Water Quality Trading Plan

Grassland Dairy Products, Inc.

Greenwood, WI

GRADA 161399 | March 24, 2025

SEH

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Engineers | Architects | Planners | Scientists

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March 24, 2025

RE: Grassland Dairy Products, Inc.
Water Quality Trading Plan
Greenwood, WI
SEH No. GRADA 161399 4.00

Jenna Monahan
Wisconsin Department of Natural Resources
1300 W Clairemont Ave
Eau Claire, WI 54701

Dear Jenna:

SEH was retained by Grassland Dairy Products, Inc. to develop a Water Quality Trading (WQT) Plan with a goal that the recommended projects contained within the enclosed plan would provide offsets to the existing calculated water quality based effluent limits (WQBELs) for phosphorus contained in Grassland's existing Wisconsin Pollutant Discharge Elimination System (WPDES) Permit, and that offsets, once practices recommended are installed, would be incorporated into a modified permit. Enclosed you will find the WQT Plan for your review and approval. Please do not hesitate to reach out with questions or comments as you begin your review.

Sincerely,

Daniel J Schaefer

Dan Schaefer, PE
Senior Engineer
(Lic. CO, KY, MI, NC, TN, WI)

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Water Quality Trading Plan

Grassland Dairy Products, Inc.
Greenwood, WI

Prepared for:
Grassland Dairy Products, Inc
Greenwood, WI

Prepared by:
Short Elliott Hendrickson Inc.
809 N. 8th Street, Suite 205
Sheboygan, WI 53081-4032
920.452.6603

I, Dan Schaefer, PE, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code.

Daniel J Schaefer

40481	March 24, 2025	
Dan Schaefer, PE, PE	PE Number	Date
Senior Engineer		

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Water Quality Trading Plan

Grassland Dairy Products, Inc.

Prepared for Grassland Dairy Products, Inc

1 Introduction

This Water Quality Trading (WQT) Plan is being developed for Grassland Dairy Products, Inc. (Grassland) in Greenwood, WI. The plan provides supplemental credits to offset reductions already made at Grassland's Wastewater Treatment Plant (WWTP) and provides a safety factor for compliance with water quality based effluent limits (WQBELs) for total phosphorus (TP) found in Grassland's WPDES permit (WI-0002984-09) for discharge to the Black River. The full WPDES permit is included in **Appendix A.**

Grassland owns (under multiple ownership entities all tied to Grassland Dairy) several agricultural fields near their production facility. Farming operations on these fields are run by multiple local farmer entities under various agreements with Grassland. The fields discussed in this plan are operated under an agreement with Four Star Ag, LLC (Four Star). **Figure 1** depicts the locations of HUC-12 subwatershed boundaries, outfall location, and proposed fields selected for WQT efforts.

1.1 Purpose for Water Quality Trading

The purpose of this plan is to describe Grassland's use of WQT in the future to provide a factor of safety and compliance with TP limits for the effluent from Grassland's WWTP. This plan was developed pursuant to the Notice of Intent (NOI) to Conduct Water Quality Trading included in **Appendix B.**

Grassland plans to develop "in-house" trading credits on property currently owned or under existing land use agreements by Grassland with farming operations by Four Star. All fields discussed within this plan are within a different, upstream HUC-12 subwatershed as the outfall. This will be accounted for in delivery factors built into WQT ratios, described in detail later in this document.

Effective June 30, 2021, Grassland's WWTP was subject to a limit of 0.075 mg/L TP on six-month average, or 0.28 lbs/day. This permit limit was also included in the renewed permit issued in 2024 (Appendix A). As will be detailed later in this report, the WWTP for the production facility is generally meeting its TP limit. However, Grassland still wishes to pursue actions outlined in this report to provide greater resilience against potential fluctuations in treatment quality at the facility as production and wastewater generation is anticipated to continue to increase.

2 Existing Conditions

2.1 Effluent Flows and Loadings

Grassland discharges treated process wastewater from Outfall 002 to the Black River from its facility located in Greenwood, WI. The outfall is located in HUC-12 Sub-watershed 070400070405. The facility treats its process wastewater through a variety of unit processes with phosphorus being chemically precipitated by dosing alum and utilizing ultra filtration for solids separation. **Table 1** shows the effluent characteristics for the period January 2021 through July 2024. Effluent phosphorus loadings and concentrations are also shown in **Figure 2**. As optimization of chemical feed and treatment has continued, the plant has shown it can meet its permitted limits on a six-month average. However, the plant is still operating relatively close to its 6-month average limits, demonstrating the need for generating internal TP credits to provide assurances against fluctuations in treatment performance.

Table 1 – Effluent Characteristics, 2021-2024

Characteristic	Units	2021	2022	2023	2024	Average	PF[1]
Annual Average Flow	MGD	0.38	0.39	0.43	0.50	0.42	
Maximum Month Flow	MGD	0.42	0.41	0.47	0.52	0.45	1.1
Maximum Week Flow	MGD	0.44	0.42	0.51	0.56	0.48	1.1
Peak Daily Flow	MGD	0.51	0.50	0.57	0.63	0.55	1.3
Annual Average BOD_5	lbs/day	9.64	11	25	24	17	
Maximum Month BOD_5	lbs/day	21.18	21	78	58	44	2.5
Peak Daily BOD_5	lbs/day	126.70	81	378	80	166	9.5
Annual Average TSS	lbs/day	11.85	11	10	10	11	
Maximum Month TSS	lbs/day	18.66	14	13	15	15	1.4
Peak Daily TSS	lbs/day	103.35	86	73	95	89	8.3
Annual Average TP	lbs/day	0.31	0.19	0.23	0.22	0.24	
Maximum Month TP	lbs/day	0.84	0.29	0.39	0.32	0.46	1.9
Peak Daily TP	lbs/day	2.23	0.82	1.04	0.57	1.17	4.9

1. Peaking Factor

2.2 Agricultural Fields Selected for WQT Efforts

For this plan, Grassland has proposed pursuing phosphorus reduction within fields it owns, which are operated by a local partner, Four Star. Other fields are owned by Grassland under other holding companies and operators, but this plan focuses on those operated by Four Star.
A summary of the fields evaluated for WQT efforts is shown in **Table 2**. The fields were further delineated into subfields based on unique field features to provide additional modeling resolution within SnapPlus and tailor TP reduction efforts as needed. These subfields were identified using natural geographic and property boundaries. The fields and subfields evaluated for WQT total 219 acres and are shown in map form in **Figure 3**, along with nearby wetlands and elevation data for the fields**.** The historic crop rotations are provided in **Appendix J**.

Table 2 – Summary of Fields Evaluated For WQT Efforts

Field No.	Subfields	Acres	Crop Rotation (Starting 2024[2])
101	A, B, D, F[1]	66	Corn - Corn - Soybeans
104	A, B, C	149.3	Corn - Corn - Soybeans

1. Field 101 F created as part of this project for WQT efforts. See figures for details.
2. 2024 was a rotation anomaly due to wet spring creating substantial demand for forage (corn silage) in the region. This anomaly was accounted for in the SnapPlus modeling.

2.2.1 Soil Sampling

Soil sampling is regularly conducted by Northside Elevator agronomists in the fields described above. New soil sampling is conducted using a regularly spaced grid pattern as prescribed by WDNR and University of Wisconsin-Madison (UW) guidelines. The most recent samples were used to calculate the current and future potentially tradeable phosphorus for the water quality trade. **Appendix C** shows soil sampling results in the fields selected for WQT activities. The phosphorus levels in the soils can generally be categorized as high to excessively high by UW Nutrient Applications Guidelines. This translates to a high potential for reducing phosphorus, and thus credits may be generated through relatively unintrusive and cost-effective means.

2.3 Sludge Characteristics

In addition, Grassland has an approved Land Application Management Plan with WDNR for land applying sludge on many of the same fields analyzed within this plan. Land application of WWTP sludge to these fields serves as a supplemental nutrient application.

Table 3 summarizes the characteristics of the sludge used in analysis of impact of nutrient applications. Sludge characteristics are an average of results from laboratory testing from 2019-2023. All units shown are as % dry matter.

Table 3 – Grassland Wastewater Sludge Characteristics

Parameter (% dry matter)	Liquid Sludge	Cake Sludge
Percent Solids	3.57	25.5
TKN	7.49	4.33
Ammonia	1.5	0.58
Organic Nitrogen	6	3.8
Total Recoverable Potassium	1.4	0.25
Total Phosphorus	3.6	2.3

2.4 Nutrient Applications

Grassland land applies sludge generated from the wastewater treatment process to its fields. The sludge has historically been applied in two forms, liquid and cake, as described in **Table 3**. **Table 4** describes historic sludge applications on Fields 101 and 104 collected from Grassland Dairy for the years 2019 through 2024. It should be noted that 2024's application to Field 101 was estimated using the updated nutrient application system described below.

Table 4 – 2019-2023 Sludge Applications

Year	Sludge Type	Field 101 (gallons)	Field 104 (gallons)
2019	Cake	12,000	-
	Liquid	932,918	-
2020	Cake	-	-
	Liquid	-	493,500
2021	Cake	-	-
	Liquid	-	-
2022	Cake	-	-
	Liquid	756,000	3,948,839
2023	Cake	-	-
	Liquid	-	-
2024	Cake	-	-
	Liquid	335,800	-

As can be seen in **Table 4,** the amount of cake sludge relative to liquid sludge applied to these fields is minimal. In the last three years no cake sludge has been applied to either field chosen for WQT efforts. Grassland has also stated that it is implementing a nutrient application system of applying each field every other year, with sludge applications performed at recommended rates determined from DNR land application standards. **Table 5** shows the basis for future nutrient applications used in modeling conditions for WQT. Total applications are based on the number of spreadable acres in DNR mapping, 46 acres for Field 101 and 130 acres across two sites for

Field 104. For the purposes of modeling, applications were only made to subfields 101A, 104A, 104B, and 104C as these most closely correspond to DNR approved sites for land application.

Based on season of application, hydraulic rates are limited by regulation. Nitrogen application rates of 165 lbs/acre also were factored in. Since the time and amount of application are variable, applications were averaged across three different times (spring, summer, and fall) at a rate to not exceed the total of 165 lbs/acre of nitrogen, nor to exceed the most conservative hydraulic limit of 6,800 gallons/acre. All limits referenced were sourced from the currently under development Grassland Dairy Land Application Management Plan.

Table 5 – Future Nutrient Applications System

Year	Field 101			Field 104		
	Avg. Planned Rate (gal/ac)	Apps per Year	Est. Total (gal)	Avg. Planned Rate (gal/ac)	Apps per Year	Est. Total (gal)
2024	-	0	-	2,200	3	858,000
2025	2,200	3	303,600	-	0	-
2026	-	0	-	2,200	3	858,000
2027	2,200	3	303,600	-	0	-
2028	-	0	-	2,200	3	858,000
2029	2,200	3	303,600	-	0	-

2.5 SnapPlus Modeling Under Existing Conditions

Appendix D includes the following SnapPlus reports assuming historic cropping and management practices continue into the future:

- Narrative and Crop Report
- Soil Test Report
- Application Summary Report
- P Trade Report
- Sediment Trade Report

Table 6 summarizes the projected Potentially Tradeable Phosphorus (PTP) from the SnapPlus P Trade Report, using the historic crop and application rotations described above.

Table 6 – Projected PTP Under Historic Conditions

Field	Acres	PTP 2025 (lbs)	PTP 2026 (lbs)	PTP 2027 (lbs)	PTP 2028 (lbs)	PTP 2029 (lbs)	AVERAGE PTP (lbs)
101A	57.9	678	280	499	278	271	401
101B	2.3	32	12	23	12	11	18
101D	1.6	10	4	8	4	4	6
101F	4.2	32	17	26	17	18	22
104A	66.2	478	241	405	235	227	317
104B	58.5	461	233	391	227	219	306
104C	24.6	186	94	157	91	88	123
Total	**219**	**1916**	**897**	**1538**	**881**	**854**	**1217**

It is important to note that PTP is highly dependent on the cropping rotation, and the crop within a given year. Therefore, for any best management practice (BMP) or operational alternative chosen, the rotational average for PTP reduction should be used to estimate impacts. The modeling range of 2025-2029 projects over 5 years per WDNR guidelines. This range includes 2 years of soy and 3 years of corn.

2.6 Filter Strips: Field 101A, 104A, 104B, 104C

The first BMP identified for TP reduction in the fields is installation of filter strips at the downstream edges of the fields. Filter strips function to capture and uptake phosphorus within runoff in the fields. Filter strips can be installed around fields with little to no reduction in the functional acreage of the fields themselves. **Figure 4** shows preliminary extents of 30-ft wide filter strips, placed at downslope locations in the fields closest to wetland areas. This approach captures a conservative area for implementation and protects the most vulnerable outlets from the fields, those nearest potential waterways and entry points to surface water. Design standards to be used in implementation of this BMP are described in detail later in this document.

2.6.1 Modeling Results

SnapPlus allows for the modeling of filter strips at both the perimeter and within the borders of the field. The latter option is much more intrusive to the fields and makes operation of the fields more difficult. For this report, filter strips were only modeled at the borders of fields, and it was assumed that acreage loss was minimal. A summary of SnapPlus results with potentially tradable phosphorus (PTP) is shown in **Table 7**.

Table 7 – Filter Strips Modeling Results

Field	Acres	Scenario	PTP 2025 (lbs)	PTP 2026 (lbs)	PTP 2027 (lbs)	PTP 2028 (lbs)	PTP 2029 (lbs)	AVERAGE PTP (lbs)
101A	57.9	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	678	280	499	278	271	401
		Edge Filter Strips	227	132	184	129	141	163
		Est. P Reduction	451	147	315	150	130	239
104A	66.2	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	478	241	405	235	227	317
		Edge Filter Strips	175	128	156	124	118	140
		Est. P Reduction	303	114	249	112	109	177
104B	58.5	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	461	233	391	227	219	306
		Edge Filter Strips	169	123	151	119	114	135
		Est. P Reduction	293	110	240	108	105	**171**
104C	24.6	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	186	94	157	91	88	123
		Edge Filter Strips	68	50	61	48	46	54
		Est. P Reduction	118	44	97	43	42	69
Total Est. P Reduction			**1165**	**415**	**900**	**412**	**386**	**656**

2.7 Perennial Vegetation (Conservation Cover)

The final BMP developed for implementation in this report is the complete conversion of Fields 101B, 101D, and 101F from row crops to perennial vegetation in the form of permanent grassland. This alternative requires some coordination to plant the correct vegetation and ensuring that the field meets all requirements set forth to be considered “conservation cover” by WDNR. It also comes with the drawback that this field will not produce crops, and thus revenue, for Grassland and Four Star in the future. However, Grassland and Four Star have indicated that these fields are not critical to overall operations and would be willing to convert portions of Field 101 to perennial vegetation (conservation cover) if they provide the necessary credits.

2.7.1 Modeling Results

In SnapPlus, this BMP was modeled by changing the cropping rotation to “permanent grassland” for the given years. Results are shown in **Table 8**.

Table 8 – Conversion to Permanent Grassland Modeling Results

Field	Acres	Scenario	PTP 2025 (lbs)	PTP 2026 (lbs)	PTP 2027 (lbs)	PTP 2028 (lbs)	PTP 2029 (lbs)	AVERAGE PTP (lbs)
101B	2.3	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	32	12	23	12	11	18
		Convert to Prairie	5	2	2	2	1	2
		Est. P Reduction	27	10	21	10	10	16
101D	1.6	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	10	4	8	4	4	6
		Convert to Prairie	2	1	1	1	1	1
		Est. P Reduction	8	3	7	3	3	5
101F	4.2	Crop	Corn	Soy	Corn	Corn	Soy	N/A
		Baseline	32	17	26	17	18	22
		Convert to Prairie	12	9	8	7	7	8
		Est. P Reduction	20	8	18	10	11	14
Total Est. P Reduction			**56**	**21**	**46**	**23**	**24**	**34**

3 Trade Ratios Calculation

In the following sections, the trade ratio calculation for the recommended plan will be explained in detail.

3.1 Individual Trade Ratio Factors

The PTP generated by the SnapPlus modeling is adjusted by the applicable trade ratio to determine the amount of credits the credit user can receive for the management practice. As described in WDNR's "Guidance for Implementing Water Quality Trading in WPDES Permits" dated June 1, 2020, the trade ratio is the sum of the delivery, downstream, equivalency, and uncertainty factors.

3.1.1 Delivery Factor

The delivery factor for trade ratios is determined by either the TMDL or USGS SPARROW modeling. Since the proposed management practices in Field 101 and 104 are in the same HUC-12, but in a different HUC-12 than the outfall (070400070403 and 070400070405, respectively) a delivery factor is necessary. However, this area is not within an approved TMDL, so no delivery factors are available. WDNR's WQT Guidance states that:

"*In the absence of an approved TMDL, the SPARROW model may be used to derive delivery fractions for phosphorus, nitrogen, and sediment when fate and transport need to be addressed. The SPARROW model was developed by the United States Geological Survey (USGS) and*

relies on regression equations from monitoring data to create a delivery fraction between two points in a watershed.

The SPARROW model produces a delivery fraction (0 to 1) which represents the fraction of the load leaving a reach that arrives at the end of a selected downstream target reach or outfall after accounting for the mass of the constituent of interest that is removed by natural attenuation processes. The delivery factor that should be used in the trade ratio equation equals:"

Delivery Factor = (1/SPARROW delivery fraction) – 1.

Delivery fractions, described above, are calculated as follows:

Delivery Fraction = 1 – (User Del. Fraction – Generator Del. Fraction)/User Del. Fraction

A map showing the SPARROW Delivery Fractions is included in Appendix F. While most of the fields reside in areas resulting in a Delivery Fraction of 1.0, a small portion of Field 104 falls within a slightly less advantageous location. Using the fraction for this location, the Delivery Fraction can be calculated as 0.96. Therefore, the corresponding Delivery Factor for this trade is equal to **0.04.**

3.1.2 Downstream Factor

A downstream factor is necessary if the point where credits are generated is downstream of the outfall point where credits are applied. Since all credits are generated upstream of the outfall, no downstream factor is applicable and is therefore set to zero.

3.1.3 Equivalency Factor

According to the WDNR WQT Guidance:

"An equivalency factor is not necessary (i.e., equals 0) for trading of TP credits. Chapters NR 102 and NR 217, Wis. Adm. Code, establish water quality criteria and WQBELs for TP and do not differentiate between forms of phosphorus. While soluble and sediment bound phosphorus have different transport capacities, these differences are accounted for in the calculation of the delivery factor."

Therefore, the equivalency factor for this trade is **0.**

3.1.4 Uncertainty Factor

Uncertainty factors account for the variability in climate, weather, inaccuracies in field testing and modeling, and the natural cycles and episodic nature of nonpoint pollution. This inherent unreliability in non-point source trades is buffered by an uncertainty factor, providing a conservative amount of credit to be generated to ensure that the pollutant load is actually reduced in the receiving waters.

According to **Appendix H** of the WDNR WQT Guidance, the uncertainty factor for Riparian Filter Strips is **3**. A Nutrient Management Plan does not exist, and historic cropping and soil testing data is not available to show falling or stable nutrient levels in the fields which would reduce this factor to 2. **Appendix H** of the WDNR WQT Guidance also dictates an uncertainty factor of **1** for whole field conservation practices, such as conversion to permanent grassland, that implement perennial vegetation.

3.2 Calculations of Trade Ratios

The total trade ratio can be calculated as the sum of the four factors detailed above. The Trade Ratio for this project is therefore equal to the following in **Table 9**.

Table 9 – Calculated Trade Ratios Across Recommended BMP's

Field	BMP	Delivery Factor	Downstream Factor	Equivalency Factor	Uncertainty Factor	Total Trade Ratio
101A 104A 104B 104C	Filter Strips	0.04	0	0	3	**3.04**
101B 101D 101F	Permanent Grassland	0.04	0	0	1	**1.2**[1]
1.Minimum trade ratio for nonpoint source trades is 1.2, per WDNR Guidance						

3.3 Credits Generated

Credits generated and available to trade are based on the selected trade ratio. For the recommended filter strips and permanent grassland conversion the trade ratios are 3.04 and 1.2, respectively. The total rotational average PTP reductions for the filter strips is 656 lbs/year and permanent grassland conversion is 34 lbs/year. Once trade ratios are applied, this results in a combined yearly credit of approximately **244 lbs/yr** of Total Phosphorous available to trade across all the recommended BMPs. Credits generated are summarized in **Table 10** below.

Table 10 – Estimated Annual Credits Available to Trade

Field	BMP	Est. TP Reduction (lbs/yr)	Total Trade Ratio	TP Credits Available to Trade (lbs/yr)
101A	Filter Strips	239	3.04	78
104A	Filter Strips	177	3.04	58
104B	Filter Strips	171	3.04	56
104C	Filter Strips	69	3.04	23
Subtotal		656		216
101B	Permanent Grassland	16	1.2	13
101D	Permanent Grassland	5	1.2	4
101F	Permanent Grassland	14	1.2	11
Subtotal		34		28
Total		**690**		**244**

4 Cost and Non-Monetary Analysis

4.1 Cost Analysis

A cost analysis to quantify implementation and maintenance costs was performed for each of the BMPs described in the previous section. The results of this analysis are included in **Appendix E**. A 20-year present worth analysis was also performed, and is presented later in this document.

4.2 Non-Monetary Analysis

The first practice examined, filter strips, would not significantly reduce yield potentials in selected fields, and would require only minimal initial investment to accomplish a large PTP. However, installation of filter strips does require operator awareness, so as to not damage the filter strips during regular operational activities, and may make maneuvering in tighter corners of the field more difficult. Regular checks on the status of the filter strips may be necessary to monitor the health of vegetation and ensure that they are functioning as designed. Minor reconstruction and reseeding may be needed periodically.

The second practice, conversion to permanent grassland (perennial vegetation – conservation cover), is the most drastic departure from current operations. Grassland and Four Star have indicated that portions of Field 101 (subfields B, D, and F) are not critical to operations and are willing to use these areas to generate potential credits. There is also potential that portions of the cost of conversion to permanent grassland may be offset by different agencies and organizations. For example, USDA has a program to incentivize farmers to convert to prairie and offset the lost revenue. However, this alternative does still require some maintenance and education. The

permanent grassland, once established, must be either mowed with cuttings cleared annually, or burned in a controlled manner. These activities require time and ongoing education.

5 Plan Summary

Grassland has no immediate need for generation of credits, based on performance of the WWTP, however seeks internal credit generation to allow for more operational flexibility at the plant, as it relies on chemicals for phosphorus removal, and chemical costs have been increasing in an inflationary market. Considering these factors, and operator input, it is recommended that Grassland pursue the practices outlined in the previous sections This is a robust solution that provides low cost on a per pound removed basis and eliminates operational burdens. This strategy will provide an easy transition for operations staff. In addition, filter strips are a recommended best practice by USDA and will have ongoing positive effects on the health of the soil and nearby waterways. For design standards relating to filter strips and conservation cover, see **Appendix H. Figure 4** shows the planned BMPs and **Table 11** summarizes the costs associated with implementation and maintenance of the plan.

Table 11 – Recommended Plan Cost Summary

BMP	Field	Total Initial Cost	Annual Maintenance Cost[1]	20-Year Net Present Worth[2]	Total Annualized Cost[2]	Tradeable PTP (lbs/yr)	Cost Per lb PTP ($/lb/yr)
Filter Strips	101A	$45,000	$4,500	$89,000	$9,100	78	$116
Filter Strips	104A	$42,000	$4,500	$86,000	$8,800	58	$151
Filter Strips	104B	$54,000	$4,600	$99,000	$10,200	56	$181
Filter Strips	104C	$36,000	$4,400	$79,000	$8,100	23	$358
Conservation Cover	101B	$40,000	$4,200	$81,000	$8,300	13	$641
Conservation Cover	101D	$34,000	$4,100	$74,000	$7,600	4	$1,837
Conservation Cover	101F	$56,000	$4,500	$100,000	$10,300	11	$914
Total		**$307,000**	**$30,800**	**$608,000**	**$62,400**	**244**	**$256**

1.Includes any estimated lost revenue
2. Assumes 8% Annual Interest Rate over 20 years

6 Management Plan

6.1 Implementation Schedule

Figure 5 is an excerpt from WDNR's Water Quality Trading Guidance document and provides an example timeline and process flow diagram for the permittee as credit user and WDNR staff. The anticipated implementation schedule for this project outlined below:

Submit Water Quality Trading Plan	December 31st, 2024
WDNR Approval of WQT Plan (90-Day Review)	March 31st, 2025

Initiate Recommended Upgrades	May 1st, 2025
WQT Practice Registration	September 1st, 2025
WPDES Permit Modification to Incorporate WQT	December 1st , 2025

6.2 Filter Strip Design, Approval, and Construction

WDNR requires documentation and completion of applicable forms for ultimate approval. The WQT Checklist (Form 3400-208) must be submitted with this WQT Plan. A Management Practice Registration (Form 3400-207) must be submitted to verify the management practice has been properly installed. Both forms have been included in **Appendix I.** A summary of forms required by WDNR throughout the WQT process is provided in **Figure 6.**

Agricultural technical standards used in Wisconsin are maintained by the USDA-Natural Resource Conservation Service (NRCS) and can be found in the Wisconsin Electronic Field Office Technical Guide (eFOTG). Major design, installation, and check-out deliverables for conversion to permanent grassland (conservation cover) and filter strips are outlined in NRCS's Statement of Work documents (Codes 327 and 393), see **Appendix H.**

General conservation cover and filter strip design should follow standards outlined in Wisconsin Agronomy Technical Notes 5,6 and 10 as well as relevant NRCS Conservation Practice Standards (Codes 327 and 393), refer to **Appendix H.**

6.3 Operation and Maintenance

Operation and Maintenance of agricultural fields is managed by Four-Star Dairy. Grassland communicates regularly with Four-Star to ensure that cropping, tilling, and nutrient application practices adhere to this plan and best management practices for reducing the Phosphorus Index (PI) in the fields and they will continue to do so in the future. Recommended management and maintenance practices for filter strip and conservation cover can be found in **Appendix H.**

Grassland plans to maintain the filter strips through regular mowing and harvesting of plant material to ensure that the phosphorus uptaken by this BMP is removed. Cut height and frequency will be determined based on the seed mix chosen and conditions observed over time in the field. Generally, plant material will only be cut and harvested during the prescribed periods in the standards found in **Appendix H.**

6.4 Inspections and Reporting

On a monthly basis, Grassland Dairy will inspect the buffer strips in Fields 101A and 104A,B,C and conservation cover in Field 101B,D,F to confirm that the anticipated management practices are still in place and operating as intended. These inspections will include field notes and any photos taken. These inspections will be used to supplement the annual inspections described later. As a part of this monthly inspection, Grassland shall also certify that the buffer strips and permanent grassland (conservation cover) installed to generate credits are being operated and maintained in a manner consistent with this plan or will note noncompliance. This certification will be made as a comment on the monthly discharge monitoring report (DMR). Usage and reporting of phosphorus credits will also be submitted on the DMRs.

Once per year, Grassland will inspect the buffer strips, and the conservation cover in the corresponding fields to confirm implementation and management practices are in accordance

with this plan. This annual inspection shall occur between the months of May and September each year and shall include at least two photographs of each field; one overall site photo, and one close-up photo of a representative area of the field.

Grassland also will notify the WDNR verbally within 24 hours of becoming aware that phosphorus reduction credits used or intended for use by Grassland are not being implemented or generated as set forth in this plan. Additionally, within five (5) days of becoming aware of noncompliance, written notification will be provided to WDNR. Both notifications will include the nature of the noncompliance, a description of how the issues will be addressed, and an appropriate timeline to address the issues.

On or before a date set in the amended permit, Grassland shall report to WDNR once per year:

- The number of credits used each month of the previous year.
- Photos from the annual inspection and monthly inspections of the buffer strips and conservation cover that have generated the credits.
- Identification of noncompliance or failure to implement any terms or conditions of the permit with respect to the water quality trade that have not been reported in the DMRs.

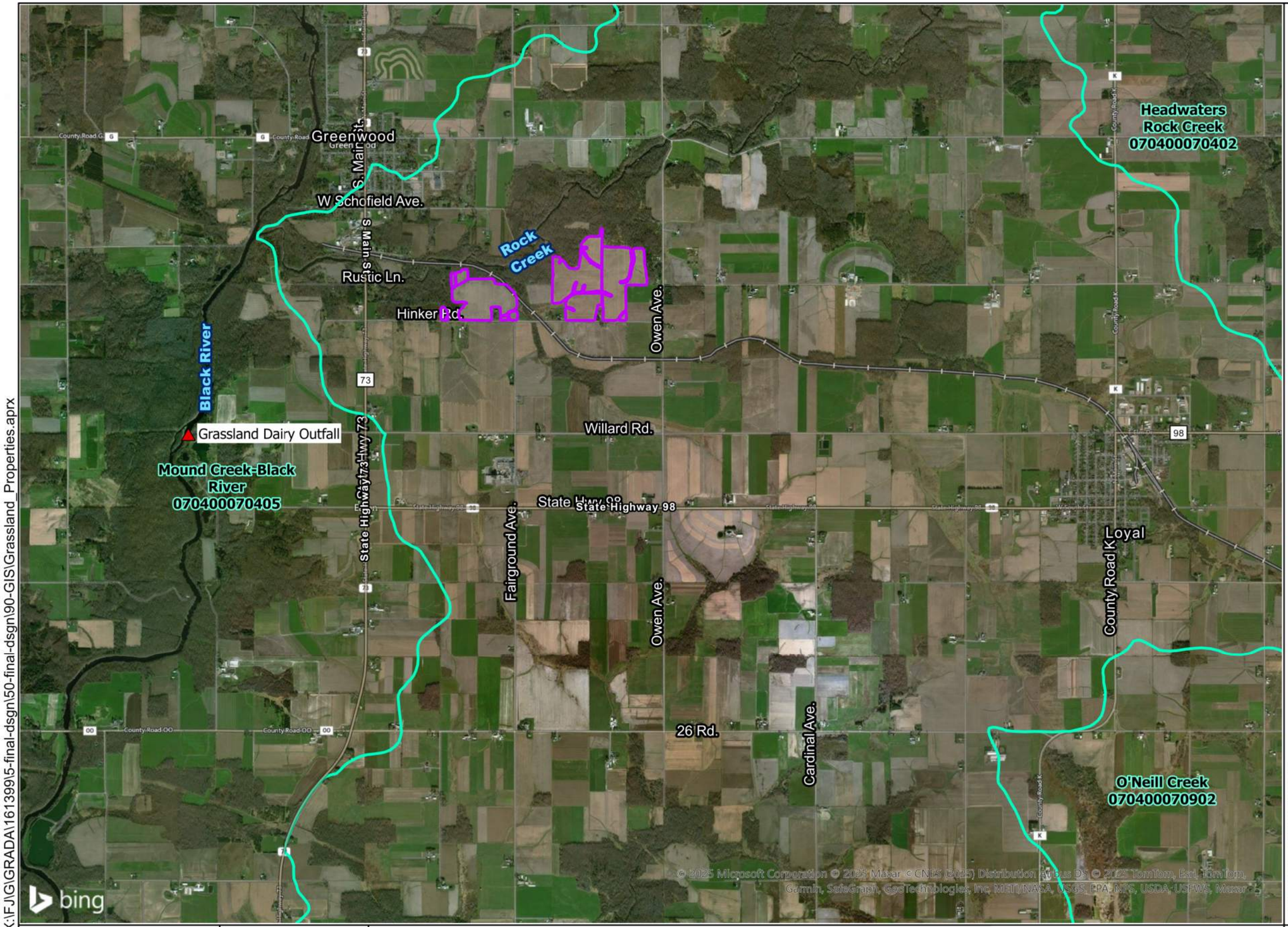
WDNR also has the right to inspect the field and management practices at any time upon giving reasonable notice to Grassland to ensure the practices are in compliance with technical standards and the terms of this plan.

SP/hbh

Figures

Figure 1 – Potential Parcels
Figure 2 – Effluent TP
Figure 3 – Fields Selected for WQT
Figure 4 – BMPs for WQT
Figure 5 – DNR WQT Development and Implementation Timeline
Figure 6 – WDNR Required Forms

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Legend

- Hydrologic_Units_-_12_digit_(Subwatersheds)
- Fields Selected for WQT
- GRADA_Outfall

N
W E
S

0 1,500 3,000
Feet

Source:
Clark County, and WIDNR.
Projection:
Clark County Coordinates, Feet
Map by:
bjk

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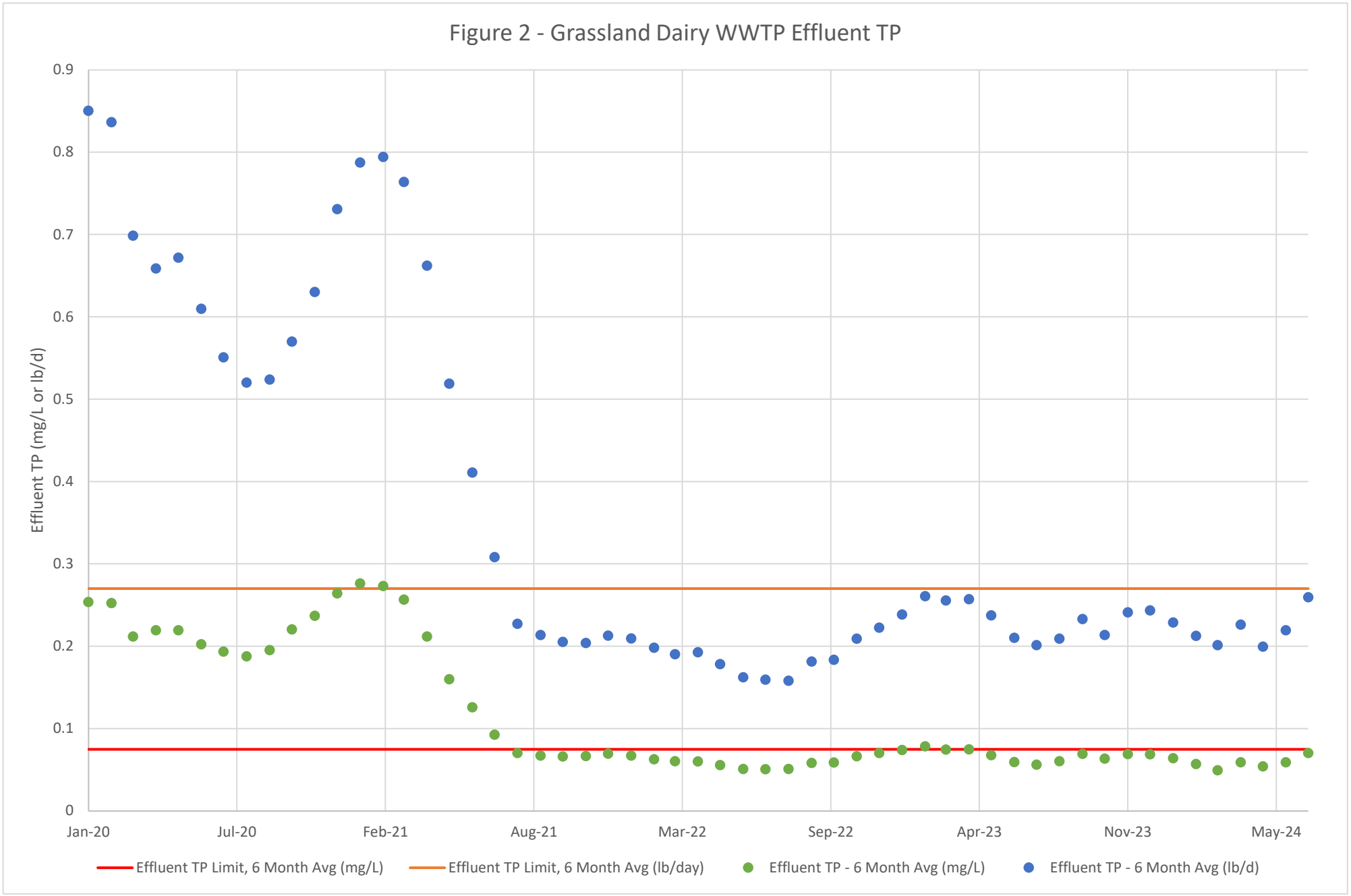
DATE: 11/14/2024

GRASSLAND DAIRY PRODUCTS, INC.
WATER QUALITY TRADING PLAN
Greenwood, Wisconsin

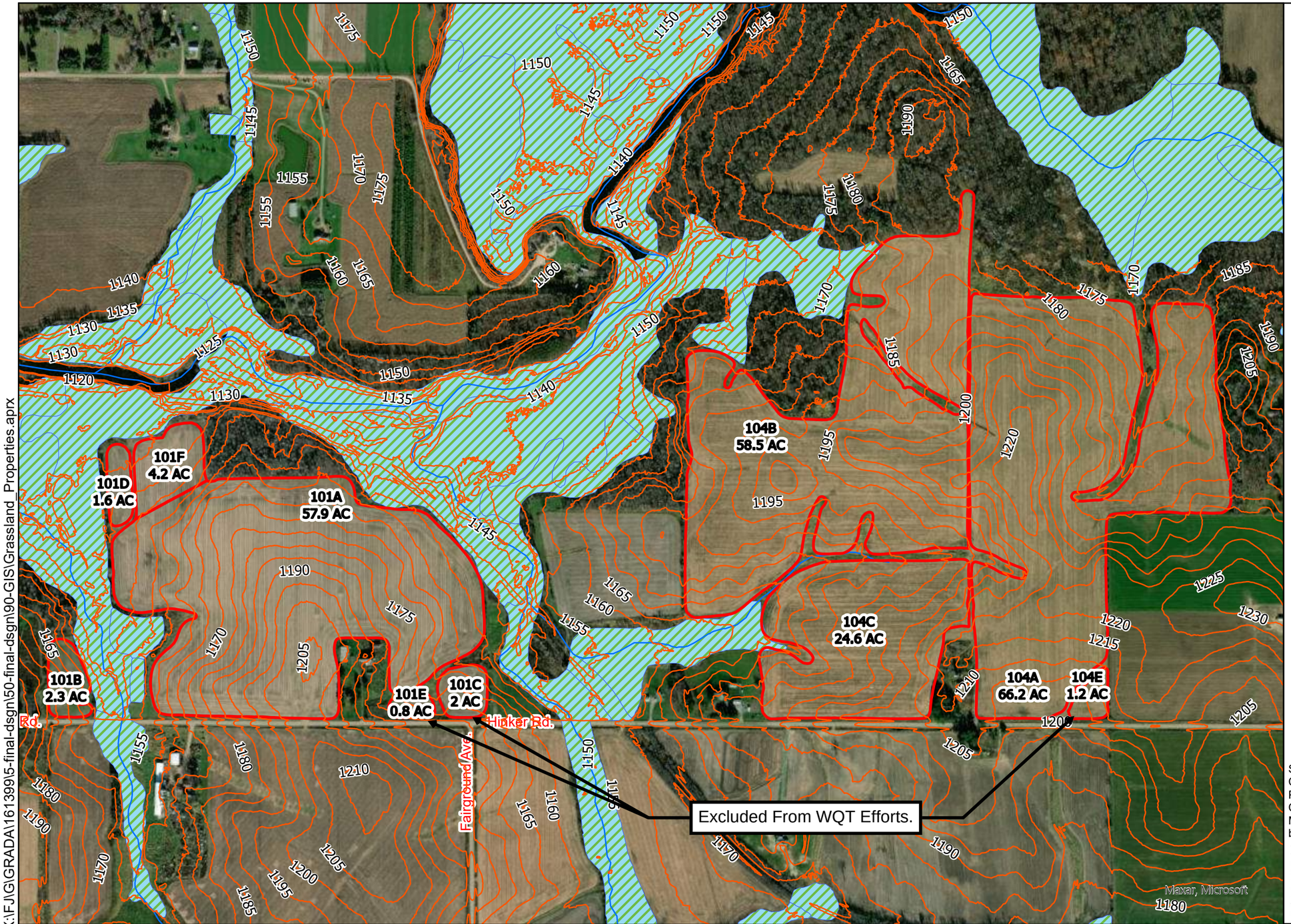
Potential Parcels for WQT

Figure 1

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Figure 2 - Grassland Dairy WWTP Effluent TP
Effluent TP (mg/L or lb/d)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Jan-20
Jul-20
Feb-21
Aug-21
Mar-22
Sep-22
Apr-23
Nov-23
May-24
Effluent TP Limit, 6 Month Avg (mg/L)
Effluent TP Limit, 6 Month Avg (lb/day)
Effluent TP - 6 Month Avg (mg/L)
Effluent TP - 6 Month Avg (lb/d)

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Legend

- 5-FT Contours
- Fields Selected for WQT
- Streams
- HUC-12 Subwatershed
- Grassland Dairy Plant
- WWI Wetlands

KEY NOTE:
All subfields of Field 101 & 104 are shown in the figure. Subfields 101C, 101E, and 104E have been excluded from Water Quality Trading Efforts.

N
W E
S

0 400 700 Feet

Source:
Clark County, and WIDNR.
Projection:
Clark County Coordinates, Feet
Map by:
bjk

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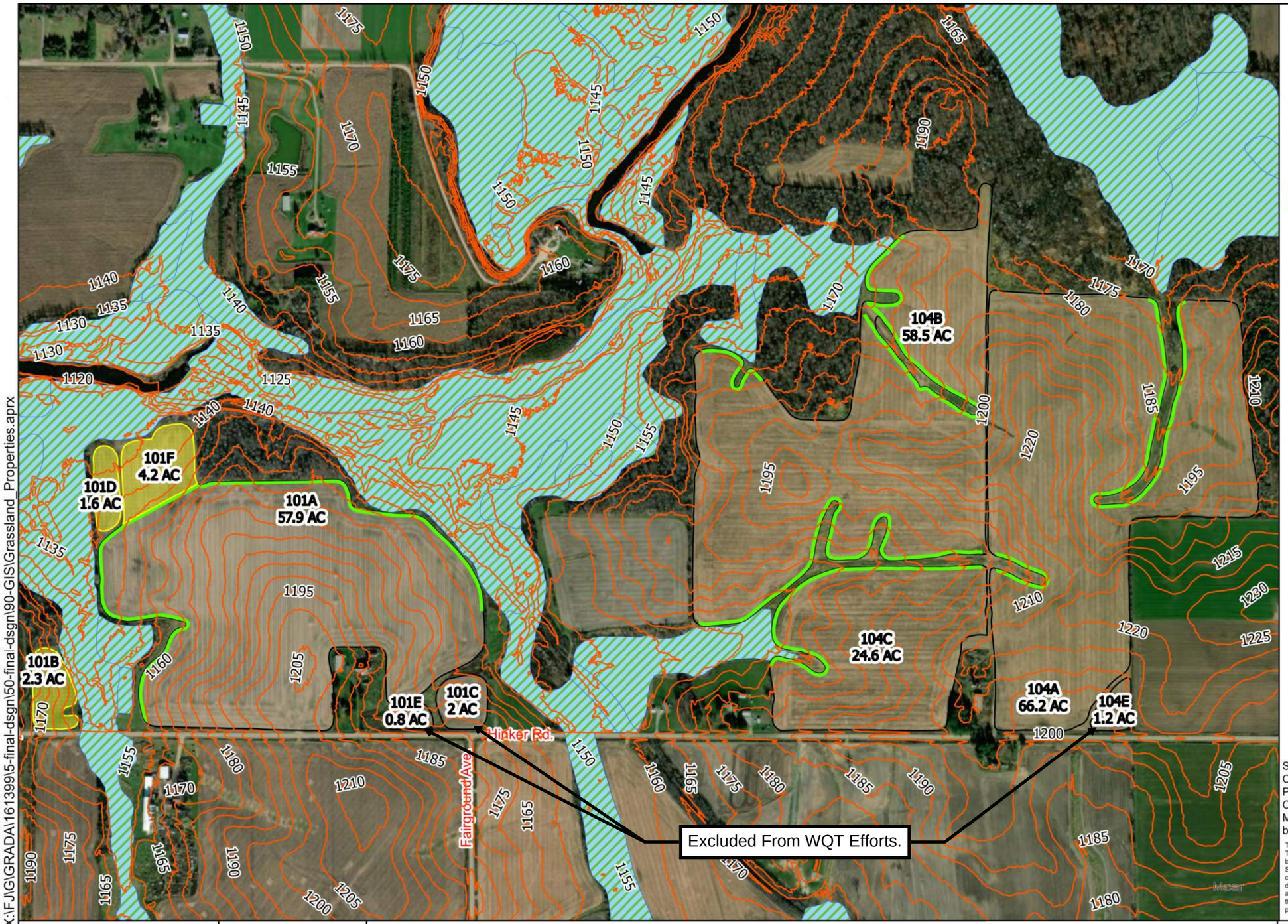
DATE: 11/14/2024

GRASSLAND DAIRY PRODUCTS, INC.
WATER QUALITY TRADING PLAN
Greenwood, Wisconsin

Fields Selected For WQT

Figure 3

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Legend

- 5-FT Contours
- Field 101 Prairie Conversion Areas
- Fields 101 and 104 - Prelim. Filter Strips
- Fields Selected for WQT
- HUC-12 Subwatershed
- WWI Wetlands

KEY NOTE:
All subfields of Field 101 & 104 are shown in the figure. Subfields 101C, 101E, and 104E have been excluded from Water Quality Trading Efforts.

N
W E
S

0 400 900 Feet

Source:
Clark County, and WIDNR.
Projection:
Clark County Coordinates, Feet
Map by:
bjk

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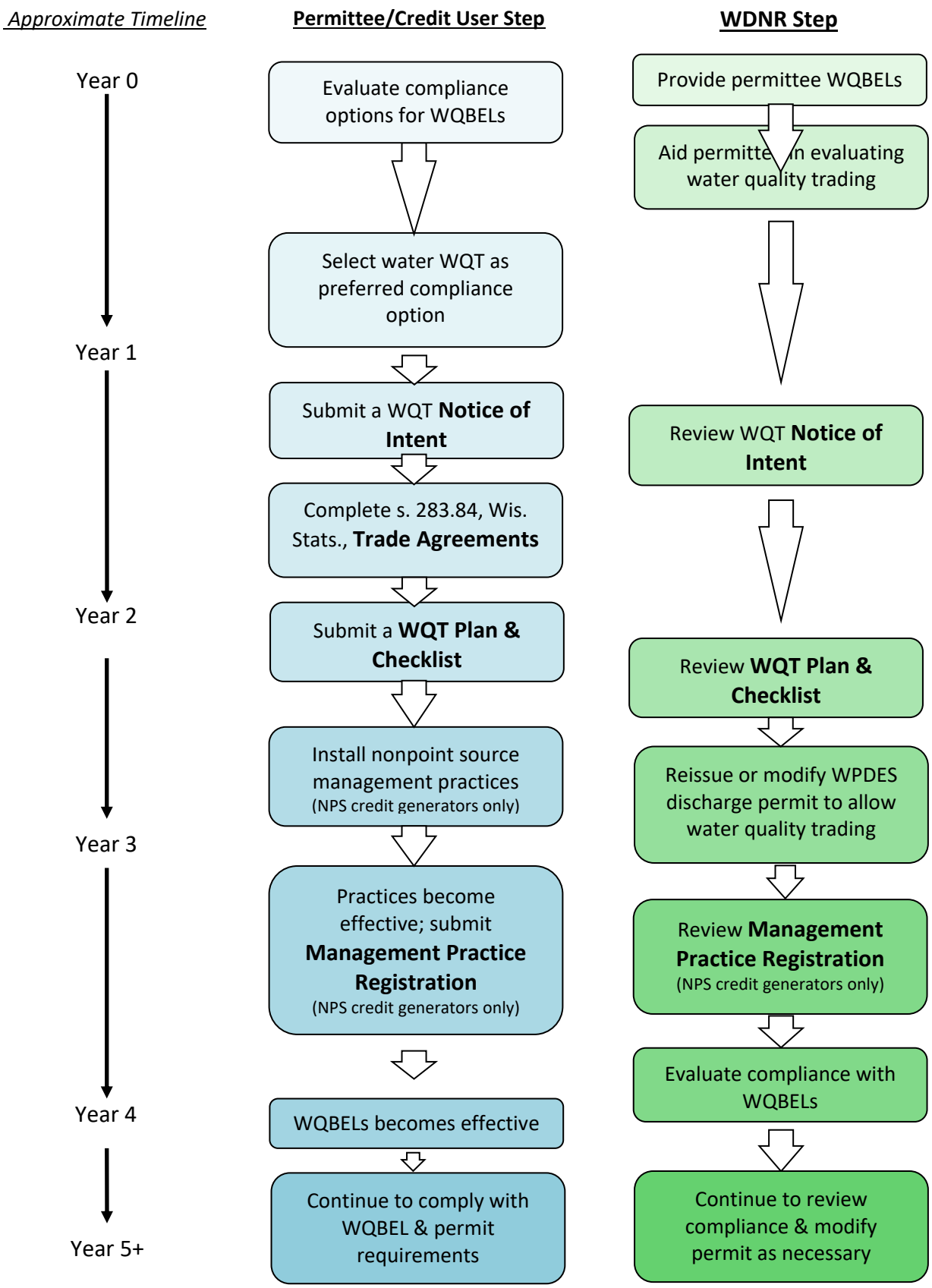
DATE: 11/14/2024

GRASSLAND DAIRY PRODUCTS, INC.
WATER QUALITY TRADING PLAN
Greenwood, Wisconsin

BMPs for WQT

Figure 4

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Approximate Timeline
Permittee/Credit User Step
WDNR Step
Year 0
Year 1
Year 2
Year 3
Year 4
Year 5+
Evaluate compliance options for WQBELs
Select water WQT as preferred compliance option
Submit a WQT Notice of Intent
Complete s. 283.84, Wis. Stats., Trade Agreements
Submit a WQT Plan & Checklist
Install nonpoint source management practices (NPS credit generators only)
Practices become effective; submit Management Practice Registration (NPS credit generators only)
WQBELs becomes effective
Continue to comply with WQBEL & permit requirements
Provide permittee WQBELs
Aid permittee in evaluating water quality trading
Review WQT Notice of Intent
Review WQT Plan & Checklist
Reissue or modify WPDES discharge permit to allow water quality trading
Review Management Practice Registration (NPS credit generators only)
Evaluate compliance with WQBELs
Continue to review compliance & modify permit as necessary

Trading Document	Purpose	Parties Involved
Notice of Intent Form #: 3400-206	• Credit user submits to WDNR for review and approval • Allows permittee to confirm trading eligibility prior to plan development • Typically submitted no later than the preliminary facility plan step of the compliance schedule for TP WQBELs or at least 24 months prior to permit expiration[2]	• Permittee/credit user • WDNR wastewater engineer/local trading coordinator
Trade Agreement	• Document required of permittee/credit user by s. 283.84, Wis. Stats. to formalize the trade • Typically completed prior to submittal of the WQT plan or at least 9 months prior to permit expiration[2]	• Permittee/credit user • Credit generator • WDNR or local governmental unit (if applicable)
WQT Checklist & Plan Form #: 3400-208	• Credit user submits to WDNR for review and approval • Documents will be public noticed with permit reissuance • Outlines the content of the WQT strategy • Typically submitted with the final facility plan step of the compliance schedule or with the permit application for reissuance at least 6 months prior to permit reissuance[2]	• Permittee/credit user • WDNR basin engineer/local trading coordinator • Statewide trading coordinator, if necessary
Management Practice Registration[1] Form #: 3400-207	• Submitted to WDNR to verify that the management practice has been properly installed in accordance with the WQT plan, or, if a management practice is adopted prior to submittal of trading plan, to document intent to be used within a trading plan • WDNR reviews and tracks registration using docket numbering system • Information can be reviewed later for trade verification and auditing	• Permittee/credit user • WDNR wastewater engineer/local trading coordinator • Statewide trading coordinator, if necessary
Annual Report Summary[1]	• Submitted to WDNR to verify management practices identified in the WQT plan are maintained • Informs WDNR of any changes made to the Trade Agreement or WQT plan • WDNR reviews, tracks, and modifies permit as necessary	• Permittee/credit user • WDNR wastewater engineer/local trading coordinator • Statewide trading coordinator
Notice of Termination[1] Form #: 3400-209	• Submitted to WDNR prior to practice termination or as soon as the permittee becomes aware of the failure of a practice • Should be submitted no later than the annual report submittal date	• Permittee/credit user • WDNR wastewater engineer/local trading coordinator

[1]-Only required if the credit generator is a nonpoint source.

[2]- Assumes that the permit contains a compliance schedule that is consistent with the P implementation guidance and is longer than five years.

Appendix A

Current WPDES Permit

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WPDES PERMIT

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

Grassland Dairy Products Inc

is permitted, under the authority of Chapter 283, Wisconsin Statutes, to discharge from a facility located at

N8790 Fairground Ave, Greenwood, WI 54437

to

the Black River and the groundwaters of the Cawley and Rock Creeks Watershed of the Black-Buffalo-Trempealeau River Basin in Clark County

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit, according to Chapter NR 200, Wis. Adm. Code, at least 180 days prior to the expiration date given below.

State of Wisconsin Department of Natural Resources
For the Secretary

By _____ for
Geisa Thielen
Wastewater Field Supervisor

08/29/2024
Date Permit Signed/Issued

PERMIT TERM: EFFECTIVE DATE – September 01, 2024 **EXPIRATION DATE – June 30, 2029**

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6 SUMMARY OF REPORTS DUE **24**

1 Influent Requirements

1.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
701	Representative influent samples shall be collected prior to the equalization tanks.

1.2 Monitoring Requirements

The permittee shall comply with the following monitoring requirements.

1.2.1 Sampling Point 701 - PRIOR TO EQ TANKS

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
BOD_5, Total		mg/L	Daily	24-Hr Comp	

2 Surface Water Requirements

2.1 Sampling Point(s)

The discharge(s) shall be limited to the waste type(s) designated for the listed sampling point(s).

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
002	Representative effluent samples (other than those for E. coli) shall be collected prior to discharge to the Grassland forcemain discharge pipe to the Black River. Representative grab samples for E. coli analysis shall be collected after UV disinfection. Discharge is limited to sanitary wastewater, process wastewater, boiler blowdown, condensate of whey (COW) water, noncontact cooling water (NCCW) and cooling tower blowdown.

2.2 Monitoring Requirements and Effluent Limitations

The permittee shall comply with the following monitoring requirements and limitations.

2.2.1 Sampling Point (Outfall) 002 - EFFLUENT TO BLACK RIVER

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
BOD_5, Total		mg/L	Daily	24-Hr Flow Prop Comp	
BOD_5, Total	Daily Max	82.6 lbs/day	Daily	Calculated	
BOD_5, Total	Monthly Avg	82.6 lbs/day	Daily	Calculated	
Suspended Solids, Total	Daily Max	378.3 lbs/day	Daily	Calculated	
Suspended Solids, Total	Monthly Avg	186.6 lbs/day	Daily	Calculated	
Phosphorus, Total	Monthly Avg	0.225 mg/L	2/Week	24-Hr Flow Prop Comp	
Phosphorus, Total	6-Month Avg	0.075 mg/L	2/Week	24-Hr Flow Prop Comp	
Phosphorus, Total	6-Month Avg	0.27 lbs/day	2/Week	Calculated	
pH Field	Daily Min	6.0 su	Daily	Grab	
pH Field	Daily Max	9.0 su	Daily	Grab	
Dissolved Oxygen	Daily Min	7.0 mg/L	5/Week	Grab	Monitoring required at permit effective date. Limit effective 10/01/2026. See comp schedule for info.
E. coli	Geometric Mean - Monthly	126 #/100 ml	Weekly	Grab	Limit & monitoring effective May - Sept

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
E. coli	% Exceedance	10 Percent	Monthly	Calculated	Limit & monitoring effective May - Sept. See the E. coli Percent Limit section below. Enter the result in the DMR on the last day of the month.
Nitrogen, Ammonia Variable Limit		mg/L	2/Week	24-Hr Flow Prop Comp	Limit varies with effluent pH. See ammonia limit section below for more info.
Nitrogen, Ammonia (NH_3-N) Total	Daily Max - Variable	mg/L	2/Week	24-Hr Flow Prop Comp	
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	56 mg/L	2/Week	24-Hr Flow Prop Comp	Limit applies May - Oct
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	27 mg/L	2/Week	24-Hr Flow Prop Comp	Limit applies Nov - April
Chloride		mg/L	Quarterly	24-Hr Flow Prop Comp	Collect chloride sample at the same time as sample for WET testing.
Temperature Maximum	Weekly Avg	deg F	3/Week	Grab	See temp section below for limits that vary monthly
Nitrogen, Total Kjeldahl		mg/L	Quarterly	24-Hr Flow Prop Comp	See Nitrogen Series Monitoring section below for more info.
Nitrogen, Nitrite + Nitrate Total		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Total		mg/L	Quarterly	Calculated	
Acute WET		TU_a	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET testing section below for more info.
Chronic WET	Monthly Avg	3.4 TU_c	Quarterly	24-Hr Flow Prop Comp	

2.2.1.1 *E. coli* Percent Limit

No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 #/100 ml. Bacteria samples may be collected more frequently than required. All samples shall be reported on the monthly discharge monitoring reports (DMRs). The following calculation should be used to calculate percent exceedances.

$$\frac{\#\ of\ Samples\ greater\ than\ 410\ \#/100}{Total\ \#\ of\ samples} \times 100 = \%\ Exceedance$$

2.2.1.2 Variable Daily Maximum Ammonia Limits

The daily maximum (acute) ammonia limit is based on effluent pH at the time of discharge. The table of daily maximum ammonia limitations corresponding to various effluent pH values is presented below. Ammonia nitrogen sampling shall occur on a day when pH monitoring is performed. Report the ammonia discharge concentration and

applicable variable limit from the table below on the eDMR in the Total Ammonia column and Ammonia Variable Limit column, respectively.

Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L	Effluent pH s.u.	Limit mg/L
6.0 ≤ pH ≤ 6.1	108	7.0 < pH ≤ 7.1	66	8.0 < pH ≤ 8.1	14
6.1 < pH ≤ 6.2	106	7.1 < pH ≤ 7.2	59	8.1 < pH ≤ 8.2	11
6.2 < pH ≤ 6.3	104	7.2 < pH ≤ 7.3	52	8.2 < pH ≤ 8.3	9.4
6.3 < pH ≤ 6.4	101	7.3 < pH ≤ 7.4	46	8.3 < pH ≤ 8.4	7.8
6.4 < pH ≤ 6.5	98	7.4 < pH ≤ 7.5	40	8.4 < pH ≤ 8.5	6.4
6.5 < pH ≤ 6.6	94	7.5 < pH ≤ 7.6	34	8.5 < pH ≤ 8.6	5.3
6.6 < pH ≤ 6.7	89	7.6 < pH ≤ 7.7	29	8.6 < pH ≤ 8.7	4.4
6.7 < pH ≤ 6.8	84	7.7 < pH ≤ 7.8	24	8.7 < pH ≤ 8.8	3.7
6.8 < pH ≤ 6.9	78	7.8 < pH ≤ 7.9	20	8.8 < pH ≤ 8.9	3.1
6.9 < pH ≤ 7.0	72	7.9 < pH ≤ 8.0	17	8.9 < pH ≤ 9.0	2.6

2.2.1.3 Effluent Temperature Monitoring & Limitations

For manually measuring effluent temperature, grab samples should be collected at 6 evenly spaced intervals during the 24-hour period. Alternative sampling intervals may be approved if the permittee can show that the maximum effluent temperature is captured during the sampling interval. For monitoring temperature continuously, collect measurements in accordance with s. NR 218.04(13). This means that discrete measurements shall be recorded at intervals of not more than 15 minutes during the 24-hour period. In either case, report the maximum temperature measured during the day on the DMR. For seasonal discharges collect measurements either manually or continuously during the period of operation and report the daily maximum effluent temperature on the DMR.

The following temperature limitations that vary monthly apply:

Month	Weekly Average Temperature Maximum Limit
January	80 deg F
February	81 deg F
March	81 deg F
April	70 deg F
May	80 deg F
June – Sept no limit applies but monitoring is required	deg F
October	85 deg F
November	69 deg F
December	76 deg F

2.2.1.4 Nitrogen Series Monitoring

Monitoring for Total Kjeldahl Nitrogen (TKN), Nitrite + Nitrate Nitrogen, and Total Nitrogen shall be conducted quarterly. Total Nitrogen shall be calculated as the sum of reported values for Total Kjeldahl Nitrogen and Total Nitrite + Nitrate Nitrogen. Monitoring shall be performed during normal operating conditions. Permittees are not allowed to turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during testing.

2.2.1.5 Whole Effluent Toxicity (WET) Testing

Primary Control Water: the Black River

Instream Waste Concentration (IWC): 29%

Dilution series: At least five effluent concentrations and dual controls must be included in each test.

- **Acute:** 100, 50, 25, 12.5, 6.25% and any additional selected by the permittee.
- **Chronic:** 100, 30, 10, 3, 1% (if the IWC $\leq$30%) and any additional selected by the permittee.

WET Testing Frequency:

Acute tests are required during the following quarters:

- 4th quarter (Oct – Dec) 2024
- 2nd quarter (April – June) 2025
- 1st quarter (Jan – March) 2026
- 3rd quarter (July – Sept) 2027
- 4th quarter (Oct – Dec) 2028

Acute WET testing shall continue after the permit expiration date (until the permit is reissued) in accordance with the WET requirements specified for the last full calendar year of this permit. For example, the next test would be required in 4th quarter (Oct – Dec) 2029.

Chronic tests are required quarterly. Quarterly chronic WET testing shall continue after the permit expiration date (until the permit is reissued).

Testing: WET testing shall be performed during normal operating conditions. Permittees are not allowed to turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during WET tests.

Reporting: The permittee shall report test results on the Discharge Monitoring Report form, and also complete the "Whole Effluent Toxicity Test Report Form" (Section 6, "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*"), for each test. The original, complete, signed version of the Whole Effluent Toxicity Test Report Form shall be sent to the Biomonitoring Coordinator, Bureau of Water Quality, 101 S. Webster St., P.O. Box 7921, Madison, WI 53707-7921, within 45 days of test completion. The Discharge Monitoring Report (DMR) form shall be submitted electronically by the required deadline.

Determination of Positive Results: An acute toxicity test shall be considered positive if the Toxic Unit - Acute (TU_a) is greater than 1.0 for either species. The TU_a shall be calculated as follows: $TU_a = 100 \div LC_{50}$. A chronic toxicity test shall be considered positive if the Toxic Unit - Chronic (TU_c) is greater than 3.4 for either species. The TU_c shall be calculated as follows: $TU_c = 100 \div IC_{25}$.

Additional Testing Requirements: Within 90 days of a test which showed positive results, the permittee shall submit the results of at least 2 retests to the Biomonitoring Coordinator on "Whole Effluent Toxicity Test Report Forms". The 90-day reporting period shall begin the day after the test which showed a positive result. The retests shall be completed using the same species and test methods specified for the original test (see the Standard Requirements section herein).

3 Land Application Requirements

3.1 Sampling Point(s)

The discharge(s) shall be limited to land application of the waste type(s) designated for the listed sampling point(s) on Department approved land spreading sites or by hauling to another facility.

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
003	Representative sludge samples shall be collected monthly during those months that sludge is land applied. Discharge is limited to landspreading of industrial sludge generated during aerobic & anaerobic treatment on Department approved sites.
005	Representative samples shall be collected monthly during those months that liquid industrial waste is land applied. Discharge is limited to landspreading of liquid industrial waste (milk & milk by-product and high strength washwater) on Department approved sites.
006	Representative samples of cake sludge from the waste activated sludge (WAS) shall be collected monthly during those months that cake sludge is land applied. Discharge is limited to landspreading of industrial cake sludge on Department approved sites.
007	Representative samples shall be collected monthly during those months that liquid industrial waste is land applied. Discharge is limited to landspreading of liquid industrial waste (antibiotic milk) on Department approved sites.

3.2 Monitoring Requirements and Limitations

The permittee shall comply with the following monitoring requirements and limitations.

3.2.1 Sampling Point (Outfall) 003 - LIQUID SLUDGE

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Monthly	Grab	
Nitrogen, Total Kjeldahl		Percent	Monthly	Grab	
Nitrogen, Ammonium (NH_4-N) Total		Percent	Monthly	Grab	
Chloride		mg/L	Monthly	Grab	
pH Field		su	Monthly	Grab	
Phosphorus, Total		Percent	Monthly	Grab	
Phosphorus, Water Extractable		% of Tot P	Monthly	Grab	
Potassium, Total Recoverable		Percent	Monthly	Grab	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
PFOA + PFOS		µg/kg	Annual	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.
PFAS Dry Wt			Annual	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

Daily Log – Monitoring Requirements and Limitations

All discharge and monitoring activity shall be documented on log sheets. Originals of the log sheets shall be kept by the permittee as described under "Records Retention" in the Standard Requirements section, and if requested, made available to the Department.

Parameters	**Limit**	**Units**	**Sample Frequency**	**Sample Type**
DNR Site Number(s)	-	Number	Daily	Log
Acres Applied	-	Acres	Daily	Log
Application Rate	-	Gal/Acre/Day	Daily	Calculated

Annual Report – Summary of Monitoring Requirements and Limitations

The Annual Report is due by January 31st of each year for the previous calendar year. See the 'Annual Land Application Report' subsection in Standard Requirements.

Parameters	**Limit**	**Units**	**Reporting Frequency**	**Sample Type**
DNR Site Number(s)	-	Number	-	-
Acres Land Applied	-	Acres	Annual	-
Total Volume Per Site	-	Gallons	Annual	Total Annual
Total Kjeldahl Nitrogen per Site	165, or alternate approved in writing	Pounds/Acre/Year	Annual	Calculated
Total Chloride per Site	340	Pounds/Acre per 2 Years	Annual	Calculated

3.2.1.1 Annual Site Nitrogen Loading

For details on nitrogen loading requirements, including approval of an alternate nitrogen pounds/acre/year site loading, see the "Nitrogen Requirements for Liquid Wastes, By-Product Solids and Sludges" paragraph in the Standard Requirements section of this permit.

3.2.1.2 Biennial Site Chloride Loading

For details on chloride requirements see the "Chloride Requirements for Liquid Wastes and By-Product Solids" paragraph in the Standard Requirements section of this permit.

3.2.2 Sampling Point (Outfall) 005 - LIQUID INDUSTRIAL WASTEWATER and 007-REJECTED MILK

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Nitrogen, Total Kjeldahl		mg/L	Monthly	Grab	
Nitrogen, Ammonia (NH_3-N) Total		mg/L	Monthly	Grab	
Chloride		mg/L	Monthly	Grab	
pH Field		su	Annual	Grab	
Phosphorus, Total		mg/L	Annual	Grab	
Phosphorus, Water Extractable		% of Tot P	Annual	Grab	
Potassium, Total Recoverable		mg/L	Annual	Grab	
BOD_5, Total		mg/L	Annual	Grab	

Daily Log – Monitoring Requirements and Limitations

All discharge and monitoring activity shall be documented on log sheets. Originals of the log sheets shall be kept by the permittee as described under "Records Retention" in the Standard Requirements section, and if requested, made available to the Department.

Parameters	**Limit**	**Units**	**Sample Frequency**	**Sample Type**
DNR Site Number(s)	-	Number	Daily	Log
Acres Applied	-	Acres	Daily	Log
Frozen Site Maximum Daily Loading Volume	6,800	Gal/Acre/Day	Daily	Calculated
Unfrozen Site Maximum Daily Loading Volume	13,500	Gal/Acre/Day	Daily	Calculated
Weekly Loading Volume	See NR 214 - Tbl 3	Inches/Week	Weekly	Calculated

Annual Report – Summary of Monitoring Requirements and Limitations The Annual Report is due by January 31st of each year for the previous calendar year. See the 'Annual Land Application Report' subsection in Standard Requirements.				
Parameters	**Limit**	**Units**	**Reporting Frequency**	**Sample Type**
DNR Site Number(s)	-	Number	-	-
Acres Land Applied	-	Acres	Annual	-
Total Volume Per Site	-	Gallons	Annual	Total Annual
Total Kjeldahl Nitrogen per Site	165, or alternate approved in writing	Pounds/Acre/Year	Annual	Calculated
Total Chloride per Site	340	Pounds/Acre per 2 Years	Annual	Calculated

3.2.2.1 Annual Site Nitrogen Loading

For details on nitrogen loading requirements, including approval of an alternate nitrogen pounds/acre/year site loading, see the "Nitrogen Requirements for Liquid Wastes, By-Product Solids and Sludges" paragraph in the Standard Requirements section of this permit.

3.2.2.2 Biennial Site Chloride Loading

For details on chloride requirements see the "Chloride Requirements for Liquid Wastes and By-Product Solids" paragraph in the Standard Requirements section of this permit.

3.2.3 Sampling Point (Outfall) 006 - CAKE SLUDGE

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Monthly	Grab	
Nitrogen, Total Kjeldahl		Percent	Monthly	Grab	
Nitrogen, Ammonium (NH_4-N) Total		mg/kg	Monthly	Grab	
Chloride		Percent	Monthly	Grab	
pH Field		su	Monthly	Grab	
Phosphorus, Total		Percent	Monthly	Grab	
Phosphorus, Water Extractable		% of Tot P	Monthly	Grab	
Potassium, Total Recoverable		mg/kg	Monthly	Grab	
PFOA + PFOS		µg/kg	Annual	Calculated	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
PFAS Dry Wt			Annual	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

Daily Log – Monitoring Requirements and Limitations

All discharge and monitoring activity shall be documented on log sheets. Originals of the log sheets shall be kept by the permittee as described under "Records Retention" in the Standard Requirements section, and if requested, made available to the Department.

Parameters	Limit	Units	Sample Frequency	Sample Type
DNR Site Number(s)	-	Number	Daily	Log
Acres Applied	-	Acres	Daily	Log
Application Rate	-	Tons/Acre/Day	Daily	Calculated

Annual Report – Summary of Monitoring Requirements and Limitations

The Annual Report is due by January 31st of each year for the previous calendar year. See the 'Annual Land Application Report' subsection in Standard Requirements.

Parameters	Limit	Units	Reporting Frequency	Sample Type
DNR Site Number(s)	-	Number	-	-
Acres Land Applied	-	Acres	Annual	-
Total Amount Per Site	-	Tons	Annual	Total Annual
Total Kjeldahl Nitrogen per Site	165, or alternate approved in writing	Pounds/Acre/Year	Annual	Calculated
Total Chloride per Site	340	Pounds/Acre per 2 Years	Annual	Calculated

3.2.3.1 Annual Site Nitrogen Loading

For details on nitrogen loading requirements, including approval of an alternate nitrogen pounds/acre/year site loading, see the "Nitrogen Requirements for Liquid Wastes, By-Product Solids and Sludges" paragraph in the Standard Requirements section of this permit.

3.2.3.2 Biennial Site Chloride Loading

For details on chloride requirements see the "Chloride Requirements for Liquid Wastes and By-Product Solids" paragraph in the Standard Requirements section of this permit.

3.2.3.3 Sludge Monitoring for PFAS

Sampling shall occur for perfluoroalkyl and polyfluoroalkyl compounds (PFAS) listed in the table below and as indicated in sampling point sections above. Monitoring shall occur at each sample point when sludge is generated regardless of the end use (i.e. land applied, hauled to another facility, landfilled).

PERFLUOROALKYLCARBOXILIC Acids (PFCAs)	
PFBA	Perfluorobutanoic acid
PFPeA	Perfluroropentanoic acid
PFHxA	Perfluorohexanoic acid
PFHpA	Perfluoroheptanoic acid
PFOA	Perfluorooctanoic acid
PFNA	Perfluorononanoic acid
PFDA	Perfluorodecanoic acid
PFUnA	Perfluroroundecanoic acid
PFDoA	Perfluorododecanoic acid
PFTriA	Perfluorotridecanoic acid
PFTeDA	Perfluorotetradecanoic acid
PERFLUOROALKYLSULFONIC Acids (PFSAs)	
PFBS	Perfluorobutane sulfonic acid
PFPeS	Perfluroropentane sulfonic acid
PFHxS	Perfluorohexane sulfonic acid
PFHpS	Perfluoroheptane sulfonic acid
PFOS	Perfluorooctane sulfonic acid
PFNS	Perfluorononane sulfonic acid
PFDS	Perfluorodecane sulfonic acid
PFDoS	Perfluorododecane sulfonic acid
TELOMER SULFONIC Acids	
4:2 FTSA	4:2 fluorotelomersulfonic acid
6:2 FTSA	6:2 fluorotelomersulfonic acid
8:2 FTSA	8:2 fluorotelomersulfonic acid
PERFLUOROOCTANCESULFONAMIDES (FOSAs)	
PFOSA	Perfluroroctane sulfonamide
N-MeFOSA	N-Methyl perfluoroocatane sulfonamide
N-EtFOSA	N-Ethyl perfluorooctane sulfonamide
PERFLUOROOCTANCESULFONAMIDOACETIC Acids	
N-MeFOSAA	N-Methyl perfluoroocatane sulfonamidoacetic acid
N-EtFOSAA	N-Ethyl perfluorooctane sulfonamidoacetic acid
NATIVE PERFLUOROOCTANCESULFONAMIDOETHANOLS (FOSEs)	
N-MeFOSE	N-Methyl perfluorooctane sulfonamideoethanol
N-EtFOSE	N-Ethyl perfluorooctane sulfonamidoethanol
PERFLUOROALKYLETHERCARBOXYLIC Acids (PFECAs)	

HFPO-DA	Hexafluoropropylene oxide dimer acid
DONA	4,8-dioxa-3H-perfluorononanoic acid
CHLORO-PERFLUOROALKYLSULFONATE	
F-53B Major	9-chloroehexadecafluoro-3-oxanone-1-sulfonic acid
F-53B Minor	11-chloroelcosafluoro-3-oxaundecane-1-sulfonic acid

Note: If WDNR Lab Certification removes a particular compound from the reporting list above and upon receiving written communication from the department, reporting for that compound is no longer required.

3.2.3.4 Sampling and Reporting Sludge Samples for PFAS

Representative sludge samples shall be collected at each sample point as listed. At minimum, liquid sludge storage/digesters should be thoroughly mixed prior to sampling. Cake sludge samples should consist of seven equal size discrete samples and be collected from different areas and depths then composited into one sample for laboratory analysis.

Note: If additional equipment is used for collecting sludge samples (i.e., shovels, compositing buckets, bottles, etc.), then a one-time equipment blank is recommended to be collected with the first sample. An equipment blank sample is collected by passing laboratory verified PFAS-free water over or through field sampling equipment before the collection of a representative sludge sample. The equipment blank result shall be reported on the annual Sludge Characteristics Form (3400-049) in the comment section when reporting PFAS concentrations in the sludge.

The permittee shall report each of the PFAS sludge monitoring results on the annual Sludge Characteristics and Monitoring Form (3400-049) as provided by the department. The permittee shall also report the summation of PFOS and PFOA on this same form. All results shall be reported in dry weight. The annual Sludge Characteristics and Monitoring Form (3400-049) are due January 31, of the year following the collection of the sludge samples.

The laboratory performing the analysis on any samples shall be certified for the applicable PFAS compounds in the solids matrix by the Wisconsin Laboratory Certification Program established under s. 299.11, Wis. Stats., and in accordance with s. NR 149.41, Wis. Adm. Code. If the EPA Office of Water publishes a 1600 series isotope dilution method for the analysis of PFAS in solids, the department recommends the use of the EPA method. The department may reject any sample results if results are produced by a laboratory that is not in compliance with certification requirements under ch. NR 149, Wis. Adm. Code.

3.2.3.5 PFAS Land Application Requirements

The department recommends the landspreading and/or land application of sludge be done in a manner consistent with the most recent version of the “Interim Strategy for Land Application of Biosolids and Industrial Sludges containing PFAS”.

4 Schedules

4.1 Land Application Management Plan

A management plan is required for the land application system.

Required Action	Due Date
Land Application Management Plan: Submit an update to the management plan to optimize the land application system performance and demonstrate compliance with Wisconsin Administrative Code NR 214.	01/31/2025

4.2 Dissolved Oxygen (DO) Schedule

This compliance schedule requires the permittee to achieve compliance by the specified date

Required Action	Due Date
Report on Effluent Discharges: Submit a report on effluent discharges of dissolved oxygen (DO) with conclusions regarding compliance.	09/30/2025
Action Plan: Submit an action plan for complying with the effluent limitation. If construction is required, include plans and specifications with the submittal.	12/31/2025
Initiate Actions: Initiate actions identified in the plan.	04/01/2026
Complete Actions: Complete actions necessary to achieve compliance with the effluent limitation. Limit becomes effective 10/01/2026.	09/30/2026

5 Standard Requirements

Chapter NR 205, Wisconsin Administrative Code (Conditions for Industrial Dischargers): The conditions in ss. NR 205.07(1) and NR 205.07(3), Wis. Adm. Code, are included by reference in this permit. The permittee shall comply with all of these requirements. Some of these requirements are outlined in the Standard Requirements section of this permit. Requirements not specifically outlined in the Standard Requirement section of this permit can be found in ss. NR 205.07(1) and NR 205.07(3), Wis. Adm. Code.

5.1 Reporting and Monitoring Requirements

5.1.1 Monitoring Results

Monitoring results obtained during the previous month shall be summarized and reported on a Department Wastewater Discharge Monitoring Report. The report may require reporting of any or all of the information specified below under 'Recording of Results'. This report is to be returned to the Department no later than the date indicated on the form. A copy of the Wastewater Discharge Monitoring Report Form or an electronic file of the report shall be retained by the permittee.

Monitoring results shall be reported on an electronic discharge monitoring report (eDMR). The eDMR shall be certified electronically by a responsible executive or officer, manager, partner or proprietor as specified in s. 283.37(3), Wis. Stats., or a duly authorized representative of the officer, manager, partner or proprietor that has been delegated signature authority pursuant to s. NR 205.07(1)(g)2, Wis. Adm. Code. The 'eReport Certify' page certifies that the electronic report form is true, accurate and complete.

If the permittee monitors any pollutant more frequently than required by this permit, the results of such monitoring shall be included on the Wastewater Discharge Monitoring Report.

The permittee shall comply with all limits for each parameter regardless of monitoring frequency. For example, monthly, weekly, and/or daily limits shall be met even with monthly monitoring. The permittee may monitor more frequently than required for any parameter.

5.1.2 Sampling and Testing Procedures

Sampling and laboratory testing procedures shall be performed in accordance with Chapters NR 218 and NR 219, Wis. Adm. Code, and completed by a laboratory certified or registered in accordance with the requirements of ch. NR 149, Wis. Adm. Code. Groundwater sampling shall be performed in accordance with procedures contained in s. NR 140.16, Wis. Adm. Code, and the WDNR publications, Groundwater Sampling Desk Reference (PUBL-DG-037-96) and Groundwater Sampling Field Manual (PUBL-DG-038-96). The analytical methodologies used shall enable the laboratory to quantitate all substances for which monitoring is required at levels below the effluent limitation and/or groundwater standard. If the required level cannot be met by any of the methods available in ch. NR 219, Wis. Adm. Code, then the method with the lowest limit of detection shall be selected. Additional test procedures may be specified in this permit.

5.1.3 Recording of Results

The permittee shall maintain records which provide the following information for each effluent measurement or sample taken:

- the date, exact place, method and time of sampling or measurements;
- the individual who performed the sampling or measurements;
- the date the analysis was performed;
- the individual who performed the analysis;
- the analytical techniques or methods used; and
- the results of the analysis.

5.1.4 Reporting of Monitoring Results

The permittee shall use the following conventions when reporting effluent monitoring results:

- Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 0.1 mg/L, report the pollutant concentration as < 0.1 mg/L.
- Pollutant concentrations equal to or greater than the limit of detection, but less than the limit of quantitation, shall be reported and the limit of quantitation shall be specified.
- For purposes of calculating fees under ch. NR 101, Wis. Adm. Code, a reporting limit of 2.0 mg/L for BOD_5 and 2.5 mg/L Total Suspended Solids shall be considered to be limits of quantitation.
- For the purposes of reporting a calculated result, average or a mass discharge value, the permittee may substitute a "0" (zero) for any pollutant concentration that is less than the limit of detection. However, if the effluent limitation is less than the limit of detection, the department may substitute a value other than zero for results less than the limit of detection, after considering the number of monitoring results that are greater than the limit of detection and if warranted when applying appropriate statistical techniques.
- If no discharge occurs through an outfall, flow related parameters (e.g. flow rate, hydraulic application rate, volume, etc.) should be reported as "0" (zero) at the required sample frequency specified for the outfall. For example: if the sample frequency is daily, "0" would be reported for any day during the month that no discharge occurred.

5.1.5 Records Retention

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings or electronic data records for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit for a period of at least 3 years from the date of the sample, measurement, report or application, except for sludge management forms and records, which shall be kept for a period of at least 5 years.

5.1.6 Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or correct information to the Department.

5.1.7 Reporting Requirements – Alterations or Additions

The permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility. Notice is only required when:

- The alteration or addition to the permitted facility may meet one of the criteria for determining whether a facility is a new source.
- The alteration or addition could significantly change the nature or increase the quantity of pollutants discharged. This notification requirement applies to pollutants which are not subject to effluent limitations in the existing permit.
- The alteration or addition results in a significant change in the permittee's sludge use or disposal practices, and such alteration, addition, or change may justify the application of permit conditions that are different from or absent in the existing permit, including notification of additional use of disposal sites not reported during the permit application process nor reported pursuant to an approved land application plan. Additional sites may not be used for the land application of sludge until department approval is received.

5.2 System Operating Requirements

5.2.1 Noncompliance Reporting

The permittee shall report the following types of noncompliance by a telephone call to the Department's regional office within 24 hours after becoming aware of the noncompliance:

- any noncompliance which may endanger health or the environment;
- any violation of an effluent limitation resulting from a bypass;
- any violation of an effluent limitation resulting from an upset; and
- any violation of a maximum discharge limitation for any of the pollutants listed by the Department in the permit, either for effluent or sludge.

A written report describing the noncompliance shall also be submitted to the Department as directed at the end of this permit within 5 days after the permittee becomes aware of the noncompliance. On a case-by-case basis, the Department may waive the requirement for submittal of a written report within 5 days and instruct the permittee to submit the written report with the next regularly scheduled monitoring report. In either case, the written report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times; the steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance; and if the noncompliance has not been corrected, the length of time it is expected to continue.
A scheduled bypass approved by the Department under the 'Scheduled Bypass' section of this permit shall not be subject to the reporting required under this section.
NOTE: Section 292.11(2)(a), Wisconsin Statutes, requires any person who possesses or controls a hazardous substance or who causes the discharge of a hazardous substance to notify the Department of Natural Resources **immediately** of any discharge not authorized by the permit. **The discharge of a hazardous substance that is not authorized by this permit or that violates this permit may be a hazardous substance spill. To report a hazardous substance spill, call DNR's 24-hour HOTLINE at 1-800-943-0003**.

5.2.2 Bypass

Except for a controlled diversion as provided in the 'Controlled Diversions' section of this permit, any bypass is prohibited and the Department may take enforcement action against a permittee for such occurrences under s. 283.89, Wis. Stats. The Department may approve a bypass if the permittee demonstrates all the following conditions apply:

- The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
- There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities or adequate back-up equipment, retention of untreated wastes, reduction of inflow and infiltration, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance. When evaluating feasibility of alternatives, the department may consider factors such as technical achievability, costs and affordability of implementation and risks to public health, the environment and, where the permittee is a municipality, the welfare of the community served; and
- The bypass was reported in accordance with the 'Noncompliance Reporting' section of this permit.

5.2.3 Scheduled Bypass

Whenever the permittee anticipates the need to bypass for purposes of efficient operations and maintenance and the permittee may not meet the conditions for controlled diversions in the 'Controlled Diversions' section of this permit, the permittee shall obtain prior written approval from the Department for the scheduled bypass. A permittee's written request for Department approval of a scheduled bypass shall demonstrate that the conditions for unscheduled bypassing are met and include the proposed date and reason for the bypass, estimated volume and duration of the bypass, alternatives to bypassing and measures to mitigate environmental harm caused by the bypass. The department may require the permittee to provide public notification for a scheduled bypass if it is determined there is significant public interest in the proposed action and may recommend mitigation measures to minimize the impact of such bypass.

5.2.4 Controlled Diversions

Controlled diversions are allowed only when necessary for essential maintenance to assure efficient operation provided the following requirements are met:

- Effluent from the wastewater treatment facility shall meet the effluent limitations established in the permit. Wastewater that is diverted around a treatment unit or treatment process during a controlled diversion shall be recombined with wastewater that is not diverted prior to the effluent sampling location and prior to effluent discharge;
- A controlled diversion may not occur during periods of excessive flow or other abnormal wastewater characteristics;
- A controlled diversion may not result in a wastewater treatment facility overflow; and
- All instances of controlled diversions shall be documented in wastewater treatment facility records and such records shall be available to the department on request.

5.2.5 Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training as required in ch. NR 114, Wis. Adm. Code, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

5.2.6 Operator Certification

The wastewater treatment facility shall be under the direct supervision of a state certified operator. In accordance with s. NR 114.53, Wis. Adm. Code, every WPDES permitted treatment plant shall have a designated operator-in-charge holding a current and valid certificate. The designated operator-in-charge shall be certified at the level and in all subclasses of the treatment plant, except laboratory. Treatment plant owners shall notify the department of any changes in the operator-in-charge within 30 days. Note that s. NR 114.52(22), Wis. Adm. Code, lists types of facilities that are excluded from operator certification requirements (i.e. private sewage systems, pretreatment facilities discharging to public sewers, industrial wastewater treatment that consists solely of land disposal, agricultural digesters and concentrated aquatic production facilities with no biological treatment).

5.2.7 Spill Reporting

The permittee shall notify the Department in accordance with ch. NR 706 (formerly NR 158), Wis. Adm. Code, in the event that a spill or accidental release of any material or substance results in the discharge of pollutants to the waters of the state at a rate or concentration greater than the effluent limitations established in this permit, or the spill or accidental release of the material is unregulated in this permit, unless the spill or release of pollutants has been reported to the Department in accordance with s. NR 205.07 (1)(s), Wis. Adm. Code.

5.2.8 Planned Changes

In accordance with ss. 283.31(4)(b) and 283.59, Stats., the permittee shall report to the Department any facility expansion, production increase or process modifications which will result in new, different or increased discharges of pollutants. The report shall either be a new permit application, or if the new discharge will not violate the effluent limitations of this permit, a written notice of the new, different or increased discharge. The notice shall contain a description of the new activities, an estimate of the new, different or increased discharge of pollutants and a description of the effect of the new or increased discharge on existing waste treatment facilities. Following receipt of this report, the Department may modify this permit to specify and limit any pollutants not previously regulated in the permit.

5.2.9 Duty to Halt or Reduce Activity

Upon failure or impairment of treatment facility operation, the permittee shall, to the extent necessary to maintain compliance with its permit, curtail production or wastewater discharges or both until the treatment facility operations are restored or an alternative method of treatment is provided.

5.3 Surface Water Requirements

5.3.1 Permittee-Determined Limit of Quantitation Incorporated into this Permit

For pollutants with water quality-based effluent limits below the Limit of Quantitation (LOQ) in this permit, the LOQ calculated by the permittee and reported on the Discharge Monitoring Reports (DMRs) is incorporated by reference into this permit. The LOQ shall be reported on the DMRs, shall be the lowest quantifiable level practicable, and shall be no greater than the minimum level (ML) specified in or approved under 40 CFR Part 136 for the pollutant at the time this permit was issued, unless this permit specifies a higher LOQ.

5.3.2 Appropriate Formulas for Effluent Calculations

The permittee shall use the following formulas for calculating effluent results to determine compliance with average concentration limits and mass limits and total load limits:

Weekly/Monthly/Six-Month/Annual Average Concentration = the sum of all daily results for that week/month/six-month/year, divided by the number of results during that time period. [Note: When a six-month average effluent limit is specified for Total Phosphorus the applicable periods are May through October and November through April, except in cases of Water Quality Trading, wherein the applicable periods are January through June and July through December.]

Weekly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the week.

Monthly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the month.

Six-Month Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the six-month period. [Note: When a six-month average effluent limit is specified for Total Phosphorus the applicable periods are May through October and November through April.]

Annual Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the entire year.

Total Monthly Discharge: = monthly average concentration (mg/L) x total flow for the month (MG/month) x 8.34.

Total Annual Discharge: = sum of total monthly discharges for the calendar year.

12-Month Rolling Sum of Total Monthly Discharge: = the sum of the most recent 12 consecutive months of Total Monthly Discharges.

5.3.3 Effluent Temperature Requirements

Weekly Average Temperature – If temperature limits are included in this permit, Weekly Average Temperature shall be calculated as the sum of all daily maximum results for that week divided by the number of daily maximum results during that time period.

Cold Shock Standard – Water temperatures of the discharge shall be controlled in a manner as to protect fish and aquatic life uses from the deleterious effects of cold shock pursuant to Wis. Adm. Code, s. NR 102.28. 'Cold Shock' means exposure of aquatic organisms to a rapid decrease in temperature and a sustained exposure to low temperature that induces abnormal behavior or physiological performance and may lead to death.

Rate of Temperature Change Standard – Temperature of a water of the state or discharge to a water of the state may not be artificially raised or lowered at such a rate that it causes detrimental health or reproductive effects to fish or aquatic life of the water of the state pursuant to Wis. Adm. Code, s. NR 102.29.

5.3.4 Visible Foam or Floating Solids

There shall be no discharge of floating solids or visible foam in other than trace amounts.

5.3.5 Surface Water Uses and Criteria

In accordance with NR 102.04, Wis. Adm. Code, surface water uses and criteria are established to govern water management decisions. Practices attributable to municipal, industrial, commercial, domestic, agricultural, land development or other activities shall be controlled so that all surface waters including the mixing zone meet the following conditions at all times and under all flow and water level conditions:

a) Substances that will cause objectionable deposits on the shore or in the bed of a body of water, shall not be present in such amounts as to interfere with public rights in waters of the state.

b) Floating or submerged debris, oil, scum or other material shall not be present in such amounts as to interfere with public rights in waters of the state.

c) Materials producing color, odor, taste or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state.

d) Substances in concentrations or in combinations which are toxic or harmful to humans shall not be present in amounts found to be of public health significance, nor shall substances be present in amounts which are acutely harmful to animal, plant or aquatic life.

5.3.6 Additives

In the event that the permittee wishes to commence use of a water treatment additive, or increase the usage of the additives greater than indicated in the permit application, the permittee must get a written approval from the Department prior to initiating such changes. This written approval shall provide authority to utilize the additives at the specific rates until the permit can be either reissued or modified in accordance with s. 283.53, Stats. Restrictions on the use of the additives may be included in the authorization letter.

5.3.7 Whole Effluent Toxicity (WET) Monitoring Requirements

In order to determine the potential impact of the discharge on aquatic organisms, static-renewal toxicity tests shall be performed on the effluent in accordance with the procedures specified in the *"State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition" (PUB-WT-797*, November 2004) as required by NR 219.04, Table A, Wis. Adm. Code). All of the WET tests required in this permit, including any required retests, shall be conducted on the *Ceriodaphnia dubia* and fathead minnow species. Receiving water samples shall not be collected from any point in contact with the permittee's mixing zone and every attempt shall be made to avoid contact with any other discharge's mixing zone.

5.3.8 Whole Effluent Toxicity (WET) Identification and Reduction

Within 60 days of a retest which showed positive results, the permittee shall submit a written report to the Biomonitoring Coordinator, Bureau of Water Quality, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, which details the following:

- A description of actions the permittee has taken or will take to remove toxicity and to prevent the recurrence of toxicity;

- A description of toxicity reduction evaluation (TRE) investigations that have been or will be done to identify potential sources of toxicity, including the following actions:
    a) Evaluate the performance of the treatment system to identify deficiencies contributing to effluent toxicity (e.g., operational problems, chemical additives, incomplete treatment)
    b) Identify the compound(s) causing toxicity. Conduct toxicity screening tests on the effluent at a minimum of once per month for six months to determine if toxicity recurs. Screening tests are WET tests using fewer effluent concentrations conducted on the most sensitive species. If any of the screening tests contain toxicity, conduct a toxicity identification evaluation (TIE) to determine the cause. TIE methods are available from USEPA "Methods for Aquatic Toxicity Identification Evaluations: Phase I Toxicity Characterization Procedures (EPA/600/6-91/003) and "Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluents, Phase I" (EPA/600/6-91/005F).
    c) Trace the compound(s) causing toxicity to their sources (e.g., industrial, commercial, domestic)
    d) Evaluate, select, and implement methods or technologies to control effluent toxicity (e.g., in-plant or pretreatment controls, source reduction or removal)
- Where corrective actions including a TRE have not been completed, an expeditious schedule under which corrective actions will be implemented;
- If no actions have been taken, the reason for not taking action.

The permittee may also request approval from the Department to postpone additional retests in order to investigate the source(s) of toxicity. Postponed retests must be completed after toxicity is believed to have been removed.

5.4 Land Application Requirements

5.4.1 General Sludge Management Information

The General Sludge Management Form 3400-48 shall be completed and submitted prior to any significant sludge management changes.

5.4.2 Land Application Characteristic Report

The analytical results from testing of liquid wastes, by-product solids and sludges that are land applied shall be reported annually on the Characteristic Report Form 3400-49. The report form shall be submitted electronically no later than the date indicated on the form. Following submittal of the electronic Characteristic Report Form 3400-49, this form shall be certified electronically via the 'eReport Certify' page by a responsible executive officer, manager, partner or proprietor as specified in s. 283.37(3), Wis. Stats., or a duly authorized representative of the officer, manager, partner or proprietor that has been delegated signature authority pursuant to s. NR 205.07(1)(g)2, Wis. Adm. Code. The 'eReport Certify' page certifies that the electronic report form is true, accurate and complete.
The permittee shall use the following convention when reporting sludge monitoring results: Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 1.0 mg/kg, report the pollutant concentration as < 1.0 mg/kg.
All sludge results shall be reported on a dry weight basis.

5.4.3 Annual Land Application Report

The annual totals for the land application loadings of liquid wastes, by-product solids and sludges to field spreading sites shall be submitted electronically on the Annual Land Application Report Form 3400-55 by January 31, each year whether or not waste is land applied. Following submittal of the electronic Annual Land Application Report Form 3400-55, this form shall be certified electronically via the 'eReport Certify' page by a responsible executive officer, manager, partner or proprietor as specified in s. 283.37(3), Wis. Stats., or a duly authorized representative of the officer, manager, partner or proprietor that has been delegated signature authority pursuant to s. NR 205.07(1)(g)2, Wis. Adm. Code. The 'eReport Certify' page certifies that the electronic report form is true, accurate and complete.

5.4.4 Other Methods of Disposal or Distribution Report

The permittee shall submit electronically the Other Methods of Disposal or Distribution Report Form 3400-52 by January 31, each year whether or not waste is hauled to another facility, landfilled, incinerated, or stored in a manure pit. Following submittal of the electronic Report Form 3400-52, this form shall be certified electronically via the 'eReport Certify' page by a responsible executive officer, manager, partner or proprietor as specified in s. 283.37(3), Wis. Stats., or a duly authorized representative of the officer, manager, partner or proprietor that has been delegated signature authority pursuant to s. NR 205.07(1)(g)2, Wis. Adm. Code. The 'eReport Certify' page certifies that the electronic report form is true, accurate and complete.

5.4.5 Land Application Site Approval

The permittee is authorized to landspread permitted liquid wastes, by-product solids and sludges on sites approved in writing by the Department in accordance with ss. NR 214.17(2) and 214.18(2), Wis. Adm. Code. Any site use restrictions or granting of case-by-case exceptions shall be identified in the approval letter. If the permittee wishes to have approval for additional sites, application shall be made using Land Application Site Request Form 3400-053. Complete information shall be submitted about each site, including location maps and soil maps, any soil analyses results and other information showing that the site complies with all application requirements and permit conditions. Spreading on a site may commence upon receipt of Department approval. If an existing spreading site is found by the Department to be environmentally unacceptable, a written notice will be issued to withdraw approval of that site.

5.4.6 Operating Requirements/Management Plan

All land application sites used for treatment of liquid wastes, by-product solids and sludges shall be operated in accordance with a Department approved management plan. The management plan shall be consistent with the requirements of this permit, ss. NR 214.17 (3) and (6), and NR 214.18 (3) and (6), Wis. Adm. Code. If operational changes are needed, the land application management plan shall be amended by submitting a written request to the Department for approval. A land application management plan shall be submitted for approval at least 60 days prior to land application.

5.4.7 Chloride Requirements for Liquid Wastes and By-Product Solids

The total pounds of chloride applied shall be limited to 340 pounds per acre per 2 year period. Calculate the chloride loading as follows:

$$\text{Wet Weight Solids: } \frac{\text{lbs of solids X \%solids X \%chloride}}{\text{acres land applied X 100 X 100}} = \text{lbs chloride/acre}$$

$$\text{Liquid: } \frac{\text{mg/L chloride X (millions of gallons) X 8.34}}{\text{acres land applied}} = \text{lbs chloride/acre}$$

5.4.8 Nitrogen Requirements for Liquid Wastes and By-Product Solids and Sludges

NR 214.17(4) and NR 214.18(4) Wis. Adm. Code specify that the total pounds of nitrogen land applied per acre per year shall be limited to the nitrogen needs of the cover crop minus any other nitrogen added to the land application site, including fertilizer or manure. Nitrogen applied can be calculated on the basis of plant available nitrogen, as long as the release of nitrogen from the organic material is credited to future years. This permit requires that the Total Kjeldahl Nitrogen calendar year application amount shall not exceed 165 pounds per acre per year, except when alternate numerical nitrogen loading limits (consistent with the above sections of NR 214) are approved in writing via the Department's land application management plan approval. Calculate nitrogen loading as follows ("TKN" represents "Total Kjeldahl Nitrogen"):

Wet Weight Solids and Sludges: $\frac{\text{lbs of solids X \%solids X \% TKN}}{\text{acres land applied X 100 X 100}}$ = lbs TKN/acre

Liquid: $\frac{\text{mg/L TKN X (millions of gallons) X 8.34}}{\text{acres land applied}}$ = lbs TKN/acre

5.4.9 Ponding

The volume of liquid wastes land applied shall be limited to prevent ponding, except for temporary conditions following rainfall events. If ponding occurs all land application shall cease immediately. The permittee shall land apply only the liquid wastes that are permitted.

5.4.10 Runoff

The volume of liquid wastes land applied shall be limited to prevent runoff. If runoff occurs all land application shall cease immediately. The permittee shall land apply only the liquid wastes that are permitted.

5.4.11 Soil Incorporation Requirements

- Liquid Sludge Requirements: The Department may require that liquid sludge be incorporated into the soil on specific land application sites when necessary to prevent surface runoff or objectionable odors. Requirements and procedures for incorporation of liquid sludge, when such incorporation may be necessary, shall be specified in the management plan or in specific site applications, subject to Department approval. The permittee shall comply with the requirements in the Department approved management plan, specific site-approval requirements and the terms and conditions of this permit.
- Cake Sludge Requirements: After land application, cake sludge shall be incorporated into the soil. The timing of such incorporation and other related requirements and procedures shall be specified in the management plan or in specific site applications, subject to Department approval. The permittee shall comply with the requirements in the Department approved management plan, specific site-approval requirements and the terms and conditions of this permit.
- Liquid Wastewater Requirements: The Department may require that liquid wastewater be incorporated or injected into the soil on specific land application sites when necessary to prevent surface runoff or objectionable odors. Requirements and procedures for injection or incorporation of liquid wastewater, when such injection or incorporation is necessary, shall be specified in the management plan or in specific site applications, subject to Department approval. The permittee shall comply with the requirements in the Department approved management plan, specific site-approval requirements and the terms and conditions of this permit.
- By-Product Solids Requirements: The Department may limit the volume of by-products solids that are landspread on a specific site when necessary to prevent surface runoff or leaching of contaminants to groundwater and objectionable odors. By-product solids shall, after application, be plowed, disced, or otherwise incorporated into the soil. Requirements and procedures for the incorporation of byproduct solids into the soil shall be specified in the management plan or in specific site applications, subject to Department approval. The permittee shall comply with the requirements in the Department approved management plan, specific site-approval requirements and the terms and conditions of this permit.

5.4.12 Field Stockpiles

The permittee is encouraged to landspread the by-product solids or sludges as they are transported to the fields; but if it becomes necessary to stockpile solids in the fields, the stockpiles shall be spread within 72 hours or as specified in the approved management plan.

5.4.13 Additional Requirements from ch. NR 214, Wis. Adm. Code

The requirements of s. NR 214.17 (4)(c) [pathogen prohibition for human consumption crop fields], (4)(d)1 [no adverse soil effects], (4)(d)10 [allowable whey spreading rates], and (4)(e)1-3 [by-product solids spreading within agricultural practices and not cause contamination] for landspreading of liquid wastes and by product solids and s. NR 214.18 (4)(b),(d)-(h) [application, nutrient, pH, metals, and PCB limitations] for sludge spreading systems are included by reference in this permit. The permittee shall comply with these requirements.

6 Summary of Reports Due

FOR INFORMATIONAL PURPOSES ONLY

Description	Date	Page
Land Application Management Plan -Land Application Management Plan	January 31, 2025	13
Dissolved Oxygen (DO) Schedule -Report on Effluent Discharges	September 30, 2025	13
Dissolved Oxygen (DO) Schedule -Action Plan	December 31, 2025	13
Dissolved Oxygen (DO) Schedule -Initiate Actions	April 1, 2026	13
Dissolved Oxygen (DO) Schedule -Complete Actions	September 30, 2026	13
General Sludge Management Form 3400-48	prior to any significant sludge management changes	20
Characteristic Report Form 3400-49	no later than the date indicated on the form	20
Land Application Report Form 3400-55	January 31, each year whether or not waste is land applied	20
Other Methods of Disposal or Distribution Report Form 3400-52	by January 31, each year whether or not waste is hauled to another facility, landfilled, incinerated, or stored in a manure pit	21
Wastewater Discharge Monitoring Report	no later than the date indicated on the form	14

Report forms shall be submitted electronically in accordance with the reporting requirements herein. Any facility plans or plans and specifications for municipal, industrial, industrial pretreatment and non industrial wastewater systems shall be submitted to the Bureau of Water Quality, P.O. Box 7921, Madison, WI 53707-7921. All other submittals required by this permit shall be submitted to: West Central Region, 1300 W. Clairemont Ave, Eau Claire, WI 54701.

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Appendix B

3400-206 Grassland Dairy WQT NOI

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State of Wisconsin
Department of Natural Resources
101 South Webster Street
Madison WI 53707-7921
dnr.wi.gov

Notice of Intent to Conduct Water Quality Trading

Form 3400-206 (1/14)

Notice: Pursuant to s. 283.84, Wis. Stats., and ch. NR 217 Wis. Adm. Code, this form must be completed by any WPDES permittee that is using water quality trading as a method of complying with a permit limitation. Failure to complete this form would not result in penalties. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records Law (ss. 19.31 - 19.39, Wis. Stats.).

Applicant Information

Permittee Name	Permit Number	Facility Site Number
Grassland Dairy Products Inc	WI- 0002984	

Facility Address	City	State	ZIP Code
N8790 Fairground Avenue	Greenwood	WI	54437

Project Contact Name (if applicable)	Address	City	State	ZIP Code
Laura Opelt	N8790 Fairground Avenue	Greenwood	WI	54437

Project Name
Grassland Dairy Products Water Quality Trading Plan

Receiving Water Name	Parameter(s) being traded	HUC 12(s)
Black River	Phosphorus	070400070405

Is the permittee in a point or nonpoint source dominated watershed?
(See PRESTO results - http://dnr.wi.gov/topic/surfacewater/presto.html)

- ○ Point source dominated
- ◉ Nonpoint source dominated

Credit Generator Information

Credit generator type (select all that apply):

- ☐ Permitted Discharge (non-MS4/CAFO)
- ☐ Permitted MS4
- ☐ Permitted CAFO
- ☐ Urban nonpoint source discharge
- ☒ Agricultural nonpoint source discharge
- ☐ Other - Specify:

Are any of the credit generators in a different HUC 12 than the applicant?

- ◉ Yes; HUC 12: 070400070404
- ○ No
- ○ Unsure

Are any of the credit generators downstream of the applicant?

- ○ Yes
- ○ No
- ◉ Unsure

Will a broker/exchange be used to facilitate trade?

- ○ Yes; Name:
- ◉ No
- ○ Unsure

Point to Point Trades (Traditional Municipal / Industrial Discharge, MS4, CAFO)

Discharge Type	Permit Number	Name	Contact Address	Is the point source credit generator currently in compliance with their permit requirements?
○ Traditional ○ MS4 ○ CAFO				○ Yes ○ No ○ Unsure
○ Traditional ○ MS4 ○ CAFO				○ Yes ○ No ○ Unsure
○ Traditional ○ MS4 ○ CAFO				○ Yes ○ No ○ Unsure
○ Traditional ○ MS4 ○ CAFO				○ Yes ○ No ○ Unsure
○ Traditional ○ MS4 ○ CAFO				○ Yes ○ No ○ Unsure

Point to Nonpoint Trades (Non-permitted Agricultural, Non-Permitted Urban, etc.)

List the practices that will be used to generate credits:

Non-Permitted Agricultural practices will be implemented on parcels under the ownership and control of Grassland Dairy Products and its legal entities, including:

- Conservation Easements
-Riparian Filter Strips

Method for quantifying credits generated:
- ☐ Monitoring
- ☒ Modeling, Names: SnapPlus
- ☐ Other: _____

Projected date credits will be available: 04/15/2024

The preparer certifies all of the following:

- I am familiar with the specifications submitted for this application, and I believe all applicable items in this checklist have been addressed.
- I have completed this document to the best of my knowledge and have not excluded pertinent information.

Signature of Preparer	Date Signed
Daniel F Schaefer	10/13/2023

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
Matthew L Bruce	11/8/2023

Appendix C

Fields 101 and 104 Soil Test Results

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ROCK RIVER LABORATORY, INC.
AGRICULTURAL ANALYSIS

Soil Test Report - Field: 101 Acres: 67.0

Northside ELEVATOR, INC.

Report For:
Grassland Dairy

Greenwood, WI

Lab #275897
County Clark
Received 10/18/2023
Field 101

Acres 67.0
Plow Depth 6.0
Soil Name Loyal
Previous Crop

Nutrient Recommendations (lbs/acre)

Cropping Sequence	Yield Goal (per acre)	Crop Nutrient Need N	Crop Nutrient Need P2O5	Crop Nutrient Need K2O	Legume N Credit	Apply N	Apply P2O5	Apply K2O
Corn, grain	185	165	0	80	0	165	0	80
Corn, silage	25	165	0	225	0	165	0	225
Soybean, grain	60	0	0	115	0	0	0	115
Alfalfa, seeding	2.5	0	0	145	0	0	0	145

The lime required for this rotation to reach pH 6.8 is 6 T/a of 60-69 lime or 4.5 T/a of 80-89 lime.

Laboratory Analysis for Field 101, Lab No 275897

Sample Num	Soil pH	Om %	P ppm	K ppm	60-69 Lime Req(T/a)	Ca ppm	Mg ppm	Est Cec	B ppm	Mn ppm	Zn ppm	Sulfate-S ppm	Sample Density	Buffer Code
1	6.0	2.7	94	140	12.0	1012	206	9					0.97	6.4
2	6.0	3.6	124	132	11.0	1103	197	10					0.89	6.5
3	6.0	3.7	122	84	8.0	1155	262	10					0.97	6.6
4	6.0	3.1	125	74	3.0	1152	236	10					0.91	6.8
5	5.8	3.8	139	99	3.0	1209	222	11					0.91	6.8
6	6.0	2.8	115	92	3.0	1161	245	10					0.91	6.8
7	6.1	3.0	137	73	6.0	1169	200	11					0.85	6.7
8	6.1	3.2	115	83	2.0	1209	239	11					0.88	6.9
9	5.9	2.1	128	143	11.0	1187	237	10					0.94	6.5
10	6.2	3.2	127	129	3.0	1296	291	11					0.94	6.8
11	5.7	3.8	120	104	6.0	1029	196	9					0.90	6.7
12	6.2	3.0	108	124	8.0	1088	226	10					0.92	6.6
13	6.0	3.0	112	69	11.0	1079	208	9					0.93	6.5
14	5.7	3.8	125	111	6.0	1069	183	9					0.90	6.7
15	5.7	3.4	179	98	3.0	1148	198	9					0.96	6.8
16	5.7	3.4	157	80	3.0	1166	200	9					0.95	6.8
17	5.7	3.5	109	85	3.0	1078	192	9					0.96	6.8
18	6.0	3.2	148	103	3.0	1085	196	9					0.94	6.8
19	6.4	3.6	98	77	2.0	1414	295	12					0.96	7.0
20	6.1	2.6	129	92	2.0	1225	267	10					1.00	6.9
21	5.8	2.6	134	75	11.0	922	160	8					0.89	6.5
22	5.6	2.6	126	125	8.0	929	152	8					0.89	6.6
23	5.9	2.5	104	78	6.0	1006	177	9					0.91	6.7
24	6.2	2.8	118	82	6.0	1159	191	10					0.91	6.7
25	5.9	2.9	137	88	3.0	1018	167	10					0.80	6.8
26	5.6	3.1	117	89	6.0	1041	178	8					0.96	6.7
27	5.8	2.9	117	96	3.0	1099	196	10					0.90	6.8
28	5.4	3.0	145	106	8.0	824	123	7					0.90	6.6
29	6.0	2.5	102	109	3.0	1112	226	10					0.92	6.8
30	6.2	2.4	97	77	8.0	1138	252	10					0.92	6.6
31	6.2	2.2	63	78	12.0	1080	269	10					0.90	6.4
Adj Avg	5.9	3.0	122	94		1108	212	10						

Base Saturation

Est CEC	Ca %	Mg %	K %
10	73.7	23.1	3.2

Test Interpretation for Field 101, Lab No 275897

Crop Name	Very Low	Low	Optimum	High	Very High	Excessive	Very Low	Low	Optimum	High	Very High	Excessive
Alfalfa, seeding	P						K					

Additional Information, Secondary & Micronutrient Recommendations

All:If a legume crop preceeds the first crop listed on the sample submission form, N credits should be subtracted from the N recommendation for the first crop listed. See Chapter 9 in UWEX Publication A2809 for more details.
All:If manure, biosolids, septage or other waste materials have been applied to this field, be sure to take nutrient credits and adjust fertilizer rate. See Chapter 9 in UWEX Publication A2809 for more details.
All:Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
All:Apply lime at a higher rate to the more acid parts of the field.
All:If lime has been applied in the last two years, more lime may not be needed due to incomplete reaction.
All:Lime recommendation may not achieve desired pH in 3 years. Retest then and apply as recommended.
Corn:Nitrogen application rates for grain and silage corn reflect the maximum return to N (MRTN) at a 0.10 N:corn price ratio (eg. $0.30/lb N and $3.00/bu; or $0.40/lb N and $4.00/bu) and the range of rates that produce profitability within $1/a of the MRTN rate. N application rates can be adjusted to reflect different prices for N and grain. See Chapter 6 in UWEX Publication A2809 for more details.
Corn:Starter fertilizer may accelerate early season corn development, which may not always translate into increased yield. Corn will benefit more from a complete starter fertilizer (e.g. 10+20+20 lbs N+P2O5+K2O/a) when grown on soils testing optimum or less in P and K.
Alfalfa:If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.
Corn, grain:If corn is harvested for silage instead of grain apply extra 90 lbs K2O per acre to next crop.
All:Ca test average value of 1108.422 is in High category.
All:Mg test average value of 212.498 is in Optimum category.

Soil Test Report - Field: 104 Acres: 160.8

ROCK RIVER LABORATORY, INC.
AGRICULTURAL ANALYSIS

Northside ELEVATOR, INC.

Report For:
Grassland Dairy

Lab #290054
County Clark
Received 10/21/2024
Field 104

Acres 160.8
Plow Depth 6.0
Soil Name Loyal
Previous Crop

Cropping Sequence	Yield Goal (per acre)	Nutrient Recommendations (lbs/acre) Crop Nutrient Need N	P2O5	K2O	Legume N Credit	Apply N	P2O5	K2O
Soybean, grain	60	0	0	85	0	0	0	85
Corn, grain	70.0	120	0	25	0	120	0	25
Corn, grain	190	165	0	50	0	165	0	50
Soybean, grain	60	0	0	85	0	0	0	85

There is no lime recommendation

Laboratory Analysis for Field 104, Lab No 290054

Sample Num	Soil pH	Om %	P ppm	K ppm	60-69 Lime Req(T/a)	Ca ppm	Mg ppm	Est Cec	B ppm	Mn ppm	Zn ppm	Sulfate-S ppm	Sample Density	Buffer Code
1	6.4	2.7	151	126		1197	143	9					1.02	7.1
2	5.8	2.3	197	126	2.0	874	78	6					1.05	6.7
3	5.7	2.4	103	92	2.0	1139	134	8					0.99	6.7
4	6.3	3.9	180	185		1468	219	12					0.94	6.8
5	6.3	2.9	171	170		1431	191	11					0.95	6.9
6	5.9	3.2	131	140	2.0	1266	148	11					0.88	6.6
7	6.2	3.7	152	98		1587	250	12					0.99	6.9
8	6.0	4.3	171	184	2.0	1430	169	11					0.93	6.7
9	6.1	3.9	214	179		1497	193	11					0.99	6.6
10	5.9	2.6	140	162	2.0	1168	122	8					1.06	6.6
11	5.8	3.1	185	132	2.0	897	86	6					1.12	6.5
12	6.1	1.7	95	112		1053	158	8					1.04	6.8
13	6.2	2.5	112	133		1057	141	8					1.03	7.0
14	5.3	3.4	112	109	7.0	800	116	7					0.89	6.3
15	5.0	1.7	199	86	6.0	498	41	3					1.13	6.4
16	5.2	2.3	160	79	5.0	515	51	4					1.03	6.4
17	6.5	2.6	73	110		1215	178	9					1.00	6.8
18	5.4	2.2	58	146	4.0	859	122	6					1.10	6.5
19	5.4	2.9	99	117	7.0	953	93	6					1.11	6.3
20	5.0	1.6	87	80	10.0	405	32	2					1.21	6.1
21	6.7	1.9	95	118		1644	100	11					1.02	N.R.
22	6.5	2.9	283	115		1627	268	13					0.97	7.0
23	6.5	3.6	244	183		1761	242	14					0.96	7.0
24	5.9	2.5	129	82	2.0	1255	192	11					0.86	6.7
25	6.0	3.1	107	105	2.0	1433	211	11					0.96	6.7
26	5.7	3.4	203	81	2.0	1249	164	9					1.00	6.7
27	6.1	2.0	213	65		1126	90	7					1.09	6.9
28	6.5	1.9	214	68		1581	66	9					1.17	7.1
29	6.5	3.0	239	128		1468	136	10					1.01	6.9
30	6.6	2.0	150	93		1123	71	6					1.23	7.1
31	6.3	1.9	245	63		1027	66	6					1.21	6.9
32	5.4	2.0	257	52	3.0	804	36	4					1.17	6.6
33	5.5	2.6	153	54	2.0	708	63	4					1.11	6.6
34	5.7	3.2	106	115	2.0	940	151	8					0.97	6.8
35	5.0	1.0	196	61	5.0	401	45	2					1.23	6.5
36	7.0	2.4	116	81		1950	127	12					1.09	N.R.
37	6.6	3.1	125	99		1984	158	13					1.00	7.1
38	7.1	3.4	162	100		2340	230	16					1.03	N.R.
39	6.8	2.9	165	87		1902	159	13					0.99	N.R.
40	6.3	2.8	241	93		1811	197	13					0.98	6.9
41	5.7	2.2	259	111	2.0	1101	96	7					1.07	6.6
42	5.8	3.6	243	102	2.0	1784	206	12					1.04	6.6
43	6.2	3.7	188	118		1611	169	12					0.96	6.7
44	5.8	2.7	181	125	2.0	1134	156	8					1.07	6.5
45	6.0	2.8	142	69	2.0	1040	95	7					1.05	6.6
46	6.2	2.2	275	104		929	78	6					1.15	6.8

These recommendations are based on University of Wisconsin publication A2809. Data represents the soil sample, not necessarily the entire field.

Laboratory Analysis for Field 104, Lab No 290054

Sample Num	Soil pH	Om %	P ppm	K ppm	60-69 Lime Req(T/a)	Ca ppm	Mg ppm	Est Cec	B ppm	Mn ppm	Zn ppm	Sulfate-S ppm	Sample Density	Buffer Code
47	5.3	2.6	170	118	6.0	1142	168	10					0.89	6.3
48	6.5	2.7	170	113		1475	167	10					1.05	6.9
49	5.4	3.7	248	81	6.0	1182	111	9					0.97	6.3
50	5.5	3.3	236	169	4.0	1091	111	8					1.02	6.4
51	7.0	3.1	160	125		1914	198	14					0.99	N.R.
52	6.9	2.4	226	93		1714	132	12					0.96	N.R.
53	6.4	2.5	240	115		1429	68	10					0.97	6.8
54	6.3	3.8	196	91		1625	176	12					0.99	6.9
55	6.2	2.6	194	103		1217	111	9					1.00	6.9
56	6.7	2.3	238	95		1283	124	8					1.10	N.R.
57	7.0	1.1	271	76		1308	29	8					1.04	N.R.
58	6.5	3.0	220	59		1496	137	11					0.98	6.9
59	6.2	3.8	184	87		1528	210	14					0.81	6.6
60	5.1	3.6	257	106	7.0	1113	98	8					0.97	6.3
61	5.9	3.1	176	115	2.0	1362	134	11					0.88	6.6
62	6.0	1.8	259	124	2.0	754	80	5					1.11	6.6
63	6.1	2.0	269	117		912	66	6					1.08	6.7
64	6.2	3.0	182	108		1320	135	10					0.93	6.8
65	6.3	3.2	193	130		1479	168	12					0.88	6.7
66	6.6	1.7	249	78		943	117	6					1.09	6.9
67	6.6	2.5	214	129		1384	72	9					1.08	7.1
68	5.4	3.0	259	94	3.0	1085	80	8					0.97	6.6
69	5.9	3.0	203	107	2.0	1179	77	8					0.99	6.7
70	6.3	2.3	236	115		934	53	6					1.05	6.9
Adj Avg	6.1	2.7	185	106		1256	129	9						

Base Saturation

Est CEC	Ca %	Mg %	K %
9	82.5	13.9	3.6

Test Interpretation for Field 104, Lab No 290054

Crop Name	Very Low	Low	Optimum	High	Very High	Excessive	Very Low	Low	Optimum	High	Very High	Excessive
Soybean, grain	P						K					

Additional Information, Secondary & Micronutrient Recommendations

All:If a legume crop preceeds the first crop listed on the sample submission form, N credits should be subtracted from the N recommendation for the first crop listed. See Chapter 9 in UWEX Publication A2809 for more details.
All:If manure, biosolids, septage or other waste materials have been applied to this field, be sure to take nutrient credits and adjust fertilizer rate. See Chapter 9 in UWEX Publication A2809 for more details.
All:Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
Corn, grain:At least one expected yield specified is outside the allowable range. Recommendations reflect more typical yields.
All:Buffer pH not required for calculation of lime requirement when soil pH is 6.6 or higher.
All:Parts of this field may benefit from liming. Please see the lime requirementsfor individual samples.
Corn:Nitrogen application rates for grain and silage corn reflect the maximum return to N (MRTN) at a 0.10 N:corn price ratio (eg. $0.30/lb N and $3.00/bu; or $0.40/lb N and $4.00/bu) and the range of rates that produce profitability within $1/a of the MRTN rate. N application rates can be adjusted to reflect different prices for N and grain. See Chapter 6 in UWEX Publication A2809 for more details.
Corn, grain:If soybean is the previous crop to corn (grain or silage) or wheat, rotational N credits are already factored in the N application rate.
Corn:Starter fertilizer may accelerate early season corn development, which may not always translate into increased yield. Corn will benefit more from a complete starter fertilizer (e.g. 10+20+20 lbs N+P2O5+K2O/a) when grown on soils testing optimum or less in P and K.
Corn, grain:If corn is harvested for silage instead of grain apply extra 90 lbs K2O per acre to next crop.
All:Ca test average value of 1255.844 is in High category.
All:Mg test average value of 129.493 is in Optimum category.

Appendix D

SnapPlus Reports for WQT

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D-1 – Baseline P Trade Report

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WQ1: P Trade Report

Reported For	Grassland Dairy WQT 2021 v1
Printed	2025-03-21
Plan Completion/Update Date	2021-10-12
SnapPlus Version 20.4 built on 2021-06-03	
X:\FJ\G\GRADA\161399\8-planning\SP Updated Modeling 062024\Snap Plus Modeling - Corn Grain 2025\20250305 - Grassland Dairy WQT - 101 and 104 Future Applications Baseline - Corn Grain 2025.snapDb	

Prepared for:
Grassland Dairy WQT 2021 v1
attn:Grassland Dairy WQT 2021 v1
Greenwood,

Prepared by: Greenwood,

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	2022	2023	2024	2025	2026	2027	2028	2029
101A	LOYAL	LoB	58	322	240	540	678	280	499	278	271
101B	HILES	LsC	2	15	12	27	32	12	23	12	11
101D	ROZELLVILLE	RzB	2	6	4	9	10	4	8	4	4
101F	KERT	WkA	4	17	17	29	32	17	26	17	18
104A	HILES	HeB	66	143	460	284	478	241	405	235	227
104B	HILES	HeB	59	138	435	274	461	233	391	227	219

P Trade Report				PTP							
Field Name	Soil Series	Soil Symbol	Acres	2022	2023	2024	2025	2026	2027	2028	2029
104C	HILES	HeB	25	50	170	110	186	94	157	91	88
Total			**215**	**690**	**1,339**	**1,272**	**1,877**	**881**	**1,509**	**865**	**838**

D-2 – Reduction P Trade Report

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WQ1: P Trade Report

Reported For	Grassland Dairy WQT 2021 v1
Printed	2025-03-21
Plan Completion/Update Date	2021-10-12
SnapPlus Version 20.4 built on 2021-06-03	
X:\FJ\G\GRADA\161399\8-planning\SP Updated Modeling 062024\Snap Plus Modeling - Corn Grain 2025\20250305 - Grassland Dairy WQT - 101A Filter Strips + 101B,D,F Prairie + 104 Filter Strips - Corn Grain 2025.snapDb	

Prepared for:
Grassland Dairy WQT 2021 v1
attn:Grassland Dairy WQT 2021 v1
Greenwood,

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	2022	2023	2024	2025	2026	2027	2028	2029
101A	LOYAL	LoB	58	108	115	176	227	132	184	129	141
101B	HILES	LsC	2	15	12	27	5	2	2	2	1
101D	ROZELLVILLE	RzB	2	6	4	9	2	1	1	1	1
101F	KERT	WkA	4	17	17	29	12	9	8	7	7
104A	HILES	HeB	66	52	144	101	175	128	156	124	118
104B	HILES	HeB	59	54	143	97	169	123	151	119	114

P Trade Report				PTP							
Field Name	Soil Series	Soil Symbol	Acres	2022	2023	2024	2025	2026	2027	2028	2029
104C	HILES	HeB	25	19	54	39	68	50	61	48	46
Total			**215**	**271**	**489**	**477**	**657**	**444**	**562**	**429**	**429**

D-3 – Baseline NM3 Report

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NM3: Field Data and 590 Assessment Plan

Reported For	Grassland Dairy WQT 2021 v1
Printed	2025-03-21
Plan Completion/Update Date	2021-10-12
SnapPlus Version 20.4 built on 2021-06-03	
X:\FJ\G\GRADA\161399\8-planning\SP Updated Modeling 062024\Snap Plus Modeling - Corn Grain 2025\20250305 - Grassland Dairy WQT - 101 and 104 Future Applications Baseline - Corn Grain 2025.snapDb	

Prepared for:
Grassland Dairy WQT 2021 v1
attn:Grassland Dairy WQT 2021 v1
Greenwood,

Prepared by: Greenwood,

Field Data: 215 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
101A				57.9	Clark	LOYAL LoB	4	200	2.1 - 6	301 - 1000	No / No	No	Yes	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**4**	**2.8**	**0.5**	**4**	122	51	-40
101B				2.3	Clark	HILES LsC	9	175	0 - 2	301 - 1000	No / No	No	No	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**3**	**4.7**	**0.4**	**6**	122	51	-40
101D				1.6	Clark	ROZELLVILLE RzB	4	300	2.1 - 6	301 - 1000	No / No	No	No	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**5**	**2**	**0.6**	**3**	122	51	-40
101F				4.2	Clark	HILES HeB	4	250	2.1 - 6	301 - 1000	No / No	No	No	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**3**	**2.2**	**0.6**	**4**	185	51	-40
104A				66.2	Clark	HILES LsC	9	175	0 - 2	1001 - 5000	No / No	No	Yes	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**3**	**4.9**	**0.3**	**6**	185	180	-40
104B				58.5	Clark	HILES HeB	4	250	0 - 2	301 - 1000	No / No	No	Yes	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**3**	**2.3**	**0.5**	**4**	185	180	-40
104C				24.6	Clark	HILES HeB	4	250	2.1 - 6	1001 - 5000	No / No	No	Yes	Cg-Sg15-Cg	SVT-SVT-SVT	2025-2027	**3**	**2.3**	**0.5**	**3**	185	180	-40

Crop Abbreviations

Abbreviation	Crop
Cg	Corn grain
Sg15	Soybeans 15-20 inch row

Tillage Abbreviations

Abbreviation	Tillage
SVT	Spring vertical tillage

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D-4 – Reduction NM3 Report

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NM3: Field Data and 590 Assessment Plan

Reported For	Grassland Dairy WQT 2021 v1
Printed	2025-03-21
Plan Completion/Update Date	2021-10-12
SnapPlus Version 20.4 built on 2021-06-03	
X:\FJ\G\GRADA\161399\8-planning\SP Updated Modeling 062024\Snap Plus Modeling - Corn Grain 2025\20250305 - Grassland Dairy WQT - 101A Filter Strips + 101B,D,F Prairie + 104 Filter Strips - Corn Grain 2025.snapDb	

Prepared for:
Grassland Dairy WQT 2021 v1
attn:Grassland Dairy WQT 2021 v1
Greenwood,

Field Data: 215 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
101A				57.9	Clark	LOYAL LoB	4	200	2.1 - 6	301 - 1000	No / Edge	No	Yes	Cg-Sg15-Cg-Cg-Sg15	SVT-SVT-SVT-SVT-SVT	2025-2029	**4**	**3.1**	**0.6**	**1**	122	162	-65
101B				2.3	Clark	HILES LsC	9	175	0 - 2	301 - 1000	No / No	No	No	Gnh-Gnh-Gnh-Gnh-Gnh	None-None-None-None-None	2025-2029	**3**	**0**	**1.6**	**0**	122	0	0
101D				1.6	Clark	ROZELLVILLE RzB	4	300	2.1 - 6	301 - 1000	No / No	No	No	Gnh-Gnh-Gnh-Gnh-Gnh	None-None-None-None-None	2025-2029	**5**	**0**	**1.6**	**0**	122	0	0
101F				4.2	Clark	HILES HeB	4	250	2.1 - 6	301 - 1000	No / No	No	No	Gnh-Gnh-Gnh-Gnh-Gnh	None-None-None-None-None	2025-2029	**3**	**0**	**1.6**	**0**	185	0	0
104A				66.2	Clark	HILES LsC	9	175	0 - 2	1001 - 5000	No / Edge	No	Yes	Cg-Sg15-Cg-Cg-Sg15	SVT-SVT-SVT-SVT-SVT	2025-2029	**3**	**5.2**	**0.5**	**2**	185	291	-65
104B				58.5	Clark	HILES HeB	4	250	0 - 2	301 - 1000	No / Edge	No	Yes	Cg-Sg15-Cg-Cg-Sg15	SVT-SVT-SVT-SVT-SVT	2025-2029	**3**	**2.5**	**0.6**	**1**	185	291	-65

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
104C				24.6	Clark	HILES HeB	4	250	2.1 - 6	1001 - 5000	No / Edge	No	Yes	Cg-Sg15-Cg-Cg-Sg15	SVT-SVT-SVT-SVT-SVT	2025-2029	**3**	**2.5**	**0.6**	**1**	185	291	-65

Crop Abbreviations

Abbreviation	Crop
Cg	Corn grain
Gnh	Grasslands, permanent, not harvested
Sg15	Soybeans 15-20 inch row

Tillage Abbreviations

Abbreviation	Tillage
None	None
SVT	Spring vertical tillage

Appendix E

Cost Analysis of Selected BMPs

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E-1 – Cost Opinion Summary

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BMP	Field	Total Initial Cost	Annual Maintenance Cost[1]	20-Year Net Present Worth[2]	Total Annualized Cost[2]	Tradeable PTP (lbs/yr)	Cost Per lb PTP ($/lb/yr)
Filter Strips	101A	$45,000	$4,500	$89,000	$9,100	78	$116
Filter Strips	104A	$42,000	$4,500	$86,000	$8,800	58	$151
Filter Strips	104B	$54,000	$4,600	$99,000	$10,200	56	$181
Filter Strips	104C	$36,000	$4,400	$79,000	$8,100	23	$358
Conservation Cover	101B	$40,000	$4,200	$81,000	$8,300	13	$641
Conservation Cover	101D	$34,000	$4,100	$74,000	$7,600	4	$1,837
Conservation Cover	101F	$56,000	$4,500	$100,000	$10,300	11	$914
Total		**$307,000**	**$30,800**	**$608,000**	**$62,400**	**244**	**$256**

1.Includes any estimated lost revenue
2. Assumes 8% Annual Interest Rate over 20 years

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E-2 –Cost Opinion Subfield Details

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Grassland Dairy Company Water Quality Trading Plan
Filter Strip Field 101A Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$939.17
3	CLEARING AND GRUBBING	AC	2.1	$330.00	$693.00
4	GRADING FOR FILTER STRIP	AC	2.1	$550.00	$1,155.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	10,164.0	$1.27	$12,857.51
A.	TOTAL CONSTRUCTION COST				$33,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$6,600.00
C.	ENGINEERING (15% OF CONSTRUCTION COST)				$4,950.00
	TOTAL INITIAL COST				**$45,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$4,600.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	2.1	$125.00	$262.50
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$175.00	$1,400.00
6	OUTREACH AND EDUCATION	HR	4	$175.00	$700.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,500.00**
	TOTAL ANNUALIZED COSTS				**$9,100.00**

Grassland Dairy Company Water Quality Trading Plan
Filter Strip Field 104A Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$876.14
3	CLEARING AND GRUBBING	AC	1.8	$330.00	$594.00
4	GRADING FOR FILTER STRIP	AC	1.8	$550.00	$990.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	8,712.0	$1.27	$11,020.72
A.	TOTAL CONSTRUCTION COST				$31,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$6,200.00
C.	ENGINEERING (15% OF CONSTRUCTION COST)				$4,650.00
	TOTAL INITIAL COST				**$42,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$4,300.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	1.8	$125.00	$225.00
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$175.00	$1,400.00
6	OUTREACH AND EDUCATION	HR	4	$175.00	$700.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,500.00**
	TOTAL ANNUALIZED COSTS				**$8,800.00**

Grassland Dairy Company Water Quality Trading Plan
Filter Strip Field 104B Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$1,149.24
3	CLEARING AND GRUBBING	AC	3.1	$330.00	$1,023.00
4	GRADING FOR FILTER STRIP	AC	3.1	$550.00	$1,705.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	15,004.1	$1.27	$18,980.14
A.	TOTAL CONSTRUCTION COST				$40,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$8,000.00
C.	ENGINEERING (15% OF CONSTRUCTION COST)				$6,000.00
	TOTAL INITIAL COST				**$54,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$5,600.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	3.1	$125.00	$387.50
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$175.00	$1,400.00
6	OUTREACH AND EDUCATION	HR	4	$175.00	$700.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,600.00**
	TOTAL ANNUALIZED COSTS				**$10,200.00**

Grassland Dairy Company Water Quality Trading Plan
Filter Strip Field 104C Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$729.09
3	CLEARING AND GRUBBING	AC	1.1	$330.00	$363.00
4	GRADING FOR FILTER STRIP	AC	1.1	$550.00	$605.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	5,324.0	$1.27	$6,734.89
A.	TOTAL CONSTRUCTION COST				$26,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$5,200.00
C.	ENGINEERING (15% OF CONSTRUCTION COST)				$3,900.00
	TOTAL INITIAL COST				**$36,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$3,700.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	1.1	$125.00	$137.50
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$175.00	$1,400.00
6	OUTREACH AND EDUCATION	HR	4	$175.00	$700.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,400.00**
	TOTAL ANNUALIZED COSTS				**$8,100.00**

Grassland Dairy Company Water Quality Trading Plan
Field 101B to Prairie Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$943.23
3	CLEARING AND GRUBBING	AC	2.3	$330.00	$759.00
4	GRADING FOR FILTER STRIP	AC	2.3	$0.00	$0.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	11,132.0	$1.27	$14,082.04
A.	TOTAL CONSTRUCTION COST				$33,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$6,600.00
	TOTAL INITIAL COST				**$40,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$4,100.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	2.3	$125.00	$287.50
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$150.00	$1,200.00
6	OUTREACH AND EDUCATION	HR	4	$150.00	$600.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,200.00**

	TOTAL ANNUALIZED COSTS	**$8,300.00**

Grassland Dairy Company Water Quality Trading Plan
Field 101D to Prairie Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$807.73
3	CLEARING AND GRUBBING	AC	1.6	$330.00	$528.00
4	GRADING FOR FILTER STRIP	AC	1.6	$0.00	$0.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	7,744.0	$1.27	$9,796.20
A.	TOTAL CONSTRUCTION COST				$28,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$5,600.00
	TOTAL INITIAL COST				**$34,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$3,500.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	1.6	$125.00	$200.00
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$150.00	$1,200.00
6	OUTREACH AND EDUCATION	HR	4	$150.00	$600.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,100.00**

	TOTAL ANNUALIZED COSTS	**$7,600.00**

Grassland Dairy Company Water Quality Trading Plan
Field 101F to Prairie Cost Estimate

INITIAL COST					
No.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
1	CONSERVATION EASEMENT	EA	1	$10,000.00	$10,000.00
2	MOBILIZATION	LS	1	3%	$1,311.03
3	CLEARING AND GRUBBING	AC	4.2	$330.00	$1,386.00
4	GRADING FOR FILTER STRIP	AC	4.2	$0.00	$0.00
5	TRADE COORDINATION	HR	40.0	$165.00	$6,600.00
6	SEEDING	SY	20,328.1	$1.27	$25,715.02
A.	TOTAL CONSTRUCTION COST				$46,000.00
B.	CONTINGENCY (20% OF CONSTRUCTION COST)				$9,200.00
	TOTAL INITIAL COST				**$56,000.00**
	ANNUALIZED INITIAL COST (8% Interest over 20 years)				**$5,800.00**

ANNUAL MAINTENANCE COSTS					
.	**ITEM**	**UNIT**	**QUANTITY**	**UNIT PRICE**	**TOTAL COST**
2	MAINTENANCE VEGETATION MOWING	HR	40	$40.00	$1,600.00
1	YIELD REVENUE LOST (GRASSLAND RENT)	AC	4.2	$125.00	$525.00
3	REGRADING AND RE-SEEDING	EA	1	$500.00	$500.00
4	LAND RENTAL COSTS	AC	0.0	$300.00	$0.00
5	COMPLIANCE CHECK	HR	8	$150.00	$1,200.00
6	OUTREACH AND EDUCATION	HR	4	$150.00	$600.00
	TOTAL ANNUAL MAINTENANCE COSTS				**$4,500.00**

	TOTAL ANNUALIZED COSTS	**$10,300.00**

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Appendix F

SPARROW Delivery Fractions Map

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Grassland Dairy Outfall

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Grassland Dairy Outfall
Fields Selected for WQT
Streams
HUC-12 Subwatershed
SPARROW Delivery Fractions
Grassland Dairy Plant

)HHW

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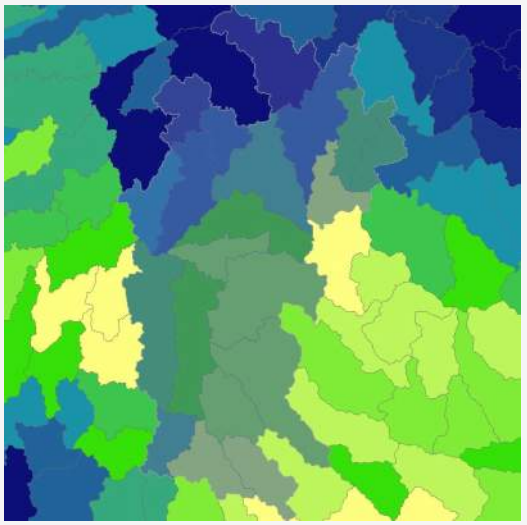
Appendix G

Presto Report – Facility Outfall in Black River

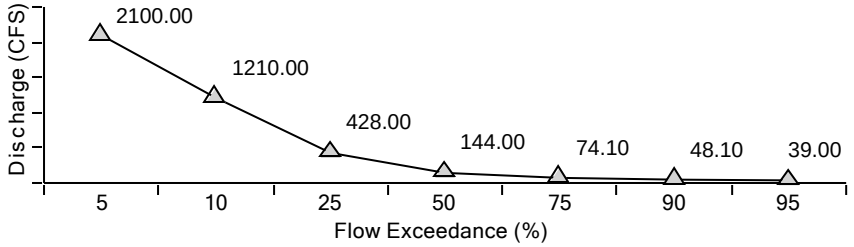
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PRESTO-Lite Watershed Delineation Report

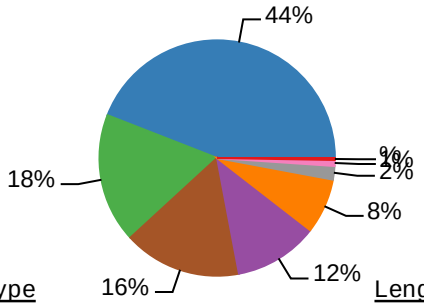
Reach ID: 200122780
Watershed Name: Mound Creek-Black River
Waterbody Name: Black River
HUC08: Black
Watershed Area: 611.33 mi²
Average Annual Precipitation: 32.24in



Stream Flow

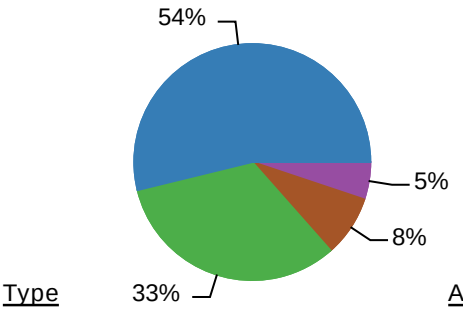


Tributary Stream Type



Type	Length
Macroinvertebrates	671637 ft
Cool-Cold Headwater	270360 ft
Cold Headwater	246008 ft
Coldwater	175886 ft
Cold Mainstem	115225 ft
Cool-Cold Mainstem	28313 ft
Warm Headwater	12310 ft
Warm Mainstem	3989 ft

Landcover



Type	Area
Agriculture	323.95 mi²
Forest	197.03 mi²
Wetland	50.25 mi²
Urban	30.87 mi²
Open Water	3.61 mi²
Grassland	3.42 mi²
Barren	2.32 mi²

PRESTO Phosphorus Load Estimate

Avg. Annual Nonpoint Phosphorous Load (80% Confidence Interval)	91,406 (42,772 - 195,340) lbs
Number of Facilities (Individual Facility Information below)	10
Avg. Annual Point-source Phosphorous Load (2010 - 2012 total of all facilities)	4,915lbs
Most Likely Point : Nonpoint Phosphorous Ratio	5% : 95%
Low Estimate Point : Nonpoint Phosphorous Ratio (Adaptive Management)	2% : 98%

Adaptive Management Results

Facilities Discharging to the Mound Creek-Black River Watershed:

Facility Name	Permit #	Outfall #	Waste Type	Receiving Water	Avg. Phosphorus Load (lbs.) (2010 - 2012)
MEDFORD CITY OF	0036731	001	Municipal	Black River	1345
DORCHESTER WASTEWATER TREATMENT FACILITY	0021571	001	Municipal	Unnamed	541
CHELSEA SANITARY DISTRICT	0035718	001	Municipal	Black River	76
GREENWOOD WASTEWATER TREATMENT FACILITY	0020249	001	Municipal	Black River	577
GRASSLAND DAIRY PRODUCTS, INC.	0002984	002	Industrial	Black River	387
OWEN WASTEWATER TREATMENT FACILITY	0020940	001	Municipal	Black River	549
CLARK COUNTY HEALTH CARE CENTER WWTF	0029700	001	Municipal	North Fork of the Popple River	371
MAPLE ISLAND INC	0003883	001	Industrial	Black River	25
CURTISS WASTEWATER TREATMENT FACILITY	0031445	001	Municipal	Unnamed	1044
LOYAL WASTEWATER TREATMENT FACILITY	0022179	001	Municipal	Black River	0

Watershed Analysis Limitations

- This analysis relies on pre-defined catchments from the Wisconsin Hydrography Data-Plus and may not delineate from the exact location required. When assessing phosphorus loads for specific facility in support of efforts such as adaptive management, care should be taken to ensure that additional downstream point sources do not exist. For adaptive management information related to specific facilities please reference the PRESTO website http://dnr.wi.gov/topic/surfacewater/presto.html
- Delineation of watersheds is based on a topographic assessment and therefore do not account for modified drainage networks such as stormwater sewer systems and ditched agriculture.
- If a watershed requires delineation from an exact location the user may use the desktop version of PRESTO that requires ESRI ArcGIS. The PRESTO tool and default datasets can be downloaded at http://dnr.wi.gov/topic/surfacewater/presto.html
- Data sources for this report originate from the WDNR's Wisconsin Hydrography Data-Plus value-added dataset and the point and non-point source loading information including in the WDNR's PRESTO model.
- If you have questions about the report generated from the PRESTO-Lite application please contact: DNRWATERQUALITYMODELING@wisconsin.gov

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Appendix H

Items for Code 303

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H-1 – Statement of Work for CPS Filter Strip (Code 393)

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STATEMENT OF WORK
Filter Strip (393)
Wisconsin

These deliverables apply to this individual practice. For deliverables for other planned practices, refer to those specific Statements of Work.

DESIGN

Deliverables

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices
   a. Practice purpose(s) as identified in the Implementation Requirements.
   b. List of required permits to be obtained by the client, if applicable
   c. List all required and/or facilitating practices, if applicable
   d. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
      i. Strip width, length and percent slope
      ii. Erosion calculations
      iii. Vegetative species selection
      iv. Size and percent slope of area contributing runoff to the filter strip
2. Written plans and specifications including sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits. Plans and specification shall be developed in accordance with the requirements of conservation practice standard Filter Strip (Code 393) and documented on the 393 Implementation Requirements Document.
3. Operation and maintenance plan
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations documented on the 393 Implementation Requirements Document.
5. Design modifications during installation as required

INSTALLATION

Deliverables

1. Pre-installation conference with client
2. Verification that client has obtained required permits
3. Staking and layout according to plans and specifications including applicable layout notes
4. Installation guidance as needed
5. Facilitate and implement required design modifications with client and original designer
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during application
7. Certification that the installation process and materials meets design and permit requirements

CHECK OUT

Deliverables

1. Records of installation
   a. Extent of practice units applied.
   b. Actual plant materials used.
2. Certification that the installation meets NRCS standards and specifications and is in compliance with permits

documented on the 393 Implementation Requirements Document.

3. Progress reporting

REFERENCES

- NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard Filter Strip (393)
- NRCS National Agronomy Manual
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

H-2 – Conservation Practice Standard Filter Strip (Code 393)

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Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

FILTER STRIP

CODE 393

(ac)

DEFINITION

A strip or area of herbaceous vegetation that removes contaminants from overland flow.

PURPOSE

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

- Reduce suspended solids and associated contaminants in runoff and excessive sediment in surface waters
- Reduce dissolved contaminant loadings in runoff
- Reduce suspended solids and associated contaminants in irrigation tailwater and excessive sediment in surface waters

CONDITIONS WHERE PRACTICE APPLIES

Filter strips are established where environmentally sensitive areas need to be protected from sediment, other suspended solids, and dissolved contaminants in runoff.

This practice **DOES NOT** apply under the following conditions:

- The treatment of conditions where high levels of pollutants can be anticipated from areas such as: a) animal feed lots, b) feed storage areas, c) milking center waste areas, d) manure stacking areas, e) direct runoff from manure land application, f) construction sites, g) urban storm water runoff and h) timber harvest locations.
- Where soil loss is above Tolerable “T” rates within the contributing watershed.
- Where the predominant source of runoff is concentrated flow.

CRITERIA

General Criteria Applicable to All Purposes

Overland flow entering the filter strip will be uniform sheet flow.

Concentrated flow will be dispersed before it enters the filter strip.

The maximum gradient along the leading edge of filter strip will not exceed one-half of the up-and-down-hill slope percent, immediately upslope from the filter strip, up to a maximum of five percent.

Filter strips will not be used as a travel lane for equipment or livestock.

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

USDA is an equal opportunity provider, employer, and lender.

Additional Criteria to Reduce Dissolved Contaminants, Suspended Solids and Associated Contaminants in Runoff and Excessive Sediment in Surface Waters

The filter strip will be designed to have a 10-year life span, following the procedure in Wisconsin Agronomy Technical Note 10, Planning, design management and maintenance of vegetative filter strips for sediment.

The minimum flow length through the filter strip will be 20 feet for suspended solids and associated contaminants in runoff and 30 feet for dissolved contaminants and pathogens in runoff.

The filter strip will be located immediately downslope from the source area of contaminants.

The drainage area immediately above the filter strip will have a slope of one percent or greater.

Vegetation

The filter strip will be established to permanent herbaceous vegetation.

Species selected will be:

- Able to withstand partial burial from sediment deposition.
- Tolerant of herbicides used on the area that contributes runoff to the filter strip.
- Stiff stemmed and a high stem density near the ground surface.
- Suited to current site conditions and intended uses including soil conditions, flooding, frequency, upland herbicide treatments, etc.
- Able to achieve adequate density and vigor within an appropriate period to stabilize the site sufficiently to permit suited uses with ordinary management activities.

Plant species, rates of seeding (lbs./acre), vegetative planting (plants/ac), minimum quality of planting stock (pure live seed [PLS] or stem caliper), and method of establishment shall be specified before application. Only viable, high quality seed or planting stock will be used.

Perform site preparation and seeding/planting at a time and in a manner that best ensures survival and growth of selected species. Successful establishment parameters, (e.g., minimum percent ground/ canopy cover, percent survival, stand density) will be specified before application.

Schedule planting dates during periods when soil moisture is adequate for germination and establishment. Seeding will be timed so that tillage for adjacent crop does not damage the seeded filter strip.

Where the purpose is to remove phosphorus, remove (or harvest) the filter strip aboveground biomass at least once each year.

The minimum seeding and stem density will be equivalent to the seeding rate for a high quality grass hay seeding rate for the climate area or the density of vegetation selected in current water erosion technology to determine trapping efficiency, whichever is the higher seeding rate.

Additional Criteria to Reduce Suspended Solids and Associated Contaminants in Irrigation Tailwater and Excessive Sediment in Surface Waters

Filter strip vegetation will be a small grain or other suitable annual plant.

The seeding rate shall be sufficient to ensure that the plant spacing does not exceed 4 inches (about 16-18 plants per square foot).

Establish filter strips prior to the irrigation season so that the vegetation is mature enough to filter sediment from the first irrigation.

CONSIDERATIONS

General Considerations

Filter strip width (flow length) can be increased as necessary to accommodate harvest and maintenance equipment.

Filters strips with the leading edge on the contour will function better than those with a gradient along the leading edge.

Seeding rates that establish a higher stem density than the normal density for a high quality grass hay crop will be more effective in trapping and treating contaminants.

When needed, invasive plant species may be controlled through mowing, herbicides, and hand weeding.

Consideration for Reducing Suspended Solids and Associated Contaminants in Runoff

Increasing the width of the filter strip beyond the minimum required will increase the potential for capturing more contaminants in runoff.

Considerations for Creating, Restoring or Enhancing Herbaceous Habitat for Wildlife and Beneficial Insects and Pollinators

Filter strips are often the only break in the monotony of intensively-cropped areas. The wildlife and pollinator benefits of this herbaceous cover can be enhanced by the following:

- When appropriate, use native grass species that fulfill the purpose(s) of the practice while also providing habitat for priority wildlife.
- Adding herbaceous plant species (including native forbs) to the seeding mix that are beneficial to wildlife and pollinators and are compatible for one of the listed purposes. Changing the seeding mix should not detract from the purpose for which the filter strip is established.
- Increasing the width beyond the minimum required. The additional area can increase food and cover for wildlife and pollinators.
- Management activities on filter strips (mowing, burning, or light disking), should not be done more often than every other year with frequency dependent on geographical location to maintain the purpose(s) of the practice.
- Management activities should be completed outside of the primary nesting, fawning, and calving seasons. Activities should be timed to allow for regrowth before the growing season ends.
- Organic producers should submit plans and specifications to their certifying agent for approval prior to installation, as part of the organic producer's organic system plan.

Considerations to Maintain or Enhance Watershed Functions and Values

Filter strips may be used to enhance connectivity of corridors and non-cultivated patches of vegetation within the watershed, enhance the aesthetics of a watershed, and be strategically located to reduce runoff, and increase infiltration and groundwater recharge throughout the watershed.

Increase Carbon Storage

Increasing the width of the filter strip beyond the minimum required will increase potential for carbon sequestration.

PLANS AND SPECIFICATIONS

Specifications for establishment and operation of this practice will be prepared for each field or treatment unit. Record the specifications using the implementation requirements document. The specifications will identify at a minimum the following:

- Practice purpose(s).
- Length, width (width refers to flow length through the filter strip), and slope of the filter strip to

accomplish the planned purpose(s).

- Plant species selection and seeding/planting/sprigging rates to accomplish the planned purpose.
- Planting dates and planting method(s).
- Specific care and handling requirements of the seed or plant material to ensure that planted materials have an acceptable rate of survival.
- A statement that only viable, high quality, and adapted seed will be used.
- Site preparation instructions sufficient to establish and grow selected species.

OPERATION AND MAINTENANCE

- For the purposes of filtering contaminants, permanent filter strip vegetative plantings shall be harvested as appropriate to encourage dense growth, maintain an upright growth habit, and remove nutrients and other contaminants that are contained in the plant tissue.
- Control undesired weed species, especially State-listed noxious weeds.
- If prescribed burning is used to manage and maintain the filter strip, an approved burn plan must be developed.
- Inspect the filter strip after storm events and repair any gullies that have formed, remove unevenly deposited sediment accumulation that will disrupt sheet flow, reseed disturbed areas, and take other measures to prevent concentrated flow through the filter strip.
- Apply supplemental nutrients as needed to maintain the desired species composition and stand density of the filter strip.
- Periodically regrade and reestablish the filter strip area when sediment deposition at the filter strip-field interface jeopardizes its function. Reestablish the filter strip vegetation in these regraded areas, if needed.
- If grazing is used to harvest vegetation from the filter strip, the grazing plan must ensure that the integrity and function of the filter strip is not adversely affected.

REFERENCES

Dillaha, T.A., J.H. Sherrard, and D. Lee. 1986. Long-Term Effectiveness and Maintenance of Vegetative Filter Strips. VPI-VWRRC Bulletin 153.

Dillaha, T.A., and J.C. Hayes. 1991. A Procedure for the Design of Vegetative Filter Strips: Final Report Prepared for U.S. Soil Conservation Service.

Foster, G.R. Revised Universal Soil Loss Equation, Version 2 (RUSLE2) Science Documentation (In Draft). USDA-ARS, Washington, DC. 2005.

Renard, K.G., G.R. Foster, G.A. Weesies, D.K. McCool, and D.C. Yoder, coordinators. 1997. Predicting Soil Erosion by Water: A Guide to Conservation Planning with the Revised Universal Soil Loss Equation (RUSLE). U.S. Department of Agriculture. Agriculture Handbook 703.

Revised Universal Soil Loss Equation Version 2 (RUSLE2) Web site (checked May 2007): http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm.

M.G. Dosskey, M.J. Helmers, and D.E. Eisenhauer 2008. A Design Aid for Determining Width of Filter Strips. Journal of Soil and Water Conservation. July/Aug 2008—vol. 63, no. 4.

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Planning, Design, Management and Maintenance of Vegetative Filter Strips (VFS)

Wisconsin Agronomy Technical Note 10
Companion Document for Wisconsin Conservation Practice Standard, Filter Strip (Code 393)



Wisconsin

Natural Resources Conservation Service

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Overview

Vegetative filter strips (VFS) have proven to be an effective practice to trap contaminates (sediment, nutrients, pesticides, pathogens) in field runoff. The effectiveness of the VFS is dependent on the (1) proper design, (2) the proper location and layout, and (3) the proper assessment of the contributing runoff area. Properly designed and located, VFS can remove 70-85% of the sediment entering the VFS (C.-X. Jin, M.J.M. Romkens).

VFS designed to trap sediment will eventually fill with sediment and inhibit the functioning of the VFS to filter/trap sediment. The life span of the VFS, for sediment removal purposes, is dependent upon the rate of soil loss from the contributing area, the ratio of contributing area to the size of the VFS, and trapping efficiency. In 1999 Theo A. Dillaha, Ph.D., P.E. and John C Hayes, Ph.D., P.E. published a report “A Procedure for the Design of Vegetative Filter Strips”. In that report the authors developed a procedure to estimate the life of a VFS based on the rate of soil loss from the contributing area, the ratio of contributing area to the size of the VFS, and trapping efficiency.

Although Dillaha and Hayes used the Water Erosion Prediction Process (WEPP), the Revised Universal Soil Loss Equation, Version 2, (RUSLE2) can also be used to design and predict the expected lifespan of a VFS designed for the purpose of sediment removal based on the procedures developed by Dillaha and Hayes.

Vegetated filter strips that meet the minimum width and have uplands treated to tolerable limits in Wisconsin will meet the minimum life span of ten years under normal conditions. Uplands may not exceed tolerable levels.



View of Filter Strip

Using RUSLE2 To Design And Estimate Sediment Removal From VFS

The following information is needed:

1. Sediment delivery rate at the upper edge of the VFS for the “contributing area” to the VFS - calculated by RUSLE2 using the “overland flow slope length”.
2. Sediment Trapping Efficiency - calculated from RUSLE2 results.
3. Ratio of Contributing Area to VFS Area.

How To Determine Sediment Delivery Rate And Sediment Trapping Efficiency

To use RUSLE2 for the VFS design procedure requires the use of the “Advance”, “Summary”, or “Science” profile templates within RUSLE2. These templates provide the options to segment slopes when changes in slope, soil type, or management change within the “Overland Flow Slope Length”.

This procedure, using RUSLE2, requires the use of the “Overland Flow Slope Length” (Figure 1). The “Overland Flow Slope Length” is defined as the slope length from the point of origin of flow to the point where the slope enters concentrated flow or the upper edge of a VFS. **Note**: This differs from the slope length used for conservation planning which is the length from origin of flow to either concentrated flow or deposition. The slope lengths used for conservation planning purposes are usually shorter. Figure 1 diagrams the difference between slope length for conservation planning purposes and overland flow slope length on a convex/concave slope.

Figures 2 and 3 represent RUSLE2 screen shots that illustrate the use of the “Worksheet” and “Profile” views with the “Advanced” template. The “Summary” and “Science” templates can also be used.

Figures 2 and 3 illustrate the overland flow slope length of 350 feet. This is the length from the point of overland flow until the slope reached the VFS or concentrated flow. The slope is broken into 3 segments for this example. Your situation may require fewer or more segment breaks.

The soil loss for this example is 5.5 tons/acre/year where the slope enters the VFS (Figures 2 and 3). The estimated sediment yield leaving the lower (exit) portion of the VFS is 0.8 tons/acre/year. From the results in Figures 2 and 3 one can calculate the amount of sediment trapped (5.5 tons entering minus (-) 0.8 tons leaving = 4.7 tons/acre/year trapped in the VFS). The trapping efficiency can be calculated by dividing the “Sediment Trapped” by the “Soil Loss Rate entering the VFS”. In this example the Sediment Trapped (4.7) divided by Soil Loss (5.5) = 85%.

Figure 1: Overland Flow Slope Length vs. Slope Length for Conservation Planning

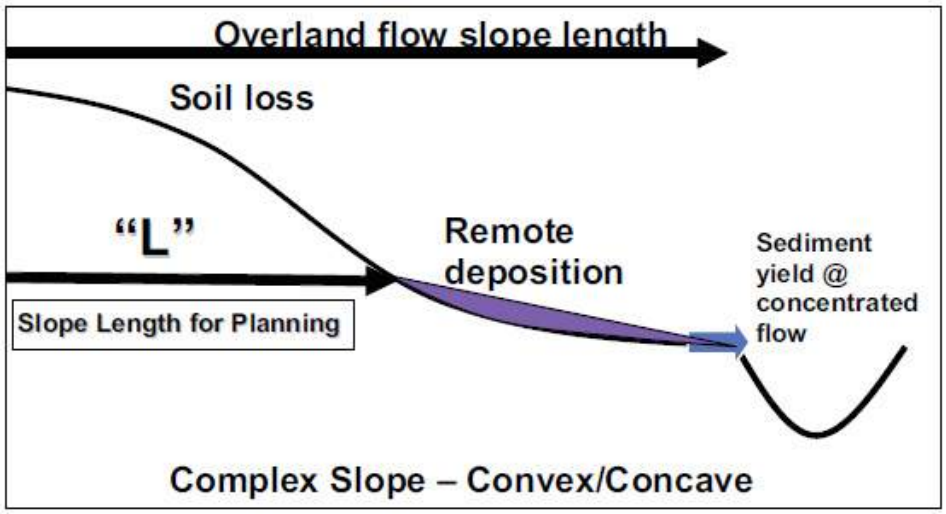
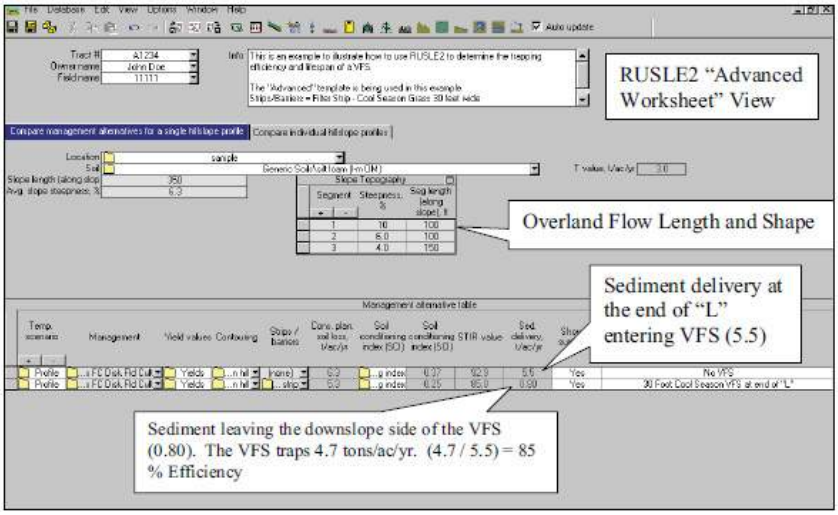


Figure 2: RUSLE2 Worksheet View Using The “Advanced” RUSLE2 Template Option



How to calculate the ratio of “Contributing Field Area” to “VFS Area”

Aside from knowing the sediment delivery rate that is entering the VFS and the sediment trapping efficiency one must also know the ratio of “Contributing Area” to “VFS Area”. Figure 4 illustrates the “Contributing Area” is defined as the area above the VFS that contributes “sheet flow” to the VFS. DO NOT COUNT ACRES THAT REACH THE VFS AS CONCENTRATED FLOW.

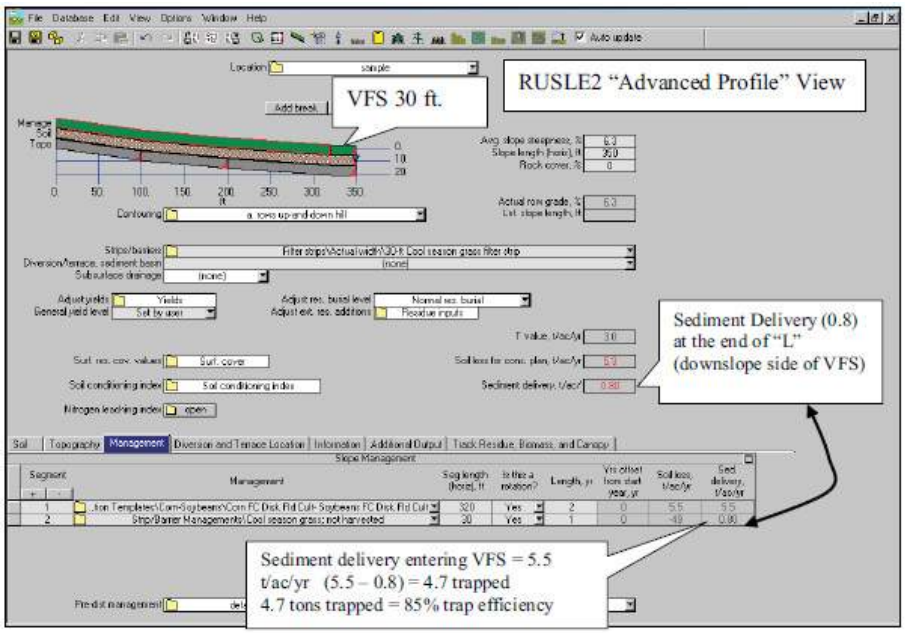
This ratio can be calculated using the following method:

(Ratio of Contributing Area to VFS Area)

1. Measure the “Contributing Area” (in acres) that sheet flows into the VFS.
2. Measure the “Area of the VFS” (in acres).
3. Divide the “Contributing Area” (in acres) by the “Area of the VFS” (in acres). For example, a 20 acre “Contributing Area” divided by a 0.8 acre VFS (20 acres / 0.8 acre. = 25). Therefore the ratio of Contributing Area to VFS is 25:1.

VFS are to be designed to have a minimum life span of ten (10) years. To maintain VFS, the rate of sediment accumulation should not exceed 0.6 inches per year (Dillaha and Hayes). At this rate of accumulation the grass should be able to adjust and survive. However, once the accumulation reaches six (6) inches the VFS will need to be re-graded and re-established.

Figure 3: RUSLE2 Profile View Using The "Advanced" RUSLE2 Template Option



Tables 1 - 3 depicts the estimated time (in years) to accumulate six (6) inches of sediment in a filter strip based on (1) sediment delivery rate to the VFS, (2) ratio of contributing area to VFS area, and (3) the trapping efficiency of the VFS. The shaded cells indicate those soil loss rates, trapping efficiencies, and drainage area to VFS ratios that fall within the 10 year projected life span criteria. Knowing the sediment delivery in ton/ac/yr. ratio of contributing area to VFS area, and the sediment trapping efficiency one can determine if the planned VFS has the minimum 10 year life span.

The following formula can also be used to calculate the number of years to accumulate six (6) inches of sediment in the VFS. This procedure assumes sediment weighs 92 lbs. /cubic foot.

1. Sediment Delivery to VFS (tons/acre/year) X 21.74 cubic feet/ton = Sediment Delivery cubic feet/acre/yr.
2. Sediment Delivery cubic feet/acre/yr. X Trapping Efficiency X Ratio = Cubic feet trapped in VFS/acre/yr.
3. Cubic feet trapped in VFS/acre/yr. / 43,560 square feet/acre X 12 in/ft. = Accumulated depth (inches/year)
4. 6 inches (Maximum Accumulation) / Accumulated depth (inches/year) = Years to Accumulate 6 inches

Figure 4: Example Illustration Showing Contribution Area, VFS Area, And Ratio Of Contributing Area To VFS Area

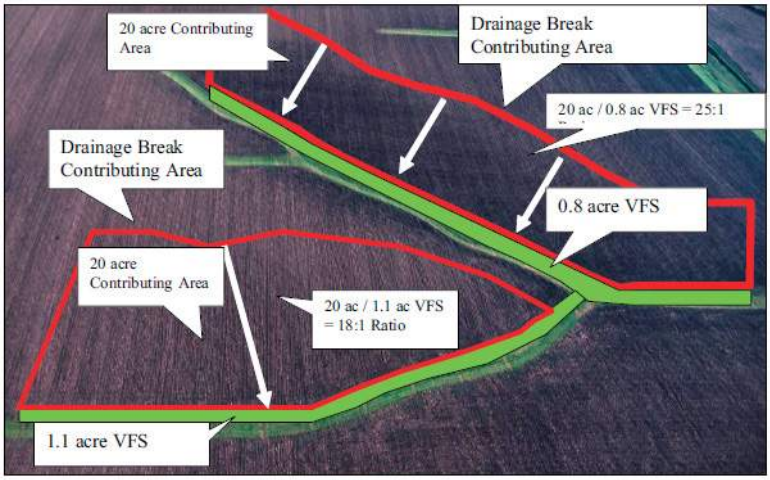


Table 1 Time to accumulate six (6) inches with a 85% trapping efficiency.

Sed. Delivery Tons/Ac/Yr @ upper edge of VFS	Time (years) to accumulate 6 inches of sediment (in years) with a **85%** trapping efficiency based on the contributing area to VFS ratio.						
	Ratio of Contributing Area to VFS						
	5:1	**10:1**	**20:1**	**50:1**	**75:1**	**100:1**	**200:1**
1.1	213.2	106.6	53.3	21.3	14.2	10.7	5.3
2.2	107.1	53.6	26.8	10.7	7.1	5.4	2.7
4.5	52.4	26.2	13.1	5.2	3.5	2.6	1.3
6.7	35.2	17.6	8.8	3.5	2.3	1.8	0.9
10.0	23.6	11.8	5.9	2.4	1.6	1.2	0.6
13.4	17.6	8.8	4.4	1.8	1.2	0.9	0.4
17.8	13.2	6.6	3.3	1.3	0.9	0.7	0.3
20.1	11.7	5.9	2.9	1.2	0.8	0.6	0.3

Table 2 Time to accumulate six (6) inches with a 75% trapping efficiency.

Sed. Delivery Tons/Ac/Yr @ upper edge of VFS	Time (years) to accumulate 6 inches of sediment (in years) with a **75%** trapping efficiency based on the contributing area to VFS ratio.						
	Ratio of Contributing Area to VFS						
	5:1	**10:1**	**20:1**	**50:1**	**75:1**	**100:1**	**200:1**
1.1	208.0	104.0	52.0	20.8	13.9	10.4	5.2
2.2	104.0	52.0	26.0	10.4	6.9	5.2	2.6
4.5	52.0	26.0	13.0	5.2	3.5	2.6	1.3
6.7	34.7	17.3	8.7	3.5	2.3	1.7	0.9
10.0	23.1	11.6	5.8	2.3	1.5	1.2	0.6
13.4	17.3	8.7	4.3	1.7	1.2	0.9	0.4
17.8	13.0	6.5	3.3	1.3	0.9	0.7	0.3
20.1	11.6	5.8	2.9	1.2	0.8	0.6	0.3

Table 3 Time to accumulate six (6) inches with a 50% trapping efficiency.

Sed. Delivery Tons/Ac/Yr @ upper edge of VFS	Time (years) to accumulate 6 inches of sediment (in years) with a **50%** trapping efficiency based on the contributing area to VFS ratio.						
	Ratio of Contributing Area to VFS						
	5:1	**10:1**	**20:1**	**50:1**	**75:1**	**100:1**	**200:1**
1.1	312.0	156.0	78.0	31.2	20.8	15.6	7.8
2.2	156.0	78.0	39.0	15.6	10.4	7.8	3.9
4.5	78.0	39.0	19.5	7.8	5.2	3.9	2.0
6.7	52.0	26.0	13.0	5.2	3.5	2.6	1.3
10.0	34.7	17.3	8.7	3.5	2.3	1.7	0.9
13.4	26.0	13.0	6.5	2.6	1.7	1.3	0.7
17.8	19.5	9.8	4.9	2.0	1.3	1.0	0.5
20.1	17.3	8.7	4.3	1.7	1.2	0.9	0.4

Example:

- Sediment Delivery = 5 tons/acre/year; Sediment Leaving the VFS = 1.25 tons/acre/year
- Trapping Efficiency = 75% (.75) (Sediment Delivered to VFS (5) - Sediment Leaving VFS 1.25) /
- Sediment Delivered to VFS (5)
- Ratio of Contributing Area (16 ac) to VFS area (0.8 acre) = 20 (16 / 0.8 = 20)

1. 5 t/ac/yr. X 21.74 ft3/ton = 108.7 ft3/ac/yr.
2. 108.7 ft3/ac/yr. X .75 Trapping Eff. X 20 Ratio = 1630.6 ft3/ac/yr. in VFS
3. (1630.6 ft3/ac/yr. in VFS / 43,560 ft2/ac) X 12 = 0.449 inches/yr. Accumulated Sediment
4. 6.0 inches (Maximum Accumulation) / 0.449 in/yr. Accumulated Sediment = 13.4 years to accumulate 6.0 inches of sediment in the VFS. (This would be an acceptable system for a minimum life span of 10 years)

Other Critical Design Components For A VFS Being Designed To Remove Sediment

1. The leading edge of the VFS must be laid out as close to the contour as possible to minimize flow paralleling the VFS. This may require the VFS that varies in width to keep the leading edge on the contour.
2. The slope entering the VFS must be at least 1% to allow runoff to enter the VFS. Slopes less than 1% will cause runoff and sediment to back up into the contributing area and not enter the VFS.
3. VFS are not effective to treat concentrated flow. Concentrated flows need to be converted to overland flow before being routed through the VFS. Care must be taken to calculate the sediment delivery and the contributing area to VFS ratio from the concentrated flow area.
4. A dense vegetation with stems less than one (1) inch apart is required to achieve treatment for sediment, nutrients, pathogens, and pesticides. This will generally require a much higher seeding rate than field borders or hay/pasture plantings.

Identifying The Resource Concern(s) That Create Conditions Where Filter Widths Should Be Increased.

1. Nutrient and pesticide applications are surface applied without incorporation.
2. Winter spreading of manure on frozen or snow-covered ground.
3. Snap Plus computations indicate more than 0.1 lbs. per acre of dissolved phosphorus could be leaving the field edge.
4. WIN-PST hazard ratings of Intermediate, or higher is an indication of potential pesticide movement in surface runoff and the leaching of pesticides to ground water is highly probable.
5. Fields or sub-fields with eroding conditions exceeding tolerable rates.

Management and Maintenance of Vegetative Filter Strips.

This section will address key management and maintenance activities identified in the filter strip standard.

Filter Strip Inspections

- The VFS should be inspected after intense storm events.
- Sediment deposits at the interface of the filter strip will require more intense maintenance as compared to the low edge or exit area of the VFS.
- Any development of rills and gullies upstream and within the filter strip must be minimized and immediately repaired.
- Remove unevenly deposits of sediment accumulation that will disrupt sheet flow and re-seed disturbed areas.

Grazing and Mechanical Harvesting of VFS Biomass

Consistent removal of biomass will result in improved water quality by exporting nutrients deposited in the VFS. The harvesting of plant materials should show a substantial reduction in phosphorus and other nutrients in the soil profile. Critical to the functioning of the VFS is the availability of living plant biomass to retard the flow of runoff from the contributing area, when the probability of runoff events are high. Caution is required when managing the filter strip nutrient loading by harvesting the plant material either mechanically or grazing critical runoff periods. Below is criteria and guidance to minimize off-site movement of dissolved and particulate pollutants when harvesting biomass in the VFS:

- Greater than 50% of the seed mixture consists of grass species.
- Vegetation cannot be harvested or removed consistently until planned vegetation is well established (12 - 16 plants per square foot).
- Introduced species shall not be cut shorter than 4 inches and native species shall not be cut shorter than 7 inches.
- Filter strips shall not have the biomass removed mechanically before May 20th or after September 15th for introduced species and no later than September 1st for native species.

Prescribed Grazing Mitigation Requirements

When grazing vegetative filter strips, an approved grazing plan shall comply wi0th the criteria of WI Practice Standard 528 Prescribed Grazing and include a grazing system that allows quick, intensive foraging under good soil conditions. Implement the following prescribed grazing techniques and requirements:

- Continuous grazing system is not allowed.
- Livestock are not allowed when soil is wet.
- Livestock must be excluded from the environmentally sensitive areas.
- Defer 1/3 of the filter strip acres from grazing during the nesting/fawning season each year.
- Grazing shall not occur after September 15th to allow regrowth.

Wildlife Mitigation Requirements

Implement the following guidance and wildlife mitigation techniques when harvesting biomass in the VFS during the primary nesting season (05-15 through 08-01):

- Deferred harvesting - Apply and maintain a or b of the following management activities to minimize the loss of wildlife species:
    - » Do not cut vegetation on at least 1/3 of the acres each year. Idle strips or blocks should be at least 30 feet wide.
    - » For at least 1/3 of the acreage, harvesting of vegetation should be either before and/or after the primary nesting season (May 15th - August 2nd).

References

C.-X. Jin, M.J.M. Romkens. October 2000. Experimental Studies of Factors in Determining Sediment Trapping in Vegetative Filter Strips. Transactions of the ASAE Vol. 44(2): 277-288

Theo A. Dillaha, Ph.D., P.E. and John C Hayes, Ph.D., P.E. 1991. “A Procedure for the Design of Vegetative Filter Strips”

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H-4 – Statement of Work for CPS Conservation Cover (Code 327)

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STATEMENT OF WORK
Conservation Cover (327)
Wisconsin

These deliverables apply to this individual practice. For deliverables for other planned practices, refer to those specific Statements of Work.

DESIGN

Deliverables

1. Design documents that demonstrate criteria in NRCS practice standard have been met and are compatible with planned and applied practices.
   a. List all required and/or facilitating practices.
   b. Practice standard criteria-related computations and analyses to develop plans and specifications including but not limited to:
      i. Planting dates.
      ii. Required site preparation activities agreed to by the client.
      iii. Species selection and seeding rates including Pure Live Seed calculation.
      iv. Required management of cover crops (if applicable) and vegetation after establishment.
      v. Wildlife considerations.
   c. Identify fields where the practice will be applied on a location map.
2. Written plans and specifications including location map, sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice and obtain necessary permits. Plans and specifications shall be developed in accordance with the conservation practice standard Conservation Cover (Code 327).
3. Operation and maintenance plan.
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
5. Documentation requirements for design modifications during practice application.
6. Itemized cost estimate.

INSTALLATION

Deliverables

1. Documentation of pre-application conference with client.
2. Verification that client has obtained required permits.
3. Staking and layout according to plans and specifications including applicable layout notes and/or maps.
4. Application guidance as needed including recommended seeding dates, site specific seedbed preparation, weed control and planting instructions.
5. Facilitate, implement and document any design modifications with the client, original designer, permitting and funding agencies.
6. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations, cost share program rules and NRCS policies during application.
7. Certification that the application process and materials meets design and permit requirements.

CHECK OUT

Deliverables

1. Records of application.
   a. Date of practice application.

b. Extent of practice units applied and location identified on a map.
c. Actual quantities of materials used and documentation of completion of required site preparation and weed control.

2. Certification that the application meets NRCS standards and specifications and is in compliance with permits.
3. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
   a. Technical Service Provider Name
   b. Customer name
   c. USDA program funding the practice (if known)
   d. Location of work (state, county, conservation district, land tract identifier)
   e. Land use of field where the practice was installed (cropland, etc.)
   f. NRCS practice name and quantity of practice installed in appropriate units
4. Documentation of exit conference with client and contractor.

REFERENCES

- WI NRCS Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard 327, Conservation Cover
- NRCS National Range and Pasture Handbook
- NRCS National Biology Manual
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

H-5 – Conservation Practice Standard Conservation Cover (Code 327)

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Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

CONSERVATION COVER

CODE 327

(ac)

DEFINITION

Establishing and maintaining permanent vegetative cover.

PURPOSE

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

- 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

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.

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.

CRITERIA

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

NRCS reviews and periodically updates conservation practice standards. To obtain the current version of this standard, contact your Natural Resources Conservation Service State office or visit the Field Office Technical Guide online by going to the NRCS website at https://www.nrcs.usda.gov/ and type FOTG in the search field.

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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
      i. A minimum of 5 grasses, sedges, or rushes and a minimum of 10 forbs and at least 1 legume must be seeded.
      ii. Seed will be planted at a minimum seeding rate of 50 seeds per square foot.
      iii. 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.
      iv. 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.

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.

1. 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.
2. 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.
3. Where applicable, this practice may be used to conserve and stabilize archeological and historic sites.
4. Consider rotating management and maintenance activities (e.g., mow only a portion each year) throughout the managed area to maximize cover diversity.
5. 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.
6. 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.
7. Consider the use of local genotype seed when native plantings are planned in the vicinity of rare remnant prairies.
8. 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.

9. 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.
10. Consider testing non-certified locally harvested native grass or forb seed genotypes when establishing native plant communities.

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.

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.

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.

1. 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

Common Name	Scientific Name	Moisture Regime	Single Species Seeding Rate (PLS)		
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

Common Name	**Scientific Name**	**PLS Oz/Ac**	**Seeds/Square Foot**
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

Common Name	Scientific Name	PLS Oz/Ac	Seeds/Square Foot
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	

Seed Calculator Code*	Mixtures	Pounds PLS per Acre	Seeds per Square Foot	Moisture Regime
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	25	
*These codes represent the mixtures used in the Wisconsin Seed Calculator.				



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

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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.

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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

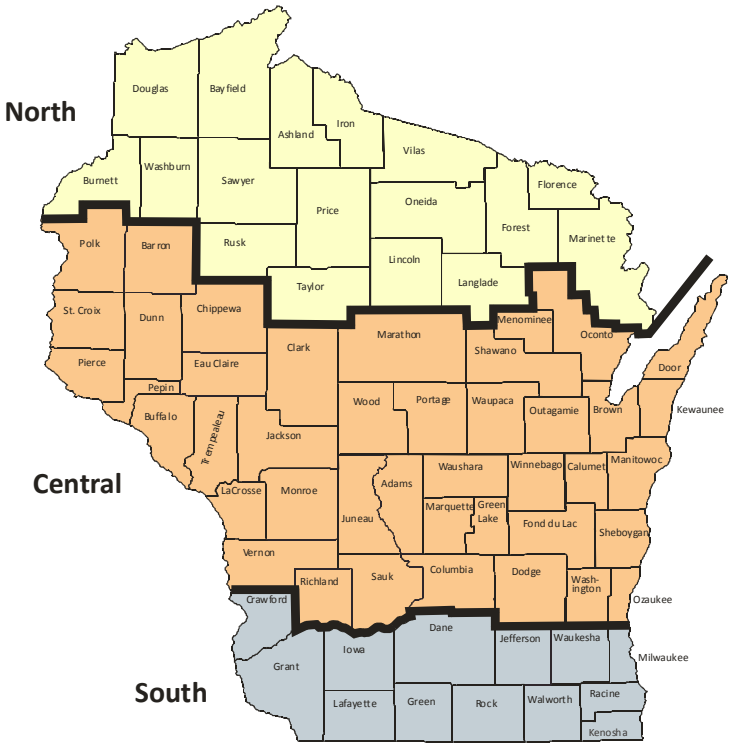


Table 2
Seeding Date/Ranges for
Warm Season Native Mixtures

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.

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United States Department of Agriculture
Natural Resources Conservation Service

Wisconsin Agronomy Technical Note 6

Establishing and Maintaining Introduced Grasses and Legumes

INTRODUCTION

This technical note will provide guidance for the establishment of introduced (non-native) plantings of perennial herbaceous vegetation for the purpose of meeting the criteria in Wisconsin Natural Resources Conservation Service (NRCS), Field Office Technical Guide (FOTG), Section IV, Practice Standards 327, Conservation Cover; 645, Wildlife Upland Habitat Establishment; 342, Critical Area Planting; and 512, Forage and Biomass Planting. Additional ecological and engineering standards will reference this technical note. Refer to those standards for specific practice purposes and requirements.

BACKGROUND

Introduced stands of perennial herbaceous vegetation have the potential to control soil erosion and sedimentation, improve water quality, and create or enhance wildlife habitat if properly established and maintained.

Introduced species are typically easier and less expensive to establish than native grasses and forbs. Seed sources are readily available, relatively inexpensive, and establishment methods are widely understood using common agricultural equipment.

Introduced plantings can provide high quality wildlife habitat with some degree of routine maintenance and cover management. These species will require some reoccurring interseeding to maintain a diverse plant community. Legumes adapted to wet and wet-mesic sites are typically short lived and will require routine reseeding to maintain plant diversity.

Introduced plantings are better adapted to the typical growing conditions in the Northern Planting Zone and tend to strive in areas where sunlight intensity is moderate, temperature is moderate, and water is readily available. These plants produce most of their growth during the spring, late summer, and early fall when the soil and air temperatures are cooler. For this group of plants, the minimum air temperature for active shoot growth is 40-42 degrees F. Growth is maximized at 65-75 degrees F.

For erosion control, on critical areas, introduced species are the preferred vegetation.

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SITE ASSESSMENT

Introduced plants are generally adapted to one or more soil moisture regimes: wet, wet-mesic, mesic, dry-mesic, and dry. These moisture regimes correlate to some degree with both drainage classes and forage suitability groups.

Drainage classes refer to the frequency and duration of wet periods under conditions similar to those under which the soil formed naturally. Alterations of the water regime by human activities are not considered in this case. These soil moisture regimes fall into one or more of the seven natural soil drainage classes.

Forage suitability groupings are an additional tool to provide guidance to planners. Forage Suitability Groups (FSG) are pasture and hay land soil interpretation reports that provide users with forage production guidance for the soils and climatic conditions present in their area of interest. The vast majority of forage plants utilized in Wisconsin are introduced grasses and legumes. For the purpose of this technical note, FSGs will focus on available water capacity, water table, and runoff potential. FSGs are divided into ten categories.

There is often no sharp division between moisture regimes, drainage classes and forage suitability groups, and oftentimes they blend or overlap into multiple categories. Understanding soil conditions plays an important role when planning a successful introduced herbaceous planting.

Refer to Table 1 correlating the five moisture regimes, seven drainage classes, and ten forage suitability groups.

SPECIE SELECTION AND SEED QUALITY

Evaluate the winter hardiness of species selected for planting. To ensure stand longevity, species listed as Hardy (H) or Very Hardy (VH) in Tables 2-8 of Wisconsin Circular A-1525, Forage Crop Variety Yield Trials for Wisconsin, are preferred. Varieties listed as Moderately Hardy-Plus (MH+) are acceptable.

Select species based on the site conditions looking closely at soil type and moisture regime. Tables 1, 2 and 3 will provide additional guidance for selecting species appropriate for the site conditions.

The recommended introduced species, listed in Table 2, are not identified as prohibited or restrictive for planting statewide in accordance with Natural Resource Law 40, Invasive Specie Control. However, Kentucky Bluegrass, Smooth Bromegrass, Redtop, Birdsfoot Trefoil, Red and White Cover are species that can propagate and spread with little difficulty due to their growth characteristics and should be evaluated carefully when plantings are planned in the vicinity of native remnants or natural areas.

- It is suggested that seed purchased be harvested within a 250 mile radius of the area where the planting will occur. This suggestion is less critical for introduced versus native species.
- For pollinator habitat, the recommended introduced bunch grasses are Orchardgrass, Tall Fescue, Perennial Ryegrass, and Timothy. Refer to Table 9 for introduced pollinator habitat mixtures.
- Kentucky Bluegrass, Bromegrass, and Redtop are examples of sod-forming plants. Refer to Table 8 for additional examples.

Introduced mixtures for wildlife habitat must contain at least 50 percent grass seed per square foot. The exception to this criteria is the establishment of pollinator habitat.

Introduced mixtures for areas with shrub and tree plantings are not required to contain 25 percent sod forming grass seed per square foot. These seed mixtures must still contain at least 50 percent grass seed per square foot. Sod-forming grasses are not recommended in shrub and tree plantings.

Below are species with multiple scientific names. The underlined specie is the most recognized genus and specie in Wisconsin and is referenced as such in vegetative Standards 327, Conservation Cover; 342, Critical Area Planting; and 512, Forage and Biomass Planting.

- **Tall Fescue:** Schedonorus arundinaceus, Lolium arundinacea, Festuca arundinacea
- **Meadow Fescue:** Schedonorus pratense, Lolium pratense

Pure Live Seed

Pure Live Seed (PLS) is a means of expressing seed quality.

PLS is the percentage of seed in a seed lot that is both pure seed and viable seed. Pure seed is the percentage by weight of the seed (kind, cultivar,

variety) that is under consideration. Inert matter, weed seed, and other crop seed is excluded from pure seed. Total Viable Seed (TVS) is the percentage estimate of the potential for germination, which includes percent hard seed and/or dormant seed.

Example: Pure Live Alfalfa Seed

(1) XYZ Seed Company, 1000 Crop Seed Lane, Ft. Collins, CO	
(2) Alfalfa, VNS	(6) Germination: 92%
(3) Lot number: 1234	Hard seed: 5%
(4) Pure Seed: 99.00%	Dormant seed: --
Other Crop: 0.25%	T.V.S.: 97%
Weed Seed: 0.10%	(7) Date Tested: 10/2000
Inert material: 0.65%	(8) Origin: CO
(5) Noxious weed seed: dodder 1 per lb.	(9) Seed Treatment: none

Pure seed x TVS = PLS
99% x 97% = 96.03%

The PLS for Lot number 1234 is 96.03%.

Nearly all species recommended for conservation plantings by NRCS uses PLS expressed in pounds or ounces per acre which is calibrated to seeds per square foot.

Seeding rates in this technical note are shown in pounds or ounces and seeds per square foot per acre.

Inoculation

Legumes are unique plants which have the ability to work with certain strains of bacteria (Rhizobia) to gather atmospheric nitrogen from the soil atmosphere and convert it to useable ammonia nitrogen. Nitrogen produced by this symbiotic relationship is virtually free and results not only in improved soil fertility, but increased protein and forage production in the legume host plant for the benefit of domesticated and wildlife heterotrophs.

Inoculate legume seed with the appropriate inoculant. Inoculants must not be exposed to sunlight or allowed to dry out prior to planting legumes.

CRITERIA FOR SEED MIXTURE DEVELOPMENT

Seed mixtures can consist of a grass component only or a grass and legume component, depending on the standard criteria and the purpose of the planting. Custom seeding mixtures can be developed from selected species listed in Table 2.

For other ecological Wisconsin standards such as Field Border (386), the planner will need to review the standard to determine the specific seeding requirements for the intended purpose. The Field Border standard will direct the planner to use Standard 342, Critical Area Planting, for erosion concerns and Standard 327, Conservation Cover, when the purpose or concern is for establishing pollinator habitat. This also includes Wisconsin engineering standards such as Standard 635, Waste Treatment Strips.

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

Conservation Cover (327)

Introduced Species

1. Wildlife Habitat Planting

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

   Fifty percent of the seeds per square foot will comprise of grasses.

   Refer to Table 7 for example mixtures.

   For dormant and frost seedings, increase seeds per square foot by 15 percent.

2. Herbaceous Pollinator Habitat

   At least one and a maximum of two bunch grasses seeded at a maximum rate of 30 seeds per square foot and a minimum of two legumes seeded at a minimum rate of 40 seeds per square foot.

Fifty percent of the seeds per square foot comprising of grasses is not a seed requirement for pollinator habitat planting mixtures.

For dormant and frost seedings, increase the seeds per square foot by 15 percent.

Critical Area Planting (342)

Introduced Species

- A minimum of 160 seeds per square foot for a solid grass planting or in combination with legumes.
- Fifty percent of the seeds per square foot will comprise of grasses and 25 percent of the seed

per square foot will consist of sod-forming grasses.
- For dormant seedings, increase the seeds per square foot by 15 percent.

Dormant seeding can be used when planting introduced species on concentrated and non-concentrated flow areas. When using dormant seedings on concentrated flow areas, the site must be mulched according to Standard 484, Mulching. Frost seeding is not an approved seeding method when using this standard.

Refer to Table 8 for example mixtures.

Forage and Biomass Planting (512)

Introduced Species

1. Pasture and Hayland Planting

    - For pasture plantings, mixtures will have at least 1 grass and 1 legume. The mixture will have at least 50 percent grass seeds per square foot, and the total mix will have at least 60 seeds per square foot.
    - For hayland establishment, mixtures and single specie plantings may be used as long as the total seeding rate is at least 60 seeds per square foot.

2. Interseeding of Grasses/Legumes Into Existing Pastures and Haylands

    - Seeding rate is half of the pure stand seeding rate as specified in Table 2. Seeds per square foot for legumes will vary according to specie.
    - Frost seeding is approved only for legumes into existing pastures at a seeding rate of two-thirds the recommended pure stand seeding rate.

    Refer to Table 10 for pasture and hayland planting seed mixtures.

Table 1
Relationship Between Moisture Regimes, Drainage Classes, and Forage Suitability Groups

Moisture Regimes	Drainage Class	Forage Suitability Group
Wet Wet mineral or organic soils are typified by very poorly drained soil types.	**Very poorly drained** Water is removed from the soil so slowly that free water remains at or very near the ground surface during much of the growing season and mesophytic crops cannot be grown. The soils are commonly level or depressed and frequently ponded.	**FSG 7** High water holding capacity, seasonal high water table, excessively wet, subject to ponding and flooding. **FSG 10** High water holding capacity, seasonal high water table, organic surface layers, subject to ponding and flooding.
Wet-Mesic Wet-mesic sites are transitional between wet and mesic. Most wet-mesic sites occur on somewhat poorly drained mineral soils.	**Very poorly drained**	**FSG 7, FSG 10**
	Somewhat poorly drained Water is removed slowly so that the soil is wet at a shallow depth for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops.	**FSG 4** Moderate water holding capacity, generally sandy, seasonal high water table, excessively wet for half of growing season. **FSG 7, FSG 10**
Mesic Mesic sites will be found on most moderately well and well drained mineral soils which have moderate to very high Available Water Capacity. Mesic sites may occur on some somewhat poorly drained soils with low or very low Available Water Capacity.	**Somewhat poorly drained**	**FSG 4, FSG 7, FSG 10**
	Moderately well drained Water is removed from the soil somewhat slowly during some periods of the year. The soils are wet for only a short time within the rooting depth during the growing season.	**FSG 1** Low water holding capacity, generally sandy, seasonal high water table. **FSG 4** **FSG 5** Moderate water holding capacity, no seasonal high water table, at times seasonal droughtiness, less than 12% slope. **FSG 6** Moderate water holding capacity, no seasonal high water table, seasonal droughtiness, greater than 12% slope, runoff concerns. **FSG 8** High water holding capacity, no seasonal high water table, less than 12% slopes.
	Well drained Water is removed from the soil readily but not rapidly. Water is available to plants throughout most of the growing season. Wetness does not inhibit growth of roots.	**FSG 1, FSG 5, FSG 6, FSG 8** **FSG 9** High water capacity, no seasonal high water table, runoff concern.
Dry-Mesic Dry-mesic sites are transitional between dry and mesic. They occur on some somewhat excessively drained and some well drained soils.	**Moderately well drained**	**FSG 1, FSG 4, FSG 5, FSG 6, FSG 8**
	Well drained	**FSG 1** **FSG 2** Low water holding capacity, generally sandy, no seasonal high water table, 0 to 12% slopes. **FSG 3** Low water holding capacity, generally sandy, no seasonal high water table, greater than 12% slopes, seasonal droughtiness. **FSG 5, FSG 6**
	Somewhat excessively drained Water is removed from the soil rapidly. The soils are commonly coarse-textured.	**FSG 1, FSG 2, FSG 3, FSG 5, FSG 6**
Dry Dry sites occur mostly on well to excessively drained soils.	**Well drained**	**FSG 1, FSG 2, FSG 3, FSG 5, FSG 6**
	Somewhat excessively drained	**FSG 2, FSG 3, FSG 6**
	Excessively drained	**FSG 2, FSG 3**

Table 2
Common Species and Recommended Pure Stand Seeding Rates

Name	Genus and species	Plant Type	Moisture Regime	Single Species Seeding Rate (PLS) Lbs./Acre	Seeds/Lb.	Seeds/Ft^2/ Lb./Ac.
Chewings Red Fescue	Festuca rubra L. ssp fallax	Grass	D, DM, M	5	350,000	8
Creeping Red Fescue	Festuca rubra	Grass	DM, M, WM	5	350,000	8
Festulolium	Festuca X Lolium	Grass	DM, M, WM	12	227,000	5.2
Italian or Annual Ryegrass	Lolium perenne L. ssp. multiflorum	Grass	DM, M, WM	20	227,000	5.2
Kentucky Bluegrass	Poa pratensis	Grass	D, DM, M, WM, W	8	2,177,000	50
Meadow Fescue	Schedonorus pratensis	Grass	DM, M, WM	12	227,000	5.2
Orchardgrass	Dactylis glomerata L.	Grass	D, DM, M, WM	10	653,000	15
Perennial Ryegrass	Lolium perenne	Grass	DM, M, WM	20	227,000	5.2
Redtop	Agrostis gigantea	Grass	M, WM, W	4	4,990,000	114.5
Smooth Bromegrass	Bromus inermis	Grass	D, DM, M, WM	20	136,000	3.1
Tall Fescue	Schedonorus arundinaceus	Grass	D, DM, M, WM	12	227,000	5.2
Timothy	Phleum pratense	Grass	DM, M, WM, W	8	1,230,000	28.2
Alfalfa	Medicago sativa	Legume	D, DM, M	12	219,000	5.0
Alsike Clover	Trifolium hybridum	Legume	M, WM, W	3	680,000	15.6
Birdsfoot Trefoil	Lotus corniculatus	Legume	DM, M, WM, W	7	375,000	8.6
Red Clover	Trifolium pratense	Legume	DM, M, WM	10	275,000	6.3
White Ladino Clover	Trifolium repens	Legume	DM, M, WM	3	871,650	20

Table 3
Plant Morphology and Physiology Characteristics

Common Name *Scientific Name*	Plant Type	Growth Habit	Practice Recom-mendation	Pure Stand Rate	Seeds per Ft^2/Lb/ Ac.	Wildlife Value	Retardance	Pollinator Habitat	Deep Rooted	Moisture Regime	Forage Suitability Group	pH	Flood Tolerance	Average Height at Maturity	Drought
Grasses															
Chewings Red Fescue *Festuca rubra L. ssp. fallax*	grass	perennial, cool season sod-forming	342, 512	5 lbs/ac	8	poor	D	no	no	D-M	2, 3, 5, 6, 8, 9	5.0 - 7.5	poor	1.5’	yes
Creeping Red Fescue *Festuca rubra*	grass	perennial, cool season sod-forming	342, 512	5 lbs/ac	8	poor	D	no	no	DM-WM	1, 4 to 9	5 - 7.5	poor	2'	yes
Festulolium *Festuca x Lolium*	grass	short-lived annual bunchgrass	342, 512	12 lbs/ac	5.2	fair	C	yes	no	DM-WM	1 to 9	5.0 - 7.5	moderate	1.5 - 2.0'	moderate
Italian (Annual) Ryegrass *Lolium perenne L. ssp. multiflorum*	grass	short-lived annual bunchgrass	327, 342, 512	12 lbs/ac	5.2	fair	C	yes	no	DM-WM	1, 4 to 9	5.0 - 7.5	moderate	1.5 - 2.0'	moderate
Kentucky Bluegrass *Poa pratensis*	grass	long-lived perennial cool season plant, sod-forming by rhizomes	327, 342, 512	8 lbs/ac	50	poor	D	no	no < 8"	D-W	1 to 9	5 - 7	fair	2.0'	yes
Meadow Fescue *Lolium pratense*	grass	perennial, cool season aggressive bunchgrass, with age produces thick sod	342, 512	12 lbs/ac	5.2	fair	D	no	no	DM-WM	1, 4 to 9	5 - 7.2	moderate	2 - 3'	yes
Orchard Grass *Dactylis glomerata*	grass	long-lived perennial bunchgrass, reproduces from seed	327, 342, 512	10 lbs/ac	15	fair	B	yes	no < 8"	D-WM	1 to 9	5.8 - 7.0	moderate	2.5'	yes
Perennial Ryegrass *Lolium perenne*	grass	short-lived perennial bunchgrass	327, 342, 512	20 lbs/ac	5.2	fair	C	yes	no	DM-WM	1, 4, 5, 6 to 9	5 - 7.5	moderate	1.5 - 2.0'	yes

Common Name *Scientific Name*	Plant Type	Growth Habit	Practice Recom-mendation	Pure Stand Rate	Seeds per Ft^2/Lb/ Ac.	Wildlife Value	Retardance	Pollinator Habitat	Deep Rooted	Moisture Regime	Forage Suitability Group	pH	Flood Tolerance	Average Height at Maturity	Drought
Redtop *Agrostis gigantea*	grass	long-lived perennial cool season plant, sod-forming by stolons	327, 342, 512	4 lbs/ac	114.5	fair	C	no	yes < 2"	M-W	1, 4, 7	4.5 - 8.0	good	3'	no
Smooth Bromegrass *Bromus inermis*	grass	tall long-lived perennial cool season plant, sod-forming by rhizomes	327, 342, 512	20 lb/ac	3.1	fair	B	no	no < 12"	D-WM	1 to 9	6 - 7.5	brief fair	3 - 4'	yes
Tall Fescue *Schedonorus arundinaceus*	grass	perennial, cool season aggressive bunchgrass, with age produces thick sod	327, 342, 512	12 lbs/ac	5.2	fair	B	yes	yes > 14"	D-WM	1 to 9	5 - 9	moderate	2.5 - 3.0'	yes
Timothy *Phleum pretense*	grass	cool season short-lived perennial bunch grass, reproduces by seed	327, 342, 512	8 lbs/ac	28.2	fair	B	no	no < 8"	DM-W	1, 4 to 9	5.5 - 7.0	moderate	3.0'	no
Legumes															
Alfalfa *Medicago sativa*	legume	single crown, warm season perennial legume, has a deep tap root	327, 342, 512	12 lbs/ac	5	good	C	yes	yes > 14"	D-M	2-3, 5, 6, 8, 9	> 6.5	poor	2.5'	yes
Alsike Clover *Trifolium hybridum*	legume	perennial, single crown, upright short-lived legume	327, 342, 512	3 lbs/ac	15.6	good	D	yes	no < 8"	M-W	1, 4, 5, 7, 8, 9	> 6.2	moderate	1'	no
Birdsfoot trefoil *Lotus corniculatus*	legume	warm season perennial legume	327, 342, 512	7 lbs/ac	8.6	good	D	yes	no < 10"	DM-W	1, 4 to 9	> 5.5	moderate-good	.5 - 1'	moderate
Red Clover *Trifolium pretense*	legume	upright short-lived perennial legume, produces runners, deep taproot	327, 342, 512	10 lbs/ac	6.3	good	C	yes	yes > 14"	DM-WM	1 to 9	> 6.0	poor	2.0'	no
White Ladino Clover *Trifolium repens*	legume	shallow-rooted perennial legume, prostrate, spreads by stolons	327, 342, 512	3 lbs/ac	20	fair	D	yes	no	DM-WM	1, 4, 5, 7 to 9	> 5.5	fair to poor	1.0'	no

Table 4
Summary of Seeding Requirements for Standards 327, 342, 512 (Introduced Species)

327 - Conservation Cover									
Mix Type	Grasses		Legumes[a]		Seeding Periods				Notes
	No.	seeds/ft^2	No.	seeds/ft^2	Spring	Late Summer	Dormant[b]	Frost[b]	
Wildlife Habitat	≥2	≥70	≥1	≥30	X	X	X	X	Grasses must be at least 50% of mix.
Pollinator Habitat	1-2	≤30	≥2	≥40	X	X	X	X	Grasses must be bunch-type.

(a) If more than 20% of legumes are hard seed, increase rate by % of hard seed.
(b) Increase rate 15% for frost and dormant seedings.

342 - Critical Area Planting									
Mix Type	Grasses		Legumes[a]		Seeding Periods				Notes
	No.	seeds/ft^2	No.	seeds/ft^2	Spring	Late Summer	Dormant[b]	Frost	
Grasses Only	≥1	160			X	X	X	NR	At least 25% of the total seeds must be sod-forming grasses.
Mixtures	≥1	≥80	≥1	See Notes	X	X	X	NR	Grasses must be at least 50% of the mix. Mix must be at least 160 seeds/ft^2 total. At least 25% of the seeds in the mix must be sod-forming grasses.

(a) If more than 20% of legumes are hard seed, increase rate by % of hard seed.
(b) Increase rate 15% for dormant seedings. Seedings in concentrated areas must be mulched.

512 - Forage & Biomass Planting									
Mix Type	Grasses		Legumes[a]		Seeding Periods				Notes
	No.	seeds/ft^2	No.	seeds/ft^2	Spring	Late Summer	Dormant	Frost	
Pasture	≥1	See Notes	≥1	See Notes	X	X	NR	NR	Mix must be at least 60 seeds/ft^2 total. Grasses must be at least 50% of the mix.
Hayland	Single species or mixture with ≥60 seeds/ft$^{2.}$				X	X	NR	NR	
Interseeding		See Notes		See Notes	X	X	NR	Legumes Only	Use 1/2 the pure stand rate for spring or late summer seeding. Use 2/3 pure stand rate for frost seeding.

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

SEEDING DATES

Date of seeding is a critical factor in determining whether a seeding will succeed or fail. 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 Table 5 for the recommended seeding dates.

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

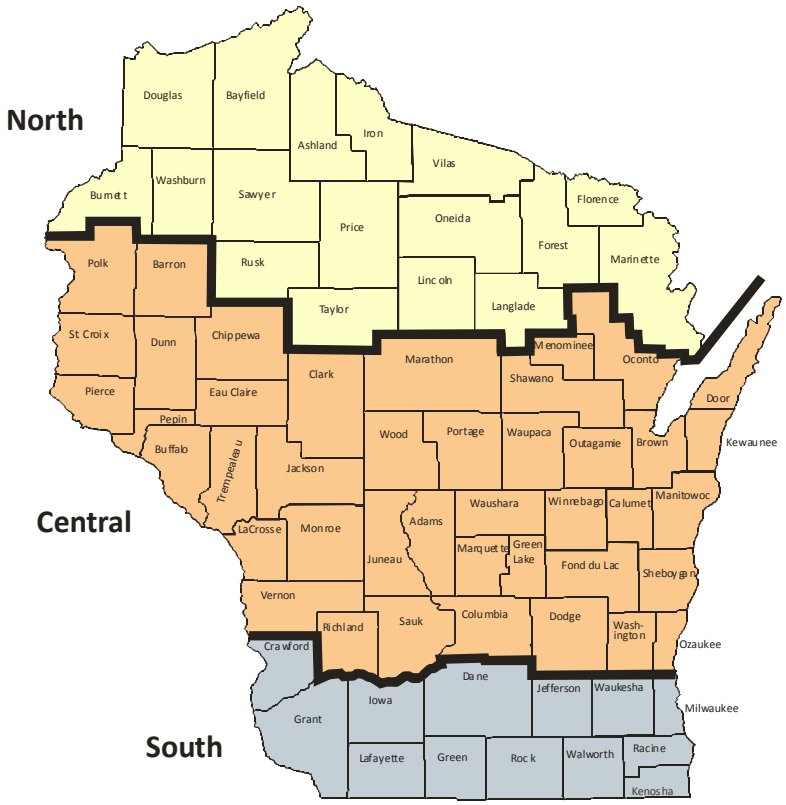
The frost seeding period in Wisconsin ranges from mid February to early March and will vary from year to year depending on the weather. Frost seeding is only allowed during active freezing and thawing cycles.

Table 5
Recommended Seeding Dates by Planting Zone

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

*See Figure 1

Figure 1
Planting Zone Map



TEMPORARY COVER AND COMPANION CROPS

Temporary Cover Crop

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:

- the required seeds or plant stock are not available,
- the normal planting period for the species has passed, or
- where herbicide carryover 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 bushel per acre (5/15 to 7/15)
    - Sorghum - Sudangrass hybrid – 1 bushel per acre (5/15 to 7/15)
    - Sudangrass – 1 bushel per acre (5/15 to 7/15)
    - Winter wheat - 2 bushels per acre (8/1 to 10/1)
    - Winter cereal rye - 2 bushels per acre (8/1 to 10/15)
    - Oats - 2 bushels per acre (4/1 to 9/1)
    - Annual ryegrass - 20 pounds per acre (4/1 to 9/1)

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

    - Forage sorghum – ½ bushel per acre (5/15 to 7/15)
    - Sorghum - Sudangrass hybrid – 1 bushel per acre (5/15 to 7/15)
    - Sudangrass – 1 bushel per acre (5/15 to 7/15)

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

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 the plant produces viable seed, preventing excessive competition to the scheduled permanent seeding. Winter wheat and rye must be terminated by tillage, crimping, herbicides, or a combination before planting the permanent seeding.

Companion Crops

Companion crops can be used to reduce the amount of erosion on critical sites, suppress weeds, and provide added protection for permanent perennial vegetation seeded during first year plantings.

Companion crop recommendations:

- Oats - 2 bushels per acre (4/1 to 9/1)
- Winter wheat - 1 bushel per acre (8/1 to 10/1)
- Annual ryegrass - 6 pounds per acre (4/1 to 9/1)
- Spring wheat - 1 bushel per acre (4/1 to 6/1)

Companion crops shall be clipped after jointing or boot stage. Second and subsequent clippings are necessary when re-growth provides competition to the new planting. Clipping height should be above the developing seedlings. Where excessive growth has accumulated, the vegetation should be mowed and vegetation distributed uniformly. Companion crops seeded with late summer introduced grasses and legumes in most cases will not require clippings prior to the first killing frost. When the growing season is prolonged, clipping may be required for late summer plantings.

Winter cereal rye is not recommended as a companion crop with introduced season grasses. Biotoxin compounds secreted by cereal rye may inhibit germination or suppress introduced grass seedlings.

SPECIAL EROSION CONTROL MEASURES

Evaluate the need for additional soil erosion controls prior to and during the establishment period. Where erosion is determined to be a concern, alternatives shall be developed to divert water from the site or stabilize the soil surface.

When soil erosion control is an identified resource concern, increase grass composition above 50 percent of the mixture and increase the percentage of sod-forming grasses above 25 percent of the mixture.

Introduced mixtures for areas with shrub and tree plantings are not required to contain 25 percent sod forming grass seed per square foot. These seed mixtures must still contain at least 50 percent grass seed per square foot. Sod-forming grasses are not recommended in shrub and tree plantings.

Mulching

Wisconsin NRCS Standard 484, Mulching, shall be followed if program or practice design requires mulching.

Mulch shall consist of either natural and/or artificial materials such as plant residue (including cereal grain straw, grass hay, wood chips, bark and wood fiber), plastic, fabric, or other equivalent materials of sufficient dimension (depth or thickness) and durability to achieve the intended effect for the required time period. Mulch material shall be relatively free of disease, pesticides, chemicals, noxious weed seeds, and other pests and pathogens.

The type of mulching material selected should be based on cost, time of year, soils, percent slope, anticipated runoff velocities, and landscape position.

Mulching will be applied as soon as possible after seeding. Prepare the seedbed, apply the fertilizer and seed, then apply and anchor the mulch material.

When construction is completed and a permanent seeding delay is anticipated, plant temporary cover or apply a temporary mulch to the site to control erosion, or seed permanent vegetation and evaluate the status of the seeding, especially when seeding outside of the recommended dates. Reseeding may be required. All dormant plantings planned on concentrated flow areas will be mulched.

Hydroseeding

Hydroseeding typically consists of applying a mixture of cellulose fiber, seed, fertilizer, and stabilizing emulsion with hydromulching equipment to provide permanent or temporary protection to disturbed areas that are susceptible to erosion by water and wind. Hydroseeding may be used as the primary mulching method only when there is sufficient time remaining in the season to ensure adequate vegetation establishment and will provide adequate erosion control. Hydroseeding can be used in conjunction with other mulching techniques. Hydroseeding advantages include:

- the protection of seeds from heat and birds during the germination process,
- a stabilized soil temperature,
- more even application of seeds than broadcast seeding,
- effective in keeping seeds from being washed away on slopes,
- provide added organic components to enrich the soil after the critical area is established,
- retention of moisture as seeds sprout, and
- allows for a better root formation as opposed to sodding.

Follow seeding dates outlined in Table 5 of this technical note.

Sodding

Specifications for site preparation, topsoiling, seedbed preparation and fertilizing are the same as conventional seeding. Sod shall consist of a dense, well rooted growth of a perennial desirable specie. All sod used shall be free of noxious weeds, diseases and insects. Only moist, fresh sod shall be used. The sod shall be sufficiently moist to withstand exposure during transport and transplanting operations. Sod should be placed on site within 24 hours after cutting and sod strips shall not have dry or dead edges.

Wet soil to a depth of two inches or more prior to laying the sod. Lay the sod from the lower end of the slope and work up slope. On steep slopes, stake the sod or peg with at least 6 inches or longer anchoring staplers. Tamp or roll the laid sod to insure uniform contact between the roots and soil surface. Outside edges of sodded areas shall be rolled in or banked flush with soil. On sites where surface drainage may try to follow sodded edges, extend sod strips 1 foot beyond the edges of the area sodded.

After laying sod, water thoroughly to wet the sod pad and the soil to a depth of 4 inches. In the absence of adequate rainfall, water during the first 30 days to keep underlying soil moist and allow the sod to become established. After the initial 30 day period, water as necessary to maintain adequate moisture in the root zone.

NUTRIENT AND SOIL AMENDMENT RECOMMENDATIONS

Fertilizer

Fertilizer will be applied according to a current soil test and will be consistent with University of Wisconsin recommendations found in Publication A-2809, Nutrient Application Guidelines for Field, Vegetable and Fruit Crops. A current soil test is defined as test results no older than four years from the time last tested to the date of the planned seeding. Guidelines for soil testing in Wisconsin can be found in Publication A-2100, Sampling Soils For Testing. In lieu of soil testing, apply 150 pounds of 20-10-10 fertilizer per acre, applicable only to Practice Standards 327, Conservation Cover; and 342, Critical Area Planting.

Lime

When alfalfa is part of the seeding mixture, the soil pH must be corrected to a minimum of 6.5. When birdsfoot trefoil, red clover or white ladino clover is a component of the seeding mixture, pH must be corrected to a minimum of 6.2. Liming material will be applied according to soil test recommendations. In lieu of soil testing, apply 2 tons of 80-89 lime or equivalent per acre, applicable only to Practice Standards 327, Conservation Cover; and 342, Critical Area Planting..

SEEDBED PREPARATION AND SEEDING RECOMMENDATIONS

Conventional Seeding

The seed is broadcasted or drilled into a partial or clean seedbed.

For conventional seeding, prepare a fine, firm seedbed to a minimum of 3 inches. All tillage operations shall be performed across the general slope of the landscape.

The seedbed should contain enough fine soil particles to provide uniform shallow coverage of the seed as well as contact with moisture and nutrients. It is important to have a firm seedbed. As a minimum, cultipack or roll before and after seeding. When walking on a properly prepared seedbed, the depth of your footprints should not exceed ¼ inch. Do not use heavy, no-till type drills to seed on conventionally prepared seedbeds. Heavy drills tend to sink into the soil and seeding depth will be difficult to control. Do not plant seed deeper than ¼ inch. The use of a drag or similar equipment after seeding is not advised when small seeds are included in the mixture.

Advantages:
- May incorporate nutrients and soil amendments such as lime.
- Provides the opportunity to destroy perennial weeds.

Disadvantages:
- Soil erosion risk increases greatly.
- Erosion can wash away new seedlings or cover and smother the seedling with sediment.
- Higher field preparation cost.
- Annual weed competition can be greater.
- A nurse crop is often needed for erosion control and to suppress weed competition.
- Requires more trips across the field resulting in higher fuel cost.

No-Till Planting

No-till is the seeding of grasses and/or legumes in the absence of tillage using planting tools capable of drilling into an undisturbed soil surface and interseeding into existing herbaceous cover or prior-year crop residue.

No-Till Planting Into the Prior-Year Crop Residue

On cropland, leave the existing crop residue on the field without tillage. Soybean stubble is the preferred residue of choice. No-tilling into large amounts of non-fragile residue such as corn and small grain will reduce germination and seedling vigor. For spring weed control, when no-tilling introduced grasses and legumes, use a burndown chemical prior to or within four days after planting to kill weeds. Keep in mind that quackgrass and many broadleaf weeds are more consistently controlled when herbicides are applied early fall and a follow-up application in the spring.

Site Preparation for No-Till Interseeding Into Existing Grass Cover

Interseeding is a good way to improve existing stands of single species on fields utilized for pasture, wildlife, or idle land. Interseeding yields a mixture of grasses and legumes that gives the greatest benefit for wildlife or forage for livestock.

Land that has been in grass for many years usually has a thick layer of residue on the soil surface. In order to prepare a good seedbed for no-till interseeding and improve herbicide effectiveness, the litter or residue must be removed or altered. Existing vegetation shall be evaluated prior to seeding and a

management strategy developed to limit competition with new seedings. Reducing competition of the existing stand is important for a successful interseeding. Options to prepare existing cover for no-till interseeding include herbicide application, grazing, mowing, haying, or burning the site.

- Mowing: Mow the site using a rotary mower or flail chopper to a height of 3 inches. The timing and type of mowing equipment selected shall be planned to uniformly distribute the mowed plant material over the field surface. Mowing should be planned before any known weeds produce mature seeds.

- Burning: Carry out a Prescribed Burn according to the requirements outlined in the plan. The burn plan must address safety concerns and document the appropriate timing for the burn to provide the maximum control of weeds and protect any existing desirable plants on the site.

- Haying: Harvest a hay crop from the site the year before the planned interseeding. The timing of the hay harvest should be planned to minimize the amount of re-growth that will occur prior to interseeding.

- Grazing: Graze the site immediately prior to herbicide application, if herbiciding is planned. The timing and duration of the grazing must be managed to prevent erosion or damage to sensitive environmental areas, but must be intensive enough to significantly reduce the existing vegetative cover. If possible, begin the grazing at a time of the year when the standing vegetation is green and growing to increase the palatability and feed value of the forage, resulting in a more uniform removal of the vegetation by grazing animals.

- Herbicide Application: Apply approved herbicides to kill or suppress existing vegetation and control weeds. The effectiveness of herbicides improves when combined with haying, grazing, or mowing.

A drill equipped for no-till planting shall be used to allow consistent penetration of disk openers.

Advantages:
- Soil erosion is minimized.
- Reduced energy usage.
- No nurse crop is required.
- Greater moisture availability due to lack of tillage.
- Drilling can occur under adverse conditions.
- Carbon sequestration improves.
- Seed placement is ensured.

Disadvantages:
- Increased herbicide use.
- No-till drill required.
- Nutrients and soil amendments cannot be incorporated.

To ensure success of the interseeding, regardless of the options selected above, the field will need constant maintenance by mowing and removal of the existing vegetation until the interseeded planting becomes well-established and can survive the competition of the existing vegetation.

Dormant Seeding

Seed is broadcasted and incorporated, no-tilled, or drilled into a partial or clean seedbed after the growing season and before freeze-up. The seed remains dormant until the following spring.

Seedbed preparation and conditions are similar to conventional seeding. A firm seedbed is strongly recommended for broadcast dormant seedings. Seed broadcasted without incorporation is more risky, and relies on snow, freezing, and thawing to embed seed. The approved dormant seeding date for introduced species statewide is November 1.

Advantages:
- Occurs at a time of year when labor is more available.
- Seedlings take advantage of early spring moisture.
- Soil erosion is minimized.

Disadvantages:
- Seeding rates should be increased.

Refer to the section, “Criteria for Seed Mixture Development,” to determine when dormant seeding is allowed.

Frost Seeding

Broadcast seed on top of existing stands of introduced grass species or on seedbeds prepared the previous fall. Frost seed in February to mid March when the freezing and thawing cycle is active to help incorporate the seed into the soil.

The soil surface is usually “honeycombed” with small cracks at this time during the year. Frost seeding SHALL NOT occur on fields covered with

solid ice or a snow cover depths greater than 2 inches. Frost seeding must be completed before the freeze and thaw cycle ends. Do not frost seed into winter wheat or winter rye cover crops. All commonly grown legumes can be frost seeded because of their greater seedling vigor, such as red clover, alsike clover, and white ladino clover. Alfalfa and birdsfoot trefoil are approved for frost seeding; however, these species at times are less successful and slower to establish.

Advantages:
- No special drill is required.
- Labor is more available in late winter.

Disadvantages:
- Stand establishment is normally less successful, particularly in dry years.
- The seeding rate must be increased.

Frost seeding is only recommended under the following conditions:

- legumes seeded into established pastures,
- seedbeds prepared in fall, and
- undisturbed sites that consist of fragile residue such as soybean stubble.

Frost seeding is not recommended in undisturbed non-fragile residue such as corn and small grain.

Refer to the section, "Criteria for Seed Mixture Development," to determine when frost seeding is allowed.

STAND EVALUATION

To determine the overall success of the planting, a monitoring program should consider the number of seedlings across a field, seeding vigor, height, and growth stage and overall diversity of plants. Preliminary evaluation of spring and fall plantings should be completed four to six weeks after germination. This inspection of seeding density and distribution can be combined with an inspection for post planting weed control recommendations.

Several methods can be used to evaluate stand adequacy. Density measurements are taken by counting the number of individual plants and species within a standard one foot quadrant. As a general rule, there should be at least two sample sites per acre.

Table 6
Plant Density and Stand Evaluation One Year After Planting

Average Seedlings/Ft^2	Action/Condition
<1	Reseed.
1-3	Wait and re-evaluate next year.
4-5	Successful planting.
>6	Very good.

COVER MAINTENANCE

Weed Control - Establishment Year

Weed control during the establishment year is required to ensure survival of the new permanent seeding. Weed control during the seeding year will have precedent over nesting season concerns and is allowed until stand is established. Activities should be minimized when possible during the nesting season.

Mow early before weeds have a chance to smother out the new seeding. Mow before the companion crop or undesirable vegetation reach boot stage. Mow introduced plantings to a height of no less than 4 inches. Depending on the weather, mowing every 2 or 3 weeks throughout the growing season may be required to increase the probability of a successful stand. In addition, approved herbicides may be used on introduced plantings for additional weed control.

Weed Control - Established Cover

Any planned maintenance after establishment, should be done before May 15 or after August 1 to protect nesting species and reduce disruption of nesting activities. The impact of any disturbance to existing cover on wildlife and threatened or endangered species must be assessed and mitigated to the extent practicable or as required by law. In the majority of situations, established plantings will only require spot treatment without disturbing the entire unit.

To control undesirable plants during the primary nesting season, utilize one or more of the following spot treatment options:

- Spot mowing can be used to control annual weeds and to suppress perennial weeds. Spot mowing must be done before the target plant produces viable seed and must continue throughout the growing season as needed. Spot mowing is not the most effective treatment

option for biennial and perennial weeds but can be used to contain these plants until other control treatments can be implemented.

- Spot treatment of herbicides is often necessary for controlling invasive plants in introduced plantings. 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 and dominating introduced stands. NRCS staff is prohibited from making herbicide recommendations.

- Spot Treatment by 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 cycle.

REFERENCES

Curtis, J. T., 1959. The Vegetation of Wisconsin: an Ordination of Plant Communities. University of Wisconsin Press, Madison.

USDA NRCS, Wisconsin Field Office Technical Guide, Section IV, Conservation Practice Standards and Specifications.

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

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

University of Wisconsin Extension Publication A2809, Nutrient Application Guidelines for Field, Vegetable and Fruit Crops.

University of Wisconsin Extension Publication A2100, Sampling Soils For Testing.

Wisconsin Administrative Code, Department of Agriculture, Trade and Consumer Protection, Chapter ATCP 20, Seed Labeling and Sale.

Wisconsin State Statutes, Chapter 94, Plant Industry, ss. 94.38 to 94.46.

Table 7
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	15	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 8
Seeding Mixtures Suitable for Critical Area Plantings

Seed Calculator Code*	Moisture Regimes	Common Name	Scientific Name	Seeding Rate in lb/ac PLS	Seeding Rate in Seeds/Ft^2 PLS	Capacity Retardance	Type of Site**
342-1	*Dry-Mesic* and *Mesic* Sites	Smooth Bromegrass	Bromus inermis	10	31	B	EB, WW, CSB
		Creeping Red Fescue	Festuca rubra	3	24		
		Alfalfa	Medicago sativa	3	15		
		Red Clover	Trifolium pratense	3	19		
		Kentucky bluegrass	Poa pratensis	1.5	75		
342-2	Dry-Mesic and Mesic Sites***	Smooth Bromegrass	Bromus inermis	15	47	B	EB, WW
		Alfalfa	Medicago sativa	7	35		
		Timothy	Phleum pratense	3	85		
342-3	Dry-Mesic and Mesic Sites	Kentucky bluegrass	Poa pratensis	1	50	B	CSB, EB, WW
		Smooth Bromegrass	Bromus inermis	10	31		
		Timothy	Phleum pratense	2	56		
		Tall Fescue	Schedonorus arundinaceus	2	10		
		Perennial Ryegrass	Lolium perenne	5	26		
342-4	Dry-Mesic and Mesic Sites	Smooth Bromegrass	Bromus inermis	20	62	B	EB, WW, CSB
		Creeping Red Fescue	Festuca rubra	5	40		
		Alfalfa	Medicago sativa	8	40		
		Red Clover	Trifolium pratense	4	25		
342-5	Dry-Mesic and Mesic Sites	Smooth Bromegrass	Bromus inermis	30	93	B	EB, WW, CSB
		Alfalfa	Medicago sativa	14	70		
342-6	Dry-Mesic, Mesic, and Wet Mesic Sites	Smooth Bromegrass	Bromus inermis	7	22	B	CSB, EB, WW
		Timothy	Phleum pratense	2	56		
		Creeping Red Fescue	Festuca rubra	1	8		
		Kentucky Bluegrass	Poa pratensis	1	50		
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
342-7	Mesic Sites***	Smooth Bromegrass	Bromus inermis	7	22	B	EB, WW
		Creeping Red Fescue	Festuca rubra	2	16		
		Kentucky bluegrass	Poa pratensis	3	150		
		Birdsfoot trefoil	Lotus corniculatus	2	17		
342-8	Mesic Sites***	Smooth Bromegrass	Bromus inermis	15	47	B	WW, EB
		Creeping Red Fescue	Festuca rubra	2	16		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-9	Mesic Sites***	Kentucky Bluegrass	Poa pratensis	3	150	C	WW, EB
		Creeping Red Fescue	Festuca rubra	4	32		
		Perennial Ryegrass	Lolium perenne	10	52		
342-10	Mesic Sites	Smooth Bromegrass	Bromus inermis	14	43	B	EB, WW, CSB
		Timothy	Phleum pratense	3	85		
		Red Clover	Trifolium pratense	3	19		
		Perennial Ryegrass	Lolium perenne	4	21		
342-11	Mesic Sites	Smooth Bromegrass	Bromus inermis	32	99	B	EB, WW
		Creeping Red Fescue	Festuca rubra	8	64		

Seed Calculator Code*	Moisture Regimes	Common Name	Scientific Name	Seeding Rate in lb/ac PLS	Seeding Rate in Seeds/Ft^2 PLS	Capacity Retardance	Type of Site**
342-12	Mesic Sites	Kentucky bluegrass	Poa pratensis	4	200	C	EB, WW
		Creeping Red Fescue	Festuca rubra	3	24		
342-13	Mesic Sites	Smooth Bromegrass	Bromus inermis	14	43	B	EB, WW, CSB
		Timothy	Phleum pratense	4	113		
		Red Clover	Trifolium pratense	3	19		
342-14	Mesic Sites	Smooth Bromegrass	Bromus inermis	15	43	B	EB, WW, CSB
		Timothy	Phleum pratense	3.5	99		
		Alsike Clover	Trifolium hybridum	2	32		
342-15	Mesic Sites	Smooth Bromegrass	Bromus inermis	15	47	B	EB, WW
		Timothy	Phleum pratense	3.5	99		
		Birdsfoot trefoil	Lotus corniculatus	3	26		
342-16	Wet Mesic Sites	Tall Fescue	Schedonorus arundinaceus	5	26	B	CSB, EB, WW
		Timothy	Phleum pratense	3	85		
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
		Smooth Bromegrass	Bromus inermis	6	19		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-17	Wet Mesic Sites	Redtop	Agrostis gigantea	1	115	C	WW, CSB, EB
		Timothy	Phleum pratense	3	85		
		Red Clover	Trifolium pratense	5	32		
342-18	Wet Mesic Sites	Timothy	Phleum pratense	3	85	B	WW, CSB, EB
		Perennial Ryegrass	Lolium perenne	3	16		
		Red Clover	Trifolium pratense	3	19		
		Smooth Bromegrass	Bromus inermis	6	19		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-19	*Wet Mesic* Sites	Redtop	Agrostis gigantea	1	115	C	WW, CSB, EB
		Timothy	Phleum pratense	1	28		
		Red Clover	Trifolium pratense	4	25		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-20	*Wet* Sites***	Redtop	Agrostis gigantea	2	229	C	WW
		Alsike Clover	Trifolium hybridum	2	31		
		Kentucky Bluegrass	Poa pratensis	2	100		
342-21	Wet Mesic Sites	Redtop	Agrostis gigantea	3	344	C	WW
		Alsike Clover	Trifolium hybridum	3	47		

*These codes represent the mixtures used in the Wisconsin Seed Calculator.
**EB = Embankments; WW = Waterways; CSB = Channel and Streambanks
***Mixtures can be used on other site descriptions when not listed.

Table 9
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.

Table 10
Forage and Hayland Planting Recommendations

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Hay Crop				
Group 1: Low water holding capacity, seasonal high water table.	512-H1	Red Clover Tall Fescue Timothy	6 6 1	38 31 28
Group 2: Low water holding capacity, 0 to 12 percent slopes.	512-H2	Alfalfa	12	60
	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 3: Low water holding capacity, greater than 12 percent slopes.	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 4: Moderate water holding capacity, seasonal high water table.	512-H4	Alsike Clover Tall Fescue Timothy	3 6 1	47 31 28
Group 5: Moderate water holding capacity, less than 12 percent slopes.	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 6: Moderate water holding capacity, greater than 12 percent slopes.	512-H3	Alfalfa Smooth Bromegrass	10 4	50 12
Group 7: High water holding capacity, seasonal high water table.	512-H4	Alsike Clover Tall Fescue Timothy	3 6 1	48 31 28
Group 8: High water holding capacity, less than 12 percent slopes.	512-H5	Alfalfa Timothy	8 2	40 56
Group 9: High water holding capacity, greater than 12 percent slopes.	512-H6	Alfalfa Smooth Bromegrass Timothy	8 4 1	40 12 28

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Group 10: Organic soils, wetlands, ledge outcrop.	---	Planting not feasible.	---	---
Rotation and Permanent Pastures				
Group 1: Low water holding capacity, seasonal high water table.	512-PP1	Alsike Clover Meadow Fescue	2 6	31 31
	512-PP1A	Alsike Clover Orchardgrass	2 3	31 45
	512-PP1B	Alsike Clover Timothy	2 1.5	31 42
Groups 2: Low water holding capacity, 0 to 12 percent slopes.	512-PP2	Alfalfa Smooth Bromegrass Orchardgrass	6 4 4	30 12 60
Group 3: Low water holding capacity, greater than 12 percent slopes.	512-PP2	Alfalfa Smooth Bromegrass Orchardgrass	6 4 4	30 12 60
Group 4: Moderate water holding capacity, seasonal high water table.	512-PP4	Alsike Clover Meadow Fescue Timothy	2 6 1	31 31 28
	512-PP4B	Birdsfoot Trefoil Meadow Fescue Timothy	3 6 1	26 31 28
Group 5: Moderate water holding capacity, less than 12 percent slopes.	512-PP5	Red Clover White Ladino Clover Orchardgrass Meadow Fescue	5 1 3 6	32 20 45 31
	512-PP5B	Red Clover White Ladino Clover Festulolium Meadow Fescue	5 1 7 6	32 20 36 31
Group 6: Moderate water holding capacity, greater than 12 percent slopes.	512-PP6	Red Clover Orchardgrass Smooth Bromegrass	5 4 4	32 60 12
Group 7: High water holding capacity, seasonal high water table.	512-PP7	Alsike Clover Meadow Fescue Timothy Redtop	2 6 1 1	31 31 28 115
	512-PP7B	Birdsfoot Trefoil Meadow Fescue Timothy Redtop	3 6 1 1	26 31 28 115
Group 8: High water holding capacity, less than 12 percent slopes.	512-PP8	White Ladino Clover Orchardgrass Meadow Fescue	1 3 6	20 45 31
	512-PP8B	White Ladino Clover Festulolium Meadow Fescue	1 7 6	20 36 31
Group 9: High water holding capacity, greater than 12 percent slopes.	512-PP9	Red Clover Orchardgrass Meadow Fescue	5 3 6	32 45 31

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Group 10: Organic soils, wetlands, ledge outcrop.	---	Planting not feasible.	---	---
Pasture for Horses/Sheep				
Groups 1, 4, 7: Seasonal high water table.	512-PHS1	Kentucky Bluegrass Meadow Fescue White Ladino Clover	4 4 1	200 21 20
	512-PSH1A	Kentucky Bluegrass Meadow Fescue Birdsfoot Trefoil	4 4 3	200 21 26
Groups 5, 6, 7, & 8: Moderate to high water holding capacity.	512-PHS2	Kentucky Bluegrass Festulolium White Ladino Clover	2 7 1	100 36 20
	512-PHS2A	Kentucky Bluegrass Perennial Ryegrass White Ladino Clover	2 7 1	100 36 20
Groups 2 & 3: Low water holding capacity.	512-PHS3	Alfalfa Orchardgrass	6 3	30 45
Pasture for Hogs				
		Alfalfa OR Red clover Forage Rape OR Oats OR Sudangrass OR Hybrid Pearl Millet	12 10 25 35 2 bu/ac	60 63 --- --- ---
Summer Annuals for Supplemental Forage				
		Hybrid Pearl Millet Winter rye (fall planted) Forage Rape Forage Turnips and Swedes Rape and Kale	25 1½ - 2 bu/ac 4 bu/ac 1½-2 lbs./ac 4 lbs./ac	--- --- --- --- ---

[1]These codes represent the mixtures used in the Wisconsin Seed Calculator.

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Appendix I

WDNR WQT Documentation

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I-1 – WDNR WQT Checklist Form 3400-208

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State of Wisconsin
Department of Natural Resources
101 South Webster Street
Madison WI 53707-7921
dnr.wi.gov

Water Quality Trading Checklist

Notice: Pursuant to s. 283.84, Wis. Stats., this form must be completed by any WPDES permittee that intends to pursue pollutant trading as a method of complying with a permit limitation. Failure to complete this form would not result in penalties. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records Law (ss. 19.31 - 19.39, Wis. Stats.).

Applicant Information

Permittee Name	Permit Number	Facility Site Number
Grassland Dairy Products, Inc.	WI- 0002984	

Facility Address	City	State	ZIP Code
N8790 Fairground Ave	Greenwood	WI	54437

Project Contact Name (if applicable)	Address	City	State	ZIP Code
Laura Opelt	N8790 Fairground Ave	Greenwood	WI	54437

Project Name
Grassland Dairy Products, Inc. WQT Plan Development

Receiving Water Name	Parameter(s) being traded	HUC 12(s)
Black River	Phosphorus	070400070405 (outfall)

Credit Generator Information

Credit generator type (select all that apply):

- ☐ Permitted Discharge (non-MS4CAFO)
- ☐ Permitted MS4
- ☐ Permitted CAFO
- ☐ Urban nonpoint source discharge
- ☒ Agricultural nonpoint source discharge
- ☐ Other - Specify:

Are any of the credit generators in a different HUC 12 than the applicant?
- ◉ Yes; HUC 12: 070400070403
- ○ No

Are any of the credit generators downstream of the applicant?
- ○ Yes
- ◉ No

[redacted]
- ○ [redacted]
- ◉ No

Point to Point Trades (Traditional Municipal / Industrial, MS4, CAFO)

Are each of the point source credit generators identified in this section in compliance with their WDPES permit requirements?
- ○ Yes
- ○ No

Discharge Type	Permit Number	Name	Contact Information	Trade Agreement Number
○ Traditional ○ MS4 ○ CAFO				
○ Traditional ○ MS4 ○ CAFO				
○ Traditional ○ MS4 ○ CAFO				
○ Traditional ○ MS4 ○ CAFO				
○ Traditional ○ MS4 ○ CAFO				

Point to Point Trades (Traditional Municipal / Industrial, MS4, CAFO) *cont.*

Does plan have a narrative that describes:			Plan Section
a. Summary of discharge and existing treatment including optimization	◯ Yes	◯ No	
b. Amount of credit being generated	◯ Yes	◯ No	
c. Timeline for credits and agreements	◯ Yes	◯ No	
d. Method for quantifying credits	◯ Yes	◯ No	
e. Tracking and verification procedures	◯ Yes	◯ No	
f. Location of credit generator in proximity to receiving water and credit user	◯ Yes	◯ No	
g. Other: _____	◯ Yes	◯ No	

Point to Nonpoint Trades (Non-Permitted Urban, Agricultural, Other)

Discharge Type	Practices Used to Generate Credits	Method of Quantification	Trade Agreement Number	Have the practice(s) been formally registered?
◯ Urban NPS ◉ Agricultural NPS ◯ Other	Filter Strips, Prairie/ Grassland conversion	SnapPlus	N/A, Internal Trade	◯ Yes ◉ No ◯ Only in part
◯ Urban NPS ◯ Agricultural NPS ◯ Other				◯ Yes ◯ No ◯ Only in part
◯ Urban NPS ◯ Agricultural NPS ◯ Other				◯ Yes ◯ No ◯ Only in part
◯ Urban NPS ◯ Agricultural NPS ◯ Other				◯ Yes ◯ No ◯ Only in part
◯ Urban NPS ◯ Agricultural NPS ◯ Other				◯ Yes ◯ No ◯ Only in part
◯ Urban NPS ◯ Agricultural NPS ◯ Other				◯ Yes ◯ No ◯ Only in part
◯ Urban NPS ◯ Agricultural NPS ◯ Other				◯ Yes ◯ No ◯ Only in part

Does plan have a narrative that describes:			Plan Section
a. Description of existing land uses	◉ Yes	◯ No	2.2
b. Management practices used to generate credits	◉ Yes	◯ No	3
c. Amount of credit being generated	◉ Yes	◯ No	4
d. Description of applicable trade ratio per agreement/management practice	◉ Yes	◯ No	4
e. Location where credits will be generated	◉ Yes	◯ No	Figure 3
f. Timeline for credits and agreements	◉ Yes	◯ No	7
g. Method for quantifying credits	◉ Yes	◯ No	4

Does plan have a narrative that describes:			Plan Section
h. Tracking procedures	◉ Yes	○ No	7
i. Conditions under which the management practices may be inspected	◉ Yes	○ No	7
j. Reporting requirements should the management practice fail	◉ Yes	○ No	7
k. Operation and maintenance plan for each management practice	◉ Yes	○ No	7
l. Location of credit generator in proximity to receiving water and credit user	◉ Yes	○ No	4 & Fig. 1
m. Practice registration documents, if available	○ Yes	◉ No	
n. History of project site(s)	○ Yes	◉ No	
o. Other: _____	○ Yes	○ No	

The preparer certifies all of the following:

- I am familiar with the specifications submitted for this application, and I believe all applicable items in this checklist have been addressed.
- 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
Daniel F Schaefer	December 4, 2024

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
Daniel F Schaefer	December 4, 2024

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I-2 – WDNR WQT MGMT Practice Registration Form 3400-20

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State of Wisconsin
Department of Natural Resources
101 South Webster Street
Madison WI 53707-7921
dnr.wi.gov

Water Quality Trading Management Practice Registration

Form 3400-207 (R 1/14)

Notice: Pursuant to s. 283.84, Wis. Stats., this form must be completed by any WPDES permittee that is using water quality trading as a method of complying with a permit limitation. Failure to complete this form would not result in penalties. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records Law (ss. 19.31 - 19.39, Wis. Stats.).

Applicant 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 Name

Address	Phone Number	Email

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	Land Parcel ID(s)	Parameter(s) being traded

The preparer certifies 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

Leave Blank – For Department Use Only

Date Received		Trade Docket Number
Entered in Tracking System ☐ Yes	Date Entered	Name of Department Reviewer

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Appendix J

Historic Crop Data

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SnapPlus - Historic Crop Data		
Year	Field 101	Field 104
2021	Soybeans	Corn Grain
2022	Corn Grain	Soybeans
2023	Soybeans	Corn Grain
2024	Corn Silage	Corn Silage

Note: Crop history above was developed via interview of Four Stary Ag, LLC (field operator) and verified against CropScape Database.

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