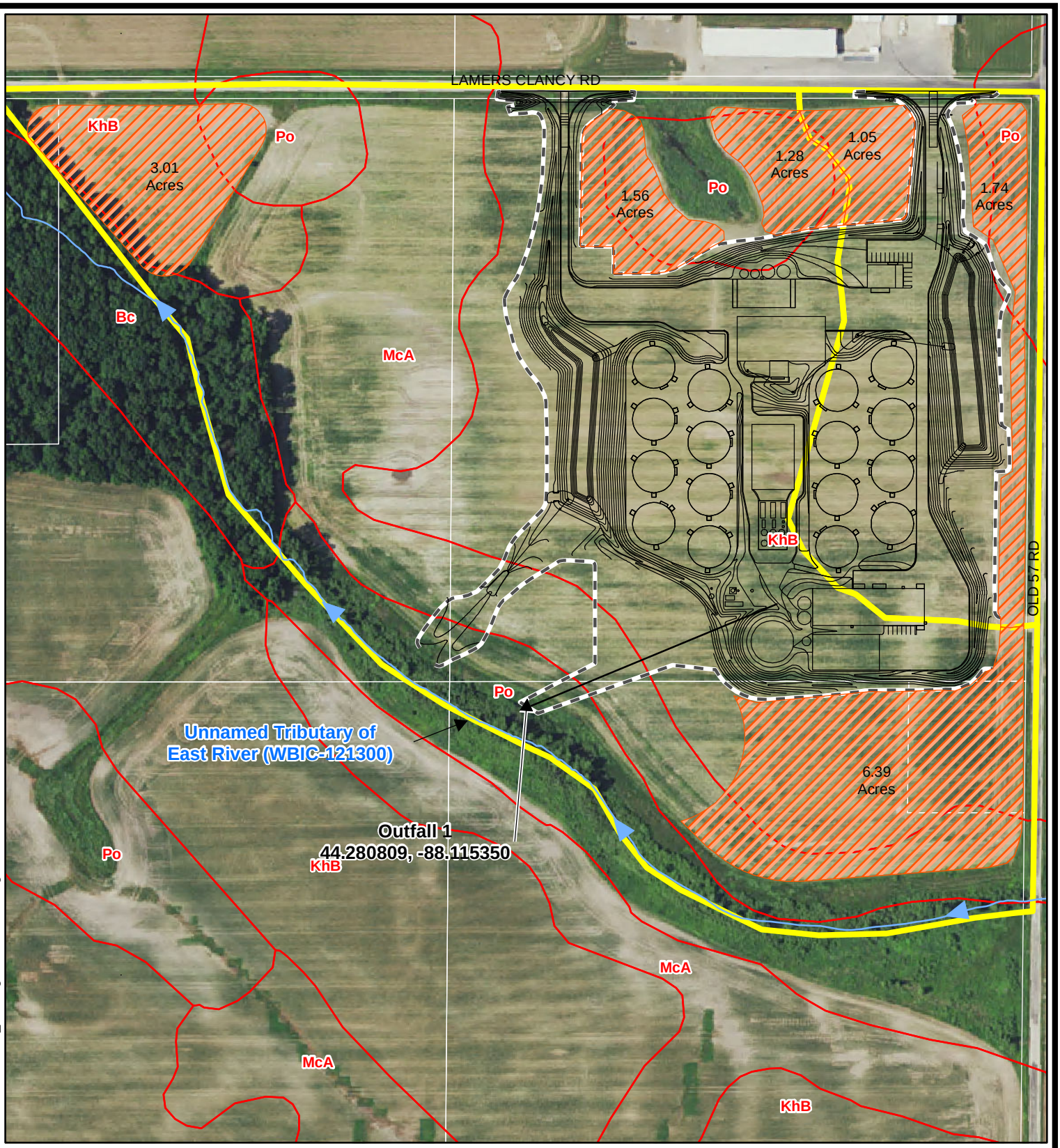
BC ORGANICS, INC.

By: _____

Name	Daniel Nemke
Title	CTO
Company	BC Organics, Inc.
Address	W175N11117 Stonewood Drive, Suite 209, Germantown, WI 53022
Phone Number	262-422-1899

APPENDIX A

Figures 1 & 2



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Mapped Features

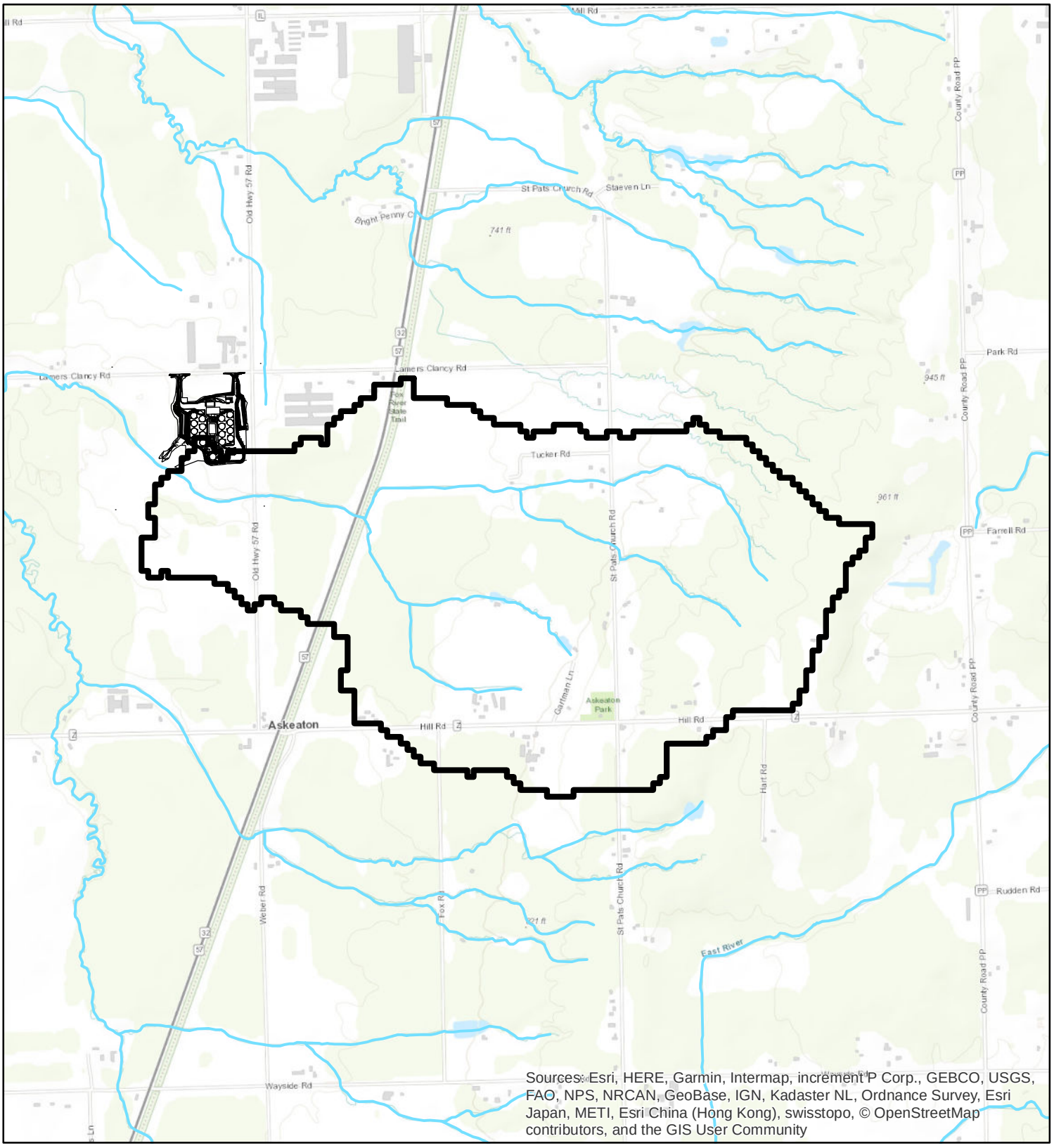
- McA — NRCS Soil ID & Boundary
- Proposed Prairie
- Drainage Areas
- Stream
- BC Organics Treatment Facility Construction Limits

0 300 Feet

McMAHON ENGINEERS ARCHITECTS
McMAHON ASSOCIATES, INC.

Source: Brown County, 2015

FIGURE 1
PRAIRIE LOCATION & FIELD DRAINAGE AREAS
BC ORAGANICS FACILITY
TOWN OF HOLLAND
BROWN COUNTY, WISCONSIN



0 2,000 Feet

McMAHON ENGINEERS ARCHITECTS
McMAHON ASSOCIATES, INC.

Mapped Features

- PRESTO Watershed
- Stream

Source: Brown County, 2015

Disclaimer: The property lines, right-of-way lines, and other property information on this drawing were developed or obtained as part of the County Geographic Information System or through the County property tax mapping function. McMAHON ASSOCIATES, INC does not guarantee this information to be correct, current, or complete. The property and right-of-way information are only intended for use as a general r eference and are not intended or suitable for site-specific uses. Any use to the contrary of the above stated uses is the responsibility of the user and such use is at the user's own risk.

FIGURE 2
PRESTO DELINEATED WATERSHED AT POINT OF DISCHARGE
BC ORAGANICS FACILITY
TOWN OF HOLLAND
BROWN COUNTY, WISCONSIN

APPENDIX B

NRCS Conservation Cover Technical Standard Code 327 & Technical Note 5

CONSERVATION COVER

(Acres)
Code 327

Natural Resources Conservation Service
Conservation Practice Standard

I. Definition

Establishing and maintaining permanent vegetative cover.

II. Purpose

This practice may be applied to accomplish one or more of the following.

- Reduce soil erosion and sedimentation.
- Improve water quality.
- Improve air quality.
- Enhance wildlife habitat.
- Improve soil quality.
- Manage plant pests.
- Promote habitat for native pollinators.

III. Conditions Where Practice Applies

This practice applies on all lands needing permanent vegetative cover. This practice does not apply to plantings for critical area protection or forage production.

IV. Federal, Tribal, State, and Local Laws

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

V. General Criteria

A. General Criteria Applicable to All Purposes

1. Specie Selection and Seed Quality

   Species shall be adapted to soil, climatic, and ecological site conditions.

   Species planted shall be suitable for the planned purpose and site conditions.

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

The minimum seeding requirements are based on seeds per square foot for the intended purpose.

Certified Seed[1] shall be used, and seeding rates will be based on *Pure Live Seed* (PLS). Seed tag information such as purity and germination and any computations to adjust seeding rates must be submitted to document actual seeding rates. *Actual adjusted seeding rates* will be based on the equivalent of 100 percent PLS, determined by multiplying the percent purity by total percent germination.

Untested introduced grass and forb seed are not approved for planting.

When certified native grass or forb seed is unavailable or difficult to locate, *non-certified* seed can be used, as long as the seed has been tested for varietal purity, germination, and other mechanical qualities, such as inert matter and other crop or weed seeds.

Untested locally harvested native grass or forb seed that is planned for use under the criteria of this standard must be approved by the NRCS State Agronomist prior to seeding.

Introduced and native legumes shall be inoculated with the proper Rhizobium bacteria.

If more than 20 percent of the legume seed is hard seed, increase the seeding rate for legumes by the percent of hard seed.

Use non-sod forming species in locations where shrub and tree establishment is planned.

[1]Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

2. Seeding Periods

   The specific date that provides the best chance for success will vary from south to north and from year to year with prevailing moisture and temperature conditions. Late summer seeding is generally riskier than spring seeding. Planting at either end of the allowable range is riskier than the middle of the range. Refer to Figure 1 for planting zones and Tables 16 and 17 for seeding dates.

   Seeding outside of the recommended dates must be approved by the Area Resource Conservationist or State Agronomist.

   The *frost seeding* period in Wisconsin ranges from mid February to early March and will vary from year to year depending on the weather. Frost seeding is allowed only during the active freezing and thaw cycle and is allowed for native and *introduced species*. For additional frost seeding information, refer to Wisconsin Agronomy Technical Note 5, Establishing and Maintaining Native Grasses, Forbs, and Legumes; and Wisconsin Agronomy Technical Note 6, Establishing and Maintaining Introduced Grasses and Legumes.

3. Nutrient and Soil Amendment Requirements

   When seeding introduced species, soil fertility and pH level will be amended to satisfy the needs of the plant species to be established. Fertilizer and lime recommendations will be determined by a soil test. If no soil test is available, apply a minimum of 150 pounds of 20-10-10 fertilizer and 2 tons of 80-89 lime or equivalent per acre. Soil amendments may be waived at the discretion of a certified conservation planner. The basis for waiving the use of soil amendments shall be documented in the client's case file.

   For establishment of *native species,* the use of soil amendments is not required.

4. Seedbed Preparation

   Prior to planting into cropland fields, verify that herbicides previously applied to the site will not "carry over" and damage the new seeding.

   Site preparation shall be adequate to assure weed suppression and to promote germination and growth of the species planted.

   Planting equipment type, use, and timing shall be appropriate for the site conditions, soil characteristics, and type of seeds (size, etc.) selected to assure uniform placement and germination.

   Refer to Wisconsin Agronomy Technical Notes 5 and 6 for detailed seedbed preparation guidance for specific situations.

5. Temporary Cover and Companion Crop

   Temporary cover and companion crops are vital practices utilized to support the successful establishment of herbaceous plantings. Temporary cover and companion crops suppress weed growth and limit soil erosion during the establishment period. Use depends on the site conditions, method of planting, and seed mixture.

   For further details regarding temporary cover and companion crop recommendations, refer to Wisconsin Agronomy Technical Notes 5 and 6.

B. Criteria for Seed Mixture Development

1. It is required that at least 50 percent (seeds/ft^2) of mixtures planted to introduced or native species for wildlife habitat consist of grasses, with the exception of introduced and native pollinator habitat mixes.

2. Increase seeds per square foot by 15 percent when dormant or frost seeding occurs.

3. Refer to Table 1 for the recommended seeding rates for the most commonly used introduced grasses, legumes and native grasses. Additional approved species can be found in Wisconsin Agronomy Technical Notes 5 and 6. Use of species not listed in Wisconsin Agronomy Technical Notes 5 and 6 must be approved by the State Agronomist.

4. For solid native grass plantings, refer to Section V.E.4. of this standard.

5. Refer to Wisconsin Agronomy Technical Notes 5 and 6 for suggested monoculture seeding recommendations, grass mixtures and seeding rate adjustments for overly aggressive species.

6. Rushes and sedges can be substituted for grasses where wet soil conditions exist. Seed mixture design requirements are the same as for grasses.

7. Native Grass, Forb and Legume Plantings

   a. Basic Prairie Plantings

      A minimum of 3 grasses seeded at a minimum total rate of 20 grass seeds per square foot, and a minimum of 3 forbs and or legumes amounting to a minimum total rate of 2.0 seeds per square foot.

   b. Restoration of Native Prairie Plantings

      A minimum of 5 grasses consisting of a minimum total rate of 15 grass seeds per square foot, and a minimum of 10 forbs and at least one legume in the mixture amounting to a minimum total rate of 8 seeds per square foot.

   c. Native Pollinator Herbaceous Plantings

      At least 1 and a maximum of 2 bunch grass species seeded at a maximum total rate of 10 seeds per square foot, and a minimum of 9 forbs and/or legumes, 3 or more from each bloom period (early, mid, late) seeded at a minimum total rate of 30 seeds per square foot.

   d. Seeding Requirements for Untested Local Genotype Seed

      1) A minimum of 5 grasses, sedges, or rushes and a minimum of 10 forbs and at least 1 legume must be seeded.

      2) Seed will be planted at a minimum seeding rate of 50 seeds per square foot.

      3) Limit seeding rates so that one specie does not comprise of more than 20 percent of the total seeds per square foot. When a specie exceeds 20 percent of the required 50 seeds per square foot, the excess seed will be excluded from the calculation of the required 50 seeds per square foot.

      4) At least 25 seeds per square foot must be native grasses, sedges, or rushes and a minimum of 10 forbs and/or legume seeds per square foot must be seeded.For more details and examples of standard native grass, forb, and legume mixes, review Wisconsin Agronomy Technical Note 5.

8. Introduced Grass and Legume Plantings

   a. Wildlife Habitat Plantings

      A minimum of 2 grasses seeded at a minimum total rate of 70 grass seeds per square foot, and at least one legume seeded at a minimum total rate of 30 seeds per square foot.

   b. Introduced Pollinator Herbaceous Plantings

      At least 1 and a maximum of 2 bunch grasses seeded at a maximum total rate of 30 seeds per square foot, and a minimum of 2 legumes seeded at a minimum total rate of 40 seeds per square foot.

      For more details and examples of standard introduced grass and legume mixes, refer to Wisconsin Agronomy Technical Note 6.

C. Additional Criteria to Reduce Soil Erosion, Sedimentation, and Improve Water Quality

1. The potential for soil erosion (sheet and rill or wind) during establishment or cover enhancement activities shall be assessed using the current water or wind erosion prediction technology.

2. The appropriate sheet and rill erosion control practices necessary to achieve the planned soil loss objectives shall be included in the planting plan (i.e., Contour Farming, No Till Planting, Cover Crop).

3. Additional conservation practices, such as Grassed Waterways and Grade Stabilization

Structures, shall be planned as needed to address erosion risk identified for the site.

D. Additional Criteria for Improving Air Quality

1. To control dust in perennial crop systems such as orchards, vineyards, berries, and nursery stock, vegetation established using this standard shall provide full ground coverage in the alleyway and headlands.

2. Carbon sequestration plantings established utilizing this standard shall result in a positive CO_2 equivalent value as determined by utilizing the current approved carbon prediction technology.

E. Additional Criteria for Enhancing Wildlife Habitat

1. Grasses, forbs, shrubs, and/or legumes shall be planted in a diverse mix to promote biodiversity and meet the needs of the wildlife species targeted for management.

2. Physical disturbances during the nesting season (May 15 to August 1) or other identified use period by wildlife species in the conservation plan shall be limited to the extent practicable.

3. The long-term objectives of the land user and the needs of the wildlife species targeted for management shall be considered in planning the vegetative cover.

4. A mixture of grasses and forbs will provide the most diversity for a wide range of animals. Solid stands of native and introduced grass plantings can provide additional benefits for certain wildlife species depending on the wildlife habitat plan that is specie-specific. Single or multiple specie grass stands can provide added protection from predators, improve concealment zone characteristics, and the vegetation may be more persistent during the winter season. Planned introduced grass plantings consisting of one specie must be approved by the State Agronomist or State Biologist prior to seeding. Refer to Table 1 for recommended seeding rates.

5. Standard seed mixtures developed as a result of the Conservation Reserve Program (CRP) rules will meet the requirements of this standard when utilized to develop seed mixtures for CRP contracts. Refer to the most current Wisconsin Farm Service Agency 2-CRP handbook for CRP standard mixtures.

6. The timing and method of prescribed burning where utilized shall be planned to enhance the growth and vigor of target species and to comply with the requirements of Wisconsin NRCS Field Office Technical Guide, Section IV, (WI FOTG), Conservation Practice Standard 338, Prescribed Burning.

F. Additional Criteria to Improve Soil Quality

The Soil Conditioning Index calculated for the site shall achieve a positive value. Plantings will be established and maintained to produce high volumes of organic materials.

G. Additional Criteria to Manage Plant Pests

In perennial crop systems such as orchards, vineyards, berries, and nursery stock, permanent vegetative cover shall be established and managed to attract beneficial species which enhance integrated pest management (IPM) strategies in effect for control of target pest species.

H. Additional Criteria for Promoting Pollination

Select plants that provide the most pollen for pollinator species targeted by the management plan. See Wisconsin Biology Technical Note 8, Pollinator Biology and Habitat, for more detailed information.

I. Additional Criteria to Evaluate the Quality of Conservation Cover Established by Plant Community Succession

If native cover establishes through natural succession in an existing plant community, a certified conservation planner may evaluate the cover to determine if the cover:

- contains grass and legume/forb diversity equal or greater than NRCS recommended seed mixtures;
- meets the intended purpose and adequately addresses all identified resource concerns;
- meets the decision maker's objective;
- meets the rules and/or requirements of the program(s) in effect on the site;

- cover consisting of plants classified as *noxious weeds* or *invasive species* as defined by Wisconsin Job Sheet 397, Maintenance on Established CRP, are managed and controlled according to Job Sheet 397 specifications; and
- cover consisting of plants classified as noxious weeds or invasive species by applicable Wisconsin state and local law, are adequately contained.

Existing cover that is determined to meet all of these criteria can be considered to meet the requirements of this standard.

If non-native cover establishes through succession of the plant community, a certified conservation planner may evaluate the site to determine if the existing cover meets the intended purpose and adequately addresses soil erosion and water quality resource concerns identified for the site using the following criteria:

- contains plant density equal to or greater than the NRCS recommended seed mixture,
- meets the intended purpose by adequately reducing the delivery of nutrients and/or sediments to the area being protected,
- meets the decision makers objective,
- converting the plant stand back to the original cover is impractical and will not enhance the performance of the practice for the intended purpose,
- meets the rules and/or requirements of the program(s) in effect on the site, and
- cover consisting of plants classified as noxious weeds or invasive species by applicable Wisconsin state and local law are being adequately contained.

Existing cover that is determined to meet all of these criteria can be considered to meet the requirements of this standard for the purpose of reducing delivery of sediment and nutrients.

VI. Considerations

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

A. This practice may be used to promote the conservation of wildlife species in general, including threatened and endangered species. Where wildlife is an objective, the food and cover value of the planting shall be planned to reflect the habitat needs of the wildlife species targeted for management.

B. On sites where annual or introduced cool season perennial grasses are an expected weed problem, it may be necessary to postpone or eliminate nitrogen fertilizer application until the planted species are well established.

C. Where applicable, this practice may be used to conserve and stabilize archeological and historic sites.

D. Consider rotating management and maintenance activities (e.g., mow only a portion each year) throughout the managed area to maximize cover diversity.

E. Consider establishing a native plant community that is adapted to the site conditions and which meets landowner objectives. Use native species when appropriate for the identified resource concern and management objective.

F. In perennial crop systems such as orchards, vineyards, and berries, flowering forbs and legumes may be included in the seed mixture to attract and hold natural pollinator insects.

G. Consider the use of local genotype seed when native plantings are planned in the vicinity of rare remnant prairies.

H. Due to the propagation and growth characteristics of grasses, grasses will have the tendency to pre-dominate and crowd out forbs and forb/legumes in diverse plantings. Seed counts per square foot above recommended minimums may lead to excessive competition and poor establishment of some species. It is strongly suggested that the seed count minimums not exceed more than 25 percent of the minimum seeds per square foot for grasses.

I. Consider reseeding erosive fields in small plots, alternating strips established on the contour over a period of years, or the use of no-till planting. Use the current approved erosion prediction tools to evaluate establishment alternatives.

J. Consider testing non-certified locally harvested native grass or forb seed genotypes when establishing native plant communities.

VII. Plans and Specifications

Prepare plans and specifications for each site or management unit according to the Criteria, Considerations, and Operations and Maintenance described in this standard.

The following elements will be addressed in the plan to meet the intended purpose:

- site preparation,
- fertilizer application (if applicable),
- seedbed preparation,
- methods of seeding/planting,
- time of seeding/planting,
- selection of species,
- type of legume inoculant used (if applicable),
- seed germination test results,
- seeding rate (adjusted based on PLS calculations),
- supplemental water for plant establishment (if applicable),
- protection of plantings (if applicable),
- weed control activities during the establishment period.

Specifications shall be recorded using Wisconsin Job Sheets 134, How to Establish and Maintain Introduced Grasses and Legumes; and 135, How to Establish and Maintain Native Grasses, Forbs and Legumes; and Job Sheet 130, Pollinator-Friendly Habitat.

VIII. Operation and Maintenance

Mowing or herbicide applications shall be used as necessary to control competitive weeds. Mowing should be done when introduced grasses reach 6-8 inches tall and before the weeds develop matured seed. The residue from mowing shall be uniformly distributed or removed as necessary to avoid smothering the new seedlings. Native warm season grasses should be mowed no lower than 7 inches.

If wildlife habitat enhancement is a purpose, practice maintenance activities shall not disturb cover during the nesting period (May 15 to August 1) for desired wildlife species. Exceptions shall be made to spot treat necessary weed invasions prior to them setting seed.

Maintenance measures must be adequate to control the establishment and spread of noxious weeds and other invasive species.

To benefit insect food sources for grassland nesting birds, spray or other means to control noxious weeds shall be done on a “spot basis” to protect forbs and legumes that benefit native pollinators and other wildlife.

IX. References

USDA, NRCS Wisconsin Field Office Technical Guide (FOTG), Section III, Conservation Management Systems.

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

University of Wisconsin Extension Publication A1525, Perennial Forage Crop Variety Update for Wisconsin.

USDA, NRCS Wisconsin Agronomy Technical Note 5, Establishing and Maintaining Native Grasses, Forbs and Legumes.

USDA, NRCS Wisconsin Agronomy Technical Note 6, Establishing and Maintaining Introduced Grasses and Legumes.

USDA, NRCS Wisconsin Biology Technical Note 8, Pollinator Biology and Habitat.

USDA, NRCS Wisconsin Job Sheet 130, Pollinator-Friendly Habitat.

USDA, NRCS Wisconsin Job Sheet 134, How To Establish and Maintain Introduced Grasses and Legumes.

USDA, NRCS Wisconsin Job Sheet 135, How to Establish and Maintain Native Grasses, Forbs, and Legumes.

USDA, NRCS Wisconsin Job Sheet 397, Maintenance on Established CRP.

University of Wisconsin Cooperative Extension, Invasive Plant Management in CRP Fields: http://ipcm.wisc.edu/Publications/tabid/54/Default.aspx.

USDA, Farm Service Agency, Agricultural resource Conservation Program 2-CRP Handbook, and Wisconsin Amendments.

X. Definitions

Actual Adjusted Seeding Rates (V.A.1.) – an increase in seeds per square foot or pounds per acre, when the PLS is less than 100 percent.

Certified Seed (V.A.1.) – Seed that meets the standards established by the designated official seed certifying agency for the purpose of ensuring species/variety, species/varietal purity and mechanical quality. The Wisconsin Crop Improvement Association is the official seed certifying agency for Wisconsin.

Frost Seeding (V.A.2.) – Broadcast seeding in February to mid-March during the active freezing and thaw cycle onto existing herbaceous stands or onto seedbeds prepared the previous fall.

Introduced Species (V.A.2.) – Plant species that historically would not have been found in North America until they were brought here by travelers from other parts of the world. This would include smooth bromegrass and alfalfa. Some of these species may have a wide distribution such as Kentucky bluegrass.

Invasive species (VI.F.) – Non-native species that have the ability to spread rapidly and overwhelm other plants, causing economic and environmental harm, or harm to human and animal health.

Native Species (V.A.3.) – Plants that have been identified as historically present in North America, such as big bluestem or green needle-grass.

Non-Certified Seed (V.A.1.) – Seed that is grown, processed, tested and labeled for species/variety and mechanical quality factors, but is not certified by an official seed certifying agency.

Noxious weeds (VI.F.) – A plant that has been designated by a county, state, or national agricultural authorities as one that is injurious to agricultural and horticultural crops, natural habitats, human, and or livestock if left uncontrolled. Most noxious weeds are introduced species.

Pure Live Seed (PLS) (V.A.1.) – PLS is a means of expressing seed quality, based on the percentage of seed in a seed lot that is both pure and viable. PLS is calculated by multiplying the percentage of total viable seed (germination + hard seed + dormant seed) by the percentage of pure seed divided by 100.

Untested (V.A.1.) – Seed that has no assurances of testing for species/variety and mechanical quality, i.e., species/variety purity, inert matter, other crop or weed seeds and germination potential. Untested seed legally cannot be labeled.

Table 1
Common Species and Recommended Seeding Rates

Common Name	Scientific Name	Moisture Regime	Single Species Seeding Rate (PLS)		
Introduced Grasses			**Lbs./Ac.**	**Seeds/Lb.**	**Seeds/Ft^2/Lb./ Ac.**
Italian or Annual Ryegrass	Lolium perenne L. ssp. multiflorum	DM, M, WM	20	227,000	5.2
Kentucky Bluegrass	Poa pratensis	D, DM, M, WM, W	8	2,177,000	50
Orchard Grass	Dactylis glomerata L.	D, DM, M, WM	10	653,000	15
Perennial Ryegrass	Lolium perenne	DM, M, WM	20	227,000	5.2
Redtop*	Agrostis gigantea	M, WM, W	4	4,990,000	114.5
Smooth Bromegrass*	Bromus inermis	D, DM, M, WM	20	136,000	3.1
Tall Fescue*	Schedonorus arundinaceus	D, DM, M, WM	12	227,000	5.2
Timothy	Phleum pratense	DM, M, WM, W	8	1,230,000	28.2
Native Grasses			**Lbs./Ac.**	**Seeds/Lb.**	**Seeds/Ft^2/Lb./ Ac.**
Big Bluestem*	Andropogon gerardii	D, DM, M, WM	11	165,000	3.8
Canada Wild Rye	Elymus canadensis	DM, M, WM	12	83,200	1.9
Fowl Managrass*	Glyceria striata	WM, W	0.5	2,560,000	58.7
Indian Grass*	Sorghastrum nutans	D, DM, M, WM, W	10	192,000	4.4
Little Bluestem	Schizachyrium scoparium	D, DM, M	8	240,000	5.5
Prairie Cordgrass	Spartina pectinata	M, WM, W	8	105,600	2.4
Prairie Dropseed	Sporobolus heterolepis	D, DM, M	3	256,000	5.9
Prairie June Grass	Koeleria macrantha	D, DM, M	0.5	2,308,672	53
Sideoats Grama	Bouteloua curtipendula	D, DM, M	8	127,000	2.9
Switchgrass*	Panicum virgatum	D, DM, M, WM, W	7	389,000	8.9
Virginia Wild Rye	Elymus virginicus	M,WM, W	17	67,200	1.5
Legumes			**Lbs./Ac.**	**Seeds/Lb.**	**Seeds/Ft^2/Lb./ Ac.**
Alfalfa	Medicago sativa	D, DM, M	12	219,000	5.0
Alsike Clover	Trifolium hybridum	M, WM, W	3	680,000	15.6
Birdsfoot Trefoil	Lotus corniculatus	DM, M, WM, W	7	375,000	8.6
Red Clover	Trifolium pratense	DM, M, WM	10	275,000	6.3
White Ladino Clover	Trifolium repens	DM, M, WM	3	871,650	20
Rush			**Oz./Ac.**	**Seeds/Oz.**	**Seeds/Ft.^{2}/Oz./ Ac.**
Wool Grass	Scirpus cyperinus	W	1.5	1,700,000	39

*Species with an asterisk can be seeded individually at the recommended pure stand rates based on Pure Live Seeds (PLS). Planned introduced single specie grass plantings require prior approval from the State Agronomist or State Biologist (V.E.4.)

Seeds per square foot for a particular specie can be calculated by multiplying the number of seeds per pound of specie by the rate of the specie in pound(s) per acre divided by 43,560 square feet.

Species not listed in the above table can be used when developing custom mixtures.

Table 2
Sample Seed Mix for Basic Dry Mesic Prairie
(Seed Calculator Code 327-2*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Purple Prairie Clover	Dalea purpurea	2.00	0.9
Bergamot	Monarda fistulosa	1.00	1.8
Yellow Cone Flower	Ratibida pinnata	1.00	0.6
Big Bluestem	Andropogon gerardii	8.00	1.9
Little Bluestem	Schizachyrium scoparium	24.00	8.3
Indian Grass	Sorghastrum nutans	16.00	4.4
Switchgrass	Panicum virgatum	8.00	4.5
Sideoats Grama	Bouteloua curtipendula	16.00	2.9

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 3
Sample Seed Mix for Basic Mesic Prairie
(Seed Calculator Code 327-3*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Yellow Cone Flower	Ratibida pinnata	1.00	0.6
Black-Eyed Susan	Rudbeckia hirta	1.00	2.2
Bergamot	Monarda fistulosa	1.00	1.8
Big Bluestem	Andropogon gerardii	16.00	3.8
Switchgrass	Panicum virgatum	8.00	4.5
Little Bluestem	Schizachyrium scoparium	20.00	6.9
Indian Grass	Sorghastrum nutans	16.00	4.4
Canada Wild Rye	Elymus canadensis	16.00	1.9

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 4
Sample Seed Mix for Basic Wet Mesic Prairie
(Seed Calculator Code 327-4*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Bergamot	Monarda fistulosa	1.00	1.8
Yellow Cone Flower	Ratibida pinnata	1.00	0.6
New England Aster	Symphyotrichum novae-angliae	1.00	1.6
Switchgrass	Panicum virgatum	16.00	8.9
Prairie Cordgrass	Spartina pectinata	8.00	1.2
Big Bluestem	Andropogon gerardii	24.00	5.8
Virginia Wild Rye	Elymus virginicus	16.00	1.5
Indian Grass	Sorghastrum nutans	16.00	4.4

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 5
Sample Seed Mix for Dry Mesic Prairie Restoration
(Seed Calculator Code 327-7*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Prairie Cinquefoil	Potentilla arguta	0.25	1.1
Leadplant	Amorpha canescens	1.00	0.4
Silky Aster	Symphyotrichum sericeum	1.00	1.3
Purple Prairie Clover	Dalea purpurea	3.00	1.4
Rough Blazing Star	Liatris aspera	0.50	0.2
Roundheaded Bushclover	Lespedeza capitata	3.00	0.8
Bergamot	Monarda fistulosa	1.00	1.8
Yellow Cone Flower	Ratibida pinnata	1.00	0.6
Stiff Goldenrod	Oligoneuron rigidum	1.00	1.1
Spiderwort	Tradescantia ohiensis	1.00	0.2
Little Bluestem	Schizachyrium scoparium	24.00	8.3
Indian Grass	Sorghastrum nutans	8.00	2.2
Prairie June Grass	Koeleria macrantha	2.00	6.6
Prairie Dropseed	Sporobolus heterolepis	2.00	0.7
Switchgrass	Panicum virgatum	4.00	2.2
Sideoats Grama	Bouteloua curtipendula	24.00	4.4

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 6
Sample Seed Mix for Mesic Native Prairie Restoration
(Seed Calculator Code 327-8*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Yellow Cone Flower	Ratibida pinnata	0.50	0.3
Black-Eyed Susan	Rudbeckia hirta	0.50	1.1
Sky Blue Aster	Symphyotrichum oolentangiense	0.50	0.9
Ox-Eye Sunflower	Heliopsis helianthoides	1.00	0.1
Bergamot	Monarda fistulosa	0.50	0.9
Culvers Root	Veronicastrum virginicum	0.25	4.3
Purple Prairie Clover	Dalea purpurea	1.00	0.5
Rosinweed	Silphium integrifolium	1.00	0.1
Prairie Blazing Star	Liatris pycnostachya	1.00	0.3
New England Aster	Symphyotrichum novae-angliae	0.50	0.8
Big Bluestem	Andropogon gerardii	16.00	3.8
Switchgrass	Panicum virgatum	8.00	4.5
Little Bluestem	Schizachyrium scoparium	24.00	8.3
Canada Wild Rye	Elymus canadensis	8.00	1.0
Indian Grass	Sorghastrum nutans	16.00	4.4

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 7
Sample Seed Mix for Wet Mesic Prairie Restoration
(Seed Calculator Code 327-9*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Black-Eyed Susan	Rudbeckia hirta	1.00	2.2
Bergamot	Monarda fistulosa	1.00	1.8
Yellow Cone Flower	Ratibida pinnata	1.00	0.6
Prairie Blazing Star	Liatris pycnostachya	1.00	0.4
Common Ironweed	Vernonia fasciculata	1.00	0.5
Cupplant	Silphium perfoliatum	4.00	0.1
Golden Alexanders	Zizia aurea	1.00	0.3
Great St. John's Wort	Hypericum ascyron	0.25	1.1
White Wild Indigo	Baptisia alba	1.50	0.1
New England Aster	Symphyotrichum novae-angliae	1.00	1.6
Switchgrass	Panicum virgatum	16.00	8.9
Prairie Cordgrass	Spartina pectinata	4.00	0.6
Big Bluestem	Andropogon gerardii	20.00	4.8
Canada Wild Rye	Elymus canadensis	16.00	1.9
Indian Grass	Sorghastrum nutans	12.00	3.4

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 8
Sample Seed Mix for Native Pollinator Seeding for Dry Mesic Sites
(Seed Calculator Code 327-12*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Little Bluestem	Schizachyrium scoparium	16	5.5
Sideoats Grama	Bouteloua curtipendula	16	2.9
Illinois Tick Trefoil	Desmodium illinoense	5	0.5
Spiderwort	Tradescantia ohiensis	5	0.9
Purple Prairie Clover	Dalea purpurea	6	2.7
Yellow Coneflower	Ratibida pinnata	1	0.6
Prairie Blazing Star	Liatris pycnostachya	3	0.8
Rattlesnake Master	Eryngium yuccifolium	6	1.1
Showy Goldenrod	Solidago speciosa	4	8.7
Stiff Goldenrod	Oligoneuron rigidum	3	3.2
Smooth Blue Aster	Symphyotricum laeve	2	2.2
Prairie Cinquefoil	Potentilla arguta	2	9.2

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 9
Sample Seed Mix for Native Pollinator Seeding for Mesic Sites
(Seed Calculator Code 327-13*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Little Bluestem	Schizachyrium scoparium	16	5.5
Sideoats Grama	Bouteloua curtipendula	16	2.9
Foxglove Beardtongue	Penstemon digitalis	4	10.6
Spiderwort	Tradescantia ohiensis	6	1.1
Golden Alexanders	Zizia aurea	6	1.5
Yellow Coneflower	Ratibida pinnata	1	0.6
Purple Prairie Clover	Dalea purpurea	6	2.7
Prairie Blazing Star	Liatris pycnostachya	4	1.1
Rattlesnake Master	Eryngium yuccifolium	6	1.1
New England Aster	Symphyotrichum novae-angliae	3	4.8
Stiff Goldenrod	Oligoneuron rigidum	3	3.2
Smooth Blue Aster	Symphyotrichum laeve	3	3.3

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 10
Sample Seed Mix for Native Pollinator Seeding for Wet Mesic Sites
(Seed Calculator Code 327-14*)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Big Bluestem	Andropogon gerardii	16	3.8
Indiangrass	Sorghastrum nutans	16	4.4
Foxglove Beardtongue	Penstemon digitalis	4	10.6
Spiderwort	Tradescantia ohiensis	6	1.1
Golden Alexanders	Zizia aurea	5	1.3
Yellow Coneflower	Ratibida pinnata	1	0.6
Prairie Blazing Star	Liatris pycnostachya	3	0.8
Rattlesnake Master	Eryngium yuccifolium	6	1.1
New England Aster	Symphyotrichum novae-angliae	3	4.8
Blue Vervain	Verbena hastata	4	8.5
Common Ironweed	Vernonia fasciculata	3	1.4
Cupplant	Silphium perfoliatum	3	0.1

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 11
Solid Native Grass Plantings

Seed Calculator Code	Common Name	Scientific Name	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
327-15A	Switchgrass	Panicum virgatum	7.0	63	DM-WM
327-15B	Big Bluestem	Andropogon gerardii	11.0	42	
327-15C	Indiangrass	Sorghastrum nutans	10.0	44	

Table 12
Wildlife Habitat Mixes

Seed Calculator Code*	Mixtures	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
327-16A	Timothy	2.5	71	DM, M
	Smooth Bromegrass	3.0	9	
	Alfalfa	6.0	30	
327-16B	Timothy	2.0	56	M, WM, W
	Orchardgrass	2.0	30	
	Red Clover	5.0	32	
327-16C	Timothy	2.0	56	DM, M
	Orchardgrass	2.0	30	
	Alfalfa	6.0	30	
327-16D	Timothy	2.5	71	M, WM
	Smooth Bromegrass	3.0	9	
	Red Clover	5.0	32	
327-16E	Timothy	2.0	56	M, WM
	Smooth Bromegrass	2.0	6	
	Orchardgrass	1.0	15	
	Red Clover	5.0	32	
	White Ladino Clover	0.5	10	
324-16F	Timothy	2.0	56	M, WM
	Orchardgrass	2.0	30	
	Red Clover	5.0	32	
	White Ladino Clover	0.5	10	
327-16G	Timothy	2.0	56	DM, M, WM
	Orchardgrass	2.0	30	
	Birdsfoot Trefoil	4.0	34	
327-16H	Tall Fescue	3.0	16	M, WM
	Red Clover	4.0	25	
	White Ladino Clover	1.0	20	
	Timothy	2.0	56	

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Table 13
Introduced Pollinator Habitat Mixes

Seed Calculator Code*	Mixtures	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
327-17A	Timothy	0.5	14	DM, M
	Orchardgrass	1.0	15	
	Alfalfa	4.0	20	
	White Ladino Clover	1.5	30	
327-17B	Tall Fescue	3.0	16	WM, W
	Perennial Ryegrass	3.0	16	
	Red Clover	4.0	25	
	Alsike Clover	1.5	23	

*These codes represent the mixtures used in the Wisconsin Seed Calculator.

Figure 1

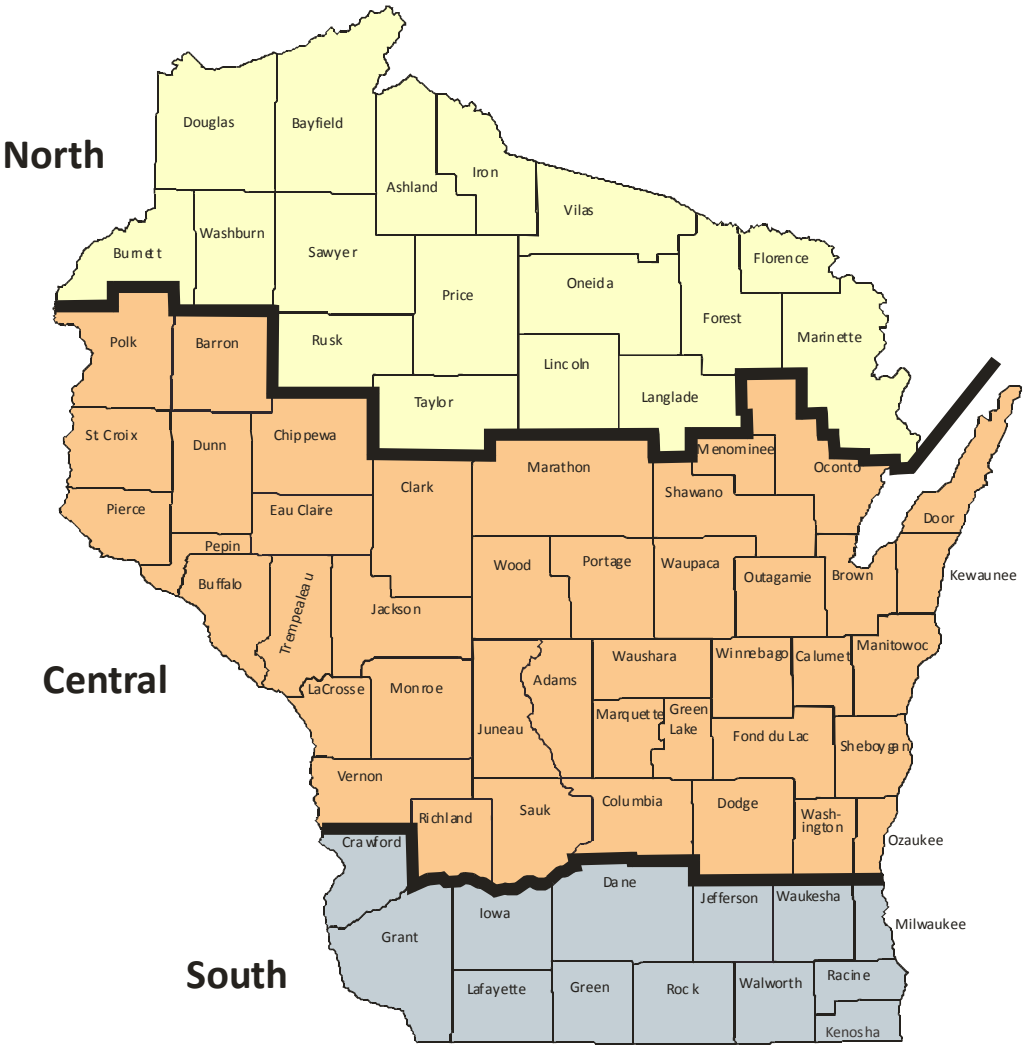


Table 14
Seeding Date/Ranges for Native Mixtures and Companion Crops

Zone	Spring Seeding	Fall Dormant Seeding
North	Thaw - 7/15	10/8 - Freeze Up
Central	Thaw - 6/30	10/15 - Freeze Up
South	Thaw - 6/30	10/20 - Freeze Up

Table 15
Seeding Date/Ranges for Introduced Grasses and Legumes and Companion Crops

Planting Zone	Spring	Late Summer	Dormant
North	5/1 - 6/15	7/15 - 8/10	11/1 - Freeze up
Central	4/15 - 6/1	8/1 - 8/21	11/1 - Freeze up
South	4/1 - 5/15	8/7 - 8/29	11/1 - Freeze up

Refer to Section V.A.2. for frost seeding recommendations.

United States Department of Agriculture
Natural Resources Conservation Service

Wisconsin Agronomy Technical Note 5

Establishing and Maintaining Native Grasses, Forbs and Legumes

INTRODUCTION

This technical note may be used to guide prairie restoration seedings for the purposes of Wisconsin Natural Resources Conservation Service (NRCS) Field Office Technical Guide (FOTG) Conservation Practice Standards 327, Conservation Cover; 645, Wildlife Upland Habitat Establishment; 512, Forage and Biomass Planting, and occasionally 342, Critical Area Planting. Other ecological science and certain engineering standards may refer to this technical note. Each standard has a specific purpose and requirement for vegetation establishment.

BACKGROUND

A prairie is a diverse plant community characterized by the number of grass, legume, shrub, and forb species. In Wisconsin, a typical prairie averages six species per square foot. Exceptionally rich sites can average as many as eight species per square foot. High quality remnants of original prairie can harbor 40 to 80 species per acre.

Prairie restoration is the art and science of reconstructing a diverse native plant community. Constructing an exact copy of the tall grass prairie plant community is not very likely. However, the more common components of the prairie can be established and will evolve into a prairie with many of the same visual and ecological components of a natural undisturbed prairie.

The vast majority of native herbaceous plants are warm season species with the exception of a few cool season native grasses and forbs. Warm season plants (C4) produce most of their annual biomass during hot summer months from late June through early September. The growth of this group of plants does not begin until the minimum air temperature reaches 60 to 65 degrees Fahrenheit and soil temperatures reach 50 degrees Fahrenheit. Optimum biomass production occurs when daytime temperatures elevate to 85 degrees Fahrenheit. At higher temperatures C4 plants have a greater potential photosynthetic rate and use nitrogen and phosphorus more efficiently. Native plants survive and adapt better than introduced species under conditions of high temperatures.

TABLE OF CONTENTS

LIST OF TABLES

SITE ASSESSMENT

Prairies are generally divided into five soil moisture regimes: Wet, Wet-Mesic, Mesic, Dry-Mesic, and Dry. There is often no sharp division between moisture regimes and one group may blend into another or multiple groups and should be considered when planning a successful prairie.

Some plant species are restricted to certain soil moisture regimes, while other plant species can be present on several if not all of the soil moisture regimes.

Wet organic soils are the most challenging when establishing most native plant species due to site conditions as well as competition from cool season and invasive plants. Wet organic soils pose issues with management activities such as mowing and spraying in a timely manner, a prerequisite to a successful planting.

PRAIRIE SOIL MOISTURE REGIMES AND SITE CONDITIONS

Wet Prairie

Wet prairies occur on mineral soils with poor drainage. They can also be found on some frequently flooded sites.

Wet-Mesic

Wet-Mesic Prairies are transitional between Wet Prairie and Mesic Prairies. Most Wet-Mesic Prairies occur on somewhat poorly drained mineral soils.

Mesic Prairie

Mesic Prairies will be found on most moderately well and well drained mineral soils that have moderate to very high Available Water Capacity. Mesic Prairies may occur on some somewhat poorly drained soils with low or very low Available Water Capacity or perched water tables.

Dry-Mesic Prairie

Dry-Mesic Prairies are transitional prairies between Dry Prairie and Mesic Prairie. They occur on some somewhat excessively drained and some well drained soils.

Dry Prairie

Dry Prairies occur mostly on well to excessively drained soils.

SPECIE SELECTION AND SEED QUALITY INFORMATION

- Evaluate the winter hardiness of species being selected for planting.
- Species identified as restricted or prohibited shall not be planted.
- Plant all the desired species at one time.
- Select species based on the site conditions for soil type and moisture regime.
- Seed as many forbs from the appropriate tables in this technical note as the budget will allow.
- If the objective is to create pollinator habitat, select species so that the prairie will be in flower throughout the growing season. Select at least three species from each bloom period (early, mid, late).
- Bunch grasses are recommended when pollinator habitat is planned.
- Due to the aggressive nature of the following plants, it is recommended to limit the seeding rates of the following species:
  - June Grass (2 oz/ac or 7 seeds/sq. ft.)
  - Switchgrass (16 oz/ac or 9 seeds/sq. ft.)
  - Blackeyed Susan (2 oz/ac or 5 seeds/sq. ft.)
  - Purple Coneflower (3 oz/ac or 2 seeds/sq. ft.)
  - Bergamot (2 oz/ac or 4 seeds/sq. ft.)
- Legumes must be inoculated with the appropriate bacteria for the specific species being planted. Inoculant must not be exposed to sunlight or allowed to dry out prior to planting native legumes.
- If more than 20 percent of the legume seed is hard seed, increase the seeding rate for legumes by the percent of hard seed in the seeding mixture.
- When using Standards 327, Conservation Cover; and 342, Critical Area Planting, Canada and Virginia Wildrye and Sideoats Grama, when combined, will not comprise of more than 20 percent of the total grass seed per square foot.
- The minimum seeding requirements are based on seeds per square foot.
- Increase seeds per square foot by 15 percent when dormant and frost seeding occurs.
- Use non-sod forming grass species in locations where shrubs and trees are planned.
- Where an existing native remnant prairie is near a planting site, it may be desirable to use locally harvested genotype seed. If this seed is

harvested locally it may be difficult to test for germination or purity in order to determine PLS. The use of locally harvested untested seed for USDA program participants must be approved by the Wisconsin NRCS State Agronomist.

- The order of preference for seed source selection is:

  1. Local genotypes.
  2. Genotypes from the same latitude.
  3. A named variety from the same latitude.
  4. Other named varieties.

- Use of local genotypes is the first preference because plants grown on or near the restoration site will be best adapted to the conditions of the site. It is especially important to use local genotypes when working with remnant prairies; introducing species from other areas may contaminate the local native plant gene pool.
- Seed purchased should be harvested within a 250 mile radius of the area where the planting will occur.
- Ideally, 40 percent of the total seeds per square foot should consist of forbs and or legumes.
- Below are species with multiple scientific names. The underlined specie is the most recognized genus and specie in Wisconsin and is referenced in vegetative Standards 327, Conservation Cover; 342, Critical Area Planting; and 512, Forage and Biomass Planting.

  – **False Boneset:** Brickellia eupatorioides, Kuhnia eupatorioides

  – **Great St. John's Wort:** Hypericum ascyron, Hypericum pyramidatum

  – **Heath Aster:** Symphyotrichum ericoides, Aster ericoides

  – **Joe-Pye Weed:** Eutrochium maculatum, Eupatoriadelphus maculates and Eupatorium maculates

  – **Porcupinegrass:** Hesperostipa spartea, Stipa spartea

  – **Silky Aster:** Symphyotrichum sericeum, Aster sericeus

  – **Smooth Blue Aster:** Symphyotrichum laeve, Aster laevis

  – **Softstem Bulrush:** Schoenoplectus tabernaemontani, Scirpus validus

  – **Stiff Goldenrod:** Oligoneuron rigidum, Solidago rigida

  – **Upland Boneset/Tall Boneset**: Eupatorium sessifolium, Eupatorium altissimum

  – **Wild Quinine:** Parthenium integrifolium, Parthenium auriculatum

Table 1
Recommended Varieties of Warm Season Grasses

Specie	Variety	Area of Adaptability
Big Bluestem	Bison	North
	Bonilla	Central
	Champ	South
	Pawnee	South
	Rountree	Central and South
Indiangrass	Holt	Central and South
	Rumsey	South
	Tomahawk	North
Switchgrass	Blackwell	South
	Cave-in-Rock	South
	Dacotah	North
	Forestburg	Central
	Nebraska 28	Central
	Pathfinder	South
	Sunburst	Central
	Trailblazer	South
Little Bluestem	Blaze	Statewide
	Aldous	South
	Camper	Central and South

PURE LIVE SEED (PLS)

PLS is a means of expressing seed quality. PLS is the percentage of seed (i.e. good viable seed) that has the potential to germinate for a measured one pound weight of any seed lot. Nearly all species recommended for conservation plantings by NRCS uses Pure Live Seed (PLS) expressed in pounds or ounces per acre which is calibrated to seeds per square foot as the basis for the calculation of seeding rates. PLS provides a basis for comparing the quality of seed lots of the same species that differ in purity and germination. PLS is calculated by multiplying the purity percentage by the total germination percentage.

Seeding rates in this Technical Note are shown in pounds or ounces of Pure Live Seed (PLS) and is calibrated to seeds per square foot. All seed shall be of high quality and labeled in accordance as required by the Wisconsin Seed Law. Seed should always be

purchased on a PLS basis. Seed tags should specify the percentage of Total Viable Seed (TVS) germination/dormant/hard and purity to determine the correct seeding rates as specified in the seeding plan.

Example: Pure Live Lupine seed

	Pure Seed:	99.93%
	Inert Matter:	0.06%
	Other Crop:	0.01%
Lupine	Weed Seeds:	0.00%
Lupinus perennis	Germination:	11.00%
Harvest ID: 018040-01	Hard Seed:	0.00%
Test Date: 2/24/2012	Dormant Seed:	85.00%
	Tetrazolium:	0.00%

Name and # of Noxious Seed:	NONE FOUND

Pure seed x TVS = PLS
99.93% x 96.0% = 95.9%

The PLS for Lot Number 018040-01 is 95.9.

CRITERIA FOR SEED MIXTURE DEVELOPMENT

Seed mixtures developed from this section will be composed of a grass component only or a grass and forb/legume component, depending on the standard criteria and purpose of the planting.

It is important to reference program rules when determining seed mixtures. Some programs have preapproved required mixtures to meet program and cost requirements.

STANDARD 327 CONSERVATION COVER

NATIVE OR WARM SEASON PLANTINGS

1. Basic Prairie Plantings

   - A minimum of 3 grasses seeded at a minimum rate of 20 grass seeds per square foot and a minimum of 3 forbs and or legumes seeded at a minimum rate of 2.0 seed per square foot.

2. Restoration of Native Prairie Plantings

   - A minimum of 5 grasses consisting of a minimum of 15 grass seeds per square foot and a minimum of 10 forbs comprising of at least one legume in the mixture amounting to a minimum of 8 seeds per square foot.

3. Untested Local Genotype Seed

The use of local genotype seed for USDA program seedings must be approved by the NRCS State Agronomist. Approval will only be considered for sites where the use of local genotype seed is necessary to address or maintain the ecological value of an area as identified in a NRCS conservation plan or similar planning document.

In order to obtain the highest quality seed possible:

- The harvesting of seeds will be supervised by someone experienced in the harvest of native seeds.
- All seed will be cleaned.
- Seed will be separated and properly stored by specie so that it can be mixed later at the planned rates.
- Collected seed will be tested for germination and viability unless a variance is granted by the NRCS State Agronomist.
- Use the following guidance for locally collected prairie seed that is untested.

a) Seed will be planted at a minimum seeding rate of 50 seeds per square foot. Limit seeding rates so that one specie does not comprise more than 20 percent of the seeds/square foot. When a specie is seeded at a seeding rate so that its number of seeds planted per square foot makes up more than 20 percent of the total planted seeds per square foot; only the seeds per square foot that fall within the 20 percent requirement will be counted toward the total required number of seeds per square foot.

   The seeding rate of plant species known to germinate aggressively in new plantings such as Switchgrass, Purple Cone Flower, Blackeyed Susan and Bergamot shall be limited to 15 percent or less of the total seed per square foot planted.

b) At least 25 seeds per square foot must be native grasses or sedges and a minimum of 10 seeds per square foot of forbs and legumes.

c) At least five species of grasses and 10 species of forbs and at least 1 legume must be seeded. In situations, where the number of species required are unavailable during the harvest of untested genotype, the

mixture may be supplemented with certified pure live seed to satisfy this requirement.

d) A final list of the species planted and the ounces of each specie actually planted must be provided to the NRCS office for review and approval.

4. Pollinator Herbaceous Plantings

- At least 1 and a maximum of 2 bunch grass species seeded at a maximum rate of 10 seeds per square foot and a minimum of 9 forbs and or legumes consisting of at least 3 species from each bloom period (early, mid, late) seeded at a minimum rate of 30 seeds per square foot.

Short bunch grasses are preferred over tall bunch grasses.

Recommended short bunch grasses are: Sideoats Grama, Prairie Junegrass, Little Bluestem, Woolgrass, and Prairie Dropseed.

Recommended tall bunch grasses are: Switchgrass, Indiangrass and Big Bluestem.

STANDARD 512 FORAGE AND BIOMASS PLANTING

5. Warm Season Pasture and Hayland Plantings

- The minimum seeds per square foot by specie is as follows: Big Bluestem (42), Indiangrass (44), Switchgrass (63).

For pasture and hayland purposes, warm-season grasses will be established in stands of single species only.

6. Warm Season Biomass Plantings

- Switchgrass is currently the only approved specie for biomass production in Wisconsin. The minimum seeding rate is 63 seeds per square foot.

STANDARD 342 CRITICAL AREA PLANTING

7. Native Herbaceous Plantings on Critical Sites

- A minimum of 60 seeds per square foot for solid native grass plantings is required.
- For grass and forb/legume mixtures, a minimum of 40 seeds per square foot for the grass component and a minimum of 20 seeds per square foot for the forb/legume component is required. The minimum of 20 forb/legume seeds per square foot is not required when native grass seed per square foot is greater than or equal to 60.

Native species are generally not recommended for critical sites due to slow establishment and because native plants grow in clumps and are not sod forming.

SEEDING DATES

Native plantings can be seeded either late fall, winter(frost seeding) or spring .

Warm season plants require a soil temperature of at least 50 degrees Fahrenheit before they will germinate. Spring is the traditional time to seed these plants and plantings are successful when recommendations are followed. Spring conditions favor warm season grasses over forbs and legumes. Under normal spring conditions moisture conditions are considered ideal or adequate.

If site conditions in the spring are not adequate due to weather, fall seedings offer an excellent opportunity for seeding native species. Fall seedings favor forbs due the cold weather stratification. The majority of forbs are stratified before purchase of seed. Fall seeding of natives in Wisconsin is considered a dormant seeding and must be seeded after the growing season has ended to ensure that the seed does not germinate before freeze up.

Frost seeding in late winter is permissible in Wisconsin and has been proven successful. These seedings are made in late winter, mid-February to early March during the freeze and thaw cycle. Seedings should not occur when snow cover is greater than 2 inches. Frost seeding timeframes will vary according to weather conditions and from year to year.

Seeding shall be carried out within the dates specified for the appropriate planting zone. See **Figure 1** and **Table 2** to determine the recommended seeding dates.

Seeding outside of the established dates may be approved by the NRCS State Agronomist or Area Resource Conservationist. All variance requests shall provide documentation of the current soil moisture conditions and proposed timeframes for seeding to be completed.

TEMPORARY COVER AND COMPANION CROPS

Temporary Cover

All land will be established to permanent vegetative cover during the first year of the land use conversion when possible. Temporary cover, during the first year, may be used if: 1) required seeds or plant stock are not available, 2) the normal planting period for species has passed or 3) where chemical residue will not allow establishment of permanent cover immediately. If temporary cover is used, the permanent vegetative cover must be established by the end of the normal planting period of the following year.

Temporary Seeding Recommendations

1. Fields where planting is delayed due to lack of suitable seed or late planting, select one of the following species:

   - Forage sorghum – ½ bu./ac. (5/15 - 7/15
   - Sorghum - Sudangrass hybrid – 1 bu./ac. (5/15 - 7/15)
   - Sudangrass – 1 bu./ac. (5/15 - 7/15)
   - Winter wheat - 2 bu/ac. (8/1-10/1)
   - Winter cereal rye - 2 bu/ac. (8/1-10/15)
   - Oats - 2 bu/ac. (4/1-9/1)
   - Annual ryegrass - 20 lbs/ac. (4/1-9/1)

   A temporary cover will typically not be necessary on those areas where at least 50 percent of the ground is covered with either crop residue or vegetative cover.

   Temporary cover crops must be clipped or destroyed before plants develop a viable seed, preventing excessive competition to the permanent seeding. Winter wheat and winter cereal rye must be terminated by tillage or herbicides before planting the permanent seeding.

2. For fields with triazine herbicide carryover, select one of the following species:

   - Forage sorghum – ½ bu./ac. (5/15 - 7/15)
   - Sorghum - Sudangrass hybrid – 1 bu./ac. (5/15 - 7/15)
   - Sudangrass – 1 bu./ac. (5/15 - 7/15)

   A bioassay test may be used to better determine chemical carryover.

Companion Crops

Companion crops can be used to reduce the amount of erosion on critical sites. The companion crops listed below are compatible with most native grass and forb plantings; will grow quickly under cooler conditions, suppress weeds and will not compete with the slower growing grasses and forbs.

Canada wildrye (*Elymus canadensis)* for mesic sites or Virginia wildrye (*Elymus virginicus)* for wet sites can be seeded at a rate of 1.0 pound PLS/acre. In addition, sideoats grama (*Bouteloua curtipendula)* can be seeded as a companion crop at a rate of 1.0 - 2.0 pounds PLS/acre on dry to dry mesic and mesic sites.

Sideoats grama or the wildrye species seeded as companion crops for the purpose of wildlife habitat and critical area plantings can be counted toward the minimum seeds per square foot, up to 20 percent of the required grass seed per square foot.

Oats (2 bu/ac) can be used as an alternative companion crop and is recommended on critical erosive sites that can be mowed before boot stage. Winter wheat or winter cereal rye is not the preferred companion crop due to the aggressive tillering nature of these plants.

SPECIAL EROSION CONTROL MEASURES

Since warm-season plants may be slow to establish, special erosion control measures will be needed on certain sites due to landscape conditions.

- Temporary cover crops may be seeded to obtain the required cover, prior to seeding.
- Seed site using no-till seeding methods.
- Divert surface water from location until vegetation has been established.
- Tillage and planting should occur on the contour only.
- Increase seeding rates by 25 percent to expedite cover establishment.
- Surface apply a mulch or solid manure on critical areas.
- Use a small grain companion crop.
- Plant species identified as aggressive in this technical note located in the section “Specie Selection and Seed Information”.

Figure 1
Planting Zone Map

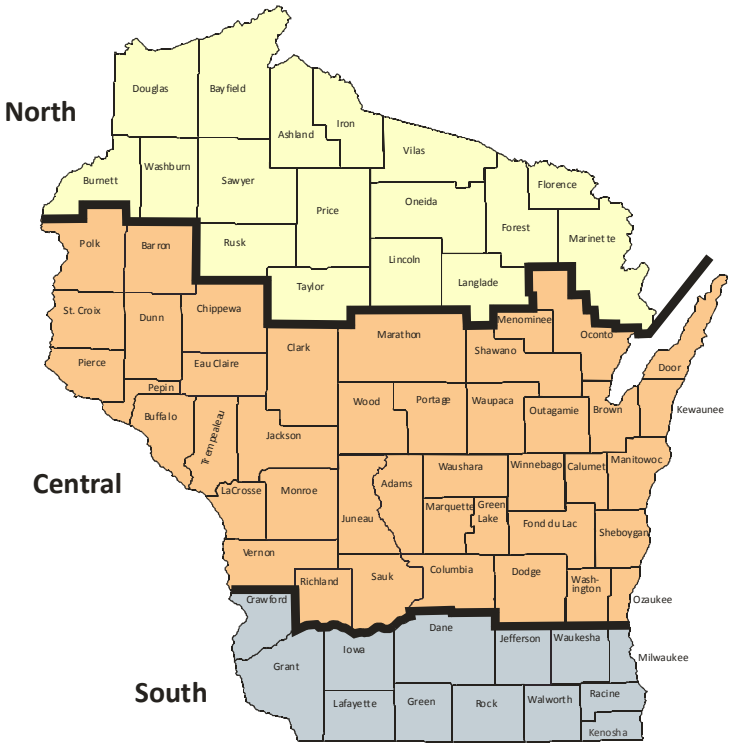


Table 2
Seeding Date/Ranges for
Warm Season Native Mixtures

Zone	Spring Seeding	Fall Dormant Seeding*
Northern	Thaw - 7/15	10/8 - Freeze Up
Central	Thaw - 6/30	10/15 - Freeze Up
Southern	Thaw - 6/30	10/20 - Freeze Up

*Dormant seeding is not allowed when using Practice Standard 342, Critical Area Planting.

GENERAL PRE-PLANT SEEDING RECOMMENDATIONS

Pre-Planting Weed Control

Pre-plant weed control is a critical step in the establishment of native plant materials. Weeds compete with seedlings for moisture, light and nutrients. Inadequate weed control causes more stand failures than any other single factor. Ideally, 6 months to a year prior to planting native species, consider this window as a pre plant weed control year. During that year a concerted effort should be made to control persistent perennials such as Canada thistle or knapweed. During the pre-plant weed control time period, evaluate the seed bed for the presence of weed seedlings. Where a significant number of weeds or invasive plants emerge consider tillage summer fallow, herbicide summer fallow, or a combination of tillage and herbicide summer fallow. Herbicide summer fallow is recommended for sites prone to erosion. For sites not susceptible to erosion, tillage or in combination with herbicide are recommended. The most effective strategy involves the integrated use of two or more weed control activities during the same growing season. Perennial weeds cannot be controlled effectively with herbicides after natives are planted.

Herbicide Carryover

Prior to planting check to ensure that any herbicides used on the previous crop will not “carry over” and

negatively impact newly seeded prairie plants. Residues of some herbicides such as Atrazine may prevent the establishment of some native plant materials for up to two years. If the residual effects of herbicides are possible, delay planting until after the recommended interval to allow residual herbicide levels to dissipate.

Fertilizing

For establishment of native species, soil testing and application of soil amendments is not a requirement; however, for maximum forage production (nutritional forage quality) and maximum biomass production for bio-energy, the application of nutrients will be based on the guidelines below.

The recommendations in this section are based on native grasses planted for hay, pasture, biomass production, and not for wildlife purposes. For pasture and hay land plantings of natives, a soil test is recommended prior to establishing vegetation. A current soil test is defined as test results no older than 4 years from the time last tested to the date of the planned seeding. Guidelines for soil testing can be found in Publication A2100, Sampling Soils for Testing. All nutrients will be applied following Wisconsin NRCS FOTG, Section IV, Standard 590, Nutrient Management.

Nitrogen should not be applied to warm season plantings until the second growing season to avoid stimulating weed growth. Applications of nutrients should not be made until spring growth has reached four to six inches.

Seedbed Preparation

When native materials are planted into undisturbed ground, the crop residue should be uniformly distributed over the soil surface prior to planting to minimize the smothering of new seedlings and to provide conditions for the operation of planting equipment. Planting native material into undisturbed soybean residue is preferred. Soybeans produce a moderate amount of crop residue that can be effectively managed and tend to leave the soil in a mellow condition that is well suited to no-till planting of prairie plants. Native material planted into undisturbed corn residue has proven successful at times. It is recommended that soil disturbance is necessary to ensure uniform germination by exposing soil, orienting and burying the corn residue, leaving 50-70 percent residue prior to planting.

Ground that has been tilled will require a firm seedbed prior to planting. A firm seedbed is important when planting native material. A firm seedbed helps conserve moisture evenly and ensures good seed to soil contact. Recently tilled ground should be firmed with a roller packer. The seedbed is firm enough when a footprint penetrates ¼ to ½ inch deep.

Sites tilled and packed are normally in a suitable condition for most seeding methods and with most types of native seed planters.

Seeding into existing sod will present special challenges. While the root and top growth of the old vegetation provide excellent erosion control, this biomass can make it difficult to achieve good seed placement. When planting native material into existing sod comprising of introduced species, the introduced species should be totally eradicated. The options available for eradicating introduced species include: tillage, tillage and herbicide, burn and herbicide, grazing, and mowing. Anytime tillage is performed, a firm seedbed is strongly recommended.

Seedbed preparation for frost seeding must occur before freeze-up. The fall before seeding occurs, evaluate the seedbed conditions to ensure that the remaining crop residue is well distributed and soil surface is level following tillage. Packing is not necessary; the weight of winter precipitation such as rain, ice and snow will naturally pack the soil, firming the seedbed. Undisturbed soybean residue is an ideal scenario for frost seeding. Frost seeding should not occur on existing sod or undisturbed corn ground. The corn stubble must be fall tilled to bury at least 30 percent of the residue and expose soil followed by a leveling tool.

A site that contains a significant remnant native plant population, consideration should be given to managing the site that would favor maintaining the species rather than eliminating them and reseeding. Stand improvement of existing natives will require a management program that allows the new seedlings to become established while maintaining the existing vegetative stand. Options available include: mowing and removing the biomass and interseeding, burn and interseed with persistent mowing until new seedlings become established. These options will require patience and persistence.

Planting Equipment and Seeding Methods

The equipment used to seed native materials should provide a consistent rate of seed flow and place the seed at a uniform depth in close contact with the soil. The characteristics of some native seeds require the use of specialized equipment or modification of

standard agricultural equipment such as grain drills. Some native seed are awned, light, fluffy, smooth, small, large and irregular in shape. Little Bluestem, Indiangrass, Big Bluestem all have light fluffy chaffy seed. Switchgrass has a small hard seed that will have several hundred thousand seeds per pound and Eastern Gamagrass has a large irregularly shaped seed and has about 8,000 seeds per pound. Any of these seed characteristics can result in uneven rates of seed flow and undesirable skips in seed rows in standard gravity fed grain drills. This makes it extremely important for the producer to understand planting methods commonly used and the need to have specialized equipment available to properly plant native species.

Whether a person is using conventional or no-till seeding methods, planting depth for native seeds should not exceed ¼ of an inch in depth. Either technique will be successful if specific guidelines are followed. There are advantages and disadvantages for using either seeding method.

Conventional seeding normally entails seedbed preparation involving some degree of tillage. The new planting is established by broadcasting or drilling into a partial or clean seedbed. The advantages and disadvantages of conventional seeding methods are:

- Advantages: may incorporate nutrients and provide the opportunity to destroy perennial weeds.

- Disadvantages: soil erosion increases greatly, erosion can wash new seedlings out or sediment can bury them, higher field preparation cost, weed competition can be greater especially from annual weeds, the need of a companion crop for erosion control and reduce weed competition.

No-till seeding is the planting of grasses, forbs and or legumes in the absence of tillage using planting tools capable of drilling into an undisturbed soil surface, interseeding into existing herbaceous cover or prior year crop residue. The advantages and disadvantages of no-till planting are:

- Advantages: soil erosion is minimized, reduced energy usage, no companion crop required, greater moisture availability, can seed under adverse conditions, carbon sequestrating approves, and proper seed placement ensured.

- Disadvantages: increased herbicide use, no-till drill required, nutrients cannot be incorporated.

Drill Seeding

Drill seeding is probably the most commonly used method of planting seed of any type. Seed is metered out from multiple seed boxes containing specialized components to mix, stir and meter seed, each adapted to planting different seed types. The soil opening and planting operation is followed by a set of packers, with no further soil preparation after seeding is completed. Drills may be classified as conventional or no-till type. A prepared seedbed is needed when using a conventional planter or drill. A no-till type drill can operate under both disturbed and undisturbed site conditions.

Whether a conventional or no-till type drill is used, prior to planting, calibrate the drill or seeder according to the manufacturer's instructions. Use a carrier material (or a small amount of seed if the carrier is not used) to test and adjust the seeding rate, distribution pattern, and planting depth.

Broadcast Seeding

Broadcast seeding is the planting or sowing seeds across an area by scattering seed either by mechanical means or by hand. Most common used mechanical broadcast planters are the rotary, cyclone and fertilizer cart with a spinning plate to evenly distribute seed material. Aerial seeding using an airplane or helicopter are common methods by which seed is broadcasted.

Broadcast planters work on the principle of centrifugal force and the inherent weight of the seed to distribute the seed uniformly across the site. When planting light, fluffy and chaffy seed, a carrier should be mix with the seed such as pelletized lime, fertilizer, damp sand, cracked corn, saw dust, vermiculite, etc. When fertilizer is used as a seed carrier, the seed must be spread immediately after mixing to prevent "salt effect" damage to the seed.

A prepared seedbed is critical to guaranteeing good seed to soil contact for uniform germination. Before and after seeding, a cultipacker or similar tool should be used to help incorporate, improve seed to soil contact and improve germination. Under certain conditions, broadcasting in an undisturbed seedbed can be successful for example on soybean stubble, when frost seeding, or fall dormant seedings. Broadcasting seed onto undisturbed ground consisting of large amounts of non-fragile residue is not recommended.

Calibration of broadcast spreaders is not as accurate as with drill seeding. To calibrate a broadcast seeder

determine your bulk seeding rate per acre and convert to an anticipated seeds per square foot. Place several tarps at multiple locations across the path of the seeder. Operate the seeder across the tarps and check each tarp for the average seed count per square foot, increasing or decreasing the rate of seed flow.

Frost Seeding

Frost seeding is the broadcasting of seed late winter through early spring. In Wisconsin, frost seeding normally should occur mid February to early March. The exact seeding date is not predetermined and will vary from year to year depending on climate.

Seed surface applied, absence of snow or onto snow cover of less than 2 inches. Seeding onto snow cover greater than 2 inches increases the risk for seeding failure. Frost seeding should not occur immediately before a predicted thaw event that could produce significant runoff. The soil surface is usually "honeycombed" with small cracks at this time during the year. The freeze/thaw cycles that occur at this time of year will embed the seed into the soil where it can germinate as growing conditions become more favorable. When the freeze-thaw cycle ends, seed according to the recommended spring seeding dates.

Frost seeding is allowed when using Practice Standards 327, Conservation Cover; and 512 Forage and Biomass Planting. Frost seeding is not allowed when using Standard 342, Critical Area Planting.

Dormant Seeding

Seed is broadcasted, no-tilled or conventional drilled into an undisturbed or disturbed partial or clean seedbed after the growing season and before freeze-up. The seed remains dormant until the following spring. A firm seedbed is required for disturbed or tilled sites. The advantages and disadvantages are:

- Advantages: seeding at a time of year when labor is more available, seedlings take advantage of early spring moisture, soil erosion is minimized.
- Disadvantage: seeding rates should be increased.

Dormant seeding is allowed when using Practice Standards 327, Conservation Cover; and 512, Forage and Biomass Planting. Dormant seeding is not allowed when using Standard 342, Critical Area Planting.

POST-PLANTING WEED CONTROL

Planting Year Post Emergence Weed Control Mowing – New Seedings

Mesic and wet sites in particular are prone to weed competition. Currently, there are limited herbicides available to control weeds in a prairie restoration planting without potentially impacting native legumes and most forbs. To combat this problem, repeated mowing is essential throughout the establishment period.

The first year following seeding, mow growing plants to a height of 7 inches whenever the canopy reaches a height of 12 inches. Depending on rainfall and growing conditions, three mowings may be required. In a normal growing season, mowing should occur around the middle of June, early to mid July as well as the first part of August. It may be necessary to remove the clippings to avoid smothering the seedlings. Utilize a rotary mower or flail chopper to uniformly distribute mowed material over the field surface. It is essential to monitor the canopy height to avoid the accumulation of excess clipped material over top of seedlings and to ensure sunlight reaches the soil surface for the new seeding. Use of this mowing strategy will stress the weeds and will not harm the prairie plants in this first year.

Second Year Weed Control

Routinely evaluate the stand in the second year to determine if mowing for weed control is necessary. When necessary to control weed canopy, mow the planting to a height of 7 inches as often as required. The strategy in year two will mirror year one maintenance activities. Establishment of your native planting will have precedent over nesting season concerns. Once the prairie is established, wildlife habitat concerns should be mitigated with seasonal or spot treatment activities that will minimally impact wildlife.

DETERMINING SUCCESS OF THE PLANTING

In determining stand adequacy, there are two major considerations: 1) adequate protection of the soil resource, and 2) adequate stand for the planned purpose.

It may be difficult to determine if the prairie restoration is successful, particularly during the seeding year. Most native species are long-lived, but develop slowly. It may take two to five years for a

stand to be fully successful. For native plantings determined to be questionable or inadequate, a final evaluation deciding whether to reseed should not be done until after the third growing season. It is often said prairie sleeps the first year (sets root structure), creeps the second year (starts to spread slowly) and leaps in the third year (distinct and prominent). Patience is a virtue.

POST ESTABLISHMENT MANAGEMENT

Any planned maintenance (except for noxious weed control) after the establishment period, should be done before May 15 or after August 1 to protect nesting cover and reduce disruption of nesting activities.

Spot Treatment By Clipping

Spot clipping can be used to control annual weeds and to suppress other weeds. Spot clipping must be done before the target plant forms viable seed and must continue throughout the growing season. Spot clipping is not an effective control for biennial and perennial weeds but can be used to contain these plants until other control treatments can be implemented.

Spot Treatment With Herbicide

It is often necessary to spot treat invasive plants in a prairie. Introduced grasses and legumes and other aggressive weeds can severely impact a prairie when these undesirable plants are not controlled. The timing of herbicide product application is an important factor to protect prairie plants. Improper herbicide selection or application timing can severely damage a prairie planting. Early spring spot treatment with herbicides is often highly effective in addressing aggressive weeds while native plants are dormant. Spot treatment should be timed to treat weeds during active growth periods. Effective herbicide spot treatment can prevent the target plants from setting seed and spreading in the prairie.

Spot Treatment By Hand Pulling/Digging

Hand pulling or digging can be an effective control if the entire root is removed from the soil. Hand pulling/digging is most effective in the spring when the soil is moist and loose from the winter freeze/thaw cycles.

Prescribed Burning – Established Cover

Burning is a good tool for long-term stand management of native vegetation. Burning may be used to manage weeds once the prairie has been established if there is enough material to carry a fire. Time of burning and frequency will impact the species that are present on the site. Fall burns and to a lesser extent early spring burns, will tend to promote forbs. Late spring burns tend to stimulate the growth of warm season grasses and suppress cool season plants. Burn when the cool season plants are growing and the warm season plants are dormant or starting to grow to control cool season species. Do not conduct sequential prescribed burns on a given site at the same time of year. This tends to reduce stand diversity and can create a negative impact on desirable prairie plants. For longevity and plant diversity, burning should be conducted periodically, every other year to every fifth year.

REFERENCES

Curtis, J. T., 1959. *The Vegetation of Wisconsin: an ordination of plant communities.* University of Wisconsin Press, Madison.

Henderson, R. A., 1995. *Plant Species Composition of Wisconsin Prairies: an Aid to Selecting Species for Plantings and Restorations Based Upon University of Wisconsin-Madison Plant Ecology Laboratory Data.*. Wisconsin Department of Natural Resources Technical Bulletin No. 188.

Nichols, S. and Entine, L., 1976. *Prairie Primer.* University of Wisconsin - Extension G2736.

Rock, H. W., 1971. *Prairie Propagation Handbook.* Boerner Botanical Gardens.

Table 3
Common Species and Recommended Seeding Rates

Name	Scientific Name	Moisture Regime	Single Species Seeding Rate (PLS)		
Native Grasses			**Lbs./Ac.**	**Seeds/Lb.**	**Seeds/Ft^2/Lb./ Ac.**
Big Bluestem	Andropogon gerardii	D, DM, M, WM	11	165,000	3.8
Canada Wildrye	Elymus canadensis	DM, M, WM	12	83,200	1.9
Fowl Mannagrass	Glyceria striata	WM, W	0.5	2,560,000	58.7
Indiangrass	Sorghastrum nutans	D, DM, M, WM, W	10	192,000	4.4
Little Bluestem	Schizachyrium scoparium	D, DM, M	8	240,000	5.5
Prairie Cordgrass	Spartina pectinata	M, WM, W	8	105,600	2.4
Prairie Dropseed	Sporobolus heterolepis	D, DM, M	3	256,000	5.9
Prairie Junegrass	Koeleria macrantha	D, DM, M	0.5	2,308,672	53
Sideoats Grama	Bouteloua curtipendula	D, DM, M	8	127,000	2.9
Switchgrass	Panicum virgatum	D, DM, M, WM, W	7	389,000	8.9
Virginia Wildrye	Elymus virginicus	M, WM, W	17	67,200	1.5
Rush			**Oz./Ac.**	**Seeds/Oz.**	**Seeds/Ft.^{2}/Oz./ Ac.**
Woolgrass	Scirpus cyperinus	W	1.5	1,700,000	39

Table 4
Wisconsin NRCS Authorized Native Plant List
(Grasses, Rushes, Sedges)

Plant Type	Common Name	Scientific Name	Seeds/oz	Seeds/sq ft @ 1 oz/ac	Moisture Regime
Grass	Big Bluestem	Andropogon gerardii	10,313	0.24	D, DM, M, WM
Grass	Bluejoint	Calamagrostis canadensis	280,004	6.428	WM, W
Grass	Canada Wildrye	Elymus canadensis	5,200	0.12	DM, M, WM
Grass	Fowl Mannagrass	Glyceria striata	159,996	3.673	WM, W
Grass	American Mannagrass	Glyceria grandis	79,976	1.836	WM, W
Grass	Hairy Grama	Bouteloua hirsuta	70,000	1.607	D, DM
Grass	Indiangrass	Sorghastrum nutans	12,000	0.28	D, DM, M, WM, W
Grass	Prairie Junegrass	Koeleria macrantha	144,292	3.312	D, DM, M
Grass	Little Bluestem	Schizachyrium scoparium	15,000	0.344	D, DM, M
Grass	Porcupinegrass	Hesperostipa spartea	11,000	0.253	D, DM
Grass	Prairie Cordgrass	Spartina pectinata	6,600	0.152	M, WM, W
Grass	Prairie Dropseed	Sporobolus heterolepis	16,000	0.37	D, DM, M
Grass	Sand Dropseed	Sporobolus cryptandrus	332,125	7.625	D, DM, M
Grass	Sideoats Grama	Bouteloua curtipendula	7,938	0.183	D, DM, M
Grass	Switchgrass	Panicum virgatum	24,313	0.562	D, DM, M, WM, W
Grass	Virginia Wildrye*	Elymus virginicus*	4,200	0.096	M, WM, W
Rush	Common Rush	Juncus effusus	1,000,007	22.957	WM, W
Rush	Green Bulrush	Scirpus atrovirens	459,994	10.56	WM, W
Rush	River Bulrush	Schoenoplectus fluviatilis	4,299	0.0987	M, WM, W
Rush	Softstem Bulrush	Schoenoplectus tabernaemontani	31,015	0.712	WM, W
Rush	Woolgrass	Scirpus cyperinus	1,700,000	39.027	W
Sedge	Longhair Sedge	Carex comosa	30,013	0.689	WM, W
Sedge	Fox Sedge	Carex vulpinoidea	99,970	2.295	WM, W
Sedge	Bottlebrush Sedge	Carex hystericina	30,013	0.689	WM, W

**Virginia wildrye (Elymus virginicus) is better adapted than Canada wildrye (Elymus canadensis) for wet site condition seedings in the south planting zone (Figure 1).*

Table 5
Wisconsin NRCS Authorized Native Plant List
(Forbs, Legumes, Shrubs)

Plant Type	Common Name	Scientific Name	Seeds/oz	Seeds/sq ft @ 1 oz/ac	Moisture Regime	Blooming Period
Forb	Angelica	Angelica atropurpurea	5401	0.124	W	Middle
Forb	Bergamot	Monarda fistulosa	77,800	1.786	DM, M, WM	Middle – Late
Forb	Biennial Beeblossom	Gaura biennis	2,700	0.062	M	Middle – Late
Forb	Bird's Foot Violet	Viola pedata	26,000	0.597	D, DM	Early, Middle, Late
Forb	Black-Eyed Susan	Rudbeckia hirta	99,600	2.287	D, DM, M, WM	Middle – Late
Forb	Blue Vervain	Verbena hastata	93,000	2.134	WM, W	Middle – Late
Forb	Blue-Eyed Grass	Sisyrinchium campestre	45,000	1.033	D, DM, M	Early – Middle
Forb	Boneset	Eupatorium perfoliatum	160,000	3.67	WM, W	Middle – Late
Forb	Bottle Gentian	Gentiana andrewsii	280,000	6.428	M	Middle – Late
Forb	Butterfly Milkweed	Asclepias tuberosa	3,480	0.08	D, DM, M	Middle
Forb	Cardinal Flower	Lobelia cardinalis	400,000	9.18	WM, W	Middle – Late
Forb	Common Ironweed	Vernonia fasciculata	20,000	0.459	WM, W	Late
Forb	Common Milkweed	Asclepias syriaca	4.000	0.09	DM, M	Middle - Late
Forb	Compass Plant	Silphium laciniatum	650	0.015	DM, M, WM	Middle – Late
Forb	Culver's Root	Veronicastrum virginicum	750,000	17.218	M, WM, W	Middle
Forb	Cupplant	Silphium perfoliatum	1,400	0.032	M, WM, W	Middle – Late
Forb	Downy Gentian	Gentiana puberulenta	435,000	9.986	DM, M	Late
Forb	Downy Wood Mint	Blephilia ciliata	400,000	9.18	DM, M, WM	Middle – Late
Forb	Evening Primrose	Oenothera biennis	90,000	2.07	D, DM, M	Late
Forb	False Boneset	Brickellia eupatorioides	24,000	0.551	D, DM	Middle – Late
Forb	False Toadflax	Comandra umbellata	700	0.016	D, DM, M, WM	Early – Middle
Forb	Few Leaf Sunflower	Helianthus occidentalis	12,960	0.298	DM, M	Middle – Late
Forb	Flowering Spurge	Euphorbia corollata	8,000	0.184	D, DM, M, WM	Middle – Late
Forb	Foxglove Beard Tongue	Penstemon digitalis	115,000	2.64	M, WM	Early – Middle
Forb	Giant Hyssop	Agastache foeniculum	65.000	1.49	DM, M	Middle - Late
Forb	Giant Sunflower	Helianthus giganteus	10,938	0.25	DM, M	Middle - Late
Forb	Goat's Rue	Tephrosia virginiana	2,500	0.057	D, DM	Early – Middle
Forb	Golden Alexanders	Zizia aurea	11,000	0.25	M, WM, W	Early
Forb	Golden Ragwort	Packera aurea	73,000	1.68	M, WM, W	Early – Middle
Forb	Great Blue Lobelia	Lobelia siphilitica	500,000	11.478	W	Middle – Late
Forb	Great St. Johnswort	Hypericum ascyron	200,000	4.59	M, WM	Middle
Forb	Green Milkweed	Asclepias viridiflora	3,600	0.083	D, DM	Early – Middle
Forb	Grooved Yellow Flax	Linum sulcatum	94,000	2.158	D, DM	Early, Middle, Late
Forb	Harebell	Campanula rotundifolia	900,000	20.66	D, DM	Middle – Late
Forb	Harelequin Blue Flag Iris	Iris versicolor	1,300	0.029	W	Early – Middle
Forb	Heath Aster	Symphyotrichum ericoides	140,000	3.214	D, DM, M, WM	Late
Forb	Hoary Vervain	Verbena stricta	32,000	0.734	D, DM	Middle – Late
Forb	Joe-Pye Weed	Eutrochium maculatum	95,000	2.18	W	Middle – Late
Forb	Large Beard Tongue	Penstemon grandiflorus	14,000	0.321	DM	Middle
Forb	Marsh Milkweed	Asclepias incarnata	4,800	0.11	W	Middle
Forb	Meadow Anemone	Anemone canadensis	8,000	0.184	M, WM	Early – Middle
Forb	Mountain Mint	Pycnanthemum virginianum	220,000	5.05	DM, M, WM, W	Middle – Late
Forb	New England Aster	Symphyotrichum novae-angliae	69,900	1.605	M, WM	Late
Forb	Nodding Beggartick	Bidens cernua	21,000	0.482	WM, W	Late
Forb	Nodding Wild Onion	Allium cernuum	7,680	0.176	DM, M	Middle
Forb	Ox-Eye Sunflower	Heliopsis helianthoides	6,480	0.149	M	Middle – Late

Plant Type	Common Name	Scientific Name	Seeds/oz	Seeds/sq ft @ 1 oz/ac	Moisture Regime	Blooming Period
Forb	Pale Purple Coneflower	Echinacea pallida	4,580	0.105	DM, M	Middle
Forb	Pale Spiked Lobelia	Lobelia spicata	900,000	20.661	D, DM, M, WM	Middle
Forb	Panicled Aster	Symphyotrichum lanceolatum	141,570	3.25	M, WM, W	Late
Forb	Partridge Pea	Chamaecrista fasciculata	3,800	0.087	D, M	Middle - Late
Forb	Pasque Flower	Pulsatilla patens	18,000	0.413	D, DM	Early
Forb	Prairie Alum-Root	Heuchera richardsonii	750,000	17.22	D, DM, M, WM	Early – Middle
Forb	Prairie Blazing Star	Liatris pycnostachya	11,970	0.275	D, DM, M, WM	Middle – Late
Forb	Prairie Cinquefoil	Potentilla arguta	200,000	4.591	D, DM, M	Middle – Late
Forb	Prairie Dock	Silphium terebinthinaceum	1,110	0.025	DM, M, WM	Middle – Late
Forb	Prairie Loosestrife	Lysimachia quadriflora	90,000	2.07	M, WM, W	Middle
Forb	Prairie Milkweed	Asclepias sullivantii	4,500	0.103	D, DM, M, WM	Early – Middle
Forb	Prairie Parsley	Polytaenia nuttallii	4,000	0.0918	D, DM, M, WM	Early – Middle
Forb	Prairie Phlox	Phlox pilosa	19,000	0.436	DM, M	Early – Middle
Forb	Prairie Smoke	Geum triflorum	27,000	0.62	D, DM	Early
Forb	Prairie Sunflower	Helianthus pauciflorus	4,580	0.105	D, DM, M	Middle – Late
Forb	Prairie Tickseed	Coreopsis palmata	11,970	0.275	D, DM	Middle – Late
Forb	Prairie Violet	Viola pedatifida	28,000	0.643	D, DM, M	Early, Middle, Late
Forb	Purple Coneflower	Echinacea purpurea	6,600	0.15	D, DM, M	Middle
Forb	Purple Meadow-Rue	Thalictrum dasycarpum	11,000	0.252	M, WM, W	Middle
Forb	Rattlesnake Master	Eryngium yuccifolium	7,980	0.183	DM, M, WM	Middle – Late
Forb	Rosinweed	Silphium integrifolium	3,990	0.092	DM, M, WM	Middle – Late
Forb	Rough Blazing Star	Liatris aspera	13,470	0.309	D, DM, M	Late
Forb	Sawtooth Sunflower	Helianthus grosseserratus	15,000	0.344	D, DM, M, WM, W	Middle – Late
Forb	Shootingstar	Dodecatheon meadia	75,000	1.722	D, DM, M, WM	Early
Forb	Showy Goldenrod	Solidago speciosa	95,000	2.18	D, DM, M	Late
Forb	Silky Aster	Symphyotrichum sericeum	56,000	1.29	D, DM	Late
Forb	Sky-Blue Aster	Symphyotrichum oolentangiense	82,000	1.882	D, DM, M	Late
Forb	Smooth Blue Aster	Symphyotrichum laeve	47,830	1.098	DM, M, WM	Late
Forb	Sneezeweed	Helenium autumnale	130,000	2.98	WM, W	Middle – Late
Forb	Spiderwort	Tradescantia ohiensis	7,980	0.183	D, DM, M, WM	Early – Middle
Forb	Spotted Jewelweed	Impatiens capensis	1,600	0.037	M, WM, W	Middle – Late
Forb	Spotted Mint	Monarda punctata	93,700	2.151	D, DM	Middle – Late
Forb	Stiff Goldenrod	Oligoneuron rigidum	45,850	1.053	D, DM, M	Late
Forb	Sweet Black-Eyed Susan	Rudbeckia subtomentosa	45,850	1.053	DM, M, WM	Middle – Late
Forb	Tall Bellflower	Campanula americana	170,000	3.9	M, WM	Middle - Late
Forb	Thimbleweed	Anemone cylindrica	20,000	0.459	D, DM	Early – Middle
Forb	Turk's Cap Lily	Lilium superbum	5,000	0.115	M, WM	Middle
Forb	Upland Boneset	Eupatorium sessilifolium	50,000	1.15	M	Late
Forb	Whorled Milkweed	Asclepias verticillata	4,000	0.092	D, DM	Middle – Late
Forb	Wild Garlic	Allium canadense	560	0.013	M, WM	Middle
Forb	Wild Quinine	Parthenium integrifolium	6,790	0.156	DM, M, WM	Middle – Late
Forb	Winged Loosestrife	Lythrium alatum	3,000,000	68.87	WM, W	Middle – Late
Forb	Wood Betony	Pedicularis canadensis	33,000	0.758	D, DM, M	Early
Forb	Yellow Cone Flower	Ratibida pinnata	26,940	0.618	D, DM, M, WM	Middle – Late
Forb	Yellow Star Grass	Hypoxis hirsuta	80,000	1.837	DM, M, WM	Early, Middle, Late
Legume	Canada Milk Vetch	Astragalus canadensis	15,960	0.366	M, WM	Middle
Legume	Cream Wild Indigo	Baptisia bracteata	1,700	0.039	M	Early
Legume	Illinois Tick Trefoil	Desmodium illinoense	4,500	0.103	DM, M	Early – Middle
Legume	Leadplant	Amorpha canescens	16,950	0.389	D, DM, M	Middle
Legume	Purple Prairie Clover	Dalea purpurea	19,950	0.458	D, DM, M	Early, Middle, Late

Plant Type	Common Name	Scientific Name	Seeds/oz	Seeds/sq ft @ 1 oz/ac	Moisture Regime	Blooming Period
Legume	Round-Headed Bush-Clover	Lespedeza capitata	9,960	0.229	D, DM	Late
Legume	Showy Tick-Trefoil	Desmodium canadense	4,500	0.103	M	Middle – Late
Legume	White Prairie Clover	Dalea candida	15,850	0.364	D, DM, M	Middle
Legume	White Wild Indigo	Baptisia alba	1,585	0.036	DM, M, WM	Middle
Legume	Wild Lupine	Lupinus perennis	990	0.023	D, DM, M	Early – Middle
Shrub	New Jersey Tea	Ceanothus americanus	7,000	0.161	DM, M	Middle - Late

Table 6
Sample Seed Mix for Basic Dry Prairie
(Seed Calculator Code 327-1)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Stiff Goldenrod	Oligoneuron rigidum	1.00	1.0
Yellow cone flower	Ratibida pinnata	1.00	0.6
Purple prairie clover	Dalea purpurea	2.00	0.9
Big bluestem	Andropogon gerardii	16.00	3.8
Little bluestem	Schizachyrium scoparium	28.00	9.6
Indiangrass	Sorghastrum nutans	16.00	4.4
Sideoats grama	Bouteloua curtipendula	28.00	5.1

Table 7
Sample Seed Mix for Basic Dry Mesic Prairie
(Seed Calculator Code 327-2)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Purple prairie clover	Dalea purpurea	2.00	0.9
Bergamot	Monarda fistulosa	1.00	1.8
Yellow cone flower	Ratibida pinnata	1.00	0.6
Big bluestem	Andropogon gerardii	8.00	1.9
Little bluestem	Schizachyrium scoparium	24.00	8.3
Indiangrass	Sorghastrum nutans	16.00	4.4
Switchgrass	Panicum virgatum	8.00	4.5
Sideoats grama	Bouteloua curtipendula	16.00	2.9

Table 8
Sample Seed Mix for Basic Mesic Prairie
(Seed Calculator Code 327-3)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Yellow cone flower	Ratibida pinnata	1.00	0.6
Blackeyed Susan	Rudbeckia hirta	1.00	2.2
Bergamot	Monarda fistulosa	1.00	1.8
Big bluestem	Andropogon gerardii	16.00	3.8
Switchgrass	Panicum virgatum	8.00	4.5
Little bluestem	Schizachyrium scoparium	20.00	6.9
Indiangrass	Sorghastrum nutans	16.00	4.4
Canada wildrye	Elymus canadensis	16.00	1.9

Table 9
Sample Seed Mix for Basic Wet Mesic Prairie
(Seed Calculator Code 327-4)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Bergamot	Monarda fistulosa	1.00	1.8
Yellow cone flower	Ratibida pinnata	1.00	0.6
New England aster	Symphyotrichum novae-angliae	1.00	1.6
Switchgrass	Panicum virgatum	16.00	8.9
Prairie cordgrass	Spartina pectinata	8.00	1.2
Big bluestem	Andropogon gerardii	24.00	5.8
Virginia wildrye	Elymus virginicus	16.00	1.5
Indiangrass	Sorghastrum nutans	16.00	4.4

Table 10
Sample Seed Mix for Basic Wet Prairie
(Seed Calculator Code 327-5)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Common ironweed	Vernonia fasciculata	1.00	0.5
Cupplant	Silphium perfoliatum	2.00	0.1
Blue vervain	Verbena hastata	1.00	2.1
Switchgrass	Panicum virgatum	16.00	8.9
Prairie cordgrass	Spartina pectinata	8.00	1.2
Big bluestem	Andropogon gerardii	16.00	3.8
Indiangrass	Sorghastrum nutans	16.00	4.4
Virginia wildrye	Elymus virginicus	20.00	1.9

Table 11
Sample Seed Mix for Dry Prairie Restoration
(Seed Calculator Code 327-6)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Prairie cinquefoil	Potentilla arguta	0.50	2.3
Silky Aster	Symphyotrichum sericeum	1.00	1.3
Leadplant	Amorpha canescens	1.00	0.4
Spotted mint	Monarda punctata	0.50	1.1
Prairie tickseed	Coreopsis palmata	1.00	0.3
Stiff Goldenrod	Oligoneuron rigidum	1.00	1.0
Hoary vervain	Verbena stricta	1.00	0.7
Yellow cone flower	Ratibida pinnata	1.00	0.6
Spiderwort	Tradescantia ohiensis	2.00	0.4
Purple prairie clover	Dalea purpurea	4.00	1.8
Big bluestem	Andropogon gerardii	4.00	1.0
Sideoats grama	Bouteloua curtipendula	24.00	4.4
Little bluestem	Schizachyrium scoparium	24.00	8.3
Indiangrass	Sorghastrum nutans	8.00	2.2
Prairie June Grass	Koeleria macrantha	2.00	6.6
Sand dropseed	Sporobolus cryptandrus	2.00	15.3

Table 12
Sample Seed Mix for Dry Mesic Prairie Restoration
(Seed Calculator Code 327-7)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Prairie cinquefoil	Potentilla arguta	0.25	1.1
Leadplant	Amorpha canescens	1.00	0.4
Silky Aster	Symphyotrichum sericeum	1.00	1.3
Purple prairie clover	Dalea purpurea	3.00	1.4
Rough blazing star	Liatris aspera	0.50	0.2
Roundheaded Bushclover	Lespedeza capitata	3.00	0.7
Bergamot	Monarda fistulosa	1.00	1.8
Yellow cone flower	Ratibida pinnata	1.00	0.6
Stiff Goldenrod	Oligoneuron rigidum	1.00	1.1
Spiderwort	Tradescantia ohiensis	1.00	0.2
Little bluestem	Schizachyrium scoparium	24.00	8.3
Indiangrass	Sorghastrum nutans	8.00	2.2
Prairie June Grass	Koeleria macrantha	2.00	6.6
Prairie dropseed	Sporobolus heterolepis	2.00	0.7
Switchgrass	Panicum virgatum	4.00	2.2
Sideoats grama	Bouteloua curtipendula	24.00	4.4

Table 13
Sample Seed Mix for Mesic Native Prairie Restoration
(Seed Calculator Code 327-8)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Yellow cone flower	Ratibida pinnata	0.50	0.3
Blackeyed Susan	Rudbeckia hirta	0.50	1.1
Sky blue aster	Aster oolentangiense	0.50	0.9
Ox-eye sunflower	Heliopsis helianthoides	1.00	0.1
Bergamot	Monarda fistulosa	0.50	0.9
Culvers root	Vernonia virginicum	0.25	4.3
Purple prairie clover	Dalea purpurea	1.00	0.5
Rosinweed	Silphium integrifolium	1.00	0.1
Prairie blazing star	Liatris pycnostachya	1.00	0.3
New england aster	Symphyotrichum novae-angliae	0.50	0.8
Big bluestem	Andropogon gerardii	16.00	3.8
Switchgrass	Panicum virgatum	8.00	4.5
Little bluestem	Schizachyrium scoparium	24.00	8.3
Canada wildrye	Elymus canadensis	8.00	1.0
Indiangrass	Sorghastrum nutans	16.00	4.4

Table 14
Sample Seed Mix for Wet Mesic Prairie Restoration
(Seed Calculator Code 327-9)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Blackeyed Susan	Rudbeckia hirta	1.00	2.2
Bergamot	Monarda fistulosa	1.00	1.8
Yellow cone flower	Ratibida pinnata	1.00	0.6
Prairie blazing star	Liatris pycnostachya	1.00	0.4
Common Ironweed	Vernonia fasciculata	1.00	0.5
Cupplant	Silphium perfoliatum	4.00	0.1
Golden Alexanders	Zizia aurea	1.00	0.3
Great St John's Wort	Hypericum ascyron	0.25	1.1
White wild indigo	Baptisia alba	1.50	0.1
New England aster	Symphyotrichum novae-angliae	1.00	1.6
Switchgrass	Panicum virgatum	16.00	8.9
Prairie cordgrass	Spartina pectinata	4.00	0.6
Big bluestem	Andropogon gerardii	20.00	4.8
Canada wildrye	Elymus canadensis	16.00	1.9
Indiangrass	Sorghastrum nutans	12.00	3.4

Table 15
Sample Seed Mix for Wet Prairie Restoration
(Seed Calculator Code 327-10)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Culver's root	Veronicastrum virginicum	0.25	4.3
Common ironweed	Vernonia fasciculata	0.50	0.2
Cupplant	Silphium perfoliatum	2.00	0.1
Marsh milkweed	Asclepias incarnata	2.00	0.2
Joe pye weed	Eutrochium maculatum	1.00	2.2
Blue vervain	Verbena hastata	2.00	4.3
Showy tick trefoil	Desmodium canadense	3.00	0.3
Boneset	Eupatorium perfoliatum	0.50	1.8
Golden alexanders	Zizia aurea	2.00	0.5
Switchgrass	Panicum virgatum	8.00	4.5
Prairie cordgrass	Spartina pectinata	4.00	0.6
Big bluestem	Andropogon gerardii	4.00	1.0
Canada wildrye	Elymus canadensis	8.00	1.0
Indiangrass	Sorghastrum nutans	4.00	1.1
Fowl mannagrass	Glyceria striata	4.00	14.7
Fox sedge	Carex vulpinoidea	4.00	9.2

Table 16
Seed Mix for Dry Mesic Karner Blue Prairie Restoration
(Seed Calculator Code 327-11)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Sq. Foot
Prairie cinquefoil	Potentilla arguta	0.50	2.2
Leadplant	Amorpha canescens	1.00	0.4
Silky Aster	Symphyotrichum sericeum	1.0	1.3
Purple prairie clover	Dalea purpurea	4.00	1.8
Rough blazing star	Liatris aspera	1.00	0.3
Wild lupine	Lupinus perennis	6.00	0.1
Bergamot	Monarda fistulosa	0.50	0.9
Yellow cone flower	Ratibida pinnata	1.00	0.6
Stiff Goldenrod	Oligoneuron rigidum	1.00	1.1
Pale Purple Coneflower	Echinacea pallida	2.00	0.2
Sideoats grama	Bouteloua curtipendula	20.00	3.7
Little bluestem	Schizachyrium scoparium	24.00	8.3
Indiangrass	Sorghastrum nutans	8.00	2.2
Prairie June Grass	Koeleria macrantha	1.00	3.3
Prairie dropseed	Sporobolus heterolepis	2.00	0.7
Switchgrass	Panicum virgatum	4.00	2.2

Table 17
Sample Seed Mix for Native Pollinator Seeding for Dry Mesic Sites
(Seed Calculator Code 327-12)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Little Bluestem	Schizachyrium scoparium	16	5.5
Sideoats Grama	Bouteloua curtipendula	16	2.9
Illinois Tick Trefoil	Desmodium illinoense	5	0.5
Spiderwort	Tradescantia ohiensis	5	0.9
Purple Prairie Clover	Dalea purpurea	6	2.7
Yellow Coneflower	Ratibida pinnata	1	0.6
Prairie Blazing Star	Liatris pycnostachya	3	0.8
Rattlesnake Master	Eryngium yuccifolium	6	1.1
Showy Goldenrod	Solidago speciosa	4	8.7
Stiff Goldenrod	Oligoneuron rigidum	3	3.2
Smooth Blue Aster	Symphyotricum laeve	2	2.2
Prairie Cinquefoil	Potentilla arguta	2	9.2

Table 18
Sample Seed Mix for Native Pollinator Seeding for Mesic Sites
(Seed Calculator Code 327-13)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Little Bluestem	Schizachyrium scoparium	16	5.5
Sideoats Grama	Bouteloua curtipendula	16	2.9
Foxglove Beardtongue	Penstemon digitalis	4	10.6
Spiderwort	Tradescantia ohiensis	6	1.1
Golden Alexanders	Zizia aurea	6	1.5
Yellow Coneflower	Ratibida pinnata	1	0.6
Purple Prairie Clover	Dalea purpurea	6	2.7
Prairie Blazing Star	Liatris pycnostachya	4	1.1
Rattlesnake Master	Eryngium yuccifolium	6	1.1
New England Aster	Symphyotrichum novae-angliae	3	4.8
Stiff Goldenrod	Oligoneuron rigidum	3	3.2
Smooth Blue Aster	Symphyotrichum laeve	3	3.3

Table 19
Sample Seed Mix for Native Pollinator Seeding for Wet Mesic Sites
(Seed Calculator Code 327-14)

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
Big Bluestem	Andropogon gerardii	16	3.8
Indiangrass	Sorghastrum nutans	16	4.4
Foxglove Beardtongue	Penstemon digitalis	4	10.6
Spiderwort	Tradescantia ohiensis	6	1.1
Golden Alexanders	Zizia aurea	5	1.3
Yellow Coneflower	Ratibida pinnata	1	0.6
Prairie Blazing Star	Liatris pycnostachya	3	0.8
Rattlesnake Master	Eryngium yuccifolium	6	1.1
New England Aster	Symphyotrichum novae-angliae	3	4.8
Blue Vervain	Verbena hastata	4	8.5
Common Ironweed	Vernonia fasciculata	3	1.4
Cupplant	Silphium perfoliatum	3	0.1

Table 20
Seeding Chart for Native Grass Species

Grass	Percent of Mixture	Pure Stand Seeding Rate	Seeds per Square Foot
Big Bluestem, Andropogon gerardii	0-100	11 lbs/ac	42
Canada Wildrye, Elymus canadensis	0-20	12 lbs/ac	23
Indiangrass, Sorghastrum nutans	0-100	10 lbs/ac	44
Little Bluestem, Schizachyrium scoparium	0-20	8 lbs./ac	44
Sideoats Grama, Bouteloua curtipendula	0-20	8 lbs/ac	23
Switchgrass, Panicum virgatum	0-100	7 lbs/ac	63
Virginia Wildrye, Elymus virginicus	0-20	17 lbs/ac	26
Prairie Junegrass, Koeleria macrantha	0-20	0.5 lbs/ac	26
Hairy Grama, Bouteloua hirsuta	0-25	1 lb/ac	26

Canada Wildrye, Virginia Wildrye and Sideoats Grama when combined will not comprise of more than 20 percent of the total grass seeds per square foot. Pure stand seeding rates for Big Bluestem and Indiangrass must be increased by 5 lbs/acre to meet the minimum seeds per square foot as required by this standard. Refer to Table 3 for suggested moisture regimes per specie.

Table 21
Biomass Planting Recommendations

Forage Suitability Group	Species	Lbs. PLS/Acre	Seeds per Square Foot
Biomass/Biofuel			
Group: 1-9	Switchgrass Varieties: Blackwell Cave-in-Rock Pathfinder Sunburst	 7 7 7 7	63

Table 22
Solid Native Grass Plantings
(Seed Calculator Code 327-15 A to C, 512 H7 to H9)

Seed Calculator Code	Mixtures	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
327-15A, 512-H7	Switchgrass (Panicum virgatum)	7.0	63	DM-WM
327-15B, 512-H8	Big Bluestem (Andropogon gerardii)	11.0	42	
327-15C, 512-H9	Indiangrass (Sorghastrum nutans)	10.0	44	

Table 23
Summary of Seeding Requirements for Standards 327, 342, and 512 (Native Species)

Standard 327 - Conservation Cover									
Mix Type	Grasses		Forbs/Legumes[a]		Seeding Periods				Notes
	No.	Seeds/Ft^2	No.	Seeds/Ft^2	Spring	Late Summer	Dormant[b]	Frost[b]	
Basic Prairie[c]	≥3	≥20	≥3	≥2	X	NR	X	X	At least 50% of mix must be grasses (mix can have up to 20% Canada and Virginia Wildrye and Sideoats Grama).
Prairie Restoration[c]	≥5	≥15	≥10	≥8	X	NR	X	X	At least 1 forb must be legume and at least 50% of seeds per square foot must be grasses (mix can have up to 20% Canada and Virginia Wildrye and Sideoats Grama).
Pollinator Habitat	1-2	≤10	≥9	≥30	X	NR	X	X	- At least 3 early, 3 mid, and 3 late blooming forbs. - Grasses must be bunch-type and maximum of 10 seeds per square foot.
Untested Local Genotype Seed	≥5	≥25	≥10	≥10	X	NR	X	X	- At least 50 seeds per square foot total. - Grasses must be at least 50% of mix. - If single specie makes up more than 20% of mix, only count 20% towards the total seeds per square foot. - At least 1 forb must be legume.

(a) If more than 20% of legumes are hard seed, increase rate by % hard seed.
(b) Increase rate 15% for frost and dormant seedings.
(c) Maximum rates/acre for the following species: Switchgrass (1 lb.), Prairie Junegrass (2.0 oz.), Black-eyed Susan (2.0 oz.), Bergamot (2.0 oz.), or Purple Coneflower (3.0 oz.)

Standard 342 - Critical Area Planting									
Mix Type	Grasses		Forbs/Legumes		Seeding Periods				Notes
	No.	Seeds/Ft^2	No.	Seeds/Ft^2	Spring	Late Summer	Dormant	Frost	
Grasses Only	≥1	≥60			X	NR	NR	NR	Limit Canada Wildrye, Virginia Wildrye, and Sideoats Grama to 20% of the total grasses.
Mixtures	≥1	≥40	≥1	≥20	X	NR	NR	NR	- Mix must be at least 60 seeds per square foot total. - Grasses must be at least 50% of the mix (can have up to 20% Canada and Virginia Wildrye and Sideoats Grama).

Standard 512 - Forage and Biomass Planting									
Mix Type	Grasses		Forbs		Seeding Periods				Notes
	No.	Seeds/Ft^2	No.	Seeds/Ft^2	Spring	Late Summer	Dormant[a]	Frost[a]	
Pasture/Hayland	1	See Notes			X	NR	X	X	- Big Bluestem: 42 seeds per square foot. - Indiangrass: 44 seeds per square foot. - Switchgrass: 63 seeds per square foot.
Biomass Seeding	1	≥60			X	NR	X	X	Only Switchgrass is approved.

(a) Increase rate 15% for frost and dormant seedings.

APPENDIX C

Prairie Establishment Plan

BC Organics Facility Prairie Plantings
Establishment Plan

This Establishment Plan was developed to establish permanent conservation cover consistent with the requirements and recommendations of NRCS Technical Standard 327. The primary purpose of the installation of conservation cover at the sites is to reduce downstream surface water quality degradation by nutrients and sedimentation.

Soil Preparation

The site was planted with soybeans in 2018, harvested, and chisel plowed and will remain fallow in 2019. In May 2019 any weeds growing on site will be sprayed with Round Up and 2,4-D.

Seed Products

Seed, with the exception of cover crop, shall be species native to Brown County, Wisconsin and from a genetic source within the Midwest. Species selected are known to grow in Brown County, WI, as listed by the University of Wisconsin's state herbarium records. Seed provided shall be measured as pure live seed, properly labeled and shipped in accordance with Wisconsin law. The species chosen have been carefully selected to ensure they are adapted to the local soils, ecological conditions and climactic conditions of the region.

A single seeding mix will be applied with a diversity to adapt to wet and dry conditions located throughout the site. The seed mix includes a large quantity of grasses since the primary purpose of the conservation cover is to reduce downstream surface water quality degradation by nutrients and sedimentation and to ensure quick site stabilization. Elymus canadensis (Canada wild rye) will operate as a quick establishing grass since, unlike the other prairie grass species, Elymus canadensis is a cool season grass that typically germinates more readily without stratification. The remaining warm season grasses are slower to establish, but will eventually come to dominate the site and provide a permanent cover that, if properly maintained, will last indefinitely. These species have deep root systems and will completely stabilize the soil at maturity. In order to ensure that the primary purpose of the conservation cover will be met, seed for native grass species will be applied at a minimum rate of 10 lbs/acre.

Since the planting areas are relatively flat and experience varying moisture regimes, a seeding mix was selected that would adapt appropriately to different soil saturations. In general, seeds vary from wet to dry moisture regimes. In addition, a seed mix specifically designed to reduce erosion will be installed under erosion control blanket, where required. The seed species and quantities are described below:

Site Seed Mix

Grasses and Sedges				
Scientific Name	*Common Name*	*lbs/Ac*	*Unit*	*Total Seed Qty*
Andropogon scoparius	Little Bluestem	2.0	lb	13.8
Elymus virginicus	Virginia Wild Rye	1.0	lb	6.9
Andropogon gerardii	Big bluestem	1.5	lb	10.4
Sorghastrum nutans	Indiangrass	1.5	lb	10.4
Elymus canadensis	Canada Wild Rye	3.0	lb	20.7
Panicum virgatum	Switch Grass	1.0	lb	6.9
	Total Grasses	*10.0*	*lb*	*69.1*

Forbs/Legumes		*oz/Ac*	*Unit*	*Total Seed Qty*
Rudbeckia hirta	Black-Eyed Susan	2.0	oz	13.8
Zizia aurea	Golden Alexanders	2.0	oz	13.8
Oligoneuron rigidum	Stiff Goldenrod	2.0	oz	13.8
	Total Forbs/Legumes	*6.0*	*oz*	*41.4*

Seed Installation

After soil preparation described above, seed will be planted in June of 2019 using a no-till drill specifically manufactured for the purpose of planting prairie seed.

Erosion Control

Erosion matting will be placed in locations where significant erosion has been noted in the past. Since slopes are brief and generally range from <1 to 5%, Class I, Type A Erosion Control Revegatative Mat (ECRM) will be applied to the planting area.

Type 1 is defined as: Class 1 Type A Urban (EG1SNN) is the single net straw with biodegradable net

- Single net straw: 100% straw with a single biodegradable jute netting. It is designed to provide erosion protection and assist with vegetation establishment for 6 to 12 months on slopes up to 2.5:1.

Seed Establishment Standards

Standards for 2019, the Year of Planting

- Germination of cover crop shall occur within 20 days of installation. Cover crop establishment shall be uniform and consistent. Any area of more than 1 square yard that is devoid of cover crop shall be reseeded within three weeks of installation.
- Germination of native grass species shall be apparent by mid-August. Areas of erosion where seed has likely been lost will be reseeded and appropriate erosion control measures applied.
- Establishment of native grasses should be consistent and widespread by the middle of September 2019, although seedlings are likely to be inconspicuous. Areas greater than 100 square yards that do not have native grasses shall be reseeded with native grasses in November.

Seed Establishment Activities

Mowing: The purpose of mowing is to keep weeds from going to seed and to allow sunlight to penetrate to native grasses seedlings and to limit competition for water by weed species.

During the Year of Planting, seeded areas shall be mowed at a height of 8 to 12 inches when vegetation has reached a height of 18 inches. Depending on the growing conditions, this may require mowing as frequently as every two weeks. In no event will mowing be conducted at a height less than 8 inches.

Herbicide Applications: Herbicide shall be applied to perennial weeds such as Canada thistle or woody plants that invade the areas seeded with prairie seed. The herbicide used shall be the most selective possible given the target species and shall be applied only to the target species to the extent practicable. Herbicide shall not be applied to annual weeds unless they cannot be controlled by mowing or if they have developed a monoculture that precludes establishment of native grasses.

Site Inspections

The site will be inspected once a month after installation to ensure cover crop germination. The site will also be inspected to confirm initial germination of native grasses in mid-September 2019 in order to provide ample time to develop a cover cropping plan for winter, if necessary. After that, the sites will be inspected per the operation and maintenance standards.

APPENDIX D

NRCS Prairie Seed Mix Calculator Example

LANDOWNER:

County: BROWN

TRACT #

FIELD #

ACRES 6.90

Design by:

Date:

Checked by:

Check Date:

NRCS STANDARD ◉ 327 ○ 342 ○ 512

CONSERVATION MIXES

○ Dry ○ Dry-Mesic ◉ Mesic ○ Wet-Mesic ○ Wet ○ All

○ Introduced ◉ Native ○ ALL

Pollinator? ○ Yes ◉ No

PASTURE MIXES

○ Introduced ○ Native ○ ALL

PREVALENT FSG

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9

Rate Specification/Acre

◉ LBS/A ○ Seeds/SF

Common Name Lookup

Select Scientific Name →

Common Name =

Enter Unit Cost for:

CHOOSE YOUR GRASSES

Common Name	Scientific Name / Functional Group	Lbs / acre PLS	Seeds/ft²/ac PLS	Blooming Period	Cost ($/lb)	Growth Form	Moisture Regime	% of Mix
Switchgrass	Panicum virgatum	1.00		Middle	$ 13.50	Bunch	D, DM, M, WM,W	26.8%
	Grass		8.9					
Big Bluestem	Andropogon gerardii	1.00		Middle	$ 10.50	Bunch	D, DM, M, WM	11.4%
	Grass		3.8					
Indiangrass	Sorghastrum nutans	1.00		Middle	$ 16.00	Bunch	D, DM, M, WM, W	13.2%
	Grass		4.4					
Virginia Wildrye	Elymus virginicus	1.00		Early	$ 10.50	Bunch	M,WM, W	4.6%
	Grass		1.5					
Canada Wildrye	Elymus canadensis	1.00		Early	$ 12.00	Bunch	DM, M,WM	5.7%
	Grass		1.9					
Little Bluestem	Schizachyrium scoparium	1.00		Middle	$ 20.00	Bunch	D, DM, M	16.6%
	Grass		5.5					

	GRASSES Total/Acre:	6.0	26.1					

CHOOSE YOUR FORBS/LEGUMES

can enter PLS in lbs/acre OR Oz./acre

Common Name	Scientific Name / Functional Group	Lbs / acre PLS	Seeds/SF/ac PLS	Oz. / acre PLS	Blooming Period	Color Code	Cost ($/lb) / Cost ($/oz)	Moisture Regime
Black-Eyed Susan	Rudbeckia hirta			2.0	Middle-Late		$ 48.00	D, DM, M, WM
	Forb	0.13	4.6				$ 3.00	
Golden Alexanders	Zizia aurea			2.0	Early		$ 108.00	M, WM, W
	Forb	0.13	0.5				$ 6.75	
Stiff Goldenrod	Oligoneuron rigidum			2.0	Late		$ 204.00	D, DM, M
	Forb	0.13	2.1				$ 12.75	

FORBS/LEGUMES TOTAL	0.4	7.2	6.0				

MIX TOTALS TABLE	lbs / acre PLS	seeds / ft^2 PLS	Oz./acre PLS	Number in Mix	% of Mix	% Sod-Forming Grasses	Estimated Cost/Acre
Introduced Grasses							
Native Grasses	6.0	26.1	96.0	6	78%		
GRASSES TOTAL	6.0	**26.1**	96.0	6	78%		$83
Forbs	0.4	7.2	6.0	3.0	22%		
Introduced Legumes							
Native Legumes							
F/L TOTAL	0.4	**7.2**	6.0	3	22%	N/A	$45
GRAND TOTAL	**6.4**	**33.3**	**102.0**	**9.0**	**100%**	**0%**	**$ 128**
Forbs (MONARCH), if applicable)	0.25	6.7	4.0		93%	Min. 60% of forbs need Monarch Friendly for Monar	

⇩

327	Native Species								
	Grasses[a]		Forbs/Legumes[b]		Seeding Periods				
Mix Type	No.	seeds/ft^2	No.	seeds/ft^2	Spring	Late Summer	Dormant[c]	Frost[c]	Notes
Basic Prairie[d]	≥ 3	≥ 20	≥ 3	≥ 2	X	NR	X	X	Grasses must be at least 50% of mix.
Prairie Restoration[d]	≥ 5	≥ 15	≥ 10	≥ 8	X	NR	X	X	Grasses must be at least 50% of mix. One forb must be a legume.
Pollinator Habitat	1-2	≤ 10	≥ 9	≥ 30	X	NR	X	X	Grasses must be bunch-type. At least 3 early, 3 middle, and 3 late-blooming forbs.
Untested Local Genotype Seed	≥ 5	≥ 25	≥ 10	≥ 10	X	NR	X	X	Mix must be at least 50 seeds/sq. ft. total. Grasses must be at least 50% of mix. One forb must be a legume. If a single species makes up more than 20% of mix, only count 20% towards the total seeds/ft2.

(a) Limit Canada Wildrye, Virginia Wildrye, and Sideoats Grama to no more than 20% of the total grasses.

(b) If more than 20% of legumes are hard seed, increase rate by % of hard seed.

(c) Increase rate 15% for frost and dormant seedings.

(d) Maximum rates/acre for the following species: Switchgrass (1 lb.), Junegrass (2 oz.), Black-eyed Susan (2 oz.), Bergamot (2 oz.), or Purple Coneflower (3 oz.).

APPENDIX E

WDNR Wet Detention Pond Technical Standard Code 1001

Wet Detention Pond
(1001)

Wisconsin Department of Natural Resources
Conservation Practice Standard

I. Definition

A permanent pool of water with designed dimensions, inlets, outlets and storage capacity, constructed to collect, detain, treat and release stormwater runoff.

II. Purposes

The primary purposes of this practice are to improve water quality and reduce peak flow.

III. Conditions Where Practice Applies

This practice applies to urban sites where stormwater runoff pollution due to particulate solids loading and attached pollutants is a concern. It also applies where increased runoff from urbanization or land use change is a concern. Site conditions must allow for runoff to be directed into the pond and a permanent pool of water to be maintained.

This standard establishes criteria for ponds to detain stormwater runoff, although some infiltration may occur. In some instances, detention ponds may present groundwater contamination risks, and this standard sets criteria for determining when liners may be necessary to address risks to groundwater. Where the detention pond will be discharging to an infiltration practice, see WDNR Conservation Practice Standards 1002-1004.

Application of this standard is not intended to address flood control. Modifications to the peak flow criteria or additional analysis of potential flooding issues may be needed or required by local authorities. For ponds used during the construction period, see WDNR Conservation Practice Standard 1064, Sediment Basin.

This practice provides a method to demonstrate that a wet detention pond achieves the total suspended solids (TSS) reduction and peak flow control required by NR 151.12, Wis. Adm. Code, for post-construction sites. Pollutant loading models such as SLAMM, P8, DETPOND or equivalent methodology may also be used to evaluate the efficiency of the design in reducing TSS.

IV. Federal, State and Local Laws

The design, construction and maintenance of wet detention ponds shall comply with all federal, state and local laws, rules or regulations. The owner/operator is responsible for securing required permits. This standard does not contain the text of any federal, state or local laws governing wet detention ponds.

The location and use of wet detention ponds may be limited by regulations relating to stormwater management, navigable waters (Ch. 30, Wis. Stats.), floodplains, wetlands, buildings, wells and other structures, or by land uses such as waste disposal sites and airports. The pond embankment may be regulated as a dam under Ch. 31, Wis. Stats., and further restricted under NR 333, Wis. Adm. Code, which includes regulations for embankment heights and storage capacities.

V. Criteria

The following minimum criteria apply to all wet detention pond designs used for the purposes stated in Section II of this standard. Use more restrictive criteria as needed to fit the conditions found in the site assessment.

A. Site Assessment – Conduct and document a site assessment to determine the site characteristics that will affect the placement, design, construction and maintenance of the pond. Document the pond design. Items to assess include:

1. At the pond site, on a site map:

    a. Identify buildings and other structures, parking lots, property lines, wells, wetlands, 100-year floodplains, surface

[1] Words in the standard that are shown in italics are described in X. Definitions. The words are italicized the first time they are used in the text.

drains, navigable streams, known drain tile, roads, and utilities (both overhead and buried) showing elevation contours and other features specified by the applicable regulatory authority.

b. Show location of soil borings and test pits on site map, characterize the soils, *seasonally high groundwater level*[1], and *bedrock* conditions to a minimum depth of 5 feet below the proposed bottom of the pond or to bedrock, whichever is less. Conduct one test pit or boring per every 2 acres of permanent pool footprint, with a minimum of two per pond. Include information on the soil texture, color, structure, moisture and groundwater indicators, and bedrock type and condition, and identify all by elevation. Characterize soils using both the USDA and USCS classification systems.

Note: USCS characterization is used for soil stability assessment while USDA soil characterization identifies the soil's potential permeability rate.

c. Investigate the potential for *karst features* nearby.

2. In the watershed, on a watershed map:

a. Identify predominant soils, the drainage ways, navigable streams and floodways, wetlands, available contour maps, land cover types and known karst features. Identify the receiving surface waters, or whether the drainage basin drains directly to groundwater.

b. Show channels and overland flow before and after development, contours, and property lines.

c. Refer to the Tc (time of concentration) flow paths and subwatershed boundaries used in runoff calculations.

B. Pond Design – Properly designed wet detention ponds are effective at trapping smaller particles, and controlling peak flows (see App. C, Figures 1-3).

1. Water Quality – Pollutant reduction (TSS and phosphorus) is a function of the permanent pool area and depth, the outlet structure and the active storage volume. The following criteria apply:

a. Permanent Pool – The elevation below which runoff volume is not discharged and particles are stored.

i. Design ponds to include a permanent pool of water. The surface area of the permanent pool is measured at the invert of the lowest outlet. The minimum surface area of the permanent pool must address the total drainage area to the pond.

Note: Use App. A for the initial estimate of the permanent pool area based on drainage area. Prorate values for mixed land uses.Use Equation 1 to solve for q_o and iterate as needed.

ii. The permanent pool surface area is sized based on the particle size and the peak outflow during the 1-yr., 24-hour design storm using Equation 1:

$$\mathbf{S_a = 1.2 * (q_o / v_s)}$$ [Equation 1(a)]

or

$$\mathbf{q_o = (v_s * S_a) / 1.2}$$ [Equation 1(b)]

Where:

$\mathbf{S_a}$ = Permanent pool surface area measured at the invert of the lowest outlet of the wet detention pond (square feet)

$\mathbf{q_o}$ = Post-construction peak outflow (cubic feet/second) during the 1-yr., 24-hour design storm for the principal outlet

$\boldsymbol{v_s}$ = Particle settling velocity (feet/second)

1.2 = EPA recommended safety factor

iii. Particle settling velocities (v_s) shall be based on representative particle sizes for the desired percent TSS reduction.

- 80% (3 micron): $\boldsymbol{v_s} = 1.91 \times 10^{-5}$ ft./sec.
- 60% (6 micron): $\boldsymbol{v_s} = 7.37 \times 10^{-5}$ ft./sec.
- 40% (12 micron): $\boldsymbol{v_s} = 2.95 \times 10^{-4}$ ft./sec.

Note: Particle settling velocities were calculated assuming a specific gravity of 2.5, a water temperature of 50 degrees Fahrenheit (10 degrees C) and a kinematic viscosity of 0.01308 $cm.^2/sec.$ (Pitt, 2002). The calculations also assume discrete and quiescent settling conditions per Stoke's Law.

b. Active Storage Volume – Volume above the permanent pool that is released slowly to settle particles. Calculate the volume with the following method:

Use a hydrograph-producing method, such as the one outlined in Natural Resources Conservation Service, Technical Release 55 (TR-55), to determine the storage volume for detention ponds. This can be accomplished by using App. B where:

$\mathbf{q_o}$ = Peak outflow during the 1-yr., 24-hour design storm for the principal outlet calculated using Equation 1 (see V.B.1.a.ii).

$\mathbf{q_i}$ = Calculated post-construction peak inflow or runoff rate during the 1-yr., 24-hour design storm.

$\mathbf{V_R}$ = Calculated volume of runoff from the 1-year, 24-hour design storm for the entire contributory area.

$\mathbf{V_S}$ = The required active storage volume determined using App. B.

Note: This method may require iterative calculations.

c. Safety – Include a safety shelf (or aquatic shelf) that extends a minimum of 8 ft. from the edge of the permanent pool waterward with a slope of 10:1 (horizontal:vertical) or flatter. The maximum depth of the permanent pool of water over the shelf shall be 1.5 ft.

d. Depth – The average water depth of the permanent pool shall be a minimum of 3 ft., excluding the safety shelf area and sediment storage depth.

e. Length to Width – Maximize the length to width ratio of the flow path to prevent short-circuiting and dead zones (areas of stagnant water). See Section VII, Considerations D and N for options to prevent short circuiting.

f. Sediment Storage – After all construction has ceased and the contributory watershed has been stabilized, one of the following applies:

i. A minimum of 2 ft. shall be available for sediment storage (for a total of 5 ft. average depth, excluding the safety shelf area). For ponds greater than 20,000 sq. ft., 50% of the total surface area of the permanent pool shall be a minimum of 5 ft. deep. For ponds less than 20,000 sq. ft., maximize the area of 5 ft. depth.

ii. Modeling shows that for 20 years of sediment accumulation, less than 2 ft. sediment storage is needed (not to be less than 0.5 feet).

iii. A minimum of 4 ft. shall be available for sediment storage if the contributory area includes cropland not stabilized by any other practice, such as strip cropping, terraces and conservation tillage.

For information on sediment storage in forebays, see Section VII, Consideration C.

Note: Municipalities that use sand in the winter may consider increasing the sediment storage depth.

g. Side Slopes Below Safety Shelf – All side slopes below the safety shelf shall be 2:1 (horizontal:vertical) or flatter as required to maintain soil stability, or as required by the applicable regulatory authority.

h. Outlets – Wet detention ponds shall have both a principal outlet and an emergency spillway.

i. Prevent Damage – Incorporate into outlet design trash accumulation preventive features, and measures for preventing ice damage and scour at the outfall. Direct outlets to channels, pipes, or similar

conveyances designed to handle prolonged flows.

ii. Principal Water Quality Outlet – Design the outlet to control the proposed 2-yr., 24-hour discharge from the pond within the primary principal outlet without use of the emergency spillway or other outlet structures. If a pipe discharge is used as the primary principal outlet, then the minimum diameter shall be 4 inches. Where an orifice is used, features to prevent clogging must be added.

iii. Backward Flow – Any storm up to the 10-yr., 24-hour design storm shall not flow backward through the principal water quality outlet or principal outlet. Flap gates or other devices may be necessary to prevent backward flow.

iv. Emergency Spillway – All ponds shall have an emergency spillway. Design the spillway to safely pass peak flows produced by a 100-yr., 24-hour design storm routed through the pond without damage to the structure. The flow routing calculations start at the permanent pool elevation.

v. Peak Flow Control – Design the peak flow control to maintain stable downstream conveyance systems and comply with local ordinances or conform with regional stormwater plans where they are more restrictive than this standard. At a minimum:

a) The post-development outflow shall not exceed pre-development peak flows for the 2-yr., 24-hour design storm.

b) Use a hydrograph-producing method such as TR-55 for all runoff and flow calculations.

c) When pre-development land cover is cropland, use the runoff curve numbers in Table 1, unless local ordinances are more restrictive**.**

d) For all other pre-development land covers, use runoff curve numbers from TR-55 assuming "good hydrologic conditions."

e) For post-development calculations, use runoff curve numbers based on proposed plans.

Note: Local ordinances may require control of larger storm events than the 2-yr., 24-hour storm. In these cases, additional or compound outlets may be required.

Table 1 - Maximum Pre-Development Runoff Curve Numbers for Cropland Areas

Hydrologic Soil Group	A	B	C	D
Runoff Curve Number	55	69	78	83

2. Other Pond Criteria

a. Inflow Points – Design all inlets to prevent scour during peak flows produced by the 10-yr., 24-hr. design storm, such as using half-submerged inlets, stilling basins and rip-rap. Where infiltration may initially occur in the pond, the scour prevention device shall extend to the basin bottom.

b. Side Slopes **–** All interior side slopes above the safety shelf shall be 3:1 (horizontal:vertical), or flatter if required by the applicable regulatory authority.

c. Ponds in Series – To determine the overall TSS removal efficiency of ponds in series, the design shall use an *approved model* such as DETPOND or P8, that can track particle size distribution from one pond to the next.

d. Earthen Embankments – Earthen embankments (see App. C, Figure 3) shall be designed to address potential risk and structural integrity issues such as seepage and saturation. All constructed earthen embankments shall meet the following criteria.

i. Vegetation – Remove a minimum of 6 in. of the parent material (including all vegetation, stumps, etc.) beneath the proposed base of the embankment.

ii. Core Trench or Key-way – For embankments where the permanent pool is ponded 3 ft. or more against the embankment, include a core trench or key-way along the centerline of the embankment up to the permanent pool elevation to prevent seepage at the joint between the existing soil and the fill material. The core trench or key-way shall be a minimum of 2 ft. below the existing grade and 8 ft. wide with a side slope of 1:1 (horizontal:vertical) or flatter. Follow the construction and compaction requirements detailed in V.B.2.d.iii below for compaction and fill material.

iii. Materials – Construct all embankments with non-organic soils and compact to 90% standard proctor according to the procedures outlined in ASTM D-698 or by using compaction requirements of USDA Natural Resources Conservation Service, Wisconsin Construction Specification 3. Do not bury tree stumps, or other organic material in the embankment. Increase the constructed embankment height by a minimum of 5% to account for settling.

iv. Freeboard – Ensure that the top of embankment, after settling, is a minimum of 1 vertical foot above the flow depth for the 100-yr., 24-hr. storm.

v. Pipe Installation, Bedding and Backfill – If pipes are installed after construction of the embankment, the pipe trench shall have side slopes of 1:1 or flatter. Bed and backfill any pipes extending through the embankment with embankment or equivalent soils. Compact the bedding and backfill in lifts and to the same standard as the original embankment.

vi. Seepage – Take measures to minimize seepage along any conduit buried in the embankment. Measures such as anti-seep collars, sand diaphragms or use of bentonite are acceptable.

vii. Exterior side slopes shall be 2:1 (horizontal:vertical) or flatter, with a minimum top width of the embankment of 4 ft., or 10 ft. if access for maintenance is needed. The embankment must be designed for slope stability.

e. Topsoil and Seeding – Spread topsoil on all disturbed areas above the safety shelf, as areas are completed, to a minimum depth of 4 inches. Stabilize according to the permanent seeding criteria in WDNR Conservation Practice Standard 1059, Seeding for Construction Site Erosion Control.

f. Liners – Use the Liner Flowchart in App. D to determine when a liner is needed. For types of liners, see the Liner Flowchart and specifications in App. D. If a liner is used, provide a narrative that sets forth the liner design and construction methods.

Note: Some municipalities have wellhead protection areas and all municipalities have source water protection areas delineated by WDNR. Consult with the local community about when a liner will be needed if located within one of these areas.

g. Depth to Bedrock – The separation distance from the proposed bottom of a wet detention pond to bedrock will determine which of the following apply:

i. If the separation distance is a minimum of 5 ft. and the soil beneath the pond to bedrock is 10% fines or more, refer to the Liner Flowchart to determine if a liner may be needed for reasons other than proximity to bedrock;

ii. If the separation distance is a minimum of 3 ft. and the soil beneath the pond to bedrock is 20% fines or more, refer to the Liner Flowchart to determine if a liner may be needed for reasons other than proximity to bedrock;

iii. If conditions in (i) or (ii) are not met, then a Type B liner is required at a minimum. Refer to the Liner

Flowchart to determine if a Type A liner may be needed for reasons other than proximity to bedrock (see liner specifications in App. D);

iv. If blasting in bedrock is performed to construct a wet detention pond in bedrock, then a Type A liner is required (see liner specifications in App. D) and an engineering design must be conducted.

h. Separation from Wells – Wet detention ponds shall be constructed 400 feet from community wells (NR 811, Wis. Adm. Code) and 25 feet from non-community and private wells (NR 812, Wis. Adm. Code).

Note: The 25 foot setback from non-community and private wells is a final construction distance. This may not be sufficient to prevent running over the well with heavy equipment during construction of the pond.

i. Wetlands – For wet detention ponds that discharge to wetlands, use level spreaders or rip-rap to prevent channelization, erosion and reduce sedimentation in the wetlands.

j. Off-site runoff – Address off-site runoff in the design of a wet detention pond.

k. Aerators/Fountains – If an aerator or fountain is desired for visual and other aesthetic effects (aerators designed to mix the contents of the pond are prohibited) they must meet one of the first two items (i – ii), and items (iii) and (iv) below.

i. Increase the surface area of the wet detention pond beyond the area needed to achieve compliance with a stormwater construction site permit. The increase in surface area is equal to or greater than the *area of influence* of the aerator/fountain. Use an aerator/fountain that does not have a *depth of influence* that extends into the sediment storage depth (see App. E, Figure 4).

ii. For wet detention ponds where the surface area is no more than required to meet the stormwater construction site permit conditions, the depth of influence of the device cannot extend below the sediment storage elevation. Include in the design an automatic shut-off of the aerator/fountain as the pond starts to rise during a storm event. The aerator/fountain must remain off while the pond depth returns to the permanent pool elevation and, further, shall remain off until such time as required for the design micron particle size to settle to below the draw depth of the pump. (See V.B.1.a.iii for the design micron particle sizes that correlate with a TSS reduction.)

iii. Aerator/fountains are not allowed in wet detention ponds with less than a 5 ft. permanent pool designed depth.

iv. Configure the pump intake to draw water primarily from a horizontal plane so as to minimize the creation of a circulatory pattern from bottom to top throughout the pond.

VI. Operation and Maintenance

Develop an operation and maintenance plan that is consistent with the purposes of this practice, the wet detention pond's intended life, safety requirements and the criteria for its design. The operation and maintenance plan will:

A. Identify the responsible party for operation, maintenance and documentation of the plan.

B. Require sediment removal once the average depth of the permanent pool is 3.5 ft. At a minimum, include details in the plan on inspecting sediment depths, frequency of accumulated sediment removal, and disposal locations for accumulated sediment (NR 500, Wis. Adm. Code).

C. Include inlet and outlet maintenance, keeping embankments clear of woody vegetation, and providing access to perform the operation and maintenance activities.

D. Identify how to reach any forebay, safety shelf, inlet and outlet structures.

E. Address weed or algae growth and removal, insect and wildlife control and any landscaping practices.

F. If a liner is used, show how the liner will be protected from damage during sediment removal or when the liner is undergoing repair.

G. Prohibit excavation below the original design depth unless geotechnical analysis is completed in accordance with V.A.1.b & c.

VII. Considerations

Consider the following items for all applications of this standard:

A. Additional conservation practices should be considered if the receiving water body is sensitive to temperature fluctuations, oxygen depletion, excess toxins or nutrients.

B. To prevent nuisance from geese, consider not mowing around the pond perimeter. To maximize safety and pollutant removal, consider spreading topsoil along the safety shelf to promote plant growth.

C. For ease of maintenance, a sediment forebay should be located at each inlet (unless inlet is < 10% of total inflow or an equivalent upstream pretreatment device exists) to trap large particles such as road sand. The storage volume of the sediment forebay should be consistent with the maintenance plan, with a goal of 5%-15% of the permanent pool surface area. The sediment forebay should be a minimum depth of 3 ft. plus the depth for sediment storage.

D. The length to width ratio of the flow path should be maximized with a goal of 3:1 or greater. The flow path is considered the general direction of water flow within the pond, including the permanent pool and forebay.

E. Consider providing additional length to the safety shelf, above or below the wet pool elevation, to enhance safety.

F. To prevent damage or failure due to ice, all risers extending above the pond surface should be incorporated into the pond embankment.

G. The use of underwater outlets should be considered to minimize ice damage, accumulation of floating trash or vortex control.

H. Watershed size and land cover should be considered to ensure adequate runoff volumes to maintain a permanent pool.

I. Aesthetics of the pond should be considered in designing the shape and specifying landscape practices. Generally, square ponds are aesthetically unappealing.

J. If downstream flood management or bank erosion is a concern, consider conducting a watershed study to determine the most appropriate location and design of stormwater management structures, including consideration of potential downstream impacts on farming practices and other land uses.

K. For wet detention ponds with surface area more than 2 acres or where the fetch is greater than 500 feet, consider reinforcing banks, extending the safety shelf, vegetating the safety shelf or other measures to prevent erosion of embankment due to wave action.

L. To prevent failure, consider reinforcing earthen emergency spillways constructed over fill material to protect against erosion.

M. All flow channels draining to the pond should be stable to minimize sediment delivery to the pond.

N. Baffles may be used to artificially lengthen the flow path in the pond. In some designs, a circular flow path is set up in a pond even when the inlet and outlet are next to each other and no baffles are used. Then the flow path can be calculated using the circular path.

O. Consider using low fertilizer inputs on the embankments and collecting the clippings.

P. Consider providing a method to facilitate dewatering during accumulated sediment removal.

Q. Consider using backflow preventers to minimize fish entrapment.

R. Consider providing a terrestrial buffer of 10-15 feet around the pond if it has low or no embankments.

S. Consider a hard surface for the bottom of the forebay to ease sediment removal.

T. Use of algaecides, herbicides or polymers to control nuisance growths or to enhance sedimentation must receive a permit under NR 107, Wis. Adm. Code. Contact the appropriate DNR specialist.

U. Consider additional safety features beyond the safety shelf where conditions warrant them.

V. Consider vegetative buffer strips along drainage ways leading to the detention pond to help filter pollutants.

W. After the site assessment is complete, review and discuss it with the local administering agency at a pre-design conference to determine and agree on appropriate pond design for the site.

X. Design so that the 10-yr., 24-hour design storm does not flow through the emergency spillway. The 10-yr. design criteria protects the embankment from premature failure due to frequent or long-duration flows through the emergency spillway.

Y. Where practical, construct the emergency spillway on original grade.

Z. Conduct a groundwater boring to 15 feet below the pond and consider the historic "mottling marks" in assessing groundwater levels.

AA. For partially or fully submerged inlet pipes, consider using pipe ties or some other method to keep pipes from dislodging during frost movement.

BB. Consider employing a geotechnical engineer if stability of the embankment is a concern and to justify slopes steeper than 2.5:1.

CC. Assess potential environmental hazards at the site from previous land uses. The assessment should use historical information about the site to determine if the potential for environmental hazard exists, e.g., contaminated soils, contaminated groundwater, abandoned dumps or landfills. Contaminated areas can be located by reviewing the Bureau of Remediation and Redevelopment Tracking System (BRRTS), the DNR Registry of Waste Disposal Sites in Wisconsin and the Solid and Hazardous Waste Information System (SHWIMS) available through the WDNR website.

DD. Consider direct and indirect impacts to area wetland hydrology and wetland hydroperiod due to area hydrologic modifications that result from routing wetland source waters through a wet detention pond or releasing the discharge from a wet detention pond directly into a wetland.

EE. Consider conducting more than one test pit or boring per every 2 acres of permanent pool footprint, with a minimum of two per pond, if more are needed to determine the variability of the soil boundary or to identify perched water tables due to clay lenses. For the soils analysis, consider providing information on soil thickness, groundwater indicators—such as soil mottle or redoximorphic features—and occurrence of saturated soil, groundwater or disturbed soil.

FF. Where the soils are fine, consider groundwater monitoring if the groundwater table is less than 10 feet below the bottom of the wet pond because the water table may fluctuate seasonally. Other impacts on the groundwater table elevation may be from seasonal pumping of irrigation wells or the influence of other nearby wells. Monitoring or modeling may be necessary in these situations to identify the groundwater elevation.

GG. For additional guidance on seepage control for embankments, consult sections V.B.1.c and V.B.1.e(2) of NRCS Conservation Practice Standard 378, Pond, particularly if a wet detention pond's embankment is considered to be a dam.

VIII. Plans and Specifications

Plans and specifications shall be prepared in accordance with the criteria of this standard and shall describe the requirements for applying the practice to achieve its intended use. Plans shall specify the materials, construction processes, location, size and elevations of all components of the practice to allow for certification of construction upon completion.

IX. References

Center for Watershed Protection, *Stormwater BMP Design for Cold Climates*, December 1997.

R. Pitt and J. Voorhees, *The Design and Use of Detention Facilities for Stormwater Management Using DETPOND*, 2000.

United States Department of Agriculture, Natural Resources Conservation Service, Conservation Practice Standard 378, *Pond*, July 2001.

United States Department of Agriculture, Natural Resources Conservation Service, *Engineering Field Handbook.*

United States Department of Agriculture, Natural Resources Conservation Service, *Ponds – Planning, Design, Construction*, Agriculture Handbook 590, revised September 1997.

United States Department of Agriculture, Natural Resources Conservation Service, Technical Release 55, *Urban Hydrology for Small Watersheds*.

United States Department of Agriculture, Natural Resources Conservation Service, *Wisconsin Field Office Technical Guide, Section IV*.

United States Department of Commerce, Weather Bureau, *Rainfall Frequency Atlas of the United States, Technical Paper 40*.

University of Wisconsin – Extension, *The Wisconsin Storm Water Manual, Part Four: Wet Detention Basins*, Publication No. G3691-P.

Wisconsin State Legislature, Revisor of Statutes Bureau, *Wisconsin Administrative Code*; for information on the codes of state agencies, including WDNR, see http://www.legis.state.wi.us/rsb/code.htm.

X. Definitions

Approved Model (V.B.2.c) – A computer model that is used to predict pollutant loads from urban lands and has been approved by the applicable regulatory authorities. SLAMM and P8 are examples of models that may be used to verify that a detention pond design meets the desired total suspended solids reduction.

Area of Influence (V.B.2.k.i) – The area of influence of an aerator/fountain is a function of the circular area of impact of the return water and the mixing area of the pump, whichever is greater.

Bedrock (V.A.1.b) – Consolidated rock material and weathered in-place material with > 50%, by volume, larger than 2 mm in size.

Depth of Influence (V.B.2.k.i) – The depth of influence of an aerator/fountain is a function of the impact depth of the return water and the draw depth of the pump, whichever is greater.

Karst Feature (V.A.1.c) – An area or surficial geologic feature subject to bedrock dissolution so that it is likely to provide a conduit to groundwater. May include caves, enlarged fractures, mine features, exposed bedrock surfaces, sinkholes, springs, seeps, swallets, fracture trace (linear feature, including stream segment, vegetative trend and soil tonal alignment), Karst pond (closed depression in a karst area containing standing water) or Karst fen (marsh formed by plants overgrowing a karst lake or seepage area).

Seasonally high groundwater level (V.A.1.b) – The higher of either the elevation to which the soil is saturated as observed as a free water surface in an unlined hole, or the elevation to which the soil has been seasonally or periodically saturated as indicated by soil color patterns throughout the soil profile.

Appendix A—Calculation of Preliminary Permanent Pool Surface Area for TSS Reduction [1]

Land Use/Description/Management[2]	Total Impervious (%)[3]	80% Minimum Surface Area of the Permanent Pool (% of Watershed Area)	60% Minimum Surface Area of the Permanent Pool (% of Watershed Area)
Residential • < 2.0 units/acre (>1/2 acre lots) (low density • 2.0 - 6.0 units/acre (medium density) • > 6.0 units/acre (high density)	8 - 28 >28 -41 >41 - 68	0.7 0.8 1.0	0.3
Commercial/Office Park/Institutional/Warehouse/Industrial/Manufacturing/Storage[4] (Non-retail related business, multi-storied buildings, large heavily used outdoor parking areas, material storage, or manufacturing operations	<60 60-80 80-90 >90	1.8 2.1 2.4 2.8	0.6
Parks/Open Space/Woodland/Cemeteries	0-12	0.6	0.2
Highways/Freeways (Includes right-of-way area) • Typically grass banks/conveyance • Mixture of grass and curb/gutter • Typically curb/gutter conveyance	<60 60-90 >90	1.4 2.1 2.8	1.0

[1] Multiply the value listed by the watershed area within the category to determine the minimum pond surface area. Prorate for drainage areas with multiple categories due to different land use, management, percent impervious, soil texture, or erosion rates. For example, to achieve an 80% TSS reduction, a 50 acre (residential, 50% imperviousness) x 0.01 (1% of watershed from table) = 0.5 acre + 50 acres (office park, 85% imperviousness) x 0.024 (2.4% of watershed) = 1.2 acre. Therefore 0.5 acre + 1.2 acre = 1.7 acres for the minimum surface area of the permanent pool.

[2] For offsite areas draining to the proposed land use, refer to local municipalities for planned land use and possible institutional arrangements as a regional stormwater plan.

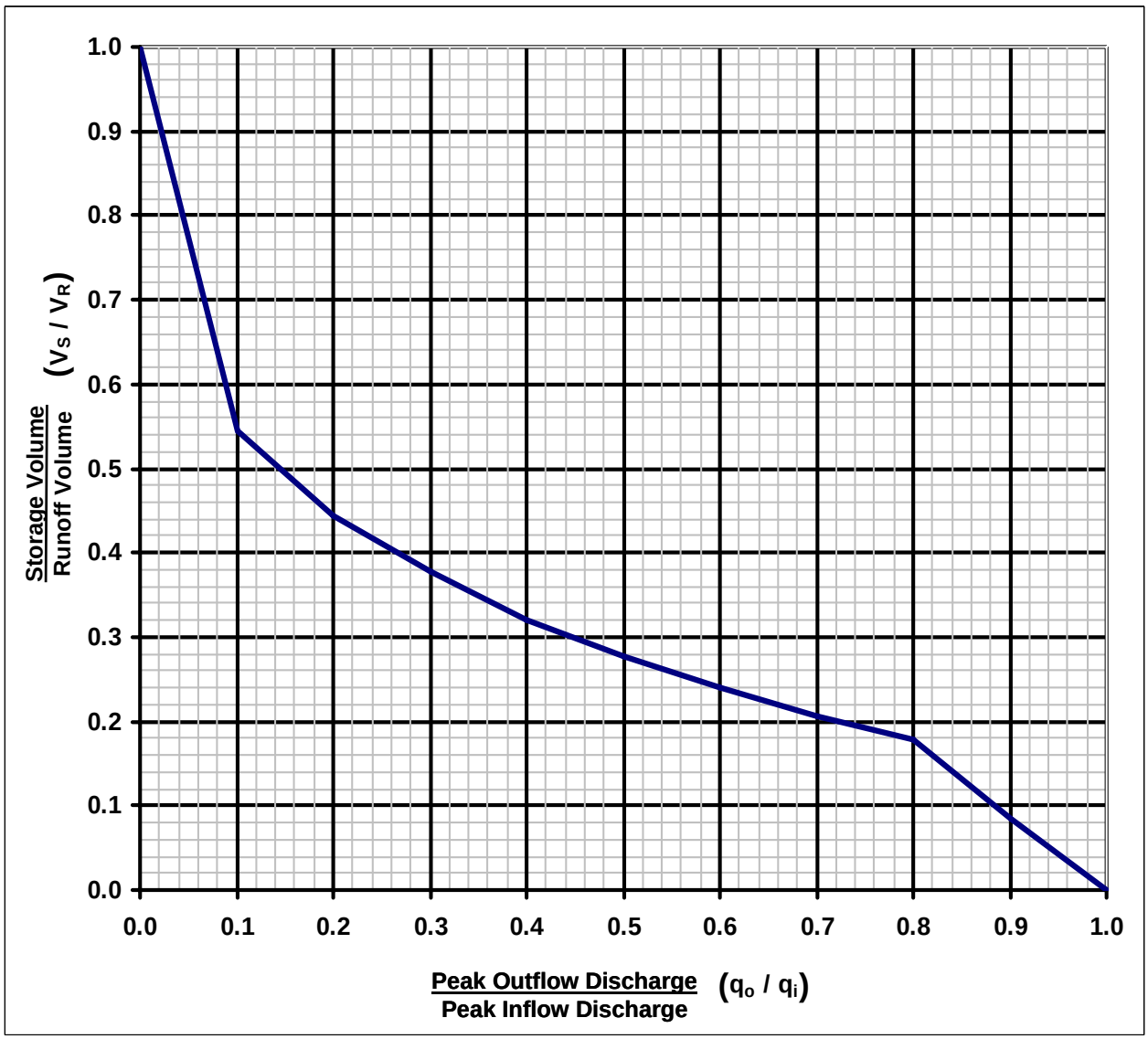
[3] Impervious surfaces include rooftops, parking lots, roads, and similar hard surfaces, including gravel driveways/parking areas.

[4] Category includes insurance offices, government buildings, company headquarters, schools, hospitals, churches, shopping centers, strip malls, power plants, steel mills, cement plants, lumber yards, auto salvage yards, grain elevators, oil tank farms, coal and salt storage areas, slaughter houses, and other outdoor storage or parking areas.

Source: This table was modified from information in "The Design and Use of Detention Facilities for Stormwater Management Using DETPOND" by R. Pitt and J. Voorhees (2000).

Appendix B

Approximate Detention Basin Routing for Type II Storms



Source: Technical Release 55, United States Department of Agriculture, Natural Resources Conservation Service, Washington, D.C. 1986. NRCS Bulletin No. WI-210-8-16 (Sept. 12, 1988) amended the TR-55 routing graph for Type II storms to include flows outside the original range.

Appendix B (cont'd.)

Rainfall Quantities:

Table 2 provides a summary of the 1-year, 24-hour rainfall totals using NRCS mandated TP-40, which has not been updated since 1961. Table 3 provides a summary of more current data from the Rainfall Frequency Atlas of the Midwest published in 1992. Local requirements may dictate the use of one dataset over the other.

Table 2 – Rainfall for Wisconsin Counties for a 1-year, 24-hour Rainfall[1]	
Inches of Rainfall	County
2.1 in.	Door, Florence, Forest, Kewaunee, Marinette, Oconto, Vilas
2.2 in.	Ashland, Bayfield, Brown, Calumet, Douglas, Iron, Langlade, Lincoln, Manitowoc, Menominee, Oneida, Outagamie, Price, Shawano, Sheboygan
2.3 in.	Barron, Burnett, Dodge, Fond du Lac, Green Lake, Marathon, Milwaukee, Ozaukee, Portage, Racine, Rusk, Sawyer, Taylor, Washburn, Washington, Waukesha, Waupaca, Waushara, Winnebago, Wood
2.4 in.	Adams, Chippewa, Clark, Columbia, Dane, Dunn, Eau Claire, Jackson, Jefferson, Juneau, Kenosha, Marquette, Pepin, Pierce, Polk, Rock, St. Croix, Walworth
2.5 in.	Buffalo, Green, Iowa, La Crosse, Monroe, Richland, Sauk, Trempealeau, Vernon
2.6 in.	Crawford, Grant, Lafayette
[1]TP – 40: Rainfall Frequency Atlas of the United States, U.S. Department of Commerce Weather Bureau.	

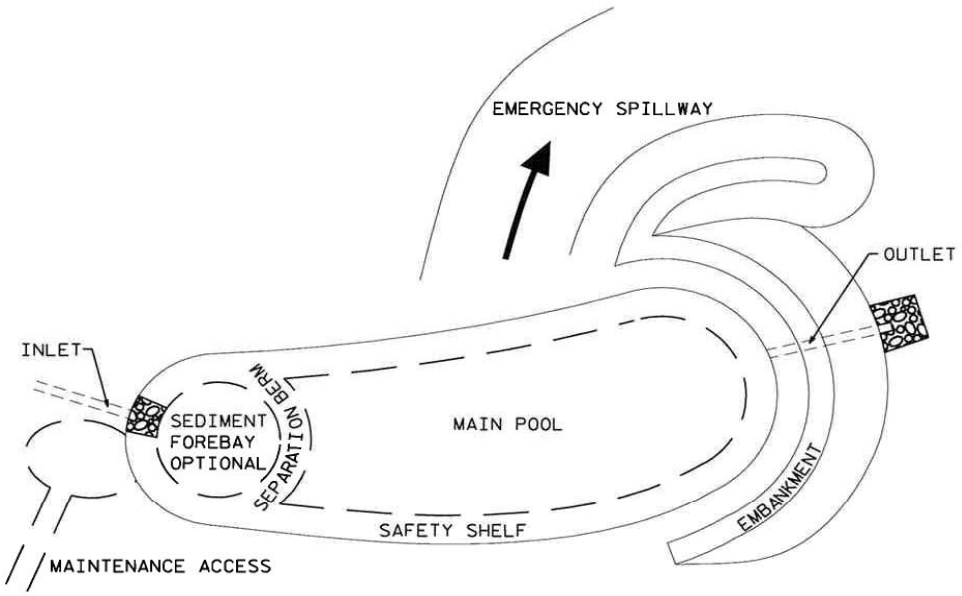
Table 3 - Rainfall for Wisconsin Counties for a 1-year, 24-hour Rainfall[2]		
Zone	Inches of Rainfall	County
1	2.22	Douglas, Bayfield, Burnett, Washburn, Sawyer, Polk, Barron, Rusk, Chippewa, Eau Claire
2	2.21	Ashland, Iron, Vilas, Price, Oneida, Taylor, Lincoln, Clark, Marathon
3	1.90	Florence, Forest, Marinette, Langlade, Menominee, Oconto, Door, Shawano
4	2.23	St. Croix, Dunn, Pierce, Pepin, Buffalo, Trempealeau, Jackson, La Crosse, Monroe
5	2.15	Wood, Portage, Waupaca, Juneau, Adams, Waushara, Marquette, Green Lake
6	1.96	Outagamie, Brown, Kewaunee, Winnebago, Calumet, Manitowoc, Fond du Lac, Sheboygan
7	2.25	Vernon, Crawford, Richland, Sauk, Grant, Iowa, Lafayette
8	2.25	Columbia, Dodge, Dane, Jefferson, Green, Rock
9	2.18	Ozaukee, Washington, Waukesha, Milwaukee, Walworth, Racine, Kenosha
[2]Bulletin 71: Rainfall Frequency Atlas of the Midwest, Midwest Climate Center and Illinois State Water Survey, 1992.		

Appendix B (cont'd.)

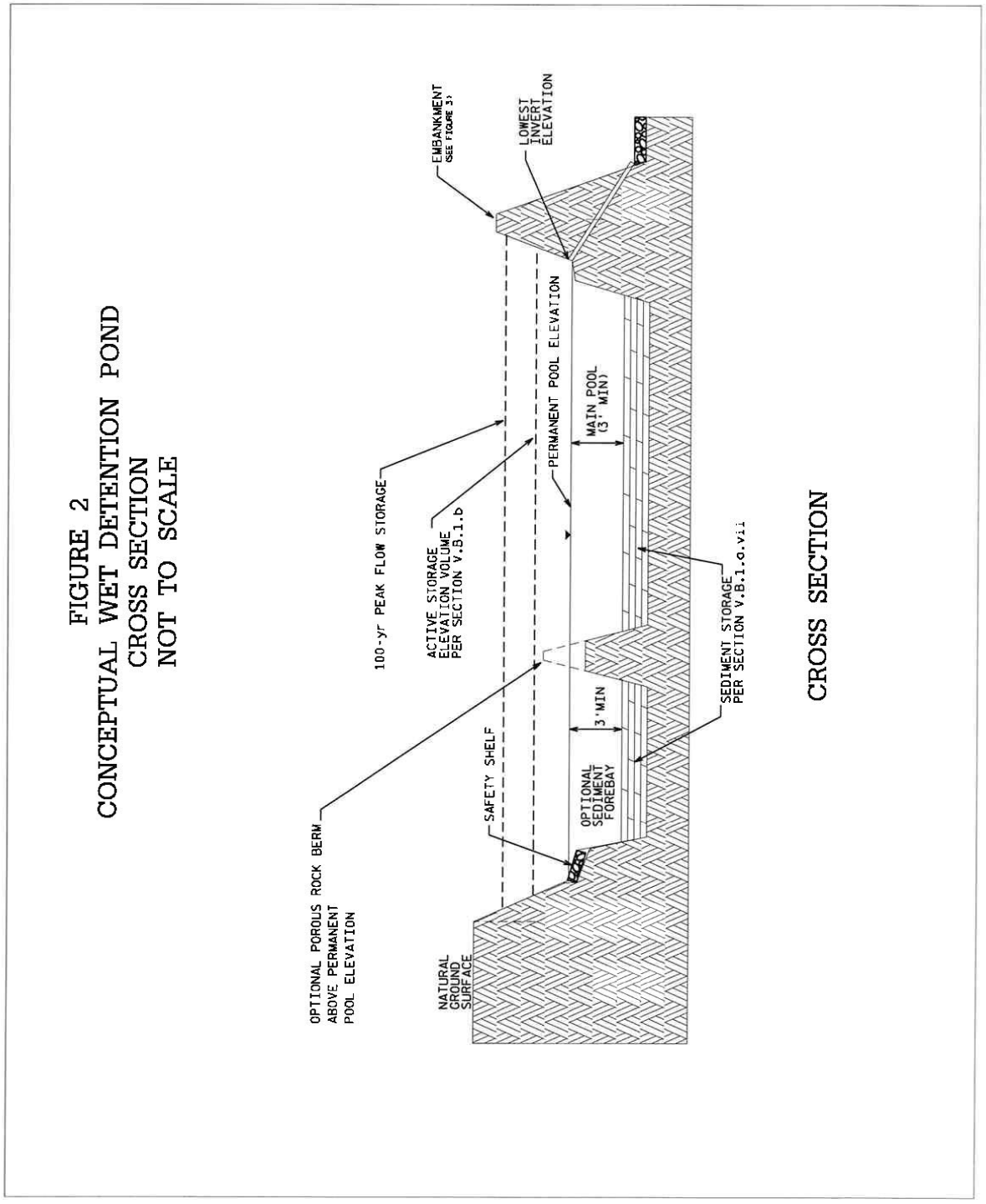
Table 4 – Runoff for Selected Curve Numbers and Rainfall Amounts[1]											
Runoff Depth in Inches for Curve Number of:											
Rainfall (inches)	50	55	60	65	70	75	80	85	90	95	98
1.9	0.00	0.01	0.04	0.11	0.20	0.33	0.50	0.72	1.01	1.39	1.68
1.96	0.00	0.01	0.05	0.12	0.23	0.36	0.54	0.77	1.06	1.44	1.73
2.1	0.00	0.02	0.08	0.16	0.28	0.43	0.62	0.87	1.18	1.58	1.87
2.15	0.00	0.03	0.09	0.18	0.30	0.46	0.66	0.91	1.22	1.63	1.92
2.18	0.00	0.03	0.10	0.19	0.31	0.47	0.68	0.93	1.25	1.65	1.95
2.2	0.00	0.04	0.10	0.19	0.32	0.48	0.69	0.94	1.27	1.67	1.97
2.21	0.00	0.04	0.10	0.20	0.32	0.49	0.69	0.95	1.28	1.68	1.98
2.22	0.00	0.04	0.10	0.20	0.33	0.49	0.70	0.96	1.28	1.69	1.99
2.23	0.01	0.04	0.11	0.20	0.33	0.50	0.71	0.97	1.29	1.70	2.00
2.25	0.01	0.04	0.11	0.21	0.34	0.51	0.72	0.98	1.31	1.72	2.02
2.3	0.01	0.05	0.12	0.23	0.36	0.54	0.75	1.02	1.35	1.77	2.07
2.4	0.02	0.07	0.15	0.26	0.41	0.59	0.82	1.10	1.44	1.87	2.17
2.5	0.02	0.08	0.17	0.30	0.46	0.65	0.89	1.18	1.53	1.96	2.27
2.6	0.03	0.10	0.20	0.34	0.50	0.71	0.96	1.26	1.62	2.06	2.37
[1]NRCS TR-55, Equations 2-1 to 2-4 used to determine runoff depths.											

Appendix C—Pond Geometry

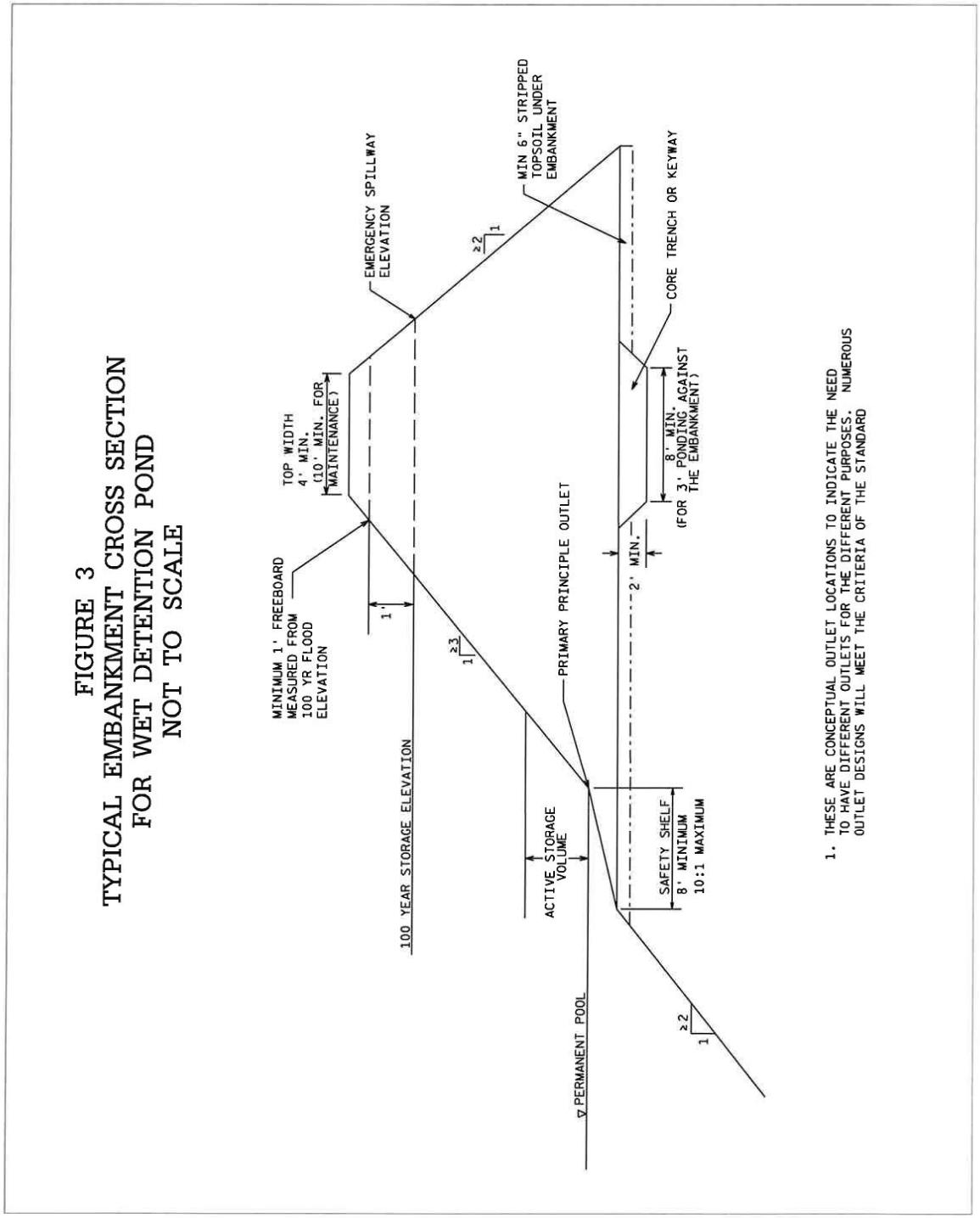
FIGURE 1
CONCEPTUAL WET DETENTION POND
PLAN VIEW
NOT TO SCALE



Appendix C—Pond Geometry (cont'd.)



Appendix C—Pond Geometry (cont'd.)



Appendix D—Pond Liner Design, Decision Flowchart

Pond Liner Design Specifications for Three Levels of Liners

A. Type A Liners—for sites with the highest potential for groundwater pollution. They include:
- Clay (natural soil, not bentonite)
- High Density Polyethylene (HDPE)
- Geosynthetic Clay Liners (GCL)

1. Clay liner criteria (essentially the same as the clay below landfills but not as thick):
   a. 50% fines (200 sieve) or more.
   b. An in-place hydraulic conductivity of 1×10^{-7} cm./sec. or less.
   c. Average liquid limit of 25 or greater, with no value less than 20.
   d. Average PI of 12 or more, with no values less than 10.
   e, Clay installed wet of optimum if using standard Proctor, and 2% wet of optimum if using modified Proctor.
   f. Clay compaction and documentation as specified in NRCS Wisconsin Construction Specification 300, Clay Liners.
   g. Minimum thickness of two feet.
   h. Specify method for keeping the pool full or use of composite soils below liner.
2. HDPE liner criteria:
   a. Minimum thickness shall be 60 mils.
   b. Design according to the criteria in Table 3 of the NRCS 313, Waste Storage Facility technical standard.
   c. Install according to NRCS Wisconsin Construction Specification 202, Polyethylene Geomembrane Lining.
3. GCL liner criteria:
   a. Design according to the criteria in Table 4 of NRCS 313, Waste Storage Facility technical standard.
   b. Install according to NRCS Wisconsin Construction Specification 203, Geosynthetic Clay Liner.

B. Type B Liners—for sites with medium potential for groundwater pollution or where need for a full pool level is high. They include:
- All liners meeting Type A criteria
- Clay
- HDPE
- Polyethylene Pond Liner (PPL)

1. Clay liner criteria:
   a. 50% fines (200 sieve) or more.
   b. An in-place hydraulic conductivity of 1×10^{-6} cm./sec. or less.
   c. Average liquid limit value of 16 or greater, with no value less than 14.
   d. Average PI of 7 or more with no values less than 5.
   e. Clay compaction and documentation as specified in NRCS Wisconsin Construction Specification 204, Earthfill for Waste Storage Facilities.
   f. Minimum thickness of two feet.
   g. Specify method for keeping the pool full or use of composite soils below liner.
2. HDPE liner criteria:
   a. Minimum thickness shall be 40 mils.
   b. All other criteria same as for Type A HDPE liner.
3. PPL liner criteria:
   a. Minimum thickness shall be 30 mils.
   b. All other criteria same as for Type A HDPE liner.

C. Type C Liners—for sites with little potential for groundwater pollution or where the need for a full pool is less important. They include:
- All liners meeting Type A or B criteria
- Silts and clays
- HDPE (<40 mil)
- PPL (20-24 mil)
- PVC (30-40 mil)
- EPDM (45 mil)

1. Silt/Clay liner criteria:
   a. 50% fines (200 sieve), or 20% fines and a PI of 7.
   b. Soil compaction and documentation as specified in NRCS Wisconsin Construction Specification 204, Earthfill for Waste Storage Facilities.
   c. Minimum thickness of two feet.
   d. Specify method for keeping the pool full or use of composite soils below liner.

D. Liner Elevation—All liners must extend above the permanent pool up to the elevation reached by the 2-yr., 24-hour storm event.

E. For synthetic liners, follow the manufacturers' recommendations for installation.

Appendix E—Aerators/Fountains

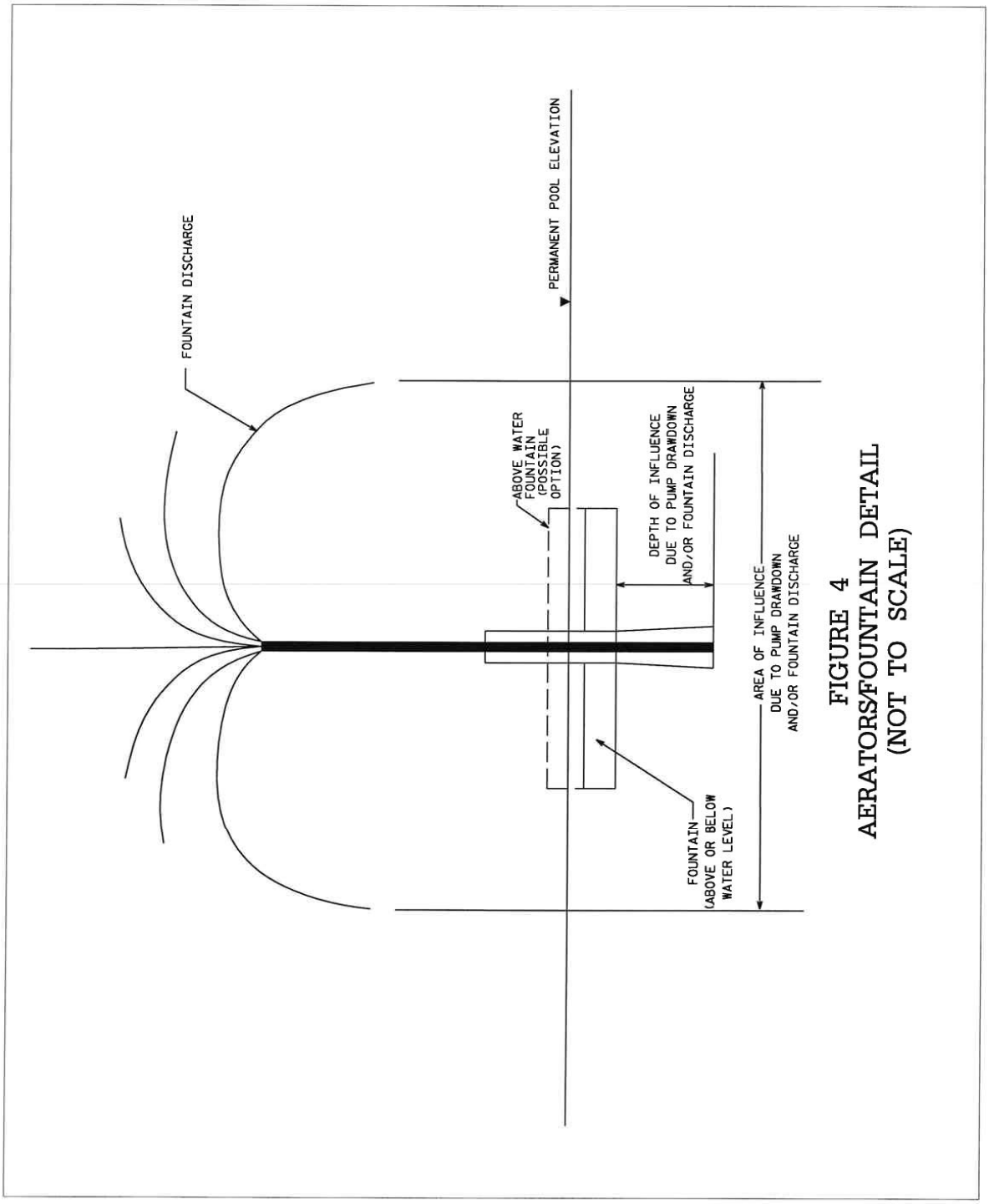


FIGURE 4
AERATORS/FOUNTAIN DETAIL
(NOT TO SCALE)

APPENDIX F

Wet Detention Pond Operations and Maintenance Plan

Operation & Maintenance Plan

BC Organics

Prepared For

BC ORGANICS LLC
BROWN COUNTY, WISCONSIN

OCTOBER 23, 2018
McM. No. D0997-9-18-00549

I. INTRODUCTION

The stormwater management system that serves BC Organics consists of two (2) stormwater ponds, ditches, swales, and a small storm sewer system. The site is located at the southwest quadrant of the intersection of Old 57 Road and Lamers Clancy Road in the Town of Holland, Brown County, WI: NE ¼ of the NE ¼ of Section 19, Township 21 North, Range 20 East.

II. RESPONSIBLE PARTY

BC Organics LLC will own the stormwater management system, including the two (2) stormwater ponds and storm sewer/ditches within the right-of-way. Because the stormwater management system will be maintained by a private party, a maintenance agreement with the County is necessary. The County is responsible for ensuring that the stormwater management system is operating in compliance with the operation and maintenance manual, and the intent as described in the stormwater management report.

III. OPERATION

The watershed for the stormwater devices is depicted in the appendices of the Stormwater Management Report. The watershed for the two (2) ponds contains approximately 19 acres of the 38.5 acre parcel. The study area currently discharges to the ditches along the two (2) adjacent roads, eventually draining to the East River. The stormwater devices are designed to satisfy the following goals:

- Reduce average annual total suspended solids load in runoff by 80% (min) as compared to no controls.

- Reduce developed peak flows to be less than meadow condition peak flows for the 1, 2, and 10 year events, and control the discharge direction and elevation for the 100 year event.

Design specifics for the two proposed stormwater ponds are listed in the tables below. Construction plans for the ponds are provided in the appendices of the Stormwater Management Report.

Table 1
Proposed Stormwater Pond Specifications

Attribute	West Pond	East Pond
Bottom Elevation	711.0	711.0
Top of Berm Elevation	720.0	719.0
Permanent Pool Elevation	716.0	716.0
Permanent Pool Volume	1.967ac-ft	2.785ac-ft
Stormwater Runoff Storage	4.524ac-ft	3.508ac-ft
Total Pond Volume	6.491ac-ft	6.293ac-ft
Outlet Structure	Pipe, overflow weir	Pipe, overflow weir
Watershed Size	9.1ac	10.4ac

The ponds are not designed to provide erosion and sediment control for the proposed construction site. Improper construction site erosion and sediment controls will result in rapid sediment accumulation and premature sediment removal within the stormwater ponds.

IV. MAINTENANCE

A. Debris & Litter

The stormwater devices are expected to accumulate debris and litter. Debris and litter should be removed on a monthly basis to maintain appearance and public acceptance of the devices. Wetland plants are not proposed within the pond, but may eventually grow. The plants will serve to hide debris and litter until removal. Trash racks are provided at pond outlet structures to minimize clogging potential and also to trap debris and litter in the ponds and infiltration basin. Despite the trash racks, pond outlet structures should be checked monthly and after each rainfall event of 0.5-inches or greater to ensure proper pond performance during the next rainfall event.

B. Vegetation & Noxious Weeds

Undesirable woody vegetation should be mowed to a height of 6-inches during late fall. Stumps from Willow trees and other aggressive woody vegetation should be painted with an herbicide to stunt growth. Some trees and shrubs may be desirable in order to shade pond water, hide litter, reduce accessibility to temporarily deep water,

discourage Canadian Geese, and improve habitat for desirable wildlife. Before trees and shrubs are allowed to grow within a pond, potential negative impacts should be evaluated (e.g. embankment failure due to root damage, branches that clog outlet structures, roots that penetrate pond liners, vegetation that reduces pond storage volumes, branches that hinder maintenance access, etc.). Landscaping, especially plants with deep roots, are encouraged near the pond. A well-maintained landscape with healthy plants/trees/shrubs with deep root growth will help improve pond performance.

C. Algae

Algae growth may occur within the pond, but should not be a major concern since the pond is to drain dry. If problematic, algae can be removed with a hand skimmer. The Wisconsin Department of Natural Resources (DNR) and the Town should be contacted if it becomes desirable to add chemicals, fountains, or aerators to the pond for algae control.

D. Erosion

In the future, erosion problems may develop within the storm sewer system, particularly on the side slopes of grassy swales and ponds. Typically, erosion problems develop before a dense mat of vegetation is established or after an area is temporarily disturbed. Below are common erosion problems that should be corrected as soon as practicable.

1. Rill erosion is typically caused by concentrated flow on moderate to steep slopes. Rill erosion is most likely to occur within the first few years after construction. If rill erosion occurs, the damaged area should be repaired with topsoil, seed, fertilizer, and mulch. An erosion blanket may be needed to provide additional protection. If rill erosion continues to occur at the same location, other devices such as downspout extenders, diversion ditches, and level spreaders may be necessary to diffuse or divert the concentrated flow.

2. Shoreline erosion is typically caused by water level fluctuations and wave action along the pond perimeter. The pond perimeter is a difficult area to establish a dense vegetated mat. If shoreline erosion occurs, the damaged area should be repaired with topsoil, water tolerant plants / seeds, and mulch. Also, wetland vegetation is recommended within the safety shelf to dissipate wave energy. If severe shoreline erosion occurs, the damaged area should be repaired with rip-rap and a layer of filter fabric.

3. Channel erosion is typically caused by high water velocity, an increase in peak flow rate, or a continuous low flow condition. If minor channel erosion occurs, the

damaged area should be repaired with topsoil, water tolerant plants / seeds, mulch, and an erosion blanket. Also, willow trees and other woody vegetation can be planted along the channel if the channel has excess hydraulic capacity. If severe channel erosion is observed, the damaged area should be repaired with rip-rap and a layer of filter fabric. Other options to control channel erosion include rock check dams, grade control measures, wing deflectors, etc.

4. Scour erosion is typically caused by high water velocity within areas of shallow water. Scour erosion is most prevalent at pond inlet and outlet structures. If scour occurs at a pond inlet or outlet structure, the damaged area should be repaired with rip-rap and a layer of filter fabric. The scour severity and anticipated water velocity will determine the appropriate rip-rap size. If scour occurs within other shallow water areas, the preferred method of repair is installation of mature wetland plants. Mature wetland plants dissipate water energy, protect bare soil, and improve habitat. If wetland plants are not expected to provide sufficient protection, the damaged area should be repaired with rip-rap and a layer of filter fabric.

E. Sediment

The ponds are designed to trap and remove suspended solids and other post construction pollutants from post-construction stormwater runoff. Occasionally, accumulated sediment will require removal to maintain performance. Typically, sediment removal is performed during late fall or early winter, since wetland vegetation is typically dormant at this time of year. During dormancy, wetland plants are less susceptible to damage due to low water levels and construction equipment.

Sediment accumulates most rapidly at pond inlets and sediment forebays. The frequency of sediment removal depends on various factors including upstream channel erosion, construction site erosion controls, winter sand application, street sweeping, catch basin cleaning, and vegetation density within the watershed. Sediment removal should be expected at pond inlets once every 5 to 7 years and at remaining pond areas and ditches once every 20 to 50 years.

Sediment removal typically involves excavating. Before excavating, pond water (if any) should be de-watered by pumping into the downstream storm sewer system (remaining sediment can be partially de-watered by sinking a well and pump into the sediment). The appropriate Wisconsin DNR permits must be obtained prior to dewatering the pond. Once de-watering is complete, sediment removal can be performed. Sediment removal can be performed using several methods: excavate/dredge before soil freezes or excavate after soil freezes. In either case, sediment should be loaded on a watertight truck and hauled to an off-site location. If space is available, the contractor may want to temporarily stockpile or dry the wet sediment before loading on a truck and hauling away.

Sediment should be tested for toxicity prior to disposal (oils, heavy metals, pesticides, and other contaminates of concern). Toxicity tests and disposal methods should be in accordance with the appropriate federal, state, and local regulations. If the sediment is deemed non-toxic, it can be hauled and disposed of at any off-site location. If the sediment is deemed toxic, it should be hauled to a permitted dumping facility or landfill.

F. Mosquitoes

Mosquitoes are attracted to tall grass, wetland vegetation, and shallow water. Mosquito populations should be monitored to control vector-borne diseases, such as the West Nile Virus and Zika Virus. Although mosquitoes cannot be permanently eliminated, natural predators can certainly reduce populations. Dragonflies, aquatic insects, bats, birds, and mosquito fish are effective natural predators. Nesting boxes can be installed to attract certain bat and bird species. If biological controls are ineffective, other measures may be utilized, such as harvesting wetland vegetation, burning / mowing tall grass, or artificially fluctuating pond water surface elevations to disrupt breeding. If these measures fail, more aggressive measures such as biological larvicides, larvicidal oils, and chemical adulticides may be necessary. The Wisconsin DNR should be contacted before a biological larvicide, larvicidal oil, or chemical adulticide is used within or near a wet pond. Chemical adulticides are toxic.

G. Nuisance Wildlife

Muskrats and geese are attracted to open water. Muskrats are often problematic because they burrow holes and eat wetland vegetation. Holes located within a fill embankment may compromise the embankment's structural integrity. Trapping is used to control muskrat populations. Geese are often problematic because they generate a significant amount of feces and eat wetland vegetation. In large amounts, feces can severely degrade water quality. Typically, wetland vegetation, tall grass, shrub thickets, and trees are used to deter geese from taking residence within a wet pond.

H. Storm Sewer Structures

The stormwater system should be inspected for structural integrity, deterioration, and sediment accumulation on a regular basis. Storm sewer system components with observed cracks, structural deterioration, or other undesirable condition should be immediately repaired or replaced. Accumulated sediment, debris or litter should be removed monthly and after each 0.5-inches rainfall event or greater. Storm sewers and manholes should be televised and cleaned once every 5 to 20 years. Trash racks and bolts should be re-galvanized or re-painted on a regular basis to prevent rust.

OPERATION AND MAINTENANCE INSPECTION REPORT

STORMWATER MANAGEMENT DEVICES

Inspector Name:_____

Tax Key No.:_____

Inspection Date:_____

Location:_____

Owner/Responsible Party:_____

Lawns/Landscaping at Grassy Swales/Ponds/Infiltration Basin	Checked/ Inspected? (Yes/No/NA)	Maintenance Needed? (Yes/No/NA)	Remarks
1. Trash and debris.			
2. Adequate vegetation and ground cover.			
3. Embankment erosion.			
4. Unauthorized/invasive plantings/tree growth.			
5. Slope protection or riprap failures.			
6. Lawn debris (leaves, grass clippings) on gutter, pavement & hard surfaces.			
7. Other (specify).			

Storm Sewer Inlets/Pipes/Pond Outlet Structures	Checked/ Inspected? (Yes/No/NA)	Maintenance Needed? (Yes/No/NA)	Inlet Number(s)	Pipe Segment(s)	Remarks
1. Erosion/undermining around inlet rims.					
2. Trash/debris removal necessary from inlet grates.					
3. Trash/debris removal necessary from inlet sumps.					
4. Inlet grate damaged/missing.					
5. Inlet structure cracked/failing.					
6. Storm sewer pipes clogged.					
7. Storm sewer pipes cracked/failed.					
8. Other (specify).					
9. Other (specify).					

STORMWATER MANAGEMENT MAINTENANCE STANDARDS

Maintenance Component	Problem/ Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance Is Performed
Swales, Lawns, and Landscaping	Trash & Debris	Any visual evidence of dumping, trash, or debris.	Trash and debris cleared from site.
	Vegetation	Cut vegetation should be removed from areas where it could enter the detention pond, either when the pond level rises or by rainfall runoff.	When cutting is needed, grass/ground cover should be mowed. Vegetation debris (leaves, lawn clippings) should be removed from hard surfaces.
	Tree Growth	Tree growth does not allow maintenance access, interferes with maintenance activity, or damages underground structures (i.e. slope mowing, silt removal or equipment movements, root damage to inlets/pipes).	Trees do not hinder maintenance activities.
	Erosion	Eroded damage where cause of damage is still present or where there is potential for continued erosion.	Slopes should be stabilized by using appropriate erosion control measures; e.g., rock rip-rap, planting of grass, erosion mat or mulch, compaction.
Storm Sewer Piping	Debris and Sediment	Sediment and/or debris clogging the pipe opening.	No clogging or blockage in the inlet and outlet piping.
	Damaged	Rust is causing more than 50% deterioration to any part of metal pipes, cracks in plastic pipe or cracks or exposed rebar in concrete pipes.	Pipe repaired or replaced.
		Any dent that decreases the cross-section area of pipe by more than 10% or retards the flowage of water.	Pipe repaired or replaced.
	Erosion/Scouring	Eroded or scoured bottom at inlet or outlet pipes; undermining of structure or end section.	Area should be stabilized by using appropriately sized rock rip-rap.
Trash	Trash and Debris	Trash or debris that is clogging the openings in the inlet grate, or accumulating at the bottom of the inlet or detention pond	Inlet grates and sumps are clear to receive capacity flow.

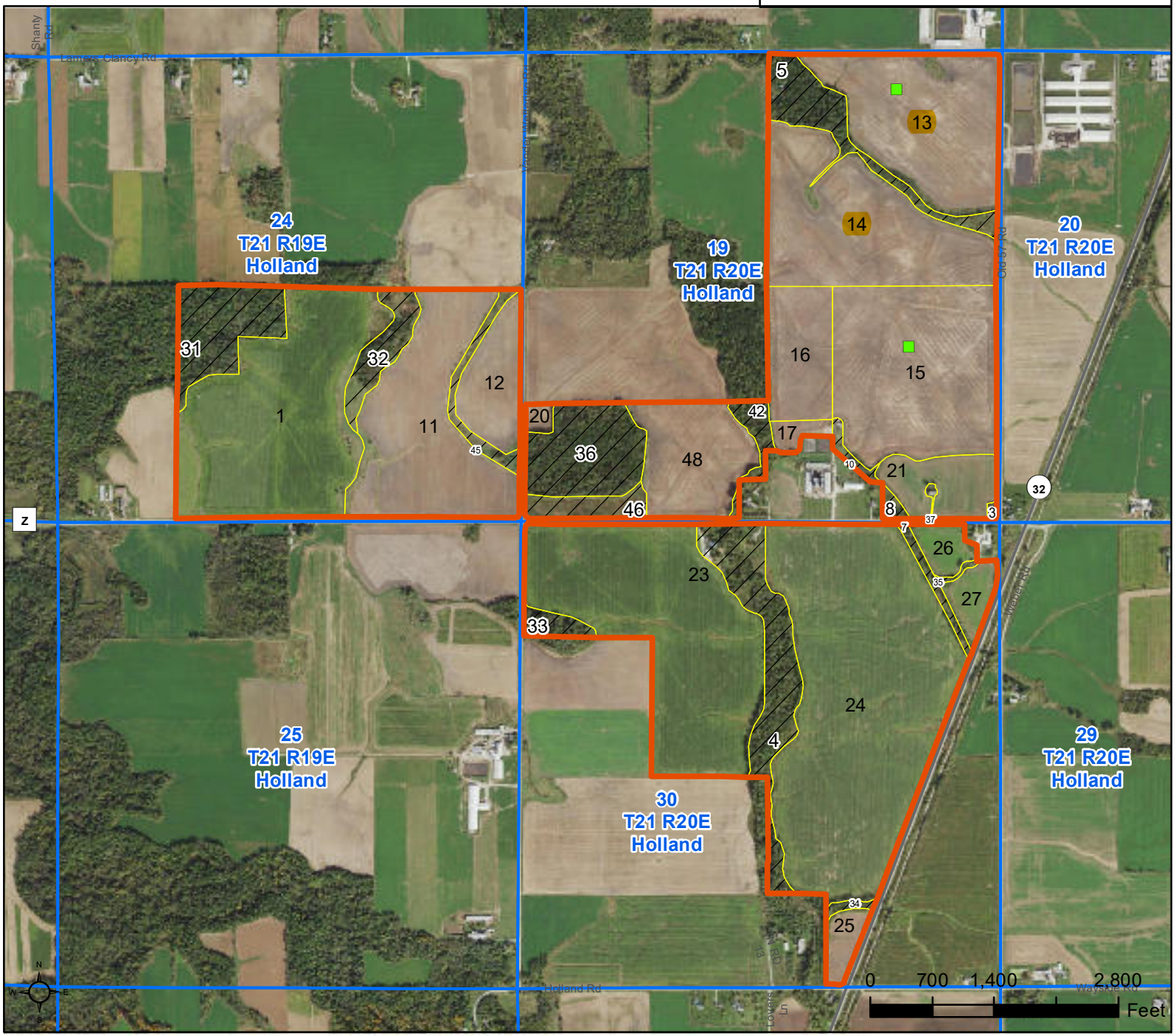
APPENDIX G

FSA Cropping Records

USDA United States Department of Agriculture

Brown County, Wisconsin

Entire Tract: IR / NI GR / FG unless otherwise labeled
Name/Shares: _____



Farm 12398
Tract 35554
2019 Program Year

CLU	Acres	HEL	Crop
1	99.74	NHEL	
3	0.43	UHEL	NC
4	33.63	UHEL	NC
5	19.17	UHEL	NC
7	3.46	NHEL	NC
8	1.57	NHEL	NC
10	2.25	NHEL	NC
11	68.93	NHEL	
12	20.6	NHEL	
13	64.62	NHEL	
14	72.99	NHEL	
15	81.48	NHEL	
16	25.54	NHEL	
17	4.01	NHEL	
20	2.35	NHEL	
21	18.71	NHEL	
23	106.39	NHEL	
24	158.51	NHEL	
25	6.76	NHEL	
26	7.13	NHEL	
27	7.95	NHEL	
31	24.42	UHEL	NC
32	11.39	UHEL	NC
33	4.56	UHEL	NC
34	1.38	UHEL	NC
35	0.75	UHEL	NC
36	28.61	UHEL	NC
37	0.45	UHEL	NC
42	5.62	UHEL	NC
45	6.3	UHEL	NC

Page Cropland Total: 780.24 acres

Map Created August 24, 2018

Common Land Unit
- Cropland
- Non-Cropland
- Tract Boundary
- PLSS

NAIP Imagery 2017

Wetland Determination Identifiers
- Restricted Use
- Limited Restrictions
- Exempt from Conservation Compliance Provisions

REPORT OF COMMODITIES
FARM AND TRACT DETAIL LISTING

Farm Number: 12398

Tract Number	CLU/ Field	Crop/ Commodity	Variety/ Type	Irr Prc	Int Use	Actual Use	Land Use	C/C Status	Reporting Unit	Reported Quantity	Determined Quantity	Crop Land	Field ID	Official/ Measured	Planting Date	Planting Period	End Date
33637																	
Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr
ALFAL		N	FG	60.70													

Photo Number/Legal Description: S19 E HOLLAND T21N R20E

Cropland: 60.69 Reported on Cropland: 60.70 Difference: 0.01 Reported on Non-Cropland: 0.00

35554	1	ALFAL		N	FG			IF	A	99.70		Yes			5-5-2009	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013
	1	CORN	YEL	N	GR			M	A	99.70		Yes			6-8-2013	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013
	2A	ALFAL		N	FG			IF	A	71.40		Yes			5-5-2009	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013
	2A	CORN	YEL	N	GR			M	A	71.40		Yes			6-8-2013	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013
	2B	ALFAL		N	FG			I	A	24.40		Yes			5-5-2009	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013
	13	CORN	YEL	N	GR			I	A	64.60		Yes			5-31-2013	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013
	14	ALFAL		N	FG			I	A	73.00		Yes			4-11-2012	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-14-2012
	15	ALFAL		N	FG			I	A	81.50		Yes			4-11-2012	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-14-2012
	16	ALFAL		N	FG			I	A	25.50		Yes			4-11-2012	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-14-2012
	17	ALFAL		N	FG			I	A	4.00		Yes			4-11-2012	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-14-2012
	18	ALFAL		N	FG			I	A	11.60		Yes			4-28-2010	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	7-10-2013

REPORT OF COMMODITIES
FARM AND TRACT DETAIL LISTING

Farm Number: 12398

Tract Number	CLU/ Field	Crop/ Commodity	Variety/ Type	Irr Prc	Int Use	Actual Use	Land Use	C/C Status	Reporting Unit	Reported Quantity	Determined Quantity	Crop Land	Field ID	Official/ Measured	Planting Date	Planting Period	End Date
4189																	
Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr
WHEAT	SRW	N	GR	82.58		CORN	YEL	N	GR	220.08							
Photo Number/Legal Description: S18 E HOLLAND T21N R20E																	
Cropland: 192.62						Reported on Cropland: 192.62					Difference: 0.00			Reported on Non-Cropland: 0.00			
33637	20	CORN	YEL	N	GR			I	A	60.69		Yes			5-30-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	6-20-2014
Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr
CORN	YEL	N	GR	60.69													
Photo Number/Legal Description: S19 E HOLLAND T21N R20E																	
Cropland: 60.69						Reported on Cropland: 60.69					Difference: 0.00			Reported on Non-Cropland: 0.00			
35554	1	CORN	YEL	N	GR			I	A	99.74		Yes			5-30-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	6-20-2014
	2A	CORN	YEL	N	GR			I	A	73.83		Yes			5-30-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	6-20-2014
	2B	CORN	YEL	N	GR			I	A	22.00		Yes			5-25-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	6-20-2014
	13	CORN	YEL	N	GR			I	A	64.62		Yes			5-31-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	6-20-2014
	13	CORN	YEL	N	GR			R	A	64.62		Yes			6-5-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	6-20-2014
	14	ALFAL		N	FG			I	A	72.99		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-6-2013
	15	ALFAL		N	FG			I	A	81.48		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-6-2013
	16	ALFAL		N	FG			I	A	25.54		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00		RMA Unit					NAP Unit	904	Signature Date:	11-6-2013

REPORT OF COMMODITIES
FARM AND TRACT DETAIL LISTING

Farm Number: 12398

Tract Number	CLU/ Field	Crop/ Commodity	Variety/ Type	Irr Prc	Int Use	Actual Use	Land Use	Organic Status	Native Sod	C/C Status	Reporting Unit	Reported Quantity	Determined Quantity	Crop Land	Field ID	Official/ Measured	Planting Date	Planting Period	End Date
33637																			
Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr		
CORN	YEL	N	GR	60.69															
Photo Number/Legal Description: S19 E HOLLAND T21N R20E																			
Cropland: 60.69					Reported on Cropland: 60.69							Difference: 0.00				Reported on Non-Cropland: 0.00			
35554	1	ALFAL		N	FG			C	N	I	A	99.74		Yes	DS		4-28-2015	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	2A	CORN	YEL	N	GR			C	N	I	A	73.83		Yes			4-28-2015	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	2B	WHEAT	SRW	N	GR			C	N	I	A	22.00		Yes			9-29-2014	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	10-28-2014	
	13	CORN	YEL	N	GR			C	N	I	A	64.62		Yes			5-1-2015	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	14	ALFAL		N	FG			C	N	IF	A	72.99		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	14	CORN	YEL	N	GR			C	N	M	A	72.99		Yes			5-14-2015	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	15	ALFAL		N	FG			C	N	IF	A	81.48		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	15	CORN	YEL	N	GR			C	N	M	A	81.48		Yes			5-14-2015	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	16	ALFAL		N	FG			C	N	IF	A	25.54		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	16	CORN	YEL	N	GR			C	N	M	A	25.54		Yes			5-14-2015	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	
	17	ALFAL		N	FG			C	N	IF	A	4.01		Yes			4-11-2012	01	
Producer	WIESE BROTHERS FARMS					Share	100.00				RMA Unit				NAP Unit	904	Signature Date:	6-19-2015	

REPORT OF COMMODITIES
FARM AND TRACT DETAIL LISTING

Farm Number: 12398

Tract Number	CLU/ Field	Crop/ Commodity	Variety/ Type	Irr Prc	Int Use	Actual Use	Land Use	Organic Status	Native Sod	C/C Status	Reporting Unit	Reported Quantity	Determined Quantity	Crop Land	Field ID	Official/ Measured	Planting Date	Planting Period	End Date
33637																			
PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr
01	CORN	YEL	N	GR	60.69															

Photo Number/Legal Description: S19 E HOLLAND T21N R20E

Cropland: 60.69 Reported on Cropland: 60.69 Difference: 0.00 Reported on Non-Cropland: 0.00

35554	1	ALFAL		N	FG			C	N	I	A	99.74		Yes			4-28-2015	01	2020
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	11-6-2015	
	2A	WHEAT	SRW	N	GR			C	N	I	A	73.83		Yes			9-15-2015	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	11-6-2015	
	2B	RYE		N	CO			C	N	C	A	22.00		Yes			8-5-2015	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	11-6-2015	
	2B	CORN	YEL	N	GR			C	N	I	A	22.00		Yes			5-6-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	
	13	WHEAT	SRW	N	GR			C	N	I	A	64.62		Yes			9-16-2015	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	11-6-2015	
	14	CORN	YEL	N	GR			C	N	I	A	72.99		Yes			5-3-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	
	15	CORN	YEL	N	GR			C	N	I	A	81.48		Yes			5-3-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	
	16	CORN	YEL	N	GR			C	N	I	A	25.54		Yes			5-3-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	
	17	CORN	YEL	N	GR			C	N	I	A	4.01		Yes			5-3-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	
	18	CORN	YEL	N	GR			C	N	I	A	11.60		Yes			5-5-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	
	19	CORN	YEL	N	GR			C	N	I	A	31.28		Yes			5-5-2016	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00			RMA Unit				NAP Unit	904	Signature Date:	6-14-2016	

REPORT OF COMMODITIES
FARM AND TRACT DETAIL LISTING

Farm Number: 12398

Tract Number	CLU/ Field	Crop/ Commodity	Variety/ Type	Irr Prc	Int Use	Actual Use	Land Use	Organic Status	Native Sod	C/C Status	Reporting Unit	Reported Quantity	Determined Quantity	Crop Land	Field ID	Official/ Measured	Planting Date	Planting Period	End Date
33637																			
PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr
01	CORN	YEL	N	GR	60.69															

Photo Number/Legal Description: S19 E HOLLAND T21N R20E

Cropland: 60.69 Reported on Cropland: 60.69 Difference: 0.00 Reported on Non-Cropland: 0.00

35554	1	ALFAL		N	FG			C	N	IF	A	99.74	99.74	Yes		DO	4-28-2015	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	1	CORN	YEL	N	GR			C	N	M	A	99.74		Yes			6-1-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	11	CORN	YEL	N	GR			C	N	I	A	68.93		Yes			5-16-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	12	CORN	YEL	N	GR			C	N	I	A	20.60		Yes			5-15-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	13	COVRC	BOB	N	CO			C	N	C	A	64.62		Yes			8-10-2016	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	13	CORN	YEL	N	GR			C	N	I	A	64.62		Yes			5-16-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	14	CORN	YEL	N	GR			C	N	I	A	72.99		Yes			5-19-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	15	CORN	YEL	N	GR			C	N	I	A	81.48		Yes			5-19-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	16	CORN	YEL	N	GR			C	N	I	A	25.54		Yes			5-19-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	17	CORN	YEL	N	GR			C	N	I	A	4.01		Yes			5-19-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	
	20	CORN	YEL	N	GR			C	N	I	A	2.35		Yes			5-15-2017	01	
	Producer	WIESE BROTHERS FARMS				Share	100.00			FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-26-2017	

REPORT OF COMMODITIES
FARM AND TRACT DETAIL LISTING

Farm Number: 12398

Tract Number	CLU/ Field	Crop/ Commodity	Variety/ Type	Irr Prc	Int Use	Actual Use	Land Use	Organic Status	Native Sod	C/C Status	Reporting Unit	Reported Quantity	Determined Quantity	Crop Land	Field ID	Official/ Measured	Planting Date	Planting Period	End Date
33637																			
PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr	PP	Cr/Co	Var/Type	Irr Prc	Int Use	Non-Irr	Irr
01	ALFAL		N	FG	60.69															

Photo Number/Legal Description: S19 E HOLLAND T21N R20E

Cropland: 60.69 Reported on Cropland: 60.69 Difference: 0.00 Reported on Non-Cropland: 0.00

35554	1	CORN	YEL	N	GR			C	N	I	A	99.74		Yes			5-24-2018	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	11	CORN	YEL	N	GR			C	N	I	A	68.93		Yes			5-22-2018	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	12	CORN	YEL	N	GR			C	N	I	A	20.60		Yes			5-21-2018	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	13	SOYBN	COM	N	GR			C	N	I	A	64.62		Yes			6-14-2018	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	14	ALFAL		N	FG			C	N	I	A	72.99		Yes	DS		5-20-2018	01	2023
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	15	ALFAL		N	FG			C	N	I	A	81.48		Yes	DS		5-20-2018	01	2023
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	16	ALFAL		N	FG			C	N	I	A	25.54		Yes	DS		5-20-2018	01	2023
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	17	ALFAL		N	FG			C	N	I	A	4.01		Yes	DS		5-20-2018	01	2023
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	20	ALFAL		N	FG			C	N	I	A	2.35		Yes	DS		5-22-2018	01	2023
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	21	CORN	YEL	N	GR			C	N	I	A	18.71		Yes			5-24-2018	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	
	23	CORN	YEL	N	GR			C	N	I	A	106.39		Yes			5-23-2018	01	
	Producer	WIESE BROTHERS FARMS					Share	100.00		FSA Physical Location:		Brown, Wisconsin			NAP Unit	904	Signature Date:	6-15-2018	

APPENDIX H

Snap Plus Phosphorus & TSS Trade Reports

WQ1: P Trade Report

Reported For	Wiese Brothers Farms
Printed	2019-03-27
Plan Completion/Update Date	2019-01-15
SnapPlus Version 18.1 built on 2019-01-15	
W:\PROJECTS\D0992\91800618\Dept\Storm\Snap Plus\FinalRuns\Baseline_Prairie.snapDb	

Prepared for:
Wiese Brothers Farms
attn:Mark Wiese
7043 Bunker Hill Road
Greenleaf, 54126

WPDES Permitted Farm

The P Trade Report estimates the annual pounds of phosphorus (P) in surface runoff from cropland entering surface waters. These P loss calculations are based on a field's soil test P concentration, crops, tillage, nutrient management practices and estimates of average runoff and sheet and rill erosion for the predominant soil type. Losses from concentrated flow channel or gully erosion with a field are not included in these calculations. Field runoff losses are calculated for each year as **PTP** (lb P/field/yr). Fields are only included if there are at least 2 years of crops before the selected start year. Before using this report as part of a Water Quality Trade activity, phosphorus losses (PTP) must be converted into 'P credits' according to DNR guidance.

For more information go to **http://dnr.wi.gov/** and type keyword: **Water Quality Trading**

Questions? Please contact DNRphosphorus@wisconsin.gov

This report was developed for Wisconsin DNR Water Quality Trading and Adaptive Management purposes and cannot be used to demonstrate compliance with NR 151 or NRCS 590 NM plan requirements.

P Trade Report				PTP										
Field Name	Soil Series	Soil Symbol	Acres	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Stock-13	KEWAUNEE	KhB	15	95	60	71	61	11	8	7	6	6	6	6
Total			**15**	**95**	**60**	**71**	**61**	**11**	**8**	**7**	**6**	**6**	**6**	**6**

WQ2: Sediment Trade Report

Reported For	Wiese Brothers Farms
Printed	2019-03-27
Plan Completion/Update Date	2019-01-15
SnapPlus Version 18.1 built on 2019-01-15	
W:\PROJECTS\D0992\91800618\Dept\Storm\Snap Plus\FinalRuns\Baseline_Prairie.snapDb	

Prepared for:
Wiese Brothers Farms
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WPDES Permitted Farm

The Sediment Trade Report estimates the annual tons of sediment in surface runoff from cropland entering surface waters. These sediment delivery calculations are based on RUSLE2 estimates of sheet and rill erosion for the predominant soil. Sediment losses from concentrated flow channel or gully erosion within a field are not included in these calculations. Field sediment yields are calculated for each year as US tons/field/year. Fields are only included if there at least 2 years of crops before the selected start year. Before using this report as part of a Water Quality Trade activity, sediment losses must be converted into 'credits' according to DNR guidance.

For more information go to **http://dnr.wi.gov** and type keyword: **Water Quality Trading**

This report was developed for Wisconsin DNR Water Quality Trading and Adaptive Management purposes and cannot be used to demonstrate compliance with NR 151 or NRCS 590 NM plan requirements.

Sediment Trading

Field Name	Soil Series	Soil Symbol	Acres	Sediment (US Tons)						
				2015	2016	2017	2018	2019	2020	2021
Stock-13	KEWAUNEE	KhB	15	10.93	7.37	2.96	2.80	0.46	0.10	0.04
Total				10.93	7.37	2.96	2.80	0.46	0.10	0.04

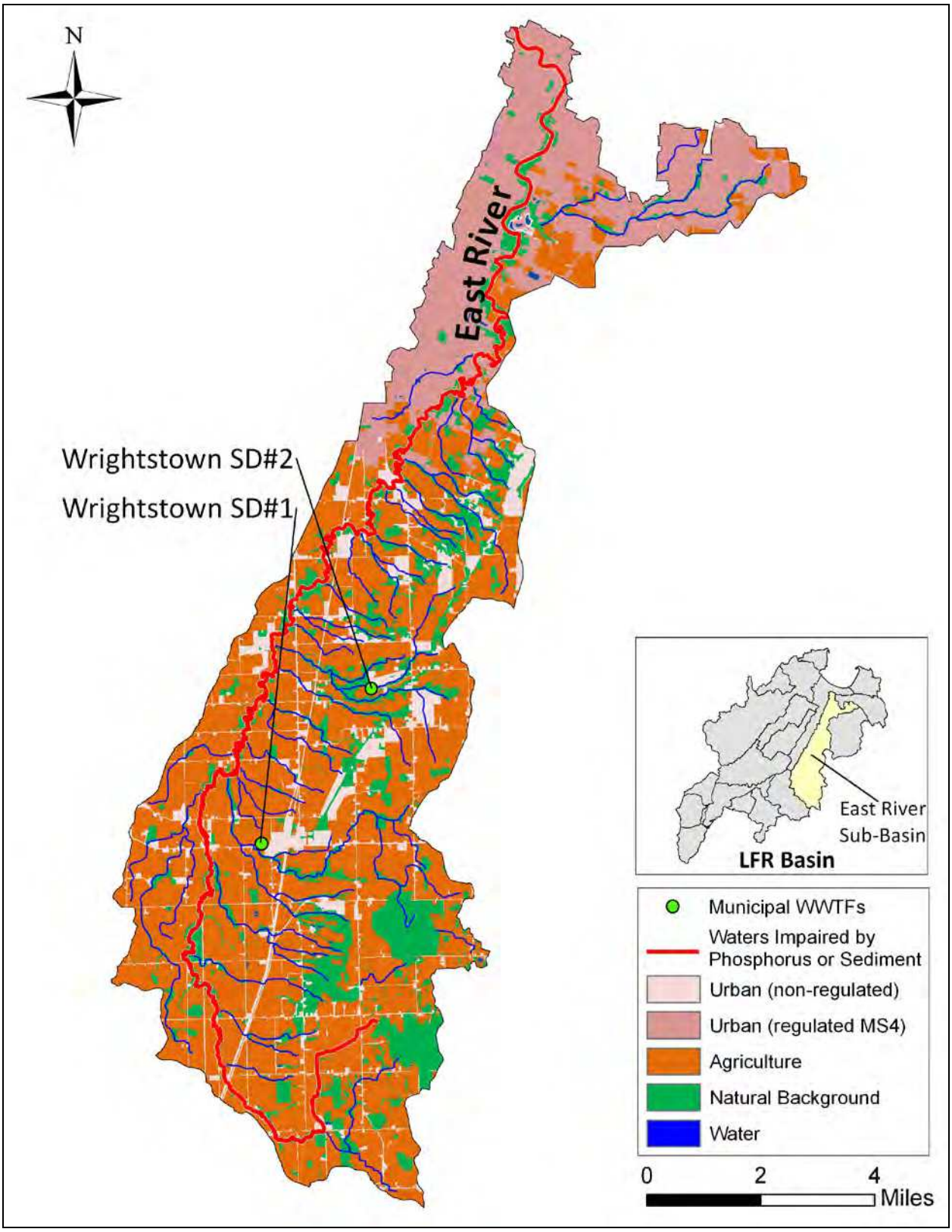
Questions? Please contact DNRphosphorus@wisconsin.gov

Sediment (US Tons)			
2022	2023	2024	2025
0.02	0.01	0.01	0.01
0.02	0.01	0.01	0.01

APPENDIX I

Lower Fox River TMDL Required Percent Reductions from Annual Baseline Load

EAST RIVER SUB-BASIN



EAST RIVER
TOTAL PHOSPHORUS

Sub-basin Loading Summary (lbs/yr)	
Baseline	48,748
TMDL	14,592
Reduction	34,156
% Reduction Needed	70.1%

Daily TMDL (lbs/day)	39.95

Land Use	Acres	% of Total
Agriculture	26,520	54.3%
Urban (non-regulated)	4,423	9.1%
Urban (MS4)	9,091	18.6%
Construction	256	0.5%
Natural Background	8,571	17.5%
TOTAL	**48,861**	**100.0%**

Sources	Total Phosphorus Load (lbs/yr)			% Reduction from Baseline	Allocated (lbs/day)
	Baseline	Allocated	Reduction		
Agriculture	38,020	6,123	31,897	83.9%	16.76
Urban (non-regulated)	2,195	2,195	-	-	6.01
Natural Background	853	853	-	-	2.34
LOAD ALLOCATION	**41,068**	**9,171**	**31,897**	**77.7%**	**25.11**
Urban (MS4)	5,797	4,058	1,739	30.0%	11.11
Construction	836	836	-	-	2.29
General Permits	322	322	-	-	0.88
WWTF-Industrial	-	-	-	-	-
WWTF-Municipal	725	205	520	71.7%	0.56
WASTELOAD ALLOCATION	**7,680**	**5,421**	**2,259**	**29.4%**	**14.84**
TOTAL (WLA + LA)	**48,748**	**14,592**	**34,156**	**70.1%**	**39.95**

Urban (MS4)	Total Phosphorus Load (lbs/yr)			% Reduction from Baseline	Allocated (lbs/day)
	Baseline	Allocated	Reduction		
Allouez	1,101	771	330	30.0%	2.11
Bellevue	1,076	753	323	30.0%	2.06
DePere	737	516	221	30.0%	1.41
Green Bay	2,122	1,485	637	30.0%	4.07
Ledgeview	761	533	228	30.0%	1.46

WWTF-Municipal	Total Phosphorus Load (lbs/yr)			% Reduction from Baseline	Allocated (lbs/day)
	Baseline	Allocated	Reduction		
Wrightstown SD#1	690	170	520	75.4%	0.47
Wrightstown SD#2	35	35	-	-	0.10

EAST RIVER
TOTAL SUSPENDED SOLIDS

Sub-basin Loading Summary (lbs/yr)	
Baseline	19,796,496
TMDL	7,231,130
Reduction	12,565,366
% Reduction Needed	63.5%

Daily TMDL (lbs/day)	19,798

Land Use	Acres	% of Total
Agriculture	26,520	54.3%
Urban	4,423	9.1%
Urban-MS4	9,091	18.6%
Construction	256	0.5%
Natural Background	8,571	17.5%
TOTAL	**48,861**	**100.0%**

Sources	Total Suspended Solids Load (lbs/yr)			% Reduction from Baseline	Allocated (lbs/day)
	Baseline	Allocated	Reduction		
Agriculture	15,364,278	4,511,822	10,852,456	70.6%	12,353
Urban (non-regulated)	581,660	581,660	-	-	1,592
Natural Background	279,417	279,417	-	-	765
LOAD ALLOCATION	**16,225,355**	**5,372,899**	**10,852,456**	**66.9%**	**14,710**
Urban (MS4)	2,622,118	1,573,271	1,048,847	40.0%	4,307
Construction	830,079	166,016	664,063	80.0%	455
General Permits	118,364	118,364	-	-	324
WWTF-Industrial	-	-	-	-	-
WWTF-Municipal	580	580	-	-	2
WASTELOAD ALLOCATION	**3,571,141**	**1,858,231**	**1,712,910**	**48.0%**	**5,088**
TOTAL (WLA + LA)	**19,796,496**	**7,231,130**	**12,565,366**	**63.5%**	**19,798**

Urban (MS4)	Total Suspended Solids Load (lbs/yr)			% Reduction from Baseline	Allocated (lbs/day)
	Baseline	Allocated	Reduction		
Allouez	444,964	266,978	177,986	40%	731
Bellevue	511,765	307,059	204,706	40%	841
DePere	273,714	164,228	109,486	40%	450
Green Bay	1,119,137	671,482	447,655	40%	1,838
Ledgeview	272,538	163,523	109,015	40%	448

WWTF-Municipal	Total Suspended Solids Load (lbs/yr)			% Reduction from Baseline	Allocated (lbs/day)
	Baseline	Allocated	Reduction		
Wrightstown SD#1	472	472	-	-	1
Wrightstown SD#2	108	108	-	-	-

APPENDIX J

Signed Water Quality Trading Management Practice Registration (Form 3400-207)

State of Wisconsin
Department of Natural Resources
101 South Webster Street
Madison, WI 53707

Water Quality Trading
Management Practice Registration
Form 8700-nnn (R10/12)

Notice: Any personally identifiable information submitted on this form will be used for program purposes only, but is available for inspection and copying under Wisconsin's public records laws. This form should be completed by any permittee that intends to pursue pollutant trading as a method for complying with a permit limitation. Failure to complete this form would not result in penalties.

Permittee Information

Permittee Name	Permit Number **WI-**	Facility Site Number

Facility Address	City	State	ZIP Code

Project Contact Name(if applicable)	*Address*	*City*	*State*	*Zip Code*

Project Name

Broker/Exchange Information (if applicable)

Was a broker/exchange be used to facilitate trade?	☐ Yes ☐ No
Broker/Exchange Organization Name:	Contact:
Address:	Phone/E-mail:

Trade Registration Information *(Use a separate form for each trade agreement)*

Type	Trade Agreement Number	Practices Used to Generate Credits	Anticipated Load Reduction & Trade Ratio	Method of Quantification
☐ Urban NPS ☐ Agricultural NPS ☐ Other				

County:	Closest Receiving Water Name:	HUC 12:	Parameter(s) Traded:

The preparer and owner certify all of the following:

- I have completed this document to the best of my knowledge and have not excluded pertinent information.
- I certify that the information in this document is true to the best of my knowledge.

Signature of Preparer	Date Signed

Authorized Representative Signature:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision. Based on my inquiry of those persons directly responsible for gathering and entering the information, the information is, to the best of my knowledge and belief, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Authorized Representative	Date Signed

For Department Use Only	
Date Received:	Trade Docket Number:
Entered in Tracking System ☐ Yes Date Entered:	Name of Department Reviewer:

NOTE: The *Authorized Representative* is someone who is authorized to sign all applications, reports or other information submitted to the DNR. This person may be; for a corporation, a responsible corporate officer including a president, secretary, treasurer, vice president or manager; and for a municipality, a ranking elected official; for a corporation or a municipality, another person authorized by one of those officers or officials and who has responsibility for the overall operation of the facility or activity regulated by the permit. This is the person to whom we will send information regarding the application, the draft permit and permit reissuance.