Fenwood Modified Permit Fact Sheet

General Information

Permit Number:	WI-0031411-09-01
Permittee:	Village of Fenwood, 3797 Beech St, Fenwood WI 54426
Discharge Location:	Fenwood WWTP, SEQ NWQ Sec 3 T27N R4E, Fenwood, WI 54426
Receiving Water:	Fenwood Creek in the Lower Big Eau Pleine River Watershed of the Upper Wisconsin River Central Sub-Basin located in Marathon County
StreamFlow ($Q_{7,10}$):	0.06 cfs
Stream Classification:	Warm Water Sport Fish Community, Non-public Water Supply
Discharge Type:	Existing, Intermittent
Annual Average Design Flow:	0.015 MGD
Significant IndustrialLoading?	No
Operator at ProperGrade?	Yes
Approved Pretreatment Program?	N/A

Facility Description

The Village of Fenwood operates a three-cell stabilization pond wastewater treatment facility. Discharge to Fenwood Creek occurs on a fill and draw basis in the spring and fall. The annual average design flow of this facility is 0.015 million gallons per day (MGD). In 2024, the actual annual average influent flow was 0.009 MGD. No significant operational changes occurred during the last permit term.

Reason for permit modification: The water quality trading reporting parameters at surface water Outfall 001 were corrected so that compliance could be determined with the annual total phosphorus limitation on a monthly basis. Also, the *E coli* monitoring requirement at Outfall 001 was changed so that monitoring is required any time there is discharge between May – September, and the *E coli* limits will be effective May – September, beginning 05/01/2029. Significant areas of change in this fact sheet are noted in grey.

Substantial Compliance Determination

After a desk top review of all discharge monitoring reports, CMARs, compliance schedule items, and a site visit by Nicholas Lindstrom on May 25, 2023, this facility has been found to be in substantial compliance with their current permit.

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, andAveraging Period**	**Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)**
701	0.009 MGD (2024)	INFLUENT: Representative influent samples shall be collected from the influent manhole at the corner of County Highways P andM.
001	0.008 MGD (2024)	EFFLUENT: Representative effluent samples shall be collectedfrom the effluent manhole prior to discharge. Discharge is onlypermitted during the months of April, May, October, and November.
003	Sludge has not been removed fromthe lagoons since 1979.	Representative composite sludge samples shall be collected fromthe first pond.

1 Influent – Monitoring Requirements

Sample Point Number: 701- INFLUENT TO PLANT

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
BOD5, Total		mg/L	2/Week	Grab	
Suspended Solids, Total		mg/L	2/Week	Grab	

Changes from Previous Permit:

BOD_5 and Total Suspended Solids: Sampling frequency increased from 2/month to 2/week.

Explanation of Limits and Monitoring Requirements

Flow Rate: Sample frequency changed to Daily from Continuous for eDMR reporting purposes.

BOD_5 and Total Suspended Solids: Tracking of BOD_5 and suspended solids are required for percent removal requirements found in s. NR 210.05, Wis. Adm. Code and in the Standard Requirements section the permit. Frequency updated.

Monitoring frequency for a permitted sewage treatment work is evaluated on a case-by-case basis pursuant s. NR 210.04, Wis. Adm. Code. Appropriate monitoring is evaluated based on the size and type of facility, the ability to characterize effluent quality and variability, to detect events of noncompliance, and to ensure fairness and consistency in permits issued across the state. After evaluation, an increase in sampling frequency for BOD and TSS is warranted to align with sampling frequencies of similarly sized facilities with similar effluent quality throughout the state.

2 Surface Water - Monitoring and Limitations

Sample Point Number: 001- TAKEN FROM EFFLUENT MANHOLE

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate	Daily Max	0 MGD	Daily	Total Daily	Limit effective Jan through March, June through September and December
Flow Rate	Daily Max	0.09 MGD	Daily	Total Daily	Limit effective in April
Flow Rate	Daily Max	0.087 MGD	Daily	Total Daily	Limit effective in May
Flow Rate	Daily Max	0.027 MGD	Daily	Total Daily	Limit effective in October
Flow Rate	Daily Max	0.075 MGD	Daily	Total Daily	Limit effective in Nov
BOD5, Total	Weekly Avg	45 mg/L	2/Week	Grab	
BOD5, Total	Monthly Avg	30 mg/L	2/Week	Grab	
Suspended Solids, Total	Weekly Avg	45 mg/L	2/Week	Grab	
Suspended Solids, Total	Monthly Avg	30 mg/L	2/Week	Grab	
pH Field	Daily Max	9.0 su	Daily	Grab	
pH Field	Daily Min	6.0 su	Daily	Grab	
Nitrogen, Ammonia Variable Limit		mg/L	2/Week	See Table	Look up the variable ammonia limit from the 'Variable Ammonia Limitation' table and report the variable limit in the Ammonia Variable Limit column on the eDMR.
Nitrogen, Ammonia (NH3-N) Total	Daily Max - Variable	mg/L	2/Week	Grab	Report the daily maximum Ammonia result in the Nitrogen, Ammonia (NH3-N) Total column of the eDMR. See Ammonia Limitation Section.
E. coli		#/100 ml	Weekly	Grab	Monitoring required weekly May – Sept during discharge
E. coli	Geometric Mean - Monthly	126 #/100 ml	Weekly	Grab	Limit effective during discharge May – Sept beginning 05/01/2029 per the Effluent Limitations for

					E. coli Schedule.
E. coli	% Exceedance	10 Percent	Monthly	Calculated	Monitoring and limit apply during discharge May – Sept beginning 05/01/2029 per the Effluent Limitations for E. coli Schedule. See the E. coli Percent Limit section in the permit. Enter the result in the DMR on the last day of the month.
Phosphorus, Total	Monthly Avg	1.2 mg/L	2/Week	Grab	Limit effective throughout the permit term, as it represents a minimum control level.
Phosphorus, Total		lbs/day	2/Week	Calculated	Report daily mass discharged using Equation 1a. in the Water Quality Trading (WQT) section.
Phosphorus, Total		lbs/month	Monthly	Calculated	Calculate the Total Monthly Discharge of phosphorus and report on the last day of the month on the DMR. See TMDL Calculations section.
Phosphorus, Total		lbs/yr	Monthly	Calculated	Calculate the 12-month rolling sum of total monthly mass of phosphorus discharged and report on the last day of the month on the DMR. See TMDL Calculations section.
WQT Credits Used (TP)	Annual Total	33.6 lbs/yr	Monthly	Calculated	Report WQT TP Credits used per month using Equation 2b in the Water Quality Trading (WQT) section. Available TP Credits are specified in Table 2 and in the approved Water Quality Trading Plan. The sum of total monthly credits used may not exceed Table 2 values listed below.
WQT Computed Compliance (TP)	Annual Total	7.0 lbs/yr	Annual	Calculated	Report the WQT TP Computed Compliance value using Equation 2 in the 'Water Quality Trading (WQT)' section. Value entered on the last day of

					the month.
Chloride		mg/L	2/Week	Grab	Monitoring in 2027 and 2028.
Nitrogen, Total Kjeldahl		mg/L	See Listed Qtr(s)	Grab	Annual in rotating quarters. See Nitrogen Series Monitoring section.
Nitrogen, Nitrite + Nitrate Total		mg/L	See Listed Qtr(s)	Grab	Annual in rotating quarters. See Nitrogen Series Monitoring section.
Nitrogen, Total		mg/L	See Listed Qtr(s)	Calculated	Annual in rotating quarters. See Nitrogen Series Monitoring section below. Total Nitrogen shall be calculated as the sum of reported values for Total Kjeldahl Nitrogen and Total Nitrite + Nitrate Nitrogen.

Changes from Previous Permit

Flow Rate- Sampling frequency updated to Daily to reflect eDMR reporting.

Ammonia Nitrogen- Sampling Frequency increased from Weekly to 2/Week.

Disinfection & E. coli- Monitoring for E coli is required May – Sept during discharge and the E coli limits become effective 05/01/2029 and will apply May – Sept whenever there is discharge during those months.

WQT Credits Used (TP)- Available Credits Total updated. See WQT Approval for more information.

Chloride- Sampling frequency increased from Weekly to 2/Week.

Total Nitrogen Monitoring (TKN, N02+N03 and Total N)- Annual monitoring in rotating quarters throughout the permit term was added to the permit.

Explanation of Limits and Monitoring Requirements

Refer to the Water Quality-Based Effluent Limitations (WQBELs) memo for Fenwood Wastewater Treatment Facility, prepared by Benjamin Hartenbower dated June 20, 2024.

Monitoring Frequencies- The Monitoring Frequencies for Individual Wastewater Permits guidance (April 12, 2021) recommends that standard monitoring frequencies be included in individual wastewater permits based on the size and type of the facility, in order to characterize effluent quality and variability, to detect events of noncompliance, and to ensure consistency in permits issued across the state. Guidance and requirements in administrative code were considered when determining the appropriate monitoring frequencies for pollutants that have final effluent limits in effect during this permit term. The permit will include an increased monitoring frequency for ammonia-nitrogen.

BOD5, Total Suspended Solids and pH- Categorical limits and WQBELs are included in the permit as outlined in ch. NR 210, Wis. Adm. Code. The effluent limitations for BOD5, Total Suspended Solids, and pH are carried over from the previous permit and are not subject to change at this time because the receiving water characteristics have not changed.

Ammonia Nitrogen- Current acute and chronic ammonia toxicity criteria for the protection of aquatic life are included in Tables 2C and 4B of ch. NR 105, Wis. Adm. Code. Subchapter IV of ch. NR 106 establishes the procedure for calculating water quality based effluent limitations (WQBELs) for ammonia. Weekly monitoring is required and the following daily

maximum limits that vary with effluent pH also apply. Report the applicable variable limit on the Discharge Monitoring Report (DMR) in the Ammonia Variable Limit column.

Disinfection & E. coli- Revisions to bacteria surface water quality criteria to protect recreational uses and accompanying E. coli WPDES permit implementation procedures became effective May 1, 2020. Section NR 102.04(5)(a), Wis. Adm. Code, states that all surface waters shall be suitable for recreational use and meet the E. coli criteria established to protect this use. Section NR 102.04(5)(b), Wis. Adm. Code, states that exceptions to the disinfection requirement can be made if the department determines, in accordance with the procedures specified in s. NR210.06(3), Wis. Adm. Code, that disinfection is not required to meet water quality criteria. As part of the reissuance process, the requirements for disinfection were reviewed under s. NR 210.06(3), Wis. Adm. Code.

In the original permit reissuance, disinfection requirements were only required during the month of May because the permittee does not normally discharge June-September. The permit modification clarifies that the E coli limits must be met whenever there is discharge May – September per the associated schedule. In the event the permittee would need to discharge in months other than May, the E coli limitations must be met during the disinfection season, May – Sept, per section NR 102.04(5), Wis. Adm. Code, beginning 05/01/2029.

Wisconsin River Total Maximum Daily Load (TMDL): The permitted facility is included within the Wisconsin River Basin Total Maximum Daily Load (TMDL), which was approved by EPA April 26, 2019. The TMDL establishes Waste Load Allocations (WLAs) for point source dischargers and determines the maximum amounts of phosphorus that can be discharged and still protect water quality. The final effluent limits and monitoring expressed in the permit were derived from Site-Specific Criteria (SSC) for Lakes Petenwell, Castle Rock, and Wisconsin originally included in Appendix K of the TMDL report and approved by the U.S. Environmental Protection Agency on July 9, 2020. The permittee's approved SSC-based limits are consistent with the assumptions and requirements of the EPA-approved WLA in the TMDL, whichis **7** lbs/yr for the permitted facility.

The approved TMDL expresses WLAs as lbs/year and lbs/day (maximum annual load divided by 365 days). As outlined in Section 4.6 of the department's *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Program*, mass limits must be given in the permit that are consistent with the TMDL WLA and the phosphorus impracticability agreement that was approved by USEPA in 2012 (see NPDES MOA Addendum dated July 12, 2012 at https://prodoasint.dnr.wi.gov/swims/downloadDocument.do?id=167886175). Methods for converting TMDL WLAs into permit limits for non-continuous discharges should be determined on a case-by-case basis and consistent withthe assumptions in the TMDL. For controlled discharges (municipal lagoon systems) and other discharges where there is no valid statistical basis for transforming annual WLAs into shorter term limits, limits should be expressed as total annual discharge.

Phosphorus reporting requirements for the TMDL and Water Quality trading are included. The TMDL parameters are required for informational purposes for the TMDL. The permittee utilizes WQT for compliance with the limits.

Phosphorus – Phosphorus requirements are based on the Phosphorus Rules that became effective December 1, 2010 as detailed in NR 102 Water Quality Standards and NR 217 Effluent Standards and Limitations for Phosphorus. Chapter NR 217 of the Wis. Adm. Code addresses point source dischargers of phosphorus to surface waters. Currently in NR 217 Wis. Adm. Code there are two methods used to determine if a phosphorus limit is needed: a technology based effluent limit (TBEL) and a water quality based effluent limit (WQBEL). For the reasons explained in the April 30, 2012 paper entitled 'Justification for Use of Monthly, Growing Season and Annual Average Periods for Expression of WPDES Permit Limits for Phosphorus Discharges in Wisconsin', WDNR has determined that it is impracticable to express the phosphorus WQBEL for the permittee as a maximum daily, weekly or monthly value. The final effluent limit for phosphorus is expressed as a six-month average. It is also expressed as a monthly average equal to three times the derivedWQBEL (which equates to 0.3 mg/L). This final effluent limit was derived from and complies with the applicable water quality criterion. A phosphorus concentration limit is necessary to prevent backsliding during the term of the permit.

The wastewater treatment facility is not able to meet the WQBEL. This permit authorizes the use of trading as a tool to

demonstrate compliance with the phosphorus WQBELs. This permit includes terms and conditions related to the Water Quality Trading Plan (WQT-2024-011) or approved amendments thereof. The total 'WQT TP Credits' available are designated in the approved WQT Plan. The Village has implemented conversion of agricultural cropland acres to permanent grassland as a conservation practice. The practices were installed in 2022 and have been maintained throughout the last permit term The WQT Plan proposes the generation of a range of 33.6 lbs/yr of phosphorus credits for the next five years.

Additional WQT subsections in the permit provide information on compliance determinations, annual reporting and re-opening of the permit.

Phosphorus WQBELS are met through WQT computed compliance limits which also require a corresponding Minimum Control Level (MCL) to be met at the discharge. The phosphorus mass limit is based on the Total Maximum Daily Load (TMDL) for the Wisconsin River Basin to address phosphorus water quality impairments within the TMDL area.

Chloride: Acute and chronic chloride toxicity criteria for the protection of aquatic life are included in Tables 1 and 5 of ch. NR 105, Wis. Adm. Code. Subchapter VII of ch. NR 106 establishes the procedure for calculating water quality based effluent limitations (WQBELs) for chloride. This permit includes 2/week chloride monitoring for years 2027 and 2028 to ensure adequate data for permit the next reissuance.

Total Nitrogen Monitoring (NO2+NO3, TKN and Total N)- The Department has included effluent monitoring for Total Nitrogen in the permit through the authority under §§ 283.55(1)(e), Wis. Stats., which allows the department to require the permittee to submit information necessary to identify the type and quantity of any pollutants discharged from the point source, and through s. NR 200.065(1)(h), Wis. Adm. Code, which allows for this monitoring to be collected during the permit term. More information on the justification to include total nitrogen monitoring in wastewater permits can be found in the "Guidance for Total Nitrogen Monitoring in Wastewater Permits" dated October 1, 2019.

PFOS and PFOA-NR 106 Subchapter VIII – Permit Requirements for PFOS and PFOA Dischargers became effective on August 1, 2022. Pursuant to s. NR 106.98(3)(b), Wis. Adm. Code, the department evaluated the need for PFOS and PFOA monitoring. Based on information available at the time the proposed permit was drafted, the department has determined the permittee does not need to sample for PFOS or PFOA as part of this permit reissuance. The department may reevaluate the need for sampling at the next permit reissuance if new information becomes available that suggests PFOS or PFOA may be present in the discharge.

3 Land Application - Monitoring and Limitations

Municipal Sludge Description						
Sample Point	**Sludge Class (A orB)**	**Sludge Type (Liquid or Cake)**	**Pathogen Reduction Method**	**Vector Attraction Method**	**Reuse Option**	**Amount Reused/Disposed (Dry Tons/Year)**
003	B	Liquid	To be evaluated with submittal of sludge management plan (should there be a need to desludge the lagoon during the permit term).			
Does sludge management demonstrate compliance? **Yes.**						
Is additional sludge storage required? **No.**						
Is Radium-226 present in the water supply at a level greater than 2 pCi/liter? **No.**						
Is a priority pollutant scan required? **No.**						

Sample Point Number: 003- LAGOON SLUDGE

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Once	Composite	
Arsenic Dry Wt	Ceiling	75 mg/kg	Once	Composite	
Arsenic Dry Wt	High Quality	41 mg/kg	Once	Composite	
Cadmium Dry Wt	Ceiling	85 mg/kg	Once	Composite	
Cadmium Dry Wt	High Quality	39 mg/kg	Once	Composite	
Copper Dry Wt	Ceiling	4,300 mg/kg	Once	Composite	
Copper Dry Wt	High Quality	1,500 mg/kg	Once	Composite	
Lead Dry Wt	Ceiling	840 mg/kg	Once	Composite	
Lead Dry Wt	High Quality	300 mg/kg	Once	Composite	
Mercury Dry Wt	Ceiling	57 mg/kg	Once	Composite	
Mercury Dry Wt	High Quality	17 mg/kg	Once	Composite	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Once	Composite	
Nickel Dry Wt	Ceiling	420 mg/kg	Once	Composite	
Nickel Dry Wt	High Quality	420 mg/kg	Once	Composite	
Selenium Dry Wt	Ceiling	100 mg/kg	Once	Composite	
Selenium Dry Wt	High Quality	100 mg/kg	Once	Composite	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Once	Composite	
Zinc Dry Wt	High Quality	2,800 mg/kg	Once	Composite	
Nitrogen, Total Kjeldahl		Percent	Once	Composite	Complete List 2 Analysis prior to land application.
Nitrogen, Ammonia (NH3-N) Total		Percent	Once	Composite	Complete List 2 Analysis prior to land application.
Phosphorus, Total		Percent	Once	Composite	Complete List 2 Analysis prior to land application.
Phosphorus, Water Extractable		% of Tot P	Once	Composite	Complete List 2 Analysis prior to land application.
Potassium, Total Recoverable		Percent	Once	Composite	Complete List 2 Analysis prior to land application.
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Composite	Sample once in calendar year 2025. See 'Sludge Analysis for PCBs' section in permit.
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Composite	Sample once in calendar year 2025. See 'Sludge Analysis for PCBs' section in permit.

PFOA + PFOS		ug/kg	Once	Calculated	Report the sum of PFOA and PFOS. See PFAS Permit Sections for more information.
PFAS Dry Wt			Once	Grab	Perfluoroalkyl and Polyfluoroalkyl Substances based on updated DNR PFAS List. See PFAS Permit Sections for more information.

Changes from Previous Permit:

Sludge monitoring requirements and limitations were re-evaluated for the proposed permit term. List 2 analysis for nutrients prior to land application has been added. PFAS monitoring once during the permit term is included in the permit pursuant to s. NR 204.06(2)(b)9, Wis. Adm. Code.

Explanation of Limits and Monitoring Requirements

Requirements for land application of municipal sludge are determined in accordance with ch. NR 204, Wis. Adm. Code. Ceiling and high-quality limits for metals in sludge are specified in s. NR 204.07(5), Wis. Adm. Code. Requirements for pathogens are specified in s. NR 204.07(6), Wis. Adm. Code and in s. NR 204.07 (7), Wis. Adm. Code for vector attraction requirements. Limitations for PCBs are addressed in s. NR 204.07(3)(k), Wis. Adm. Code.

List 2 Analysis for Nutrients – Monitoring for nutrients has been added to facilitate land application of removed sludge should this occur during the permit term. Sample collection shall occur prior to land application.

PFAS- The presence and fate of PFAS in municipal and industrial sludges is an emerging public health concern. EPA is currently developing a risk assessment to determine future land application rates and expects to release this risk assessment by the end of 2024. In the interim, the department has developed the "Interim Strategy for Land Application ofBiosolids and Industrial Sludges Containing PFAS".

Collecting sludge data on PFAS concentrations from a wide range of wastewater treatment facilities will help protect public health from exposure to elevated levels of PFAS and determine the department's implementation of EPA's recommendations. To quantitate this risk, PFAS sampling has been included in the proposed WPDES permit pursuant to ss. NR 214.18(5)(b) and NR 204.06(2)(b)9, Wis. Adm. Code.

4 Schedules

4.1 Disinfection and Effluent Limitations for E. coli

Required Action	Due Date
Progress Report: The permittee shall submit a progress report on development and submittal of a facility plan for upgrades to meet disinfection requirements and E. coli limits.	06/30/2025
Submit Facility Plan: The permittee shall submit a Facility Plan per s. NR 110.09, Wis. Adm. Code for meeting disinfection requirements and complying with E. coli surface water limitations. The permittee may submit an abbreviated facility plan if the Department determines that the modifications are minor.	04/30/2026

Final Plans and Specifications: The permittee shall submit final construction plans to the Department for approval pursuant to ch. NR 108, Wis. Adm. Code, specifying treatment plant upgrades that must be constructed to meet disinfection requirements per s. NR 210.06(1), Wis. Adm Code, achieve compliance with final E. coli limitations, and a schedule for completing construction of the upgrades by the complete construction date specified below.	03/31/2027
Treatment Plant Upgrade to Meet Limitations: The permittee shall initiate bidding, procurement, and/or construction of the project. The permittee shall obtain approval of the final construction plans and schedule from the Department pursuant to s. 281.41. Stats., prior to initiating activities defined as construction under ch. NR 108, Wis. Adm. Code. Upon approval of the final construction plans and schedule by the Department pursuant to s. 281.41, Stats., the permittee shall construct the treatment plant upgrades in accordance with the approved plans and specifications.	09/30/2027
Construction Upgrade Progress Report: The permittee shall submit a progress report on construction upgrades.	09/30/2028
Complete Construction: The permittee shall complete construction of wastewater treatment system upgrades.	03/31/2029
Achieve Compliance: The permittee shall achieve compliance with final E. coli limitations.	04/30/2029

4.2 Annual Water Quality Trading (WQT) Report

Required Action	Due Date
Annual WQT Report: Submit an annual WQT report that shall cover the first year of the permit term. The WQT Report shall include: The number of pollutant reduction credits (lbs/month) used each month of the previous year to demonstrate compliance; The source of each month's pollutant reduction credits by identifying the approved water quality trading plan that details the source; A summary of the annual inspection of each nonpoint source management practice that generated any of the pollutant reduction credits used during the previous year; and Identification of noncompliance or failure to implement any terms or conditions of this permit with respect to water quality trading that have not been reported in discharge monitoring reports.	01/31/2025
Annual WQT Report #2: Submit an annual WQT report that shall cover the previous year.	01/31/2026
Annual WQT Report #3: Submit an annual WQT report that shall cover the previous year.	01/31/2027
Annual WQT Report #4: Submit the 4th annual WQT report that shall cover the previous year.	01/31/2028
Annual WQT Report #5: Submit the 5th annual WQT report. If the permittee wishes to continue to comply with phosphorus limits through WQT in subsequent permit terms, the permittee shall submita revised WQT plan including a demonstration of credit need, compliance record of the existing WQT, and any additional practices needed to maintain compliance over time.	01/31/2029

Annual WQT Report Required After Permit Expiration: In the event that this permit is not reissued by the expiration date, the permittee shall continue to submit annual WQT reports by January 31 each year covering the total number of pollutant credits used, the source of the pollution reduction credits, a summary of annual inspection reports performed, and identification of noncompliance or failure to implement any terms or conditions of the approved water quality tradingplan for the previous calendar year.	

4.3 Sludge Management Plan

A sludge management plan is required for the removal of sludge and land application.

Required Action	Due Date
Sludge Management Plan: The permittee shall submit an updated Sludge Management Plan for approval if removal of sludge will occur during this permit term. The plan shall demonstrate compliance with ch. NR 204, Wis. Adm. Code and at minimum address 1) How and where is sludge sampled; 2) Available sludge storage details and location(s); 3) How will the sludge be removed with details on volume, characterization and how will the treatment plant continue to function during the drawdown; 4) describe the type of transportation and spreading vehicles and loading and unloading practices; 5) identify approved land application sites, apply for needed sites, site limitations, total acres needed and vegetative cover management; 6) specify record keeping procedures including site loading; 7) address contingency plans for adverse weather and odor/nuisance abatement; and 8) include any other pertinent information such as other disposal options that may be used or specifications of any pretreatment processes Once approved, all sludge management activities shall be conducted in accordance with the plan. Any changes to the plan must be approved by the Department prior to implementing the changes. No desludging may occur unless approval from the Department is obtained. Daily logs shall be kept that record where the sludge has been disposed.	60 days prior to desludging.

Explanation of Schedules

Disinfection and Effluent Limitations for E. coli

A compliance schedule is included in the permit to provide time for the permittee to submit plans and specs and install disinfection treatment for meeting effluent E. coli water quality-based effluent limits and disinfection requirements pursuant s. NR 210.06, Wis. Adm. Code.

Annual Water Quality Trading (WQT) Reports

Reports are required to continue in this permit term with the first report due in 2025. The reports should include the following information:

- Verification that site inspections occurred;
- Brief summary of site inspection findings;
- Identification of noncompliance or failure to implement any terms or conditions of the permit or trading plan that have not been reported in discharge monitoring reports;
- Any applicable notices of termination or management practice registration; and
- A summary of credits used each month over the calendar year

Sludge Management Plan

If a lagoon will be desludged during this permit term a management plan is needed to explain how the sludge will be safely removed, what contingencies are in place, the type of equipment that will be used and how the sludge will be land applied to ensure the proper precautions are in place to prevent any negative impacts to surface water or groundwater. The60 days allows the department adequate time to review the sludge management plan and approve sites for land applicationof sludge should the facility select this as the means for final disposition. This timeframe presumes that the sludge management plan and site request packages are complete.

Special Reporting Requirements

None

Other Comments:

Publishing Newspaper: Wausau Daily Herald, 800 Scott Street, Wausau, WI, 54402-1286

Attachments:

Water Quality-Based Effluent Limitations for Fenwood Wastewater Treatment Facility, prepared by Benjamin Hartenbower dated June 20, 2024

Water Quality Trading Plan (WQT-2024-0011) for the Village of Fenwood submitted on January 31, 2024.

Water Quality Trading Plan Conditional Approval for Fenwood Wastewater Treatment Facility - WPDES Permit WI-0031411-01, prepared by Jenna Monahan dated April 15, 2024.

Expiration Date:

September 30, 2029

Justification Of Any Waivers From Permit Application Requirements

No waivers requested or given as a part of this permit reissuance.

Originally Prepared By: Melanie Burns, Wastewater Specialist **Date:** July 24, 2024

Modified by: Holly Heldstab, Wastewater Specialist **Date**: May 12, 2025

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: June 20, 2024

TO: Melanie Burns – SER/Milwaukee

FROM: Benjamin Hartenbower – WCR/Eau Claire

SUBJECT: Water Quality-Based Effluent Limitations for the Fenwood Wastewater Treatment Facility WPDES Permit No. WI-0031411

This is in response to your request for an evaluation of the need for water quality-based effluent limitations (WQBELs) using chapters NR 102, 104, 105, 106, 207, 210, 212, and 217 of the Wisconsin Administrative Code (where applicable), for the discharge from the Fenwood Wastewater Treatment Facility in Marathon County. This municipal wastewater treatment facility (WWTF) discharges to Fenwood Creek, located in the Lower Big Eau Pleine River Watershed in the Central Wisconsin River Basin. This discharge is included in the Wisconsin River TMDL as approved by EPA on April 26, 2019 with site-specific criteria approved by EPA on July 9, 2020. The evaluation of the permit recommendations is discussed in more detail in the attached report.

Based on our review, the following recommendations are made on a chemical-specific basis at Outfall 001:

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Annual Total	Footnotes
Flow Rate April May October November	 0.09 MGD 0.087 MGD 0.027 MGD 0.075 MGD					1,2
BOD_5			45 mg/L	30 mg/L		1
TSS			45 mg/L	30 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Ammonia Nitrogen	Variable					3
E.Coli						4
Chloride						5
Phosphorus MCL WQT Computed (TP)				1.2 mg/L	 7 lbs/year	6
TKN, Nitrate+Nitrite, and Total Nitrogen						7

Footnotes:

1. No changes from the current permit.
2. Discharge is only authorized for April through May and October through November.

3. The variable daily maximum ammonia nitrogen limit table corresponding to effluent pH values.

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	82	7.0 < pH ≤ 7.1	50	8.0 < pH ≤ 8.1	11
6.1 < pH ≤ 6.2	81	7.1 < pH ≤ 7.2	45	8.1 < pH ≤ 8.2	8.7
6.2 < pH ≤ 6.3	79	7.2 < pH ≤ 7.3	40	8.2 < pH ≤ 8.3	7.1
6.3 < pH ≤ 6.4	77	7.3 < pH ≤ 7.4	35	8.3 < pH ≤ 8.4	5.9
6.4 < pH ≤ 6.5	74	7.4 < pH ≤ 7.5	30	8.4 < pH ≤ 8.5	4.8
6.5 < pH ≤ 6.6	71	7.5 < pH ≤ 7.6	26	8.5 < pH ≤ 8.6	4.0
6.6 < pH ≤ 6.7	68	7.6 < pH ≤ 7.7	22	8.6 < pH ≤ 8.7	3.3
6.7 < pH ≤ 6.8	64	7.7 < pH ≤ 7.8	18	8.7 < pH ≤ 8.8	2.8
6.8 < pH ≤ 6.9	59	7.8 < pH ≤ 7.9	15	8.8 < pH ≤ 8.9	2.3
6.9 < pH ≤ 7.0	55	7.9 < pH ≤ 8.0	13	8.9 < pH ≤ 9.0	2.0

4. Monitoring only required during the month of May.
5. Monitoring only.
6. Phosphorus WQBELS are met through WQT computed compliance limits which also require a corresponding Minimum Control Level (MCL) to be met at the discharge.The phosphorus mass limit is based on the Total Maximum Daily Load (TMDL) for the Wisconsin River Basin to address phosphorus water quality impairments within the TMDL area. The TMDL was approved by EPA on April 26, 2019 with site-specific criteria approved by EPA on July 9, 2020.
7. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, annual total nitrogen monitoring is recommended for all minor municipal permittees. Total Nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total kjeldahl nitrogen (TKN) (all expressed as N).

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Benjamin Hartenbower at (715) 225-4705 or Benjamin.Hartenbower@wisconsin.gov or Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, Thermal Table, & Map

PREPARED BY: _____ Date: 06/20/2024

Benjamin Hartenbower, PE,
Water Resources Engineer

E-cc:

Nick Lindstrom, Wastewater Engineer – WCR/Eau Claire
Geisa Thielen, Regional Wastewater Supervisor – WCR/Eau Claire
Diane Figiel, Water Resources Engineer – WY/3
Scott Provost, Water Quality Biologist – WCR/Wisconsin Rapids
Nate Willis, Wastewater Engineer – WY/3

Attachment #1

Water Quality-Based Effluent Limitations for the Fenwood Wastewater Treatment Facility WPDES Permit No. WI-0031411

Prepared by: Benjamin P. Hartenbower

PART 1 – BACKGROUND INFORMATION

Facility Description:
The Village of Fenwood operates a three-cell stabilization pond wastewater treatment facility. Discharge to Fenwood Creek occurs on a fill and draw basis in the spring and fall.

Attachment #3 is a map of the area showing the approximate location of Outfall 001.

Existing Permit Limitations
The current permit, which expired on March 31, 2024, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Average	Annual Total	Footnotes
Flow Rate April May October November	 0.09 MGD 0.087 MGD 0.027 MGD 0.075 MGD					1,2
BOD_5			45 mg/L	30 mg/L		1
TSS			45 mg/L	30 mg/L		1
pH	9.0 s.u.	6.0 s.u.				1
Ammonia Nitrogen	Variable					3
Chloride						4
Phosphorus MCL WQT Computed (TP)				 1.20 mg/L	 7 lbs/year	

Footnotes:

1. These limitations are not being evaluated as part of this review. Because the water quality criteria (WQC), reference effluent flow rates, and receiving water characteristics have not changed, limitations for these water quality characteristics do not need to be re-evaluated at this time.
2. Discharge is only authorized for April through May and October through November.

3. The variable daily maximum ammonia nitrogen limit table corresponding to effluent pH values.

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	82	7.0 < pH ≤ 7.1	50	8.0 < pH ≤ 8.1	11
6.1 < pH ≤ 6.2	81	7.1 < pH ≤ 7.2	45	8.1 < pH ≤ 8.2	8.7
6.2 < pH ≤ 6.3	79	7.2 < pH ≤ 7.3	40	8.2 < pH ≤ 8.3	7.1
6.3 < pH ≤ 6.4	77	7.3 < pH ≤ 7.4	35	8.3 < pH ≤ 8.4	5.9
6.4 < pH ≤ 6.5	74	7.4 < pH ≤ 7.5	30	8.4 < pH ≤ 8.5	4.8
6.5 < pH ≤ 6.6	71	7.5 < pH ≤ 7.6	26	8.5 < pH ≤ 8.6	4.0
6.6 < pH ≤ 6.7	68	7.6 < pH ≤ 7.7	22	8.6 < pH ≤ 8.7	3.3
6.7 < pH ≤ 6.8	64	7.7 < pH ≤ 7.8	18	8.7 < pH ≤ 8.8	2.8
6.8 < pH ≤ 6.9	59	7.8 < pH ≤ 7.9	15	8.8 < pH ≤ 8.9	2.3
6.9 < pH ≤ 7.0	55	7.9 < pH ≤ 8.0	13	8.9 < pH ≤ 9.0	2.0

4. Monitoring only.

Receiving Water Information

- Name: Fenwood Creek
- Waterbody Identification Code (WBIC): 1428700
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply.
  Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: USGS by taking 5 discharge measurements collected from USGS for Station 053995527 at Highway P in Fenwood, 3200 ft upstream of Outfall 001 and relating the data to the Big Eau Pleine River at Stratford, USGS Station 05399500. (July 6, 2005 memo from USGS)

  $7\text{-}Q_{10}$ = 0.06 cfs (cubic feet per second)

  $7\text{-}Q_2$ = 0.24 cfs

  Harmonic Mean Flow = 1.00 cfs using a drainage area of 16.7 mi^2.

	Apr	May	Oct	Nov
$7\text{-}Q_{10}$ (cfs)	2.63	0.78	0.20	0.45
$7\text{-}Q_2$ (cfs)	6.00	2.02	0.79	1.29
$30\text{-}Q_5$ (cfs)	16.7	4.41	0.78	1.33

  The Harmonic Mean has been estimated based on average flow and the $7\text{-}Q_{10}$ using an equation from U.S. EPA's *Technical Support Document for Water Quality-Based Toxics Control* (March 1991, EPA/505/2-90-001, pgs. 88-89).
- Hardness = 148 mg/L as $CaCO_3$. This value represents the geometric mean of effluent samples collected July 2023. Effluent hardness is used in place of receiving water because there is no data available for Fenwood Creek.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: 25%

- Source of background concentration data: Chloride data is from Lower Big Eau Pleine River watershed. Metals data from Big Eau Pleine River at Cherokee is used for this evaluation because there is no data available for Fenwood Creek and the Big Eau Pleine River is within the same ecological landscape so ambient water quality characteristics are expected to be similar. The numerical values are shown in the tables below. If no data is available, the background concentration is assumed to be negligible and a value of zero is used in the computations. Background data for calculating effluent limitations for ammonia nitrogen are described later.
- Multiple dischargers: None
- Impaired water status: Fenwood Creek is listed as impaired for Total Phosphorus.

Effluent Information:

- Design Flow Rates(s):
  Annual Average = 0.090 MGD (Million Gallons per Day)
  For reference, the actual average flow from May 2019 to December 2023 during discharge occurences was 0.061 MGD.
- Hardness = 148 mg/L as $CaCO_3$. This value represents the geometric mean of 4 effluent samples collected from 07/10/2023 to 07/19/2023.
- Acute dilution factor used in accordance with s. NR 106.06 (3) (c), Wis. Adm. Code: Not applicable – this facility does not have an approved Zone of Initial Dilution (ZID).
- Water Source: Domestic wastewater with water supply from private wells
- Additives: None
- Total Phosphorus Wasteload Allocation: 7 lbs/year
- Effluent characterization: This facility is categorized as a minor municipality, so the permit application required effluent sample analyses for a limited number of common pollutants, as specified in s. NR 200.065, Table 1, Wis. Adm. Code, primarily metal substances plus Ammonia, Chloride, and hardness. The permit-required monitoring for Chloride and Phosphorus from April 2019 to March 2024 is used in this evaluation.

Chemical Specific Effluent Data at Outfall 001

	Chloride mg/L
1-day P_{99}	296
4-day P_{99}	235
30-day P_{99}	202
Mean	184
Std	40
Sample size	20
Range	146 - 341

Attachment #1

Chemical Specific Effluent Data at Outfall 001

Sample Date	Copper µg/L
07/10/2023	<3
07/13/2023	<3
07/16/2023	<3
07/19/2023	<3
07/22/2023	<3
07/25/2023	<3
07/28/2023	<3
07/31/2023	<3
08/14/2023	<3
08/17/2023	<3
08/20/2023	<3
mean	<3

"<" means that the pollutant was not detected at the indicated level of detection. The mean concentration was calculated using zero in place of the non-detected results.

Effluent data for substances for which a single sample was analyzed is shown in the tables in Part 2 below, in the column titled "MEAN EFFL. CONC.".

The following table presents the average concentrations and loadings at Outfall 001 from May 2019 to December 2023 for all parameters with limits in the current permit to meet the requirements of s. NR 201.03(6):

Parameter Averages with Limits

	Average Measurement	Average Mass Discharged
BOD_5	12 mg/L	
TSS	15 mg/L	
pH	7.35 s.u.	
Ammonia Nitrogen	1.1 mg/L	
Phosphorus	0.87 mg/L	0.427 lbs/day

PART 2 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR TOXIC SUBSTANCES – EXCEPT AMMONIA NITROGEN

Permit limits for toxic substances are required whenever any of the following occur:

1. The maximum effluent concentration exceeds the calculated limit (s. NR 106.05(3), Wis. Adm. Code)
2. If 11 or more detected results are available in the effluent, the upper 99th percentile (or P_{99}) value exceeds the comparable calculated limit (s. NR 106.05(4), Wis. Adm. Code)
3. If fewer than 11 detected results are available, the mean effluent concentration exceeds 1/5 of the calculated limit (s. NR 106.05(6), Wis. Adm. Code)

Acute Limits based on 1-Q_{10}

Daily maximum effluent limitations for toxic substances are based on the acute toxicity criteria (ATC), listed in ch. NR 105, Wis. Adm. Code. Previously daily maximum limits for toxic substances were calculated as two times the ATC. However, changes to ch. NR 106, Wis. Code, (September 1, 2016) require the Department to calculate acute limitations using the same mass balance equation as used for other limits along with the 1-Q_{10} receiving water low flow to determine if more restrictive effluent limitations are needed to protect the receiving stream from discharges which may cause or contribute to an exceedance of the acute water quality standards. The mass balance equation is provided below.

$$\text{Limitation} = \frac{(WQC)\,(Qs + (1-f)\,Qe) - (Qs - f\,Qe)\,(Cs)}{Qe}$$

Where:

WQC =Acute toxicity criterion or secondary acute value according to ch. NR 105, Wis. Adm. Code.

Qs = average minimum 1-day flow which occurs once in 10 years (1-day Q_{10}) if the 1-day Q_{10} flow data is not available = 80% of the average minimum 7-day flow which occurs once in 10 years (7-day Q_{10}).

Qe = Effluent flow (in units of volume per unit time) as specified in s. NR 106.06(4)(d), Wis. Adm. Code.

f = Fraction of the effluent flow that is withdrawn from the receiving water, and

Cs = Background concentration of the substance (in units of mass per unit volume) as specified in s. NR 106.06(4)(e), Wis. Adm. Code.

If the receiving water is effluent dominated under low stream flow conditions, the 1-Q_{10} method of limit calculation produces the most stringent daily maximum limitations and should be used while making reasonable potential determinations. This is the case for the Village of Fenwood Wastewater Treatment Facility.

The following tables list the calculated WQBELs for this discharge along with the results of effluent sampling. All concentrations are expressed in terms of micrograms per Liter (µg/L), except for hardness and chloride (mg/L).

Daily Maximum Limits based on Acute Toxicity Criteria (ATC)

RECEIVING WATER FLOW = 0.05 cfs, (1-Q_{10} (estimated as 80% of 7-Q_{10})), as specified in s. NR 106.06 (3) (bm), Wis. Adm. Code.

SUBSTANCE	REF. HARD. mg/L	ATC	MEAN BACK-GRD.	MAX. EFFL. LIMIT**	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day P_{99}	1-day MAX. CONC.
Arsenic		339.8		456.9	91.4	1.2		
Cadmium	148	16.13	0.025	21.7	4.3	<2		
Chromium (+3)	148	2481.99	0.337	3337.4	667.5	<3		
Copper	148	22.42	1.266	29.7	5.9	<3		<3
Lead	148	155.89	0.283	209.5	41.9	<1		
Nickel	148	652.68		877.7	175.5	<8		
Zinc	148	169.33	2.011	227	45	34		
Chloride		757	28.9	1008			296	341

* * Per the changes to s. NR 106.07(3), Wis. Adm. Code, effective 09/01/2016 consideration of ambient concentrations and 1-Q_{10} flow rates yields a more restrictive limit than the 2 × ATC method of limit calculation.

Weekly Average Limits based on Chronic Toxicity Criteria (CTC)
RECEIVING WATER FLOW = 0.02 cfs (¼ of the 7-Q_{10}), as specified in s. NR 106.06 (4) (c), Wis. Adm. Code

SUBSTANCE	REF. HARD. mg/L	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	4-day P_{99}
Arsenic		152.2		168.6	33.7	1.2	
Cadmium	148	3.34	0.025	3.7	0.7	<2	
Chromium (+3)	148	181.86	0.337	201.4	40.3	<3	
Copper	148	14.45	1.266	15.9	3.2	<3	
Lead	148	40.83	0.283	45.2	9.0	<1	
Nickel	148	72.61		80.4	16.1	<8	
Zinc	148	169.33	2.011	187.4	37.5	34	
Chloride		395	28.9	434			235

Monthly Average Limits based on Wildlife Criteria (WC)
The effluent characterization did not include any effluent sampling results for substances for which Wildlife Criteria exist.

Monthly Average Limits based on Human Threshold Criteria (HTC)
RECEIVING WATER FLOW = 0.25 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Cadmium	370	0.025	1038	208	<2
Chromium (+3)	3818000	0.337	10706611	2141322	<3
Lead	140	0.283	392.1	78.4	<1
Nickel	43000		120583	24117	<8

Monthly Average Limits based on Human Cancer Criteria (HCC)
RECEIVING WATER FLOW = 0.25 cfs (¼ of Harmonic Mean), as specified in s. NR 106.06 (4), Wis. Adm. Code.

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	13.3		37.3	7.5	1.2

In addition to evaluating the need for limits for each individual substance for which HCC exist, s. NR 106.06(8), Wis. Adm. Code, requires the evaluation of the cumulative cancer risk. Because no effluent limits are needed based on HCC, determination of the cumulative cancer risk is not needed per s. NR 106.06(8), Wis. Adm. Code.

Conclusions and Recommendations: Based on a comparison of the effluent data and calculated effluent limitations, limits are not required for toxic substances.

PFOS and PFOA
The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98, Wis. Adm. Code. Based on the annual design flow and lack of nondomestic contributions, it is unlikely that the effluent will contain PFOS or PFOA. **Therefore, monitoring is not recommended.** If information becomes available that indicates PFOS or PFOA may be present in the effluent, the monitoring requirements may change.

Mercury – The permit application did not require monitoring for mercury because the Fenwood Wastewater Treatment Facility is categorized as a minor facility as defined in s. NR 200.02(8), Wis. Adm. Code. In accordance with s. NR 106.145(3)(a)3., Wis. Adm. Code, a minor municipal discharger shall monitor, and report results of influent and effluent mercury monitoring once every three months if, there are two or more exceedances in the last five years of the high-quality sludge mercury concentration of 17 mg/kg specified in s. NR 204.07(5). A review of the past five years of sludge characteristics data reveals that all the sample results are within expected analytical ranges and well below the 17 mg/kg level. The average concentration in the sludge from 2020 was 0.04 mg/kg. **Therefore, no mercury monitoring is recommended at Outfall 001.**

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR AMMONIA NITROGEN

The State of Wisconsin promulgated revised water quality standards for ammonia nitrogen in ch. NR 105, Wis. Adm. Code, effective March 1, 2004 which includes criteria based on both acute and chronic toxicity to aquatic life. The current permit has daily maximum limits. These limits are re-evaluated at this time due to the following changes:

- Subchapter IV of ch. NR 106, Wis. Adm. Code allows limits based on available dilution instead of limits set to twice the acute criteria.
- The maximum expected effluent pH has changed

Daily Maximum Limits based on Acute Toxicity Criteria (ATC):
Daily maximum limitations are based on acute toxicity criteria in ch. NR 105, Wis. Adm. Code, which are a function of the effluent pH and the receiving water classification. The acute toxicity criterion (ATC) for ammonia is calculated using the following equation.

$$\text{ATC in mg/L} = [A \div (1 + 10^{(7.204 - pH)})] + [B \div (1 + 10^{(pH - 7.204)})]$$

Where:

A = 0.411 and B = 58.4 for a Warm Water Sport fishery, and
pH (s.u.) = that characteristic of the effluent.

The effluent pH data was examined as part of this evaluation. A total of 186 sample results were reported from May 2019 to November 2023. The maximum reported value was 8.30 s.u. (Standard pH Units). The effluent pH was 8.30 s.u. or less 99% of the time. The 1-day P_{99}, calculated in accordance with s. NR 106.05(5), Wis. Adm. Code, is 8.17 s.u. The mean plus the standard deviation multiplied by a factor of 2.33, an estimate of the upper ninety ninth percentile for a normally distributed dataset, is 8.14 s.u. Therefore, a value of 8.30 s.u. is believed to represent the maximum reasonably expected pH, and therefore most appropriate for determining daily maximum limitations for ammonia nitrogen. Substituting a value of 8.30 s.u. into the equation above yields an ATC = 4.71 mg/L.

Daily Maximum Ammonia Nitrogen Effluent Limitations Calculation Method

In accordance with s. NR 106.32(2), Wis. Adm. Code daily maximum ammonia limitations are calculated using the 1-Q_{10} receiving water low flow if it is determined that the previous method of acute ammonia limit calculation (2×ATC) is not sufficiently protective of the fish and aquatic life. The more restrictive calculated limits shall apply.

The calculated daily maximum ammonia nitrogen effluent limits using the mass balance approach with the 1-Q_{10} (estimated as 80 % of 7-Q_{10}) and the 2×ATC approach are shown below.

Daily Maximum Ammonia Nitrogen Determination

	April Ammonia Nitrogen Limit mg/L	May Ammonia Nitrogen Limit mg/L	October Ammonia Nitrogen Limit mg/L	November Ammonia Nitrogen Limit mg/L
2×ATC	9.43	9.43	9.43	9.43
1-Q_{10}	74.89	26.25	22.54	19.16

The 2×ATC method yields the most stringent limits for the Fenwood Wastewater Treatment Facility.

The current permit has variable daily maximum effluent limits based on effluent pH. Presented below is a table of daily maximum limitations corresponding to various effluent pH values. Use of this table is not necessarily recommended in the permit, but it is presented herein for informational purposes.

Daily Maximum Ammonia Nitrogen Limits – WWSF

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

Weekly and Monthly Average Limits based on Chronic Toxicity Criteria (CTC)
The ammonia limit calculation also warrants evaluation of weekly and monthly average limits based on chronic toxicity criteria for ammonia, since those limits relate to the assimilative capacity of the receiving water.

Weekly average and monthly average limits for ammonia nitrogen are based on chronic toxicity criteria in ch. NR 105, Wis. Adm. Code.

The 30-day chronic toxicity criterion (CTC) for ammonia in waters classified as Warm Water Sport Fish Community is calculated by the following equation, according to subchapter IV of NR 106, Wis. Adm. Code.

$$CTC = E \times \{[0.0676 \div (1 + 10^{(7.688 - pH)})] + [2.912 \div (1 + 10^{(pH - 7.688)})]\} \times C$$

Where:

pH = the pH (s.u.) of the receiving water,
E = 0.854,
C = the minimum of 2.85 or $1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Present), or
$C = 1.45 \times 10^{(0.028 \times (25 - T))}$ – (Early Life Stages Absent), and
T= the temperature (ºC) of the receiving water – (Early Life Stages Present), or
T = the maximum of the actual temperature (ºC) and 7 - (Early Life Stages Absent)

The 4-day criterion is equal to the 30-day criterion multiplied by 2.5. The 4-day criteria are used in a mass-balance equation with the 7-Q_{10} (4-Q3, if available) to derive weekly average limitations. And the 30-day criteria are used with the 30-Q_5 (estimated as 85% of the 7-Q_2 if the 30-Q_5 is not available) to derive monthly average limitations. The stream flow value is further adjusted to temperature; 100% of the flow is used if the Temperature ≥ 16 ºC, 25% of the flow is used if the Temperature < 11 ºC, and 50% of the flow is used if the Temperature ≥ 11 ºC but < 16 ºC.

Section NR 106.32 (3), Wis. Adm. Code, provides a mechanism for less stringent weekly average and monthly average effluent limitations when early life stages (ELS) of critical organisms are absent from the receiving water. This applies only when the water temperature is less than 14.5 ºC, during the winter and spring months. Based on a review of the DNR Fisheries database, burbot, an early spawning species, are not believed to be present in Fenwood Creek. So "ELS Absent" criteria apply from October through March, and "ELS Present" criteria will apply from April through September for a WWSF classification.

The "default" basin assumed values are used for temperature and background ammonia concentrations, because minimum ambient data is available. The values for pH are based on data collected within the Lower Big Eau Pleine River Watershed. These values are shown in the table below, with the resulting criteria and effluent limitations.

Attachment #1

Weekly and Monthly Ammonia Nitrogen Limits – WWSF

		April	May	October	November
Effluent Flow	Qe (MGD)	0.139	0.135	0.042	0.116
Background Information	7-Q_{10} (cfs)	2.63	0.78	0.20	0.45
	30-Q_5 (cfs)	0.18	0.18	0.18	0.18
	Ammonia (mg/L)	0.07	0.07	0.06	0.06
	Temperature (°C)	8.9	14.4	10.0	4.4
	pH (s.u.)	7.59	7.72	7.55	7.77
	% of Flow used	25	50	25	25
	Reference Weekly Flow (cfs)	0.658	0.390	0.050	0.113
	Reference Monthly Flow (cfs)	0.045	0.090	0.045	0.045
Criteria mg/L	4-day Chronic				
	Early Life Stages Present	10.05	8.78	10.48	8.27
	Early Life Stages Absent	14.44	8.82	14.02	13.43
	30-day Chronic				
	Early Life Stages Present	4.02	3.51	4.19	3.31
	Early Life Stages Absent	5.78	3.53	5.61	5.37
Effluent Limitations mg/L	Weekly Average				
	Early Life Stages Present	57.15	34.02		
	Early Life Stages Absent			30.72	26.40
	Monthly Average				
	Early Life Stages Present	5.29	5.81		
	Early Life Stages Absent			11.58	7.43

Effluent Data

The following table evaluates the statistics based upon ammonia data reported from May 2019 to November 2023, with those results being compared to the calculated limits to determine the need to include ammonia limits in the Fenwood Wastewater Treatment Facility permit for the respective month ranges.

Ammonia Nitrogen Effluent Data

Ammonia Nitrogen mg/L	
1-day P_{99}	5.80
4-day P_{99}	3.20
30-day P_{99}	1.70
Mean	1.10
Std	1.20
Sample size	72
Range	0.1 - 4.3

Based on this comparison, there is no reasonable potential for the discharge to exceed any of the calculated ammonia nitrogen limits.

The permit currently has daily maximum limits. Where there are existing ammonia nitrogen limits in the permit, the limits must be retained regardless of reasonable potential, consistent with s. NR 106.33(1)(b), Wis. Adm. Code:

> (b) If a permittee is subject to an ammonia limitation in an existing permit, the limitation shall be included in any reissued permit. Ammonia limitations shall be included in the permit if the permitted facility will be providing treatment for ammonia discharges.

Antidegradation

The variable daily maximum ammonia nitrogen limit table less restrictive than the table in the current permit. Without a demonstration of need for higher limits in accordance with s. NR 207.04, Wis. Adm. Code, the current daily maximum limit table must be continued in the reissued permit.

Conclusions and Recommendations

In summary, no changes to the ammonia nitrogen limitations are recommended. The variable daily maximum ammonia nitrogen limit table corresponding to effluent pH values should be included the reissued permit.

PART 4 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR BACTERIA

Section NR 102.04(5), Wis. Adm. Code, states that all surface waters shall be suitable for supporting recreational use and shall meet *E. coli* criteria during the recreation season. Section NR 102.04(5)(b), Wis. Adm. Code, allows the Department to make exceptions when it determines, in accordance with s. NR 210.06(3), Wis. Adm. Code, that wastewater disinfection is not required to meet *E. coli* limits and protect the recreational use. Section NR 210.06(3), Wis. Adm. Code, tasks the Department with determining the need for disinfection using a site-specific analysis based on potential risk to human or animal health. It sets out the factors that must be considered in determining the necessity to disinfect municipal wastewater or to change the length of the disinfection season.

1. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.
2. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

The last permit term's flow data from 701 indicates that the detention time reached a minimum of 120 days. Since data shows that the facility does not provide > 180-d detention time, monitoring is needed in the reissued permit to determine if the discharge can meet bacteria limits during the recreation season without disinfection. Monitoring should be conducted at a minimum of 1x weekly during the permit term and the need for disinfection revisited at permit reissuance or if factors such as dilution or detention times change.

PART 5 – PHOSPHORUS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires municipal wastewater treatment facilities that discharge greater than 150 pounds of Total Phosphorus per month to comply with a monthly average limit of 1.0 mg/L, or an approved alternative concentration limit.

Because the Fenwood Wastewater Treatment Facility does not currently have an existing technology-based limit, the need for this limit in the reissued permit is evaluated. The data demonstrates that the annual monthly average phosphorus loading is less than 150 lbs/month, which is the threshold for municipalities in accordance to s. NR 217.04(1)(a)1, Wis. Adm. Code, and therefore a technology-based limit is not required.

Annual Average Mass Total Phosphorus Loading

Month	Monthly Avg. mg/L	Total Flow MG/month	Total Phosphorus lb./mo.
May 2019	1.19	2.06	20.38
Nov 2019	0.69	1.71	9.90
May 2020	0.68	1.53	8.71
Nov 2020	0.37	1.65	5.08
May 2021	0.98	1.61	13.18
Nov 2021	0.91	1.24	9.38
May 2022	1.19	1.49	14.83
Nov 2022	1.05	1.23	10.79
May 2023	1.04	1.39	12.06
Nov 2023	0.68	1.57	8.93
		Average =	**11.32**

Total P (lbs/month) = Monthly average (mg/L) × total flow (MG/month) × 8.34 (lbs/gallon)
Where total flow is the sum of the actual (not design) flow (in MGD) for that month

In addition, the need for a WQBEL for phosphorus must be considered.

TMDL Limits – Phosphorus

Total phosphorus (TP) effluent limits in lbs/day are calculated as recommended in the *TMDL Development and Implementation Guidance: Integrating the WPDES and Impaired Waters Programs (*May 2020). The wasteload allocations (WLA) that implement site-specific criteria for Lakes Petenwell, Castle Rock, and Wisconsin are found in Appendix K of the *Total Maximum Daily Loads for Total Phosphorus in the Wisconsin River Basin (WRB TMDL)* report dated April 26, 2019 and are expressed as maximum annual loads (lbs/year) and maximum daily loads (lbs/day). The WLA that implement statewide criteria found in Appendix J of the TMDL report are no longer applicable following approval of these site-specific criteria. The daily WLAs in the WRB TMDL equals the annual WLA divided by the number of days in the year. Therefore, the daily WLA is an annual average.

Total Phosphorus Wasteload Allocation: 7 lbs/year (see Appendix K of the TMDL document)

Because this discharge operates under a fill and draw basis, the TMDL limits are best expressed as a total annual discharge limit. This limit should be set equal to the wasteload allocation of **7 lbs/year.**

WQT Minimum Control Level (MCL)
A water quality trading plan has been submitted as an alternative compliance option to offset any Total Phosphorus discharged from Outfall 001 that exceeds the TMDL limit. The annual phosphorus limit may be expressed as computed a compliance limit, but a Minimum Control Level (MCL) must be set as a limit not to be exceeded at the outfall location. **The current MCL of 1.2 mg/L is recommended to continue.**

Conclusions:
In summary, the following limits are recommended by this evaluation:

- Annual Total Phosphorus mass limit of 7 lbs/year
- Monthly average Total Phosphorus concentration limit of 1.2 mg/L

PART 6 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR THERMAL

Surface water quality standards for temperature took effect on October 1, 2010. These regulations are detailed in chs. NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code. Daily maximum and weekly average temperature criteria are available for the 12 different months of the year depending on the receiving water classification.

In accordance with s. NR 106.53(2)(b), Wis. Adm. Code, the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), Wis. Adm. Code, the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off actual flow reported from May 2019 to December 2023.

Monthly Temperature Effluent Data & Limits

Month	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Weekly Maximum (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
APR MAY OCT NOV	69 40	72 41	76 59	118 113

Reasonable Potential
Permit limits for temperature are recommended based on the procedures in s. NR 106.56, Wis. Adm. Code.

- An acute limit for temperature is recommended for each month in which the representative daily maximum effluent temperature for that month exceeds the acute WQBEL. The representative daily maximum effluent temperature is the greater of the following:
  (a) The highest recorded representative daily maximum effluent temperature
  (b) The projected 99th percentile of all representative daily maximum effluent temperatures
- A sub−lethal limitation for temperature is recommended for each month in which the representative weekly average effluent temperature for that month exceeds the weekly average WQBEL. The representative weekly average effluent temperature is the greater of the following:
  (a) The highest weekly average effluent temperature for the month.
  (b) The projected 99th percentile of all representative weekly average effluent temperatures for the month

Comparing the representative highest effluent temperature to the calculated effluent limits determines the reasonable potential of exceeding the effluent limits. Although effluent temperature data is not available for April and October, based on data from May and November and the >120 day detention time, there is no reasonable potential for these limits to be exceeded. **Therefore, temperature limits and monitoring are not recommended.**

PART 7 – WHOLE EFFLUENT TOXICITY (WET)

WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time and effects are recorded. Decisions below related to the selection of representative data and the need for WET limits were made according to ss. NR 106.08 and 106.09, Wis. Adm. Code. WET monitoring frequency and toxicity reduction evaluation (TRE) recommendations were made using the best professional judgment of staff familiar with the discharge after consideration of the guidance in the *Whole Effluent Toxicity (WET) Program Guidance Document (2022).*

Guidance in Chapter 1.11 of the WET Guidance Document (WET Testing of Minor Municipal Discharges) was consulted. This is a minor municipal discharge (< 1.0 MGD) comprised solely of domestic wastewater, with no history of WET failures and no toxic compounds detected at levels of concern. No WET testing is recommended at this time because of the low risk in effluent toxicity..

Attachment #2

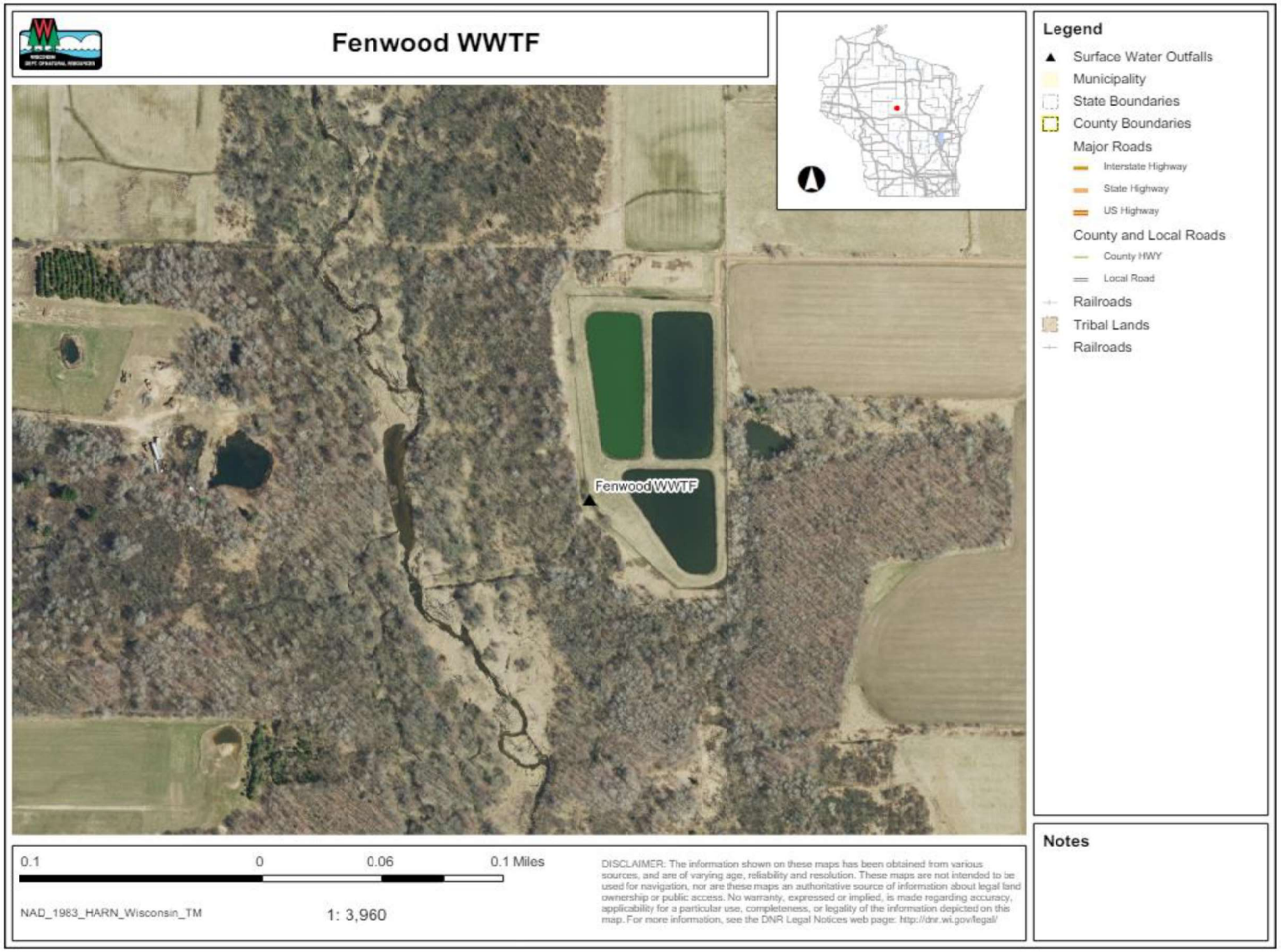
Temperature limits for receiving waters with unidirectional flow

(calculation using default ambient temperature data)

						Temp Dates	Flow Dates
Facility:	Fenwood WWTF		**7-Q_{10}:**	0.06	cfs		
Outfall(s):	001		**Dilution:**	25%		**Start:**	05/01/17	05/01/19
Date Prepared:	05/16/2024		**f:**	0		**End:**	11/23/17	12/31/23
Design Flow (Qe):	0.090	MGD	**Stream type:**	Small warm water sport or forage fish community			
Storm Sewer Dist.	0	ft	**Qs:Qe ratio:**	0.1	:1		
			Calculation Needed?	YES			

Month	Water Quality Criteria			Receiving Water Flow Rate (Qs)	Representative Highest Effluent Flow Rate (Qe)		f	Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default)	Sub-Lethal WQC	Acute WQC		7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)		Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(cfs)	(MGD)	(MGD)		(°F)	(°F)	(°F)	(°F)
JAN	33	49	76	0.02							
FEB	34	50	76	0.02							
MAR	38	52	77	0.02							
APR	48	55	79	0.66							
MAY	58	65	82	0.20	0.078	0.085	0	69	72	76	118
JUN	66	76	84	0.02							
JUL	69	81	85	0.02							
AUG	67	81	84	0.02							
SEP	60	73	82	0.02							
OCT	50	61	80	0.05							
NOV	40	49	77	0.11	0.069	0.074	0	40	41	59	113
DEC	35	49	76	0.02							

Attachment #2



VILLAGE of FENWOOD
WATER QUALITY TRADING PLAN
Hydrologic Unit Code (HUC) - 070700021602
WPDES Permit No. WI-0031411-09-0.

January 31, 2024

Edward Mielke – President
Jane Fischer – Trustee
Paul Leffel – Trustee
Jamie Weiler – Clerk
Christina Hart – Treasurer
Chris (Buck) Furger – Public Works

Prepared by:
Johnson Consulting
Andy Johnson
131151 Raven Falls Trail
Edgar, WI 54426
Phone: 715-551-7257

This page left intentionally blank.

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
1300 W. Clairemont Avenue
Eau Claire, WI 54701

Tony Evers, Governor
Preston D. Cole, Secretary
Telephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

April 22, 2022

Christopher Furger
Village of Fenwood
W648 County Rd P
Stratford, WI 54484

Subject: Fenwood Wastewater Treatment Facility WPDES Permit #WI-0031411
Water Quality Trading Plan – CONDITIONAL CREDIT CERTIFICATION

Dear Mr. Furger

The Department received a water quality trading plan (WQT Plan) for compliance with phosphorus effluent limits at the Fenwood Wastewater Treatment Facility. Based on WDNR review, the final WQT Plan is in general conformance with the WDNR Water Quality Trading Guidance and Section 283.84 of the Wisconsin Statutes. The WQT plan proposes conversion of agricultural cropland acres to permanent grassland as a conservation practice. The timeline for practice installation, as set forth in the WQT plan, indicates practices will be established by the fall of 2022. Credits generated from approved practices result in available credit quantities shown in Table 1. These credits will be incorporated into the reissued WPDES permit and will be used to demonstrate compliance with final phosphorus effluent limits in the reissued permit.

As a condition of this certification, please note the following:

Rotational Average – The projected credits from 2022 to 2026 were used for the rotational average calculation. The calculated credit values may be extended to the expiration date of the reissued permit.

Interim Credits – The interim credit contribution from this practice will expire by the end of 2032. Only reductions that are made below the credit threshold of 0.5 lbs/acre/year will be eligible as long term credit.

Table 1: Total Phosphorus Credits Available per WQT-2022-0005

Year	Available Credits (lbs/yr) – Interim	Available Credits (lbs/yr) – Long Term	Available Credits (lbs/yr) – Total
2022	27.9	5.0	32.9
2023	27.9	5.0	32.9
2024	27.9	5.0	32.9
2025	27.9	5.0	32.9
2026	27.9	5.0	32.9

The Department conditionally certifies the WQT Plan as a basis for water quality trading during the next WPDES permit term. The Department has assigned the WQT plan a tracking number of WQT-2022-0005 and will be referenced as such in the draft WPDES permit. The final WQT plan will be included as part of the public notice package for permit reissuance. The draft WPDES permit will include a requirement for an annual trading report and effluent monitoring for total phosphorus.

If you have any questions or comments, please contact me at 715-225-4705 or at benjamin.hartenbower@wisconsn.gov

Thank You,

Benjamin Hartenbower, P.E.
Water Resources Engineer
Wisconsin Department of Natural Resources

e-CC:

Andy Johnson, Johnson Consulting
Matt Claucherty, WDNR
Geisa Thielen, WDNR
Holly Heldstab, WDNR
Nick Lindstrom, WDNR

TABLE OF CONTENTS

APPENDICES

This page left intentionally blank.

SECTION I — INTRODUCTION

EXECUTIVE SUMMARY

The Village of Fenwood has developed a Water Quality Trading Plan to comply with the phosphorus discharge limit requirements of the Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-0031411-09-0. The Village has contracted with a landowner with cropland located along Fenwood Creek within the northern extents of the village boundary to generate phosphorus credits. Specifically, the twenty acres of cropland in the Village will be converted to permanent grass/hay cover to generate phosphorus credits. See Figure 1 for location of the Village of Fenwood and the Russel Kraft property.

A Notice of Intent to Conduct Water Quality Trading (WQT) dated December 14, 2021, is included in Appendix A.

The Water Quality Trading Plan checklist is in Appendix B.

On an annual basis, over the last eight (8) years, the Village of Fenwood has discharged an average of 19 pounds per year of phosphorus. See Appendix H and WWTF Optimization Plan - 2020. The discharge rate varies from a low of 9 pounds per year to a maximum of 31 pounds per year. The WPDES Permit limits the Village's phosphorus discharge to Fenwood Creek to approximately 7 pounds per year. For planning purposes, the Village proposes to potentially reduce 32-pounds/year of phosphorus (31 lbs./yr. -7 lbs./yr.) X 1.2) by Water Quality Trading. Upon approval of this Water Quality Trading Plan, the Village will exercise their option to enter WQT with Russel Kraft to generate approximately 32.0 pounds of phosphorus credits annually for the Village.

Figure 1 - Boundary of the Village of Fenwood and location of Kraft property

BACKGROUND AND WQT NEEDS

The Village of Fenwood owns and operates a municipal Wastewater Treatment Facility (WWTF). This WWTF is authorized to operate by the DNR under its current WPDES Permit, No. WI-0031411-08-0 which is due to expire March 31, 2024.

The Village of Fenwood has 158 people according to the 2020 census. Fenwood owns and operates almost 2 miles of sanitary sewer collection system consisting of nearly 8,700 lineal feet of gravity sewer main and approximately 1,659 lineal feet of four (4) inch diameter force main. Nearly 84% of the Village's sewer collection system is composed of components greater than 25-years old. This includes the gravity lines that were originally installed in 1975.

The Village of Fenwood's WWTF discharges directly into Fenwood Creek which discharges into the Lower Big Eau Pleine River (LBEP). The Lower Big Eau Pleine River receives wastewater effluent from Fenwood, WI and Stratford, WI as well as agricultural runoff (such as manure discharges and soil erosion contributions). There are several non-metallic mining operations present in the LBEP Watershed.

Soil maps from the Natural Resources Conservation Service (NRCS) indicate that soils near Fenwood include the Loyal, Fordum, Marshfield, Withee, and Fenwood-Rozellville Point series. The soil consists of silty loams and gravel, with slopes ranging from flat to 6 percent.
See Figure 2 (Source – Wastewater Treatment Facility Optimization Plan – Fenwood – 2020).

Figure 2 – Village of Fenwood Area Soil Map

The existing WWTF was constructed in 1975 and functions to treat its wastewater with a three-stage stabilization pond. Other than a phosphorus reduction strategy, no upgrades or increased capacity is required. The WWTF is designed with a 15,000 gallons per day (GPD) influent flow rate. Currently, the sanitary system flow rate averages approximately 8,000 GPD. Effluent from the stabilization pond is discharged twice per year, in May and November on a fill and draw basis to Fenwood Creek. There are no expected or planned changes in the effluent quality or flows during the next WPDES permit period.

The outfall is in HUC 070700021602. See Figure 3 for location of stabilization ponds and outfall into the Fenwood Creek (Source – Wastewater Treatment Facility Optimization Plan – 2020).

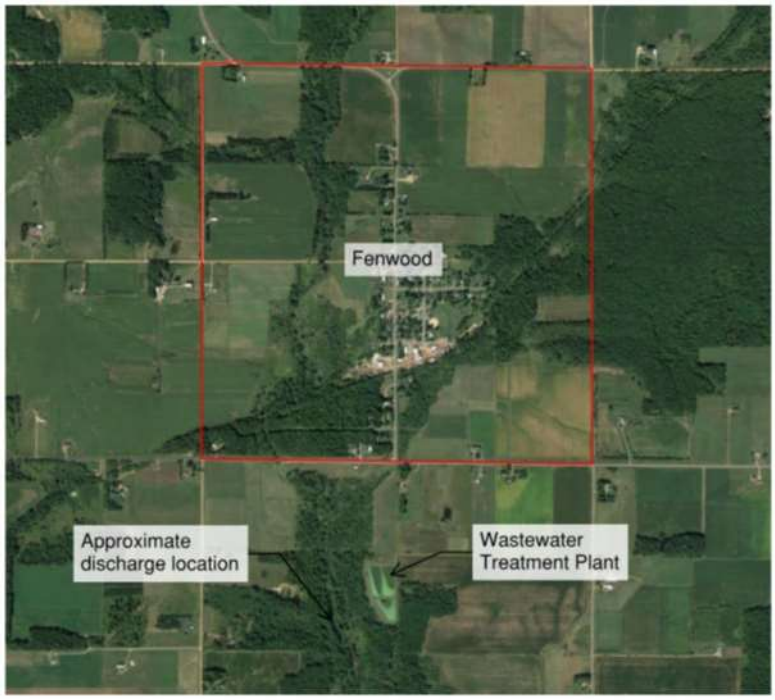


Figure 3 – Village of Fenwood boundary and wastewater ponds/outfall location

The management of the Village's WWTF has consistently met prescribed effluent limits and is in substantial compliance with current WPDES Permit effluent limits. The proposed Total Maximum Daily Load (TMDL) limit of seven (7) pounds/year (equivalent to 0.287 mg/l) will be in effect if WQT is not utilized. The phosphorus currently contained in the effluent is averaging 0.78 mg/l (19 lbs./yr.). The new limit is 7 lbs./yr. Table 1 shows phosphorus reduction requirements for proposed phosphorus reduction alternatives.

Table 1. Total Phosphorus Reduction Required

Phosphorus	Design
Effluent at 0.78 mg/L	19 pounds/year
Effluent at 0.287 mg/L	7 pounds/year
Removal mass to meet .287 mg/L	12 pounds/day

Source - Wastewater Treatment Facility Optimization Plan – Fenwood – March 31, 2020.

Since the WPDES permit will only allow seven (7) pounds of phosphorous to be discharged to Fenwood Creek on an annual basis, and the WWTF has discharged a maximum 31 pounds, all exceedances must be eliminated. Water Quality Trading (WQT) will be used as the method to comply with the required phosphorous effluent limits at the outfall to Fenwood Creek.

WATERSHED CHARACTERISTICS: SEDIMENT AND PHOSPORUS DELIVERY

In 2015, the Wisconsin Department of Natural Resources (WDNR) determined that the current estimated phosphorus concentration (expressed as the flow-weighted mean) for Fenwood Creek was 187 micrograms per liter. Furthermore, DNR staff estimated that a 45% reduction in the flow-weighted mean concentration is needed to reach median concentration of 75 micrograms per liter, the water quality goal for Fenwood Creek. Figure 4 shows the location of the Fenwood Creek watershed within the Upper Big Eau Pleine (UBEP) River watershed.

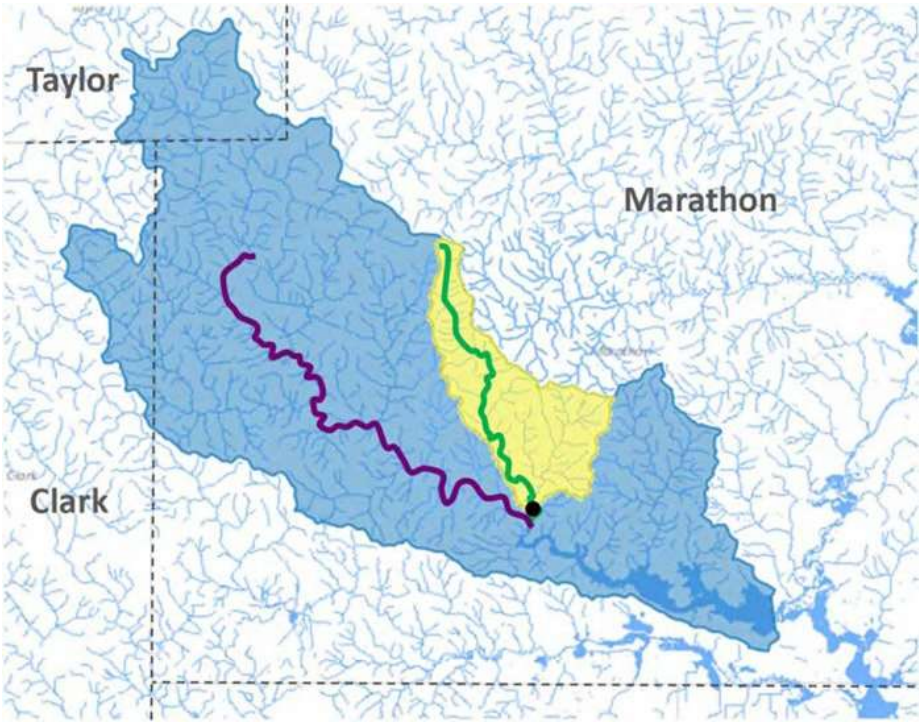


Figure 4: Big Eau Pleine River Watershed (Blue Highlight) and Fenwood Creek Watershed (Yellow Highlight) – HUC 12

Currently, Marathon County and the WDNR are pursuing an interim in-stream concentration reduction goal of 45%. Marathon County's efforts will focus on reducing phosphorus and sediment delivery from farmsteads and cropland by 45%. The Village of Fenwood Water Quality Trading (WQT) Plan is developed to be consistent and supportive of the Marathon County – DNR phosphorus reduction strategy.

SnapPlus (**S**oil **N**utrient **A**pplication **P**lanner) is Wisconsin's nutrient management planning software. SnapPlus provides Wisconsin farmers with a tool for protecting soil and water quality. Specifically, the SNAP+ model predicts phosphorus delivered from cropland to stream. However, the model cannot be directly compared with the measured in-stream phosphorus concentration and loading in the watershed.

Marathon County utilized the SNAP+ model (cropland) and BARNY model (animal feedlot delivery) to establish the "baseline" values for cropland and farmstead phosphorus contributions that reflect current agricultural practices within the watershed. The SNAP+ model was also used to assess the reductions of phosphorus and soil sediment loading after the implementation of best management practices.

For this Village of Fenwood WQT Plan, the SNAP+ model (Matt Luther, CCA) was used to determine the "baseline" phosphorus discharge from the cropland controlled by Russel Kraft (20 acres), as well as the phosphorus reduction (pounds/acres) resulting from the establishment of permanent vegetated cover. Furthermore, the Natural Resources Conservation Service (NRCS) Gully Erosion Calculation Spreadsheet (2015) was used to estimate the reduction of soil erosion and phosphorus losses resulting from the best management practices.

See Appendix C for calculations, cropping inputs, and Potential Tradeable Phosphorus (PTP) model estimates used to generate phosphorus credits.

BASELINE CROPLAND PHOSPHORUS CONTRIBUTIONS – FENWOOD CREEK WATERSHED

The SNAP+ model was used to model Fenwood Creek watershed average cropland phosphorus loss (pounds/acre) and soil erosion rates (tons/acre/year) by incorporating the following variables provided in the WIDNR Wisconsin River Basin SWAT model and Revised Universal Soil Loss Equation (RUSLE):

1. Cropping rotations:
    a. Dairy forage rotation (60% of cropland acres), and
    b. Cash commodity rotation (40% of cropland acres)
2. Predominant soil types for cropland
3. Average soil slope steepness and slope lengths for cropland
4. Current conservation management practices
5. Current tillage management practices

Table 2 shows the contribution comparisons between representative commodity and dairy cropping scenarios relative to phosphorus index and soil erosion rate values.

Table 2: Baseline Phosphorus Index and Soil Erosion Rates for Fenwood Creek

Rotation	Phosphorus Index	Soil Erosion Rate
Average Dairy (60%)	5.6	3.0
Commodity Crop (40%) *	3.5	3.2
Watershed Average	**4.8**	**3.1***

*The Kraft cropland has a baseline rotation of cash commodity of corn and beans

MANAGEMENT PRACTICES – TARGETING HIGH RISK SITES

Disproportionality is a watershed planning concept that states that a few cropland acres or livestock facilities produce the largest percentage of the water quality degradation in a watershed. Furthermore, research has evaluated the following:

1. The application of the universal soil loss equation (USLE) in the Big Eau Pleine River watershed showed the USLE significantly underestimates soil loss by not accounting for ephemeral and snowmelt erosion, and
2. As slope steepness increases (doubles) the erosion rate increases 250%.

Because of long slopes and fine textured soils, Marathon County has defined the focus of disproportionality on cropland in the Fenwood Creek watershed as follows:

- Cropland field slopes greater than 3%,
- Slope lengths over 200 ft., and
- Fenwood, Withee and Marathon soil types

For the Village of Fenwood Water Quality Trading Plan, the Russel Kraft cropland field has slopes lengths between 250 – 400 feet. The soils mapping unit on the cropland is a Withee silt loam on a 2-3 percent slope. This cropland, which lies along surface drainage conveyances and Fenwood Creek, represents high risk fields for discharge of soil sediment and phosphorus. See the SNAP+ estimates of phosphorus loss in Appendix C.

The primary strategies to generate phosphorus credits will be to retire the cropland from a commodity crop rotation of corn and soybeans and convert the cropland to a permanent grass-sod cover.

Consistent with the Marathon County Fenwood Creek Water Plan (2016), the greatest benefit to the water quality and soil health of the watershed is to add vegetated cover or residue cover to the cropland during spring and fall. To that end, the Village of Fenwood and Russel Kraft will permanently cover the cropland with vegetated cover per the following USDA – NRCS Technical Standards:

- Critical Area Planting – Code 342. The purpose is to establish permanent vegetation of high erosion rates. The practice is most applicable to the ephemeral gully sites with the cropland physical, chemical (fertility), and biological conditions have been negatively impacted and a suitable seedbed must be repaired.
- Conservation Cover – Code 327. The purpose is to establish permanent vegetative cover to the twenty acres of cropland for the purpose of improving water quality, enhance wildlife habitat, and reduce soil sedimentation.

See Appendix F for USDA-Natural Resource Conservation Service (NRCS) technical standards.

SECTION II — WATER QUALITY TRADING

PURPOSE

This Water Quality Trading Plan for phosphorus will be used by the Village of Fenwood to comply with the future WPDES permit requirements for effluent phosphorus. The TMDL phosphorus in-stream criteria for Fenwood Creek is 75 micrograms per liter. The Village will continue to discharge to Fenwood Creek but will offset the discharge exceedances for phosphorus at the outfall by crediting the nonpoint discharge phosphorus runoff reductions from an agricultural property currently owned by Russel Kraft. The agricultural practices on the cropland will be transitioned from commodity cropping to permanent grassland.

The cropland was modeled using the Snap+ model. With all croplands, a "baseline" phosphorus delivery scenario was calculated utilizing the farm's current management system. Additionally, the farm's cropland phosphorus delivery was calculated after establishing a prescribed best management cropping practice (C-factor).

In summary, the average annual Potential Tradeable Phosphorus (PTP) for the Kraft cropland is approximately 29.2 pounds. An additional, 18.5 pounds of phosphorus loss is removed from the cropland system through the treatment and elimination of chronic ephemeral erosion concerns. See Appendix C.

LOCATION OF VILLAGE OF FENWOOD AND CROPLAND

1. Location of Village Outfall: The Village of Fenwood discharges from its WWTF outfall to Fenwood Creek at approximate latitude 45.511580, longitude 90.70847°. The discharge point is in HUC 12 – 070700021602.
   TMDL sub-basin – 90.

2. Russel Kraft –- Location of Agricultural Property: The property generating the phosphorus credits is located upstream of the Village of Fenwood outfall in the same HUC 12 watershed. The property also discharges to Fenwood Creek at the northern most point within the village boundaries. Figure 4 shows the drainage area of the Fenwood Creek watershed. Photo 1 shows the Fenwood Creek segment adjacent to the Kraft property. The agricultural property is in NE 1/4 of the NW 1/4, Section 34, T.28N.-R.4E., Town of Wien, Village of Fenwood, Marathon County.

   PIN – Russel and Brianna Kraft: 12628043429999.
   TMDL sub-basin – 90.
   Baseline TP loss – 3.10 pounds/acre/year.
   TMDL percent reduction – 84%
   Rounded TP Credit Threshold – 0.50 pounds/acre/year (16% of 3.10 baseline TP loss)
   Interim Floor – 0.8 lbs./acre/year.

Photo 1 - View of Fenwood Creek at NW corner of Kraft property

EXISTING CROPLAND CONDITIONS

A. Kraft Cropland. The cropland has been under the management of R. Kraft since 2016. The primary crops grown are corn grain and soybeans. Spring tillage is performed to create the seed bed for the crop. The most recent soil samples were collected in November 2019 to be compliant with nutrient management best management practices. The soil test phosphorus is 48 ppm. For the WQT program, twenty (20) acres will be contracted for cropland conversion to permanent vegetative cover. See photo 2.

Photo 2 - View of soybean field/cropland (2020). The view is from County Hwy M looking South.

The Kraft cropland field does not have any tile drainage lines. The typical fertilizer applications for the cropland with the crop rotation identified is as follows:

- Commercial starter fertilizer 200 lb. per acre of 9-20-30
- Commercial fertilizer 100 lb. per acre of 46-0-0

In the north one-half of the cropland field there is a chronic ephemeral erosion condition evident. The NRCS Gully Erosion Calculation Spreadsheet was used to determine the sediment and phosphorus loss from this concentrated flow condition. See Appendix C. The channel length is greater than 550 ft long, 4 inches deep, and 6-12 ft wide on channel top. (See Photos 3 and 4.)

Photo 3 - Ephemeral erosion channel

Photo 4 - Kraft cropland boundary and ephemeral erosion location

PROPOSED OPERATING CONDITONS OF THE FARM

The entire farm cropland and pastures were frost-seeded to permanent grass cover in the spring of 2022. See Appendices E and F for specific implementation requirements and certification.

Soil preparation: The fields were not disturbed by tillage prior to seeding. The seedbed preparation required some fertilization. After the grass and vegetation were established, no manure or commercial fertilizer were added.

Seeding Specifications: The landowner followed seeding recommendations relative to plant species and rates found in USDA – Technical Standard 327 and 342. Seeding year 2022. "Cave-N-Rock" switchgrass was planted at 6-8 pounds per acre.

Schedule of Implementation: The entire 20 acres of cropland were implemented to permanent vegetation in 2022. The credits were generated and available for trading in the fall of 2022.

TRADEABLE PHOSPHORUS

The partnership between the Village of Fenwood and Russel Kraft is a "point to nonpoint" trace arrangement where the credit generator (Kraft) is "upstream" of the Village. Additionally, the trade was facilitated by a third party (Andy Johnson) who brokered the phosphorus credits and facilitated the agronomic assessments.

The partnership established between the Village of Fenwood, Russel Kraft, and Andy Johnson in 2021 remains in place for the upcoming WPDES permit cycle. See Appendix D for details.

The Potentially Tradeable Phosphorus values generated through SNAP+ modeling does not reflect the trade ratios. The trade ratio is applied to determine the phosphorus credits available resulting from changes in management practices.

Trade Ratio Factors

1. Delivery – N/A. The delivery factor is reflected in the credit threshold. Value 0.
2. Downstream – N/A. Credit generator and user within same HUC-12 and upstream of the Village of Fenwood. Value 0
3. Equivalency – N/A. The equivalency factor is not necessary since the trade is for TP credits. Value 0.
4. Uncertainty – The conversation cover (switchgrass) and critical area planting practices will address pollutant loads through a full range of hydrologic conditions and effectively mitigate pollutant delivery. Whole Field Management. Value -1.
5. Habitat Adjustment – N/A no habitat work

The maximum allowed trade ratio from a nonpoint source to a point source is 1.2:1. Therefore, a 1.2:1 trade ratio will be applied between the Kraft cropland and the Village of Fenwood WWTF.

Phosphorus Credit Generation. Credits are calculated as the difference between phosphorus lost under current "baseline" practices and phosphorus lost under the proposed best management practices. The credits are calculated on an annual basis. Tables 3 and 4 below show the trade rates per field beginning in 2022 and extending to 2029.

In summary, the average annual Potential Tradeable Phosphorus (PTP) for the Kraft cropland is 29.2 pounds of phosphorus. An additional, 18.5 pounds of phosphorus loss is corrected with the treatment and elimination of chronic ephemeral erosion concerns. See Photo 4 and Appendix C for specific calculations and variables. Note that the trading ratios of credits generated via the SNAP+ model (sheet erosion) and the NRCS gully erosion spreadsheet (ephemeral losses) will have differing trading ratios.

Table 3. Comparison of Baseline and Reduction Reports

Scenario	Unit	Acres	PTP 2022	PTP 2023	PTP 2024	PTP 2025	PTP 2026	PTP 2027	PTP 2028	PTP 2029	Rotational Average
PTP – Baseline	lbs./field	20	47	31	45	30	44	29	42	28	37.0
PTP – BMP	lbs./field	20	26	6	6	5	5	5	5	5	7.8
Phosphorus Reduction	lbs./field	20	21	25	40	25	39	24	37	23	29.2

Table 4. Phosphorus Credit Generation Summary

Trade Ratio	1.2	
TMDL Subbasin	90	
Credit Threshold	10.0 lbs./field/year – (0.5 lbs./acre/year x 20 acres)	
Interim Floor	16.0 lbs./field/year - (0.8 lbs./acre/year x 20 acres)	
Baseline Average (2022-2029)	37.0lbs./field/year	
BMP Average (2022-2029)	7.8 lbs./field/year	
Long Term Credit	2.2 lbs./field/year Credit threshold (10 lbs.) – BMP Average (7.8 lbs.)	**Trade Ratio adjusted credit.** 1.8 lbs./field/year (2.2 lbs./field/year/1.2)
Interim Credit	27.0 lbs./field/year Rot. Average Reduction (29.2 lbs.) – LT credits (2.2(lbs./year)	**Trade Ratio adjusted credit.** 22.5 lbs./field/year (27.0 lbs./field/year/1.2)
Full Credit		24.3 lbs./field/year

See Appendix C for SNAP+ Raw Data and Reference Documents

Table 5. Ephemeral Erosion Reduction Trade Report

Trade Ratio	2.0	
TMDL Subbasin	90	
WI River TMDL Reduction Criteria	84 %	
Baseline Loading	18.5 lbs./field/year	
BMP	0 lbs./field/year	
Long Term Credit	1.5.lbs/field/year (Full credit (9.2 lbs.) x 16% reduction criteria)	**Trade Ratio adjusted credit.** 1.5 lbs./field/year
Interim Credit	7.8 lbs./field/year (Full credit (9.2 lbs.) x 84% reduction criteria)	**Trade Ratio adjusted credit.** 7.8 lbs./field/year
Full Credit	9.3 lbs./field/year (Baseline loading/trading Ratio (2)	9.3 lbs./field/year

See Appendix C for NRCS Gully Erosion Calculation Spreadsheet Raw Data and Reference Documents

SECTION 3 – WQT ADMINISTRATION AND REPORTING

In Appendix D, the two parties to the WQT contract have outlined the specifics of the WQT administration relative to credit generation, best management practice verification, reporting responsibilities, and payment. The contract duration is twenty (20) years. Specific administrative responsibilities will include the following:

1. Management Practice – Credit Generation Registration
   Submit the following to the DNR to register that the management practices have been installed (2022):
   - Date of contract
   - Date corrective measures have been completed.
   - Date of seeding.
   - Date of 90% ground cover and photo verification.
   - Date of nurse crop harvest.
   - Date and photos of permanent seeding upon regrowth.
   - Report any deviation of the applied practices as outlined in the WQT plan and any seeding failures that will need to be reseeded prior to the close of the first growing season.

2. Bi-annual Reporting. Twice a year the Village shall report that the management practices installed are being maintained in a manner consistent with the WQT plan. This will be done by making a statement, as a comment, on the monthly discharge report certifying that management practices established are in good condition and properly maintained.

3. Annual Reporting. The Village will file an annual report to the DNR of the status of management practices and provide an update of the overall trading project. The content of the annual report will include:
   - Verification that the site inspection has occurred.
   - Summary of site inspection findings.
   - Identification of noncompliance or failure to follow any of the terms or conditions of the trading plan that have not been previously reported.
   - Any application of nutrients and a copy of the soil test recommending that application
   - At least 1 photo of the permanent vegetative cover, indicating condition.
   - A summary of credits used each month over the calendar year.

   Note: See Appendix G – Practice Registration and Annual Trade Certification for set of completed reporting documents for Water Quality Trading activity in YR 2022.

Notification of Problems with Permanent Grass Cover. The Village shall notify the DNR within seven (7) days of becoming aware that the phosphorus reduction credits used by the Village are not being generated as approved in the WQT plan. The Village will work to restore the vegetative cover and update the DNR on the progress.

DNR RIGHT OF ENTRY

The Village of Fenwood and the landowner grants to the DNR the right to inspect the permanent grass cover management and cover crop practices throughout the term of the WQT plan for the purpose of verifying that the WQT plan is being implemented.

COMPLIANCE WITH THE WATER QUALITY TRADING CHECKLIST

The Village of Fenwood Water Quality Trading Plan complies with the Water Quality Trading Checklist contained within the WDNR's guidance document entitled *Implementing WQT in WPDES Permits*.

See Appendix B for the checklist.

Certification of The Water Quality Trading Plan

The undersigned hereby certify that this Village of Fenwood Water Quality Trading Plan is accurate and correct to the best of my knowledge and belief.

Village of Fenwood

Chris Furger — 1/23/2024

Chris Furger - Public Works — Date — January 23, 2024

Project Consultant — WQT Plan

Andy Johnson — 1/24/2024

Andy Johnson — Date – January 29, 2024

This page left intentionally blank.

APPENDIX A

NOTICE OF INTENT TO CONDUCT WATER QUALITY TRADING
(Form 3400-206)

This page left intentionally blank.

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
Village of Fenwood	WI- 0031411	

Facility Address	City	State	ZIP Code
3797 Beech Street	Fenwood	WI	54426

Project Contact Name (if applicable)	Address	City	State	ZIP Code
Chris Furger	648 County Road P	Stratford	WI	54448

Project Name: Fenwood Water Quality Trading PLan

Receiving Water Name	Parameter(s) being traded	HUC 12(s)
Fenwood Creek	Phosphorus	070700021602

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: _____
- ◉ 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: Andy Johnson
- ◯ 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:

Std 342 - Critical Area Planting
Std 327 - Conservation Cover

Permanent vegetation for erosion prevention and wildlife habitat.

Method for quantifying credits generated:
- ☐ Monitoring
- ☒ Modeling, Names: SNAP+
- ☒ Other: NCSC Gully Erosion Calculator

Projected date credits will be available: 05/01/2022

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
Andrew G. Johnson	12/14/2021

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
Chris Enger	12/14/2021

APPENDIX B

WATER QUALITY TRADING CHECKLIST

This page left intentionally blank.

Appendix B

Compliance with Water Quality Trading Checklist

The Village of Fenwood Water Quality Trading Plan complies with the Water Quality Trading Checklist contained within the WDNR's guidance document entitled "Implementing WQT in WPDES Permits". This plan complies with requirements for Credit Source.

Checklist 3400-207

WI Content of WQT Plan **Table 5 – Content of WQT Plan (WDNR Guidance)**	Page
Permitee's/Credit Buyer's WPDES permit Number – No. 0031411-08-0	Cover, 1-2
Permitee's/Credit Buyer's Contact Information	Appendices A and D
Pollutant for which credits will be generated – phosphorus	1 and 11-12
Number of Credits available from management practice (farm owner) – > 33 pounds	11-12, Appendix C
Certification that the content of trading application is accurate and correct	15
Signature and date of Permittee's authorized representative	Appendix D, 15
Location where credits will be generated	1 (Fig 1) and 8
Identification of management practices to be used to generate credits – Critical area seeding, and permanent vegetation	11 and Appendix C
Duration of agreement – Buyer-Seller contract – 20 years	14 and Appendix D
Schedule of BMP implementation – Initiated Spring 2022	12 Appendices C1 and D
Operation and Maintenance Plan for each BMP	Appendix E
Date when credits become available for each BMP	11-12 Appendix C
Models used to derive credits	8, 12 Appendix C
Application of trading ratio for each BMP	11-13

INSERT WQT CHECKLIST HERE – ONLY 1 PAGE

This page left intentionally blank.

APPENDIX C

SOIL AND PHOSPHORUS DELIVERY MODELING

- SNAP+ Calculation for Russel Kraft Property
- NRCS Gully Erosion Calculation Spreadsheet
- Kraft – Field 1 – Raw Data SNAP+
- 2022 Credit Verification Documentation

This page left intentionally blank.

INSERT NRCS GULLY EROSION CALCULATION SPREADSHEET HERE – ONLY 1 PAGE

SNAP+ calculation for Russel Kraft Property C1
Agronomist (CCA) - Matt Luther

County	Farm	Field	Year	PTP	Acres	Soil Series	Soil Symbol	Crop
Marathon	Fenwood - Kraft	Russell Kraft **AFTER**	2021	**34**	20.0	WITHEE	WtA	Soybeans 15-20 inch row
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2022	**26**	20.0	WITHEE	WtA	Grass hay seeding
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2023	**6**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2024	**6**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2025	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2026	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2027	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2028	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft AFTER	2029	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2021	**34**	20.0	WITHEE	WtA	Soybeans 15-20 inch row
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2022	**47**	20.0	WITHEE	WtA	Corn grain
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2023	**31**	20.0	WITHEE	WtA	Soybeans 15-20 inch row
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2024	**45**	20.0	WITHEE	WtA	Corn grain
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2025	**30**	20.0	WITHEE	WtA	Soybeans 15-20 inch row
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2026	**44**	20.0	WITHEE	WtA	Corn grain
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2027	**29**	20.0	WITHEE	WtA	Soybeans 15-20 inch row
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2028	**42**	20.0	WITHEE	WtA	Corn grain
Marathon	Fenwood - Kraft	Russell Kraft BEFORE	2029	**28**	20.0	WITHEE	WtA	Soybeans 15-20 inch row

Kraft

Trade Ratio	1.2	
Subbasin	90	
Credit Threshold	0.5 lbs/acre/yr	10.0 lbs/yr
Interim Floor	0.8 lbs/acre/yr	16.0 lbs/yr
Baseline AVG (2022-2029)		37.0 lbs/yr
BMP AVG (2022-2029)		7.8 lbs/yr
Long Term Credit	2.2 lbs/yr	1.8 lbs/yr
Interim Credit	27.0 lbs/yr	22.5 lbs/yr
Full Credit		**24.3 lbs/yr**

For Trading Ratio documentation, see P 11.

Source of Credit Threshold and Interim Floor Values: Guidance for Implementing Water Quality Trading in WPDES Permits.
Guidance Number - 3200-3400-3800-2020-03. WI DNR. Date - June 1, 2020.

Kraft (Gully)

Trade Ratio	2	
Subbasin	90	
TMDL Reduction%	84%	
Baseline		18.5 lbs/yr
BMP		0.0 lbs/yr
Long Term Credit		1.5 lbs/yr
Interim Credit		7.8 lbs/yr
Full Credit		**9.3 lbs/yr**

See Appendix C3 for NRCS Gully Erosion Calculation Spreadsheet values

Represents 16% of full credit (9.2 lbs/yr)
Represents 84% of full credit (9.2 lbs/yr) - TMDL reduction goal.
Calculation: Baseline (18.5 lbs/year)/Trading Ration (2)

Note 1 - TMDL Reduction Goals – 84%.
Source of TMDL Reduction Value: Guidance for Implementing Water Quality Trading in WPDES Permits.

Guidance Number - 3200-3400-3800-2020-03. WI DNR. Date - June 1, 2020.

Note 2. Uncertainty Factor – A waterway (Std 342) will be established in the ephemeral gully area along with permanent conservation cover (Std – 327).
An approved nutrient management plan (Std 590) had been in place with the cropland prior to conversion.
Therefore, an uncertainty factor of 2.0 is used. Trading ratio – 2.0.

Tillage	Slope	Slope Length	Below Field Slope	Below Field Slope Length	Soil Group	Soil Test OM	Soil Test P	Soil Loss	Contour	FilterStrip	Tiled	Irrigated
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.2	0	0	FALSE	FALSE
None - Frost seed	2	250	2.1 - 6	301 - 1000	D	3.3	48	0,6	0	0	FALSE	FALSE
None	2	250	2.1 - 6	301 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
None	2	250	2.1 - 6	301 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
None	2	250	2.1 - 6	301 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
None	2	250	2.1 - 6	301 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
None		250	2.1 - 7	302 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
None		250	2.1 - 8	303 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
None		250	2.1 - 9	304 - 1000	D	3.3	48	0.0	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.2	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.9	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.1	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.9	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.1	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.9	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.1	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.9	0	0	FALSE	FALSE
Spring Cultivation	2	250	2.1 - 6	301 - 1000	D	3.3	48	1.1	0	0	FALSE	FALSE

NRCS Gully Erosion Calculation Spreadsheet

Landowner: Russel Kraft
Conservation Practice: Conservation Cover (Code 327) and Critcal Area Seeding (Code 342)
Purpose: Quantify chronic ephemeral erosion in a commodity crop rotation.

		WW#1	WW#2	
Channel Depth	ft	0.25	0.25	
Top Channel Width	ft	8	4	
Bottom Channel Width	ft	1.5	0.5	
Channel Length	ft	300	300	
Years to Develop	year	1	1	
Soil Test P	ppm	48	48	
% Organic Matter	%	3.3	2	
Sediment Loss	tons/yr	**16.9**	**8.0**	
P Loss	pounds/yr	**18.5**	**6.3**	

Note 1: WW#2 is a lateral located south of the main ephemeral channel. WW#2 is not included in trading considerations.

Note 2: WW#1 has a total length of 550 ft. However, deposition of sediment occurs at 300 ft segments. The calculation used 300 ft length to reduce the risk of overstimation of P loss.

Sediment loss equation from NRCS Gully Erosion Calculation Spreadsheet updated on 6/30/2015
P Loss uses sediment loss equation and equations from SNAP Plus

This page left intentionally blank.

INSERT KRAFT – FIELD 1 – RAW DATA SNAP+
HERE – ONLY 1 PAGE

Kraft - Field 1 - Raw Date SNAP+. Compiled by Matt Luther - CCA

County	Farm	Field	Year	PTP	Acres	Soil Series	Soil Symbol	Crop	Tillage	Slope	Slope Length	Below Field Slope	Below Field Slope Length	Soil Test OM	Soil Test P	Soil Loss	Tiled	Irrigated
Marathon	Kraft	1- BEFORE	2021	**34**	20.0	WITHEE	WtA	Soybeans 15-20 inch row	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.2	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2022	**47**	20.0	WITHEE	WtA	Corn grain	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.9	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2023	**31**	20.0	WITHEE	WtA	Soybeans 15-20 inch row	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.1	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2024	**45**	20.0	WITHEE	WtA	Corn grain	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.9	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2025	**30**	20.0	WITHEE	WtA	Soybeans 15-20 inch row	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.1	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2026	**44**	20.0	WITHEE	WtA	Corn grain	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.9	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2027	**29**	20.0	WITHEE	WtA	Soybeans 15-20 inch row	Spring Cultivation	2	250	2.1 - 7	302 - 1000	3.3	48	1.1	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2028	**42**	20.0	WITHEE	WtA	Corn grain	Spring Cultivation	2	250	2.1 - 8	303 - 1000	3.3	48	1.9	FALSE	FALSE
Marathon	Kraft	1- BEFORE	2029	**28**	20.0	WITHEE	WtA	Soybeans 15-20 inch row	Spring Cultivation	2	250	2.1 - 9	304 - 1000	3.3	48	1.1	FALSE	FALSE

County	Farm	Field	Year	PTP	Acres	Soil Series	Soil Symbol	Crop	Tillage	Slope	Slope Length	Below Field Slope	Below Field Slope Length	Soil Test OM	Soil Test P	Soil Loss	Tiled	Irrigated
Marathon	Kraft	1 - AFTER	2021	**34**	20.0	WITHEE	WtA	Soybeans 15-20 inch row	Spring Cultivation	2	250	2.1 - 6	301 - 1000	3.3	48	1.2	FALSE	FALSE
Marathon	Kraft	2 - AFTER	2022	**26**	20.0	WITHEE	WtA	Grass hay Seeding	No Till	2	250	2.1 - 6	301 - 1000	3.3	48	0.6	FALSE	FALSE
Marathon	Kraft	3 - AFTER	2023	**6**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 6	301 - 1000	3.3	48	0.0	FALSE	FALSE
Marathon	Kraft	4 - AFTER	2024	**6**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 6	301 - 1000	3.3	48	0.0	FALSE	FALSE
Marathon	Kraft	5 - AFTER	2025	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 6	301 - 1000	3.3	48	0.0	FALSE	FALSE
Marathon	Kraft	6 - AFTER	2026	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 6	301 - 1000	3.3	48	0.0	FALSE	FALSE
Marathon	Kraft	7 - AFTER	2027	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 7	302 - 1000	3.3	48	0.0	FALSE	FALSE
Marathon	Kraft	8 - AFTER	2028	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 8	303 - 1000	3.3	48	0.0	FALSE	FALSE
Marathon	Kraft	9 - AFTER	2029	**5**	20.0	WITHEE	WtA	Grasslands, permanent, not harvested	None	2	250	2.1 - 9	304 - 1000	3.3	48	0.0	FALSE	FALSE

Source of WQT – TP parameters

Guidance for Implementing Water Quality Trading in WPDES Permits

Guidance Number: 3200-3400-3800-2020-03

Wisconsin Department of Natural Resources

Date - 6/1/2020 Edition: 2

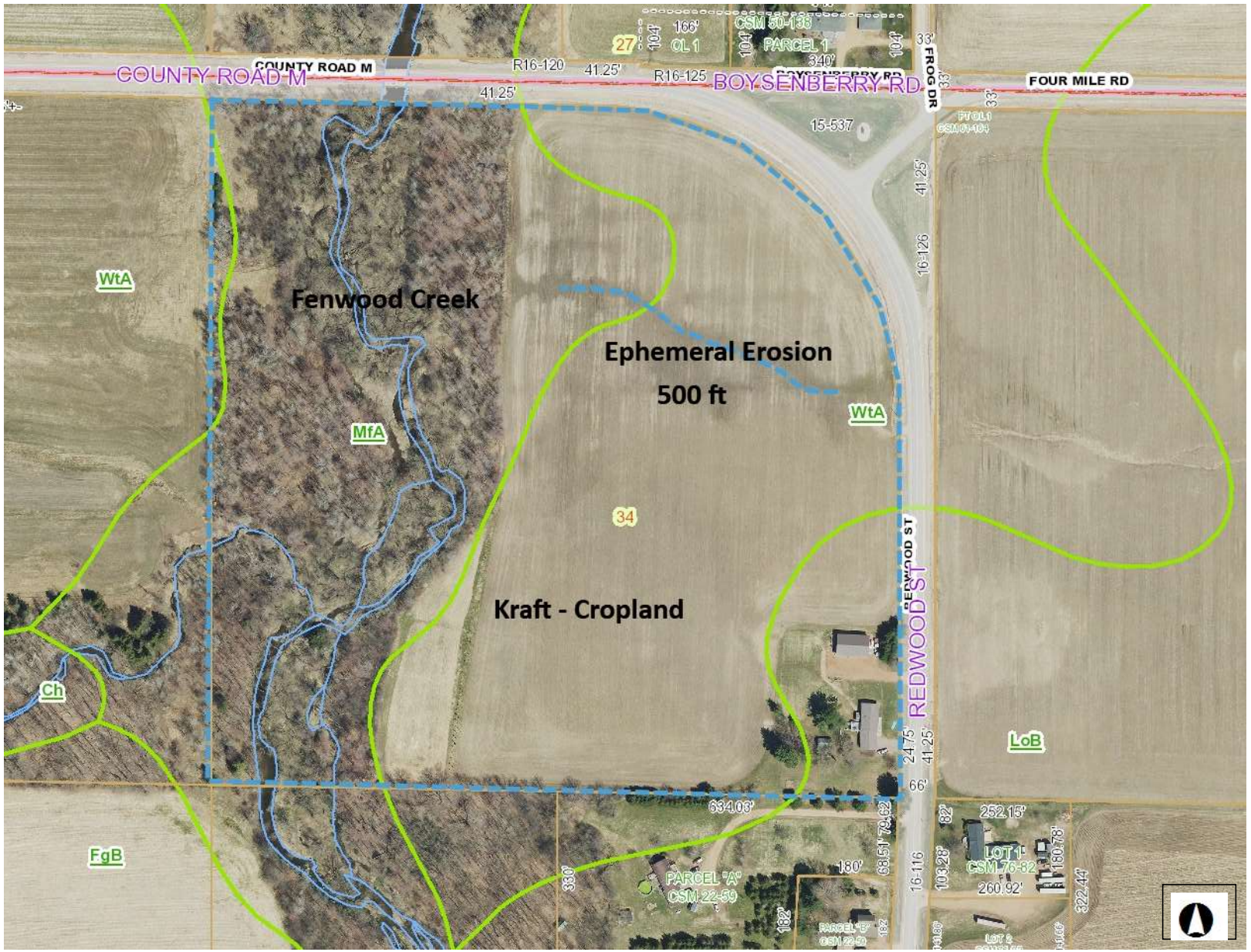
Appendix E – TMDL Credit Threshold and Interim Floor Values

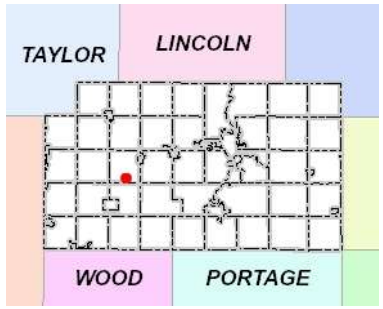
Table 6. Wi River TMDL

WI River TMDL TP Parameters and Rounded Credit Threshold						Interim Floor Calculations			Feasibility Analysis
TMDL Subbasin	Baseline TP loss lb/ac/yr	TMDL % Reduction	TP Credit Threshold lb/ac/yr	Rounded TP Credit Threshold lb/ac/yr		Conservation Scenario 1 lb/ac/yr	Interim Floor lb/ac/yr		Conservation Scenario 2 lb/ac/yr
86	2.00	63%	0.74	1.00		0.47	NA		0.26
87	3.40	84%	0.56	0.50		0.74	0.74		0.45
88	3.60	84%	0.58	0.50		0.79	0.79		0.47
89	3.80	84%	0.61	1.00		0.82	0.82		0.46
90	3.10	84%	0.51	0.50		0.80	0.80		0.56
91	3.30	84%	0.54	0.50		0.82	0.82		0.53
92	3.30	84%	0.54	0.50		0.83	0.83		0.60
93	3.00	84%	0.48	0.50		0.82	0.82		0.64

Note 1: Fenwood Creek - Subbasin No. 90

Land Information Mapping System





Legend

- Road Names
- Parcels
- Parcel Lot Lines
- Land Hooks
- Section Lines/Numbers
- Right Of Ways
- Named Places
- Municipalities
- NRCS Soils
- Streams-Rivers
- 2020 Orthos Countywide
  - Red: Band_1
  - Green: Band_2
  - Blue: Band_3

137.52 0 137.52 Feet

NAD_1983_HARN_WISCRS_Marathon_County_Feet

Notes

Russel Kraft - Cropland boundary, ephemeral erosion location, and Soils.

This page left intentionally blank.

APPENDIX D

VILLAGE AND FARM CONTRACT / AGREEMENT
(Signed WQT Agreement)

This page left intentionally blank.

Appendix D: Village and Farm Contract / Agreement

Point to Nonpoint Multi-Discharger Watershed Project Contract

1. Buyer/Permittee/Credit User Information	
Buyer/Permittee/ Credit Username: Village of Fenwood	Individual Point of Contact: Chris Furger, Public Works
Trade Agreement Number *(assigned by WDNR)*:	WPDES Permit Number: WI-0031411
Permittee Address: 3797 Beech Street Fenwood, WI 54426	County: Marathon HUC12 code: 07070021602 Watershed name: Fenwood Creek
2. Seller/Credit Generator	
Credit Generator/Seller Name: Russ and Brianna Kraft	Individual Point of Contact: Russ Kraft
Credit Generator/Seller Address: 3852 Redwood Street Fenwood, WI 54426	County: Marathon HUC12 code: 070700021602 Watershed names: • Fenwood Creek (HUC 12) • Big Eau Pleine River (HUC 10) Properties / fields where credit generating practices will be installed: See Appendix E of WQT Watershed Project Plan

Recitals

A. Water quality trading (WQT) is an alternative compliance options for Wisconsin Permit Discharge Elimination System (WPDES) permit holders and is authorized by § 283.84, and § 283.16 Wis. Stats., respectively.

B. The Wisconsin Department of Natural Resources (WDNR) has issued Water Quality Trading Guidance (Guidance) in June 2020. The WQT Guidance has been accepted by the U.S. EPA.

C. In January 2003 and again, in February 2019, the U.S. EPA issued memorandums to Regional Administrators in support for water-quality trading and other market-based programs to maximize pollutant reduction efforts and improve water quality. The US EPA comments will provide DNR, Buyers, and Sellers of environmental commodities guidance to reduce adoption barriers to environmental markets.

D. This contract certifies that the Village of Fenwood Water Quality Trading Plan is being used to meet the terms and requirements of the WQT option as set forth by § 283.16, Wis. Stats.

E. Funds exchanged as part of this WQT Watershed Project contract shall be used for the installation and maintenance of credit generating practices that will reduce the loading of pollutants identified in Section 3 into Fenwood Creek tributary.

F. Before WDNR can modify or reissue a WPDES permit that allows the WQT, where the permittee has chosen to implement a watershed project, the permittee must submit a watershed project plan (WQT WP Plan) and checklist (WQT Checklist). The WQT WP Plan must contain sufficient detail to allow WDNR to conclude that proposed project will comply with § 283.16, Wis. Stats., that credits are generated in an acceptable manner and correctly calculated, and that the permittee will comply with their Wisconsin Pollution Discharge Elimination System (WPDES) interim permit limits. The WQT Checklist provides an outline for the WQT WP Plan's content to guide the permittee and streamlines WDNR's review. This WQT Watershed Project Contract comports with the WQT WP Plan and WQT Checklist. The WQT WP Plan, WQT Checklist and Section 13 of this WQT Watershed Project (which certifies that a WQT Watershed Project Contract is in place) will be submitted by the permittee to WDNR. Copies of the WQT WP Plan and WQT Checklist will be attached as addenda to this Contract and incorporated herein.

G. Buyer is a WPDES permit holder who will purchase total phosphorus (TP) credits to either wholly or partially fulfill their permit requirements.

H. Conservation practices (CPs) and best management practices (BMPs) are activities performed to reduce pollutant loadings into nearby receiving waters, herein referred to as "credit generating practices."

H. All water quality credits must be used for compliance within the year that the credit is generated.

I. Long term credits can be used for compliance for the lifespan of the credit generating practice.[1]

J. The approximate credit generating practices installation dates and the date at which all credits become effective for WPDES permit compliance are found in the Credit Certification Report which is provided as an addendum to this Contract. The date at which all credits become effective is also identified in Section 3 of this contract.

This Contract establishes a binding agreement between Village of Fenwood ("Buyer") and Russel Kraft ("Seller") (collectively referred to herein as "Parties"). The properties/fields where credit generating practices will be installed is referred to herein as "Property".

In consideration of the preceding recitals, and the consideration, obligations, covenants, and agreements set forth herein, the legal sufficiency of which the Parties hereby acknowledge, Buyer and Seller agree as follows:

---

[1] The life of credit generating practices, sometimes called best management practices (BMPs) or conservation practices (CPs) is based on practice lifespans determined by NRCS. NRCS Wisconsin State Conservationist can offer more information on conservation lifespan determinations.

3. Sale of Pollutant Loading Credit

3.1 Credits will be generated by Seller for purchase by Buyer on an annual basis from January 1, 2022, through December 31, 2042 (20-year agreement).

3.2 Subject to the conditions set forth in this Contract, the Seller agrees to sell to Buyer and Buyer agrees to purchase from Seller a total quantity of 32.9 pounds of TP Credits per year. For purposes of WQT compliance, all TP credits generated are either interim (10 -year shelf-life as determined by DNR) or long-term credits. See Credit Certification Report and Appendix C of the WQT Plan for credit generation details.

3.3 The Buyer agrees to pay $75.98 per acre for TP credit generated from practices identified in Section 5 below resulting in a total annual payment of $2,500.00 to Seller.

3.4 Additionally, the Buyer agrees to financially assist the Seller in the implementation of Best Management Practices (seeding) at the following schedule: YR 1 -$2,500 to establish permanent grass/legume vegetation cover, and YR 2 - $2,500 to establish permanent trees and wildlife habitat vegetation in designated areas.

3.5 Water Quality Trading Ratio. One and two tenths (1.2) Total Phosphorus (TP) Credit is equal to One (1) pound of phosphorus.

4. Payment Terms

4.1 Buyer shall annually pay the seller with a check made out to Russell Kraft.

4.2 Buyer shall make the annual payment in whole within 60 days of the field and Credit Verification Report being certified and submitted to the Village. The annual Credit Verification Report will be prepared by the Verifier in each year (by May1st) from 2022 through 2042.

4.3 Should Buyer fail to make any annual payments within thirty days of the date such payment is due, then interest shall accrue at the rate of five percent per annum.

4.4 Failure of Buyer to pay Seller within sixty days from the date payment is due shall be considered a material breach of this Contract, entitling Seller to terminate this Contract and seek equitable relief along with any other appropriate relief.

5. TP Credit Generating Practices

Seller proposes to leverage 20 acres of the Property in the WQT Watershed Project and install credit generating BMP's consisting of permanent grass vegetation, wildlife habitat, and wetland buffers. The Buyer agrees to purchase 32.9 pounds of phosphorus credits (P Credits) annually and pay $75.98 per pound for phosphorus reduced as calculated by the SNAP+ modeling (see Appendix C) resulting in a total annual payment of $2,500.00 to Seller. The quantity and timing of P Credits generated per year may be amended only based on the WQT Plan or revisions to the WQT Plan as approved by WDNR. See WQT Plan for list of proposed BMP's.

6. Installation and Verification of Credit Generating Practices

6.1 Seller shall install and maintain credit generating practices on the Property described in WQT Plan, and in accordance with the final WQT Watershed Project Plan as approved by WDNR. Pending approval from WDNR the WQT Watershed Project Plan will be attached as addenda to this Contract and incorporated herein.

6.2 Verification of the credit generating practices will be performed by a third-party Verifier that is selected by the Buyer that has applicable knowledge and is licensed or certified to practice in Wisconsin or is otherwise accepted by WDNR to verify proper installation, operation, and maintenance of credit generating practices and associated load reductions used to determine credit generation.

6.3 Buyer is responsible for selecting a Verifier to perform on-site inspection of credit generating practices on credit generation sites and to review appropriate records and documents. Verification may also include interviews with the landowner, or operator.

6.4 Verification shall be conducted at least annually at an appropriate time of year based on the type of credit generating practice(s) that is/are installed. The parties agree to verification of the credit generating practice(s) during the month of April.

6.5 Buyer is responsible for ensuring that verification of credit generating practices occurs and that the Verifier complete and submit a Credit Generating Practice Installation Report and a Management Practice Registration form to the permittee (Buyer) within thirty days of the first-time installation of credit generating practices. The permittee (Buyer) is responsible for submitting the Management Practice Registration Form and Credit Generating Practice Installation Report to WDNR.

6.6 Buyer is responsible for ensuring that the Verifier complete and submit a Credit Verification Report to the permittee (Buyer) within thirty days of annual site visits described in Section 6.4 above. The permittee (Buyer) is responsible for submitting the Credit Verification Report to WDNR. Credit Verification Reports shall include information related to document and record reviews; interviews; site inspections (and associated photos).

7. Credit Terms and Conditions

7.1 If Seller wishes to modify the type, timing, or location of credit generating practices outlined in the Credit Certification Report and/or the WQT Watershed Project Plan *prior to* credit generating practice installation, Seller must provide the Buyer with the information necessary to complete and submit an updated Credit Certification Report and/or WQT Watershed Plan, as appropriate, to WDNR.

7.2 If Seller wishes to modify the type, timing, or location of credit generating practices outlined in the WQT Watershed Project Plan, Credit Certification Report, and Management Practice Registration form *after* credit generating practice installation, Seller must provide the Buyer with the information necessary to complete and submit an updated WQT Watershed Project Plan, Credit Certification Report, Management Practice Registration form, and Credit Generation Practice Installation Report to WDNR showing that the modifications will result in the quantity of TP agreed to in the WQT Watershed Project Contract. No modifications shall be made by Seller until Buyer has received written approval for the updated documents and plans from WDNR.

7.3 Deliberate removal or substantial alteration of a credit generating practice by Seller, Seller's agents, employees, or affiliates (other entities that conduct land, crop or livestock management activities on the property or premises where credit generating practices are installed) without written approval of Buyer or Buyer's agent and notification to the WDNR, shall constitute a material breach of this Contract by Seller, entitling Buyer to terminate this Contract and seek equitable relief along with any other appropriate relief.

7.4 Damage to a credit generating practice due to an action or event beyond the Seller's (or Seller's agents, employees, or affiliates) control is not in and of itself considered a violation of this Contract. If such an event occurs, the Seller, Seller's agent or Verifier shall report the damage(s) to the permittee (Buyer) within three (3) days of discovering the damage. The permittee is responsible for notification of non-compliance to WDNR. The Seller shall repair damaged credit generating practice(s), to the maximum extent practicable within thirty (30) days of discovering the damage.

7.5 Credits from credit generating practices damaged due to an action or event beyond the Seller's (or Seller's agents, employees, or affiliates) control will remain valid and effective for ninety (90) days or until the credit generating practice has been repaired, suspended or cancelled, whichever comes sooner.

7.6 If damages due to an action or event beyond the Seller's (or Seller's agents, employees, or affiliates) control cannot reasonably be repaired within thirty (30) days, Seller shall notify Buyer or Buyer's agent and Seller agrees to assist the Verifier, as necessary, to prepare and submit a Credit Suspension or Cancellation Notice; such notice shall be provided to the Buyer or Buyer's agent.

7.7 Damaged credit generating practices that are not repaired within thirty (30) days of discovery shall constitute a material breach of this Contract by Seller, entitling Buyer to terminate this Contract and seek equitable relief along with any other appropriate relief.

7.8 Buyer shall not be responsible or liable for any personal injury or property damage caused by Verifier, Seller, or Seller's credit generating practices.

7.9 A party is not liable for failure to perform the party's obligations if such failure is as a result of Acts of God (including fire, flood, earthquake, storm, hurricane or other natural disaster), war, invasion, act of foreign enemies, hostilities (regardless of whether war is declared), civil war, rebellion, revolution, insurrection, military or usurped power or confiscation, terrorist activities, nationalization, government sanction, blockade, embargo, labor dispute, strike, lockout or interruption or failure of electricity. No party is entitled to terminate this Agreement in such circumstances.

7.10 If a party asserts Force Majeure as an excuse for failure to perform the party's obligation, then the nonperforming party must prove that the party took reasonable steps to minimize delay or damages caused by foreseeable events, that the party substantially fulfilled all non-excused obligations, and that the other party was timely notified of the likelihood or actual occurrence of an event described in 7.9.

8. Contract Timing, Termination and Renewal

8.1 This Contract enters into force upon signature by Parties or their designated representative(s), pending approval of an associated WQT Watershed Project Plan by WDNR. Note the DNR certified the Village of Fenwood WQT Plan on April 22, 2022.

8.2 This Contract shall expire on the following date: December 31, 2042.

8.3 This Contract may be modified only by a written document signed by Seller (or Seller's Agent) and Buyer (or Buyer's Agent).

8.4 This Contract may be amended by mutual agreement of both Parties (Buyer and Seller or their agents), so long as the Contract has not yet expired. At minimum, the terms of the contract will be discussed and modified (if needed), every 5 years.

8.5 This Contract may be terminated in writing, by mutual agreement of the Parties, at any time prior to the contract termination date agreed upon herein.

8.6 This Contract may be renewed upon mutual agreement by the parties provided neither party is in default under this Contract as of the termination date. Buyer or Buyer's agent must inform Seller or Seller's agent, in writing, of intent to renew thirty (30) days before termination of the current contract.

8.7 This Contract and the terms contained herein shall be binding and enforceable against the Parties, their successors, and assigns for as long as the Contract remains in effect.

8.8 A deed addendum shall be recorded by the Seller (or Seller's agent) specifying that any credit generating practices must be maintained for as long as the Contract remains in effect. The deed addendum must incorporate the Contract and the WQT Watershed Project Plan documents.

8.9 If the credit generating practices are or will be installed on land that is leased or rented (i.e., land that the seller does not own), both the seller and the landowner must agree to the terms of this section.

8.10 This Agreement shall terminate, without notice, upon the institution by or against either party of insolvency, receivership or bankruptcy proceedings or any other proceedings for the settlement of either party's debts, (ii) upon either party making an assignment for the benefit of creditors, or (iii) upon either party's dissolution or ceasing to do business.

8.11 If prior to the end of the term of this contract, if the SELLER (1.) become the subject of a voluntary petition in bankruptcy or any voluntary proceeding related to insolvency, receivership, liquidation or comparable proceeding or any assignment for the benefit of creditors, or (2.) become the subject of an involuntary petition in bankruptcy or any involuntary proceeding related to insolvency, receivership, liquidation or comparable proceeding or any assignment for the benefit of creditors which is not dismissed within sixty (60) days, (the "Bankrupt") then the other party to this Agreement (the "Non-Bankrupt") shall have the right to terminate this Agreement. A termination under this provision shall constitute a material breach of this Contract by Seller, entitling Buyer to terminate this Contract and seek equitable relief along with any other appropriate relief.

9. Seller Warranties: Seller hereby represents and warrants to Buyer, and such warranties shall be applicable and in full force and effect throughout the entire Contract Term, that:

9.1 Seller has the authority to enter this Contract and to carry out the transaction contemplated herein.

9.2 No known actions, proceedings or investigations are pending or threatened against Seller that would interfere with Seller's ability to enter this Contract or carry out the transaction.

9.3 No damage nor condemnation with respect to the Seller's property or any part thereof has occurred that would interfere with Seller's ability to enter this Contract or carry out this transaction and no such known condemnation is pending or threatened.

9.4 No uncured violations of any law, ordinance, order, or regulation of any governmental authority having jurisdiction of Seller's property exist that would impede the installation of credit generating practices outlined in this Contract.

9.5 Seller has not entered into any contract or agreement that would impede the installation of credit generating practices outlined in this Contract.

9.6 Seller agrees to install and maintain credit generating practices in exchange for payment as outlined in this Contract and as detailed in the supporting Credit Certification Report.

9.7 Seller agrees to assist the Verifier, as necessary, in preparing a Credit Generating Practice Installation Report to document the type and timing of credit Generating practices installed. Such report shall be provided to Buyer or Buyer's Agent.

10. Default, Remedies and Dispute Resolution

10.1 If Seller and Buyer are unable to reconcile a dispute arising out of or related to this Contract, the parties agree to first submit the claim to mediation. Parties shall mutually agree on a mediator. The mediation process will be held in Fenwood, Wisconsin.

10.2 All disputes arising out of or relating to the Contract not otherwise settled through mediation will then move to arbitration.

10.3 Seller and Buyer are responsible for their own attorney fees related to mediation or arbitration and will equally share the common costs and fees associated with the alternative dispute resolution process such as filing fees and arbitrator's costs.

10.4 For any dispute arising out of or relating to this Contract, including but not limited to enforcement of any term or condition of the Contract, the prevailing Party in any action brought for the purpose of enforcing such provisions shall be entitled to recover attorney fees, reasonable expenses, and associated costs of such action from the non-prevailing party.

10.5 Failure of either Party to enforce any term or condition of this Contract shall not constitute a waiver of that term or condition or of any other term or condition of this Contract.

10.6 The Parties agree that a cause of action for breach of any provision of this Contract shall not accrue until the non-breaching Party discovers the breach.

11. Representations. Buyer and Seller each makes the following representations, as applicable:

11.1 Buyer and/or Seller can authorize an Agent to represent Buyer or Seller on their behalf. Such Agents must have notarized authorization to act on behalf of the Buyer or Seller.

11.2 Buyer (or Buyer's Agent) and Seller (and Seller's Agent) each warrant that the person signing this Contract is individually authorized and competent to enter contracts and to bind each respective Party to the terms hereof.

11.3 The Parties have read the Contract and agree to be bound by its terms.

11.4 If any party knowingly makes a false or incorrect representation, then such false or incorrect representation shall constitute a material breach of this Contract and the non-breaching party may terminate the contract or seek equitable relief along with any other appropriate relief.

12. Miscellaneous

12.1 *Governing Law.* This Contract shall be governed under, and construed pursuant to, the laws of the State of Wisconsin and, as applicable, under the laws of the United States. Each of the parties acknowledge that they have been given the opportunity to obtain counsel, or that they have been represented by counsel of their own choice and that they have read this Contract and have had it fully explained to them by such counsel, and that they are fully aware of the contents of this Contract and of its legal effect.

12.2 This Contract shall be terminated if the WDNR fails to approve the WQT Watershed Project Plan associated with this Contract.

12.3 *Severability.* If any of the provisions contained in the Contract are held illegal, invalid or unenforceable, such provision(s) shall be deemed severable, and the remaining provisions of this Contract shall continue in full force and effect.

12.4 This Contract constitutes the entire agreement between the Parties and supersedes all prior written or oral communications.

12.5 Except where specifically provided otherwise in this Contract whenever any notice, demand or request is required or provided for under this Contract, such notice, demand or request shall be made in writing by either Party postage prepaid, certified or registered mail).

12.6 This Contract may be executed in two or more counterparts, each of which is deemed original, but all constitute one and the same instrument. The Parties agree that a facsimile copy of a signature, including a PDF of such signature, will be deemed original and binding.

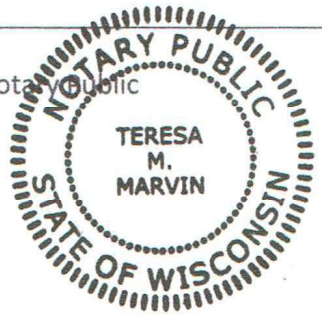
12.7 By executing this Contract, each Party grants the other permission to share the price of pollution credits sold and purchased pursuant to this Contract.

==========

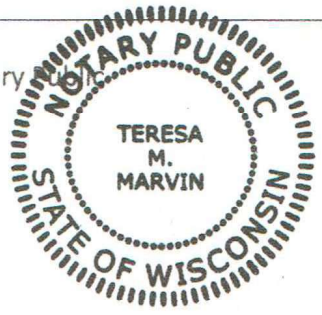
In lieu of the entire Contract, a copy of the following section of this Contract can be supplied independently to the Wisconsin DNR to certify that a Water Quality Trading Watershed Project Contract exists and has been agreed to by the signatories.

13. Signatures, Notarization, and Certification	
Buyer Name (Printed): Village of Fenwood Village President – Edward Mielke	Seller Name (Printed): Russel Kraft
Buyer Agent Name (if applicable): Chris Furger, Public Works Director	Seller Agent Name (if applicable): NA
HUC12 code: 070700021602 Watershed name: Fenwood Creek WPDES permit: WI-0031411	County: Marathon HUC12 code: 070700021602 Watershed name: • Fenwood Creek (HUC 12) • Big Eau Pleine River Properties / fields where credit generating practices will be installed: See Appendix E of WQT Watershed Project Plan
Buyer/Buyer Agent Signature: Chris Furger	Seller (Landowner)/Seller Agent Signature: Russell Kraft
Date: 5-5-2022	Date: 5-5-22

Chris Furger personally came before me this 5 day of May 2022.
I hereby certify that the above-named **person Chris Furger (Agent for the Village of Fenwood)** is known to be the person(s) who executed the foregoing WQT Watershed Project Contract and acknowledge the same.

Notary Public Marathon County, Wisconsin	Signature of Notary Public:
Seal of Notary Public 	My commission expires: 03/20/2023.

Russel Kraft personally came before me this 5th day of May 2022.
I hereby certify that the above-named person **Russel Kraft** is known to be the person(s) who executed the foregoing WQT Watershed Project Contract and acknowledge the same.

Notary Public Marathon County, Wisconsin	Signature of Notary Public: Teresa M Marvin
Seal of Notary Public 	My commission expires: 03/20/2023.

APPENDIX E

327 – CONSERVATION COVERED IMPLEMENTATION REQUIREMENTS

(Signed Operation and Maintenance Agreement)

This page left intentionally blank.

USDA United States Department of Agriculture

Natural Resources Conservation Service

327 –Conservation Cover Implementation Requirements

Customer Name:	Russel Kraft	**Date:**	April 1, 2022
Farm:	Russel Kraft	**Planned Acres:**	20
Tract:		**County:**	Marathon
Field:	1	**Prepared by:**	Andy Johnson

Install this practice in accordance with the drawings, specifications and special requirements shown below.

1. Practice Purpose(s): Select all resource concerns that the client is addressing.

X Reduce soil erosion and sedimentation X Improve water quality X Enhance wildlife habitat X Improve soil quality, soil health

2. Follow specifications: X 327 Introduced Species (refer to 327 WI Guidance Document - TN 6)

3. Plant Selection: Utilize the WI Seeding Calculator. Attach the report to this IR sheet.

   Refer to the appropriate guidance document for optimum seeding dates. These are identified in the seeding plan.

4. Plant Bloom Season: If applicable (Identified in the WI Seeding Calculator)

Bloom Period:	Early	Middle	Late
Number of Species	NA		

5. Site Preparation: X Herbicide ☐ Mowing ☐ Solarization X Tillage ☐ Other:

   Planned date: Spring 2022

   Considerations: Frost seed

6. Planting Method: XDrill X Broadcasting ☐ Dormant

Planned date: April 2022

Considerations: _____

7. Soil testing: NA. The cropland has been under a nutrient management plan for several years. The fertility is adequate to sow switchgrass.

8. Temporary cover or companion crop: NA

9. Weed Management during establishment: X Herbicide spot spray weeds (as needed.

☐ Whole field herbicide ☐ Grass specific herbicide ☐ Mowing

Planned Date: April 2022

Weed Management Considerations: NA

2 Long-term Management (Operation and Maintenance):

A. Implementation Date(s) Of Management Practices:
X Spot mowing
X Whole field mowing
X Spot herbicide treatment
X Prescribed burning – requires an approved 338 Prescribed Burning Plan

Planned date: On-going.

B. For Pollinator or Wildlife Enhancement purposes, consider appropriate timing of management activities to reduce potential disturbance to birds, or other wildlife.

Avoidance dates: Nesting season.

☐ **Once the cover is established, disturbance (i.e. mowing or spraying) shall NOT occur during the primary nesting season – May 15 to Aug 01.**

Other Considerations:

Signature: Russell Kraft Date: 5-5-22

Russel Kraft

APPENDIX F

USDA – NRCS TECHNICAL STANDARDS

- NRCS Conservation Practice Standards – Conservation Cover – Code 327
- NRCS Conservation Practice Standards – Critical Area Planting – Code 342
- NRCS Conservation Practice Standards – Cover Crop – Code 340
- WI Agronomy Technical Note No. 6

This page left intentionally blank.

INSERT NRCS CP STD CODE 340 HERE – ONLY 5 PAGES

NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD

COVER CROP

CODE 340

(Acre)

I. DEFINITION

Grasses, small grains, legumes, forbs, and/or other herbaceous plants established for seasonal cover and conservation purposes.

II. PURPOSE

This practice may be applied as part of a conservation management system to support one or more of the following purposes:

- Improve soil health and condition
- Improve soil structure/biodiversity
- Increase soil organic matter
- Manage excess nutrients in the soil
- Minimize and reduce soil compaction
- Promote biological nitrogen fixation
- Reduce wind abrasion damage
- Provide supplemental forage
- Reduce particle emissions
- Reduce water and wind erosion
- Soil moisture management
- Suppress weeds and break pest cycles

III. CONDITIONS WHERE PRACTICE APPLIES

This practice applies on all lands requiring seasonal vegetative cover for natural resource protection or improvement.

IV. CRITERIA

A. General Criteria Applicable To All Purposes

1. Plant species, seedbed preparation, seeding rates, seeding dates, seeding depths, fertility requirements, and planting methods will be consistent with Wisconsin Agronomy Technical Note 7, "*Cover and Green Manure Crops*". Soil and site conditions will be evaluated.
2. Non-certified seed can be used. At a minimum, cover crop seed must be 85 percent germination.
3. Select species and planting dates that will not compete with the production crop yield or harvest.
4. The cover crop plant species selected will be compatible with the current cropping system, previously applied herbicides, nutrient and pest management plans and other components of the conversation plan.
5. Cover crops shall meet the grower's objective and follow termination guidance in Wisconsin Agronomy Technical Note 7 Cover and Green Manure Crops.
6. Do not burn cover crop residue.
7. When grazing or haying a cover crop follow pesticide label restrictions Grazing or haying of the cover crop shall not compromise the performance of the crop to meet conservation purposes.
8. Soil testing and nutrient applications are not required for the establishment of cover crops.

B. Additional Criteria To Reduce Erosion From Wind And Water

1. Time cover crop establishment in conjunction with other practices so that the soil will be adequately protected during the critical erosion period(s).
2. Select plants that have the physical characteristics necessary to produce adequate root structure and protect the soil during critical periods.

3. Use the current erosion prediction technology (RUSLE2 or WEPS) to determine the amount of surface and/or canopy cover needed from the cover crop to achieve the erosion objective.

C. Additional Criteria to Maintain or Increase Soil Health and Organic Matter Content

1. Cover crop species will be selected on the basis of producing higher volumes of organic material and root mass to maintain or increase soil organic matter.
2. The planned crop rotation, including the cover crop management activities, will score a Soil Conditioning Index (SCI) value > 0, as determined using the current approved NRCS SCI procedure.
3. The cover crop shall be planted as early as possible and be terminated as late as practical for the producer's cropping system to maximize and plant biomass production. Allow time to prepare the field for planting the next crop, and to avoid soil moisture depletion.

D. Additional Criteria To Reduce Water Quality Degradation By Utilizing Excessive Soil Nutrients

1. Cover crops will be established and actively growing before expected periods of high precipitation can cause nutrient leaching.
2. Cover crop species shall be selected for their ability to adsorb large amounts of nutrients from the rooting profile of the soil. Use fibrous-rooted cereal grains or grasses to maximize the utilization of excess nitrogen.
3. Cover crops harvested for feed (hay/balage) shall be suitable for the planned livestock, and capable of removing the excess nutrients present.
4. The above ground biomass shall be removed from the field when maximum nutrient removal efficiency is required. Cover crop termination method and timing shall be determined based on the objectives for managing nutrients in the soil profile. Terminate the cover crop as late as practical to maximize plant biomass production and nutrient uptake.
5. Deep-rooted cover crops shall be used to extract excessive nutrients in the soil profile.
6. Nitrogen credits from legume cover crops shall be accounted for in the following crop year nutrient management plan using current University of Wisconsin recommendations.

E. Additional Criteria To Suppress Excessive Weed Pressures And Break Pest Cycles

1. Select cover crops for their life cycles, growth habits, and other biological, chemical or physical characteristics to provide one or more of the following:
   - Suppress or compete with weeds such as Allelophatic (chemically suppress), compete for light, moisture, and/or nutrients.
   - Break pest life cycles or suppress plant pests or pathogens.
   - Provide food or habitat for natural enemies of pests.
2. Select cover crop species that do not harbor pests or diseases known to affect subsequent crops in the rotation.

F. Additional Criteria To Improve Soil Moisture Use Efficiency

1. In areas of limited soil moisture, terminate sufficiently early to conserve soil moisture for the subsequent crop. Utilize the NRCS Cover Crop Termination Guidelines found in Wisconsin Agronomic Technical Note 7, "*Cover and Green Manure Crops*" to determine the appropriate timing for termination.

2. Cover crops established for moisture conservation shall be left on the soil surface until the subsequent crop is planted.

3. In areas of potential excess soil moisture, allow the cover crop to grow as long as possible to soil moisture removal.

G. Additional Criteria to Minimize Soil Compaction

1. Select cover crop species that have the ability to root deeply and capacity to penetrate or prevent compacted layers, increase soil organic matter, improve soil structure and increase infiltration.

V. CONSIDERATIONS

1. Plant cover crops in a timely matter and when there is adequate moisture to establish a good stand.

2. When applicable, ensure cover crops are managed and are compatible with the client's crop insurance criteria.

3. Optimal cover crop benefits are usually accomplished when the plant density is at least 25 stems per square foot; the combined canopy and surface cover is at least 80 percent, and the above ground (dry weight) biomass production is at least 2700 pounds per acre.

4. Higher density cover crop stands promote rapid canopy closure and greater weed suppression. Increased seeding rates (1.5 to 2 times normal) can improve weed competitiveness.

5. Consider designing cover crop mixtures with at least one grass and one legume.

6. Consider that grasses utilize primarily soil nitrogen, and legumes utilize both soil nitrogen and phosphorus.

7. Consider the use of cover crops to improve site conditions for establishment of perennial species.

8. Consider the risk for seed produced by cover crops to provide weed competition to subsequent crops. Termination of covers may need to be done timely to avoid this risk.

9. Consider the use of plant species that may attract beneficial pollinators. Refer to Wisconsin Biology Technical Note 8, "*Pollinator Biology and Habitat*" for a list of diverse legumes and other forbs that promote pollinator habitat that can be used in cover crop mixes.

10. Consider the benefits of cover crop species with desired forage traits, and palatable to livestock, that will not interfere with the production of the subsequent crop.

11. Select a mixture of two or more cover crop species from different plant families to achieve one or more of the following: (1) species mix with different maturity dates, (2) attract beneficial insects, (3) attract pollinators, (4) increase soil biological diversity, (5) serve as a trap crop for insect pests, or (6) provide food and cover for wildlife habitat management.

12. Plant legumes or mixtures of legumes with grasses, with other forbs to achieve biological nitrogen fixation. Select cover crop mixture, timing, and method of termination that will maximize efficiency of nitrogen utilization by the following crop. Use University of Wisconsin recommended to capture nitrogen credits from the legume.

13. Time the termination of cover crops to meet nutrient release goals. Termination at early vegetative stages may cause a more rapid release compared to termination at a more mature stage.

A. Additional Considerations to Reduce Erosion by Wind or Water

1. To reduce erosion, best results are achieved when the combined canopy and surface residue cover attains 90

percent or greater during the period of potentially erosive wind or rainfall.

B. Additional Considerations to Reduce Water Quality Degradation by Utilizing Excessive Soil Nutrients

1. Use deep-rooted species to maximize nutrient recovery.
2. When appropriate for the crop production system, mowing certain grass cover crops (e.g., sorghum-sudan grass, pearl millet) prior to heading and allowing the cover crop to regrow can enhance rooting depth and density, thereby increasing their subsoiling and nutrient-recycling efficiency.

C. Additional Considerations to Increase Soil Health and Organic Matter Content

1. Increase the diversity of cover crops (e.g., mixtures of several plant species) to promote a wider diversity of soil organisms, and thereby promote increased soil organic matter.
2. Plant legumes or mixtures of legumes with grasses, with other forbs to provide nitrogen through biological nitrogen fixation.
3. Legumes add the most plant-available N if terminated when about 30 percent of the crop is in bloom.

VI. PLANS AND SPECIFICATIONS

Plans and specifications will be prepared for each field according to planning criteria. Plans for the establishment of cover crops shall include:

- Field number and acres,
- Species of plant(s) to be established,
- Seeding rates,
- Seeding dates,
- Establishment procedure,
- Rates, timing and forms of nutrient application (if needed),
- Dates and method of cover crop termination,
- Other information pertinent to establishing and managing the cover crop such as specifics for haying or grazing planning.

All Specifications shall be recorded using Wisconsin Job Sheet 340, "*How to Establish Cover and Green Manure Crops*".

VII. OPERATION AND MAINTENANCE

1. Evaluate the cover crop to determine if the cover crop is meeting the planned purpose(s). If the cover crop is not meeting the purpose(s) adjust the management, change the species of cover crop, or choose a different technology.
2. Terminate cover crop according to design (timing/method) to prevent negative impact on primary crop.
3. Maintain adequate biomass on the soil surface to meet the intended use of the practice, when the cover crop will be grazed or harvested.

VIII. 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 cover crops. This standard does not contain the text of federal, tribal, state or local laws.

IX. REFERENCES

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

USDA, NRCS Wisconsin Agronomy Technical Note 7, "*Cover and Green Manure Crop Benefits to Soil Quality*".

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

USDA, NRCS Wisconsin Job Sheet 340, "*How to Establish Cover and Green Manure Crops*".

Cover Crops on the Intensive Market Farm, University of Wisconsin – Madison, Center for Integrated Agricultural Systems, College of Agricultural and Life Sciences.

A. Clark 2007. Managing Cover Crops Profitably, 3rd Edition, Sustainable Agriculture Network Handbook Series; Handbook K9.

Magdoff, Fred, and Harold Van Es. Building Soils for Better Crops – Sustainable Soil Management 3rd Edition, Handbook Series Book 10.

Moyer, Jeff, Organic No-Till Farming –Advancing No-Till Agriculture, Crops, Soil, Equipment.

Midwest Cover Crop Council: http://www.mccc.msu.edu/

Midwest Cover Crop Decision Tool: http://mcccdev.anr.msu.edu/VertIndex.php

NRCS Cover Crop Termination Guidelines: http://efotg.sc.egov.usda.gov/references/public/ UT/CoverCropTerminationGuidelines.pdf

UW Extension Publications: Cover Crop Termination, Forage Herbicide Quick Sheet – Cereal Rye Forage after Corn Silage, Forage Herbicides Quick Sheet – Spring-Seeded Forages after Corn and Herbicide Rotation Restrictions in Forage and Cover Cropping Systems located at the Wisconsin Crop Weed Science Website: http://wcws.cals.wisc.edu

United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

CRITICAL AREA PLANTING

CODE 342

(ac)

DEFINITION

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

PURPOSE

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

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

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to highly disturbed areas such as—

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

CRITERIA

General Criteria Applicable to All Purposes

Site preparation

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

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

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

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

For details on seedbed preparation, refer to Wisconsin Agronomy Technical Notes 5, Establishing and Maintaining Native Grasses, Legumes, and Forbs; and 6, Establishing and Maintaining Introduced Grasses and Legumes.

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

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

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

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

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

Seeding rates will be based on Pure Live Seed (PLS). Actual adjusted seeding rates will be based on the equivalent of 100 percent PLS, determined by multiplying the percent purity by total percent germination.

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

Introduced and native legume seed shall be inoculated immediately prior to planting. Rhizobia inoculant shall be specific to the legume seeded. When more than one legume specie is used, each specie will be inoculated separately.

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

Seeding Periods
Seeding will follow planting zone dates. Refer to Figure 1 for planting zones and Tables 1 and 2 for seeding dates.

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.

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

Frost seeding is not an authorized seeding method when using this standard.

Dormant seeding can be used when planting introduced species. When dormant seeding in concentrated flow areas, the site must be mulched according to the engineering design (if applicable) and Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), Mulching (Code 484).

Figure 1. Planning Zones

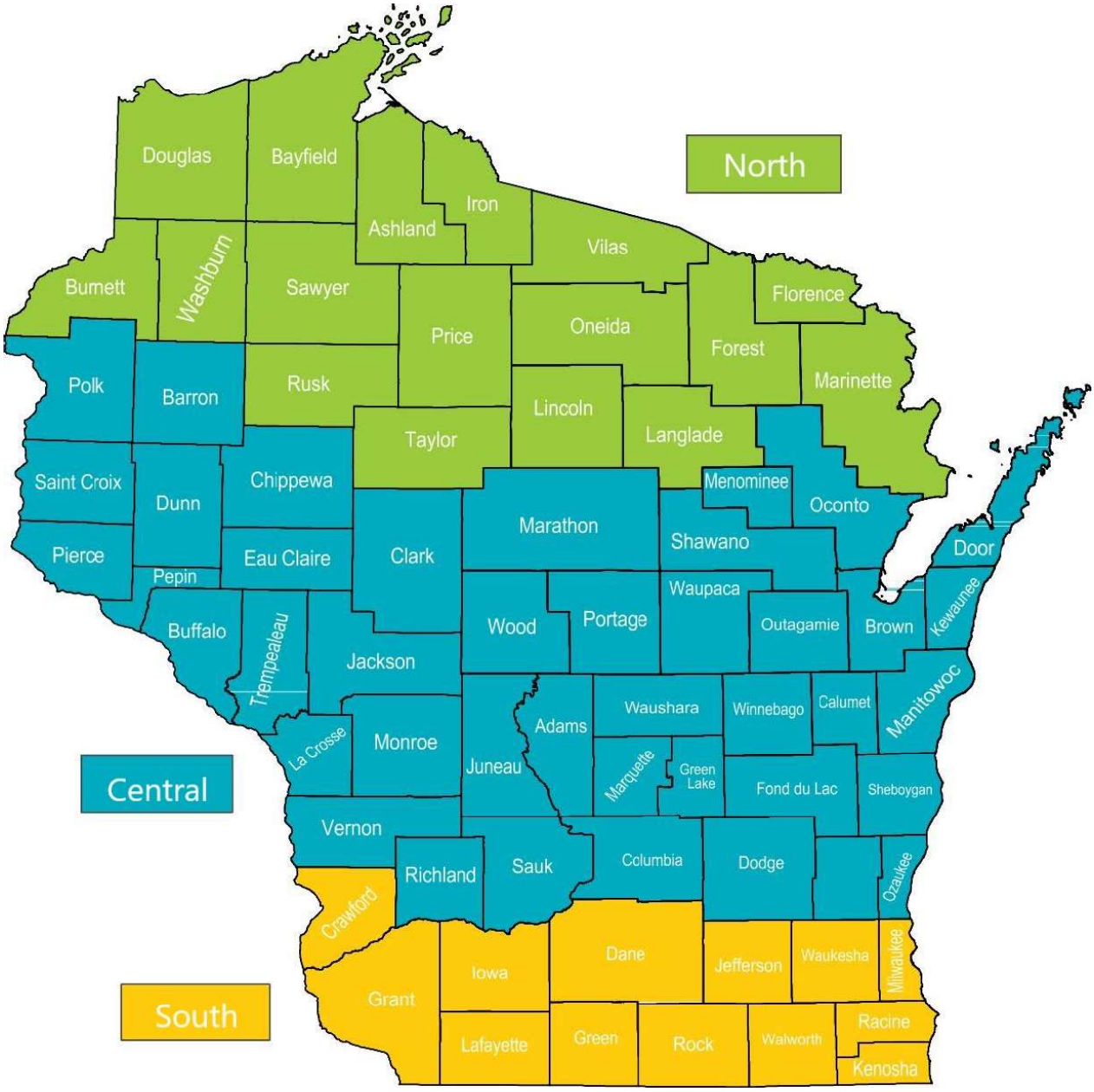


Table 1. Seeding Date/Ranges for Native Mixtures and Companion Crops

Zone	Spring Seeding
Northern	Thaw - 7/15
Central	Thaw - 6/30
Southern	Thaw - 6/30

Table 2. Seeding Date/Ranges for Introduced Grasses, 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

Nutrient and Soil Amendment Requirements
When seeding introduced species, soil fertility and pH level will be amended to satisfy the needs of the plant species to be established. Fertilizer andlime recommendations will be determined by a soil test, and all nutrients will be applied following WI NRCS CPS, Nutrient Management (Code 590). If no soil test is available, apply a minimum of 150 pounds of 20-10-10 fertilizer and 2 tons of 80-89 lime or equivalent per acre. Soil amendments may be waived at the discretion of a certified conservation planner. The basis for waiving the use of soil amendments shall be documented in the client's case file.

For establishment of native species, use of soil amendments should not be used.

Seedbed Preparation
A minimum of 4 inches of friable soil material or topsoil shall be added and mixed to exposed rocky, sandy, gravelly, shale material, or extremely fine textured subsoil.

All gullies and deep rills will be filled and leveled during seedbed preparation.

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

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

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

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

Mulching, Temporary Cover, and Companion Crop
Plantings shall be mulched as necessary to ensure establishment. Other disturbed areas shall be mulched as necessary to prevent erosion.

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

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

Criteria for Seed Mixture Development
Seeding rates are based on seeds per square foot of Pure Live Seeds. Refer to Wisconsin Agronomy Technical Notes 5 and 6 for the recommended species and seeding rates.

Approved species for critical area planting can be found in Wisconsin Agronomy Technical Notes 5 and 6. Species not listed in the technical notes must be approved in advance by the State Agronomist.

Introduced Grass and Legume Plantings on Critical Sites
Custom and standard mixtures will contain at least 50 percent grass seed of which 25 percent will be sod forming (not bunch) grass.

A minimum of 160 seeds per square foot is required for either a solid stand of grasses or a combination of grasses and legumes.

Increase seeding rate by 15 percent when dormant seeding occurs.

Refer to Table 8 of Agronomy Technical Note 6 for suggested seed mixes.

Native Herbaceous Plantings on Critical Sites
Native species are generally not recommended for critical area plantings due to their slow establishment and because they are clump grasses rather than sod forming. Only sod forming grasses are permitted in concentrated flow channels.

Competition and poor establishment of some species. Seeds per square foot should not exceed 25 percent of the minimum requirement, with the exception of mixtures designed for wet mesic and wet sites.

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

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

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

On sites that are too steep for regular seeding equipment to operate, the use of hydro-seeding and mechanically blown mulch is recommended. For more information regarding hydro-seeding, refer to Wisconsin Agronomy Technical Note 6.

Species selection.
Plant material used for this purpose must:

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

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

Identify and protect desirable existing vegetation during practice installation.

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

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

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

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

Additional Criteria to Stabilize Areas with Existing or expected High Rates of Erosion by Wind and Water

The amount of plant biomass and cover needed to reduce wind and water erosion to the planned soil loss objective shall be determined using the current approved wind and/or water erosion prediction technology.

Do not use tillage where desirable vegetation is already present or where soil disturbance will increase the potential for erosion or cause sedimentation to environmentally sensitive areas.

Use a companion crop as added protection.

The toe of the slope, or the outlet of the concentrated flow channel, shall be stable before attempting seeding on the slope.

Concentrated flow may need to be diverted from the critical area during the establishment period.

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

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

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

CONSIDERATIONS

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

Consider planting native vegetation and/or local genotypes when restoring sites adjacent to remnant prairies.

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

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

Areas of vegetation established with this practice can create habitat for various type of wildlife. Maintenance activities, such as mowing or spraying, can have detrimental effects on certain species. Perform management activities at the times and in a manner that causes the least disruption to wildlife (May 15th – August 31st).

PLANS AND SPECIFICATIONS

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

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

- Practice purpose(s)
- Site preparation
- Topsoil requirements
- Fertilizer application

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

OPERATION AND MAINTENANCE

- Control access to the area to ensure the site remains stable.
- Protect plantings shall be protected from pests (e.g., weeds, insects, diseases, livestock, or wildlife) as necessary to ensure long-term survival.
- Inspections, reseeding or replanting, and fertilization may be needed to ensure that this practice functions as intended throughout its expected life.
- Observe establishment progress and success at regular intervals until the practice has met the criteria for successful establishment and implementation.
- Description of successful establishment (e.g., minimum percent ground/canopy cover, percent survival, stand density).
- Sites may require on-going periodic maintenance consisting of mowing or herbicide treatment to control invasive pressure.
- All areas to be grazed will follow a grazing plan that meets the criteria in the WI CPS, Prescribed Grazing (Code 528).
- Grazing will be permanently excluded on high hazard sites, such as cut banks, areas of seepage, or other potential unstable areas.
- All areas to be grazed will follow a grazing plan that meets the criteria in the WI NRCS CPS, Prescribed Grazing (Code 528).
- Grazing will be permanently excluded on high hazard sites, such as cut banks, areas of seepage, or other potential unstable areas.

REFERENCES

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

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

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.

Ladd, D. and Oberle, F. 1995. Tallgrass Prairie Wildflowers, A Field Guide. The Nature Conservancy.

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

Packard, S. and Mutel, C. 1997. The Tallgrass Restoration Handbook for Prairies, Savannas and Woodlands. Society for Ecological Restoration.

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

USDA, NRCS, National Engineering Handbook, Part 650, Engineering Field Handbook.

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

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

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

This page left intentionally blank.

INSERT WI AGRONOMY TECH NOTE NO 6 HERE – 23 PAGES

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

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

USDA NRCS
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.

TABLE OF CONTENTS

LIST OF TABLES

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.

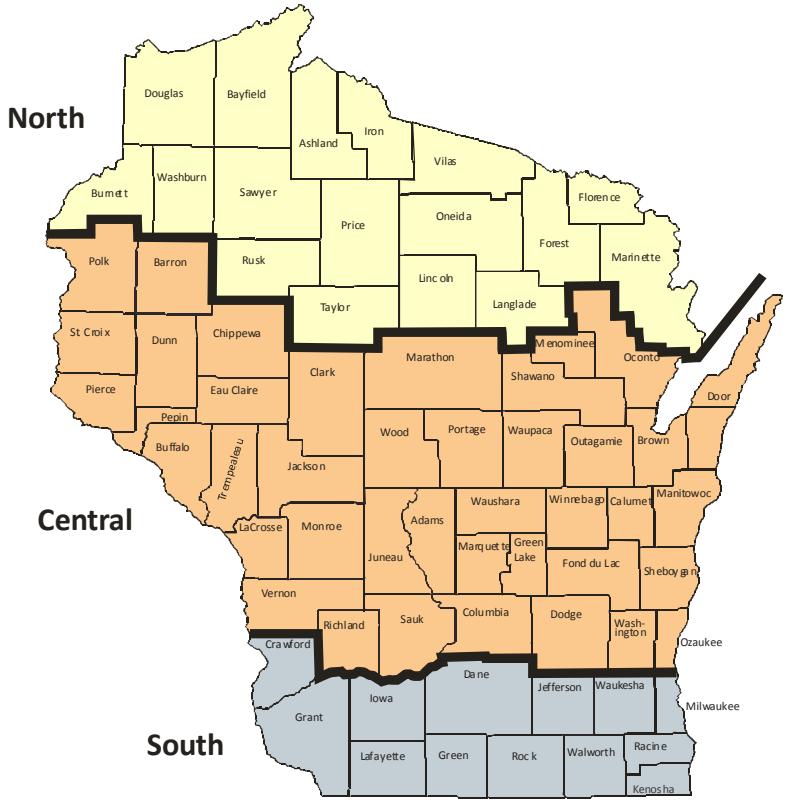
The frost seeding period in Wisconsin ranges from mid February to early March and will vary from year to year depending on the weather. Frost seeding is only allowed during active freezing and thawing cycles.

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.

This page left intentionally blank.

APPENDIX G

WATER QUALITY TRADING ADMINISTRATIVE FORMS

- Village of Fenwood and R. Kraft and Miltrim Farms – Practice Registration Form
- Village of Fenwood and R. Kraft and Miltrim Farms – Credit Generating Practice Verification Report

This page left intentionally blank.

Village of Fenwood and R. Kraft and Miltrim Farms

Practice Registration Form

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

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

Notice: Any personally identifiable information submitted on this form will be used for program purposes only but

Permittee Information

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

Facility Address	City	State	ZIP Code

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

Project Name

Broker/Exchange Information

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

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

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

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

The preparer and owner certify all of the following:

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

Signature of Preparer	Date Signed

Authorized Representative Signature:

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

Signature of Authorized Representative	Date Signed

For Department Use Only

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

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

Trade Agreement #:_____ Date _____

Credit Generating Practice Verification Report

1. Verifier Information	
Name & Title: Russel Kraft	Agency/Organization: Village of Fenwood
Phone:	Email:

2. Credit Generating Practice Information *(attach numbered photographs to this form showing the installed practice; attach additional sheets as necessary)*

Field	Credit Generating Practice	Original Installation Date	Meets NRCS Performance Standard? (Y/N)	Included in Credit Certification Report? (Y/N)	Photo #(s)
1	Conservation Cover	Spring 2022			
2	Critical Area Planting (Gully Areas)	Spring 2022			
042	Cover Crop	2021			
044	Cover Crop	2021			

3.2 If any deviations are reported in 3.1, describe if and how they nevertheless conform to the requirements of the WQT Plan approved by WDNR *(Note: a revised Credit Certification Report must be completed and attached to this form if any deviations occurred)*:

4. Are there any gullies present on the fields of the farm?

Y/N

If yes, please describe location and size, and any control mechanisms currently in place.

5. Comments

Provide any additional comments here:

5. Attestation

I certify that the Credit Generating Practices specified in the Credit Certification Report (as appended to the WQT Plan approved by WDNR) were present and have been operated and maintained according to NRCS Performance Standards and the Operations & Maintenance Plan, with Performance Verification associated with the Trade Agreement. I further certify that there were no deviations between the installed and contracted Credit Generating Practices, other than those noted herein.

Signed: _____ Date: _____

Print Name: _____

Trade Agreement #: _____ Date _____

Further Instructions:

Verifier shall complete and submit this Credit Generating Practice Verification Report to the permittee (Buyer) and the Broker (if applicable) according to the timeline indicated in the Water Quality Trading Contract (Agreement).

INSERT V FENWOOD & R KRAFT – CREDIT GENERATING PRACTICE VERIFICATION REPORT – 3 PAGES

This page left intentionally blank.

APPENDIX H

VILLAGE OF FENWOOD – MULTI DISCHARGE VARIANCE – PAYMENT CALCULATIONS

- WI-DNR 2/6/2020 Payment Calculations
- WI-DNR 2/8/2021 Payment Calculations
- WI-DNR 2/8/2022 Payment Calculations
- DNR 2023 Monitoring Discharge Report

This page left intentionally blank.

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Tony Evers, Governor
Preston D. Cole, Secretary
Telephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

2/6/2020

Edward Mielke
3796 Redwood Street
Edgar, WI 54426

Subject: County Payment for Phosphorus Multi-discharger Variance
Permittee: FENWOOD WASTEWATER TREATMENT FACILITY, WPDES WI-0031411

Dear Mr. Mielke:

In accordance with s. 283.16 of the Wisconsin Statutes, you have been granted coverage under Wisconsin's multi-discharger phosphorus variance for FENWOOD WASTEWATER TREATMENT FACILITY with a permit effective date of 4/1/2019. The permitted facility has agreed to reduce the amount of phosphorus entering surface waters by making payments to the counties pursuant to s. 283.16(6)(b)1., Wis. Stats.

Payment Calculation

The permittee shall make a total payment by March 1 of each year in the amount equal to the per pound amount $53.01 times the number of pounds by which the effluent phosphorus discharged during the previous year exceeded the permittee's target value or $640,000, whichever is less. This billing statement contains the payment to be made to participating counties based on the discharge monitoring reports (DMR) data. The following table contains the DMR data used to calculate the payment value.

Facility Name	Sample Point	Month	Monthly Average Phosphorus (mg/L)	Monthly Total Flow (MG)	Monthly Phosphorus Loading (lbs)	Monthly Loading at Target Value (lbs)	Monthly Loading Above Target (lbs)	MDV Effective?	Annual Total Loading Above Target (lbs)
FENWOOD WASTEWATER TREATMENT FACILITY	001	05	1.19	2.055	20.4	3.43	16.97	Y	
FENWOOD WASTEWATER TREATMENT FACILITY	001	11	0.69	1.713	9.86	2.86	7	Y	23.97

Total payment value for 2019: $1,270.65

County Payment

Counties were required to submit a "County Participation Form" to the department by January 2nd and payments are distributed proportionately amongst the participating counties based on their total land area in the HUC 8 watershed. If there are no participating counties within a facility's HUC 8, the department selects another participating county to receive the payments. Counties are required to use payments to reduce phosphorus entering the surface waters of the state pursuant to s. 283.16(8)(b) Wis. Stats.

Based on participating counties, FENWOOD WASTEWATER TREATMENT FACILITY is required to make the annual payment to the following counties:

HUC8 Code	HUC 8 Name	County Name	Percent of HUC 8	Payment Amount
7070002	Lake Dubay	Marathon	85.2%	$ 1,081.98
7070002	Lake Dubay	Taylor	11.0%	$ 139.21
7070002	Lake Dubay	Wood	3.9%	$ 49.46

Please make checks payable and distribute to:

Make Checks Payable To:	Mailing Address	
Marathon County CPZ	210 River Drive	Wausau WI 54403
Taylor County Land Conservation Department	925 Donald Street, Room 104	Medford, WI 54451
Wood County Land and Water Conservation Department	111 West Jackson Street	Wisconsin Rapids, WI 54495

Payment Verification

As is required per the schedules section within the WPDES permit, the permittee shall submit Form 3200-151 to the Department by March 1 of each calendar year indicating total amount remitted to the participating counties to verify that the correct payment was made. A copy of the required form has been included and should be submitted to the address shown on the form.

Should you have further questions regarding this matter, please contact me at matthew.claucherty@wisconsin.gov or (608) 264-9244.

Sincerely,

Matt Claucherty
MDV Point Source Coordinator
Bureau of Water Quality

Attachment

e-cc: Nick Lindstrom, WDNR

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Tony Evers, Governor
Preston D. Cole, Secretary
Telephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

2/8/2021

Edward Mielke
3796 Redwood Street
Edgar, WI 54426

Subject: County Payment for Phosphorus Multi-discharger Variance
Permittee: FENWOOD WASTEWATER TREATMENT FACILITY, WPDES WI-0031411

Dear Edward Mielke:

In accordance with s. 283.16 of the Wisconsin Statutes, you have been granted coverage under Wisconsin's multi-discharger phosphorus variance for FENWOOD WASTEWATER TREATMENT FACILITY with a permit effective date of 4/1/2019. The permitted facility has agreed to reduce the amount of phosphorus entering surface waters by making payments to the counties pursuant to s. 283.16(6)(b)1., Wis. Stats.

Payment Calculation

The permittee shall make a total payment by March 1 of each year in the amount equal to the per pound amount $53.01 times the number of pounds by which the effluent phosphorus discharged during the previous year exceeded the permittee's target value or $640,000, whichever is less. This billing statement contains the payment to be made to participating counties based on the discharge monitoring reports (DMR) data. The following table contains the DMR data used to calculate the payment value.

Facility Name	Sample Point	Month	Monthly Average Phosphorus Concentration (mg/L)	Monthly Total Flow (MG)	Monthly Phosphorus Load (lbs)	Monthly Load at Target Value (lbs)	Monthly Load Above Target (lbs)	MDV Effective?	Annual Total Loading Above Target
FENWOOD WASTEWATER TREATMENT FACILITY	001	05	0.68	1.531	8.68	2.55	6.13	Y	
FENWOOD WASTEWATER TREATMENT FACILITY	001	11	0.37	1.646	5.08	2.75	2.33	Y	8.46

Total payment value for 2020: $448.46

County Payment

Counties were required to submit a "County Participation Form" to the department by January 2nd and payments are distributed proportionately amongst the participating counties based on their total land area in the HUC 8 watershed. If there are no participating counties within a facility's HUC 8, the department selects another participating county to receive the payments. Counties are required to use payments to reduce phosphorus entering the surface waters of the state pursuant to s. 283.16(8)(b) Wis. Stats.

Based on participating counties, FENWOOD WASTEWATER TREATMENT FACILITY is required to make the annual payment to the following counties:

HUC8 Code	HUC 8 Name	County Name	Percent of HUC 8	Payment Amount
7070002	Lake Dubay	Lincoln	28.5%	$ 127.73
7070002	Lake Dubay	Marathon	60.9%	$ 273.11
7070002	Lake Dubay	Taylor	7.8%	$ 35.14
7070002	Lake Dubay	Wood	2.8%	$ 12.49

Please make checks payable and distribute to:

Make Checks Payable To:	Mailing Address	
Lincoln County Land Services Department	801 N Sales St, Rm 103	Merrill, WI 54452
Marathon County CPZ	210 River Drive	Wausau WI 54403
Taylor County Land Conservation Department	925 Donald Street, Room 104	Medford, WI 54451
Wood County Land & Water Conservation Department	111 West Jackson Street	Wisconsin Rapids, WI 54495

Payment Verification

As is required per the schedules section within the WPDES permit, the permittee shall submit Form 3200-151 to the Department by March 1 of each calendar year indicating total amount remitted to the participating counties to verify that the correct payment was made. A copy of the required form has been included and should be submitted by mail at the address on the form, or by email to matthew.claucherty@wisconsin.gov. Electronic correspondence preferred.

Should you have further questions regarding this matter, please contact me at matthew.claucherty@wisconsin.gov.

Sincerely,

Matt Claucherty
MDV Point Source Coordinator
Bureau of Water Quality

e-cc:

Nicholas Lindstrom, WDNR

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
Box 7921
Madison WI 53707-7921

Tony Evers, Governor
Preston D. Cole, Secretary
Telephone 608-266-2621
FAX 608-267-3579
TTY Access via relay - 711

2/8/2022

Christopher Furger
W648 County Rd P
Stratford, WI 54484

Subject: County Payment for Phosphorus Multi-discharger Variance
Permittee: Fenwood Wastewater Treatment Facility, WPDES WI-0031411

Dear Christopher Furger:

In accordance with s. 283.16 of the Wisconsin Statutes, you have been granted coverage under Wisconsin's multi-discharger phosphorus variance for Fenwood Wastewater Treatment Facility with a permit effective date of 4/1/2019. The permitted facility has agreed to reduce the amount of phosphorus entering surface waters by making payments to the counties pursuant to s. 283.16(6)(b)1., Wis. Stats.

Payment Calculation

The permittee shall make a total payment by March 1 of each year in the amount equal to the per pound amount $53.01 times the number of pounds by which the effluent phosphorus discharged during the previous year exceeded the permittee's target value or $640,000, whichever is less. This billing statement contains the payment to be made to participating counties based on the discharge monitoring reports (DMR) data. The following table contains the DMR data used to calculate the payment value.

Facility Name	Sample Point	Month	Monthly Average Phosphorus Concentration (mg/L)	Monthly Total Flow (MG)	Monthly Phosphorus Load (lbs)	Monthly Load at Target Value (lbs)	Monthly Load Above Target (lbs)	MDV Effective?	Annual Load Above Target (lbs)
Fenwood Wastewater Treatment Facility	001	05	0.98	1.570	12.83	2.62	10.21	Y	
Fenwood Wastewater Treatment Facility	001	11	0.91	1.150	8.73	1.92	6.81	Y	17.02

Total payment value for 2021: $902.23

County Payment

Counties were required to submit a "County Participation Form" to the department by January 2nd and payments are distributed proportionately amongst the participating counties based on their total land area in the HUC 8 watershed. If there are no participating counties within a facility's watershed, the department selects another participating county to receive the payments. Counties are required to use payments to reduce phosphorus entering the surface waters of the state pursuant to s. 283.16(8)(b), Wis. Stats.

Based on participating counties, Fenwood Wastewater Treatment Facility is required to make the annual payment to the following counties:

HUC8 Code	Watershed Name	County Name	Percent of HUC 8	Payment Amount
7070002	Lake Dubay	Marathon	85.2%	$ 768.26
7070002	Lake Dubay	Taylor	11.0%	$ 98.84
7070002	Lake Dubay	Wood	3.9%	$ 35.12

Please make checks payable and distribute to:

Make Checks Payable To:	Mailing Address	
Marathon County CPZ	210 River Drive	Wausau WI 54403
Taylor County Land Conservation Department	925 Donald Street, Room 104	Medford, WI 54451
Wood County Land & Water Conservation Department	111 West Jackson Street	Wisconsin Rapids, WI 54495

Payment Verification

As is required per the schedules section within the WPDES permit, the permittee shall submit Form 3200-151 to the Department by March 1 of each calendar year indicating total amount remitted to the participating counties to verify that the correct payment was made. A copy of the required form has been included and should be submitted by mail at the address on the form, or by email to matthew.claucherty@wisconsin.gov. Electronic correspondence preferred.

Should you have further questions regarding this matter, please contact me at matthew.claucherty@wisconsin.gov or (608) 400-5596.

Sincerely,

Matt Claucherty
MDV Point Source Coordinator
Bureau of Water Quality

e-cc:
Nicholas Lindstrom, WDNR

Wastewater Discharge Monitoring Short Report

Facility Name : FENWOOD WASTEWATER TREATMENT FACILITY
Contact Address : W648 County Rd P
Stratford, WI 54484
Facility Contact : Christopher Furger, Operator
Phone Number : 715-805-8888
Reporting Period : 04/01/2023 - 12/31/2023
Form Due Date : 01/21/2024
Permit Number : **0031411**

For DNR Use Only

Date Received:	
DOC:	520664
FIN:	6387
FID:	737012100
Region:	West Central Region
Permit Drafter:	Amanda R Perdzock
Reviewer:	Nicholas E Lindstrom
Office:	Eau Claire

Sample Point	Parameter #	Parameter	Date Sample	Sample Type	Sample Results	Units	Limit Type	Limit	LOD	LOQ	QC Exceed?	Lab Certification
001	388	Phosphorus, Total	11/30/2023	CALCULATED	19.46	lbs/yr		*****			N	
001	1343	WQT Credits Used (TP)	11/30/2023	CALCULATED		lbs/yr	Annual Total	32.90(0)			N	
001	1344	WQT Computed Compliance (TP)	11/30/2023	CALCULATED		lbs/yr	Annual Total	7(0)			N	

Village of Fenwood and Russel Kraft

WPDES Permit Number: WI-0031411-08-01 Date May 1, 2023

2022 – Credit Generating Practice Verification Report

1. Verifier Information	
Name & Title: Andy Johnson	Agency/Organization: Johnson Consulting
Phone: 715-571-7257	Email: andygjohns@gmail.com
Phosphorus Credit Exceedance – 20.3 pounds	

2. Credit Generation Field Report

Field ID	Acres	Field Name	Owned (O) Or Rented ®	Watershed	Credit Generating BMP	Seed Mixture #	Installation Date	Inspection Date	Meets NRCS Technical Standard? (Y/N)	Photo(s)	PTP Credits
001	20.0	Home	O	Fenwood	Permanent grass	1	5/2022	4/2023	YES	2	32.9

Seed Mix – Switchgrass – permanent grass cover

3.1. Deviations from WQT Plan. **Not applicable.**
(Provide documentation of deviations)

3.2 If deviations, describe how they conform to the requirements of the WQT Plan. **Not applicable**

4. Are there any gullies present on the fields? **No**

5. Additional Comments: **NA**

6. **Attestation – Certification**

I certify that the Credit Generating Practices specified in the Credit Certification Report were present and have been operated and maintained according to NRCS Performance Standards and the Operations & Maintenance Plan, with Performance Verification associated with the Trade Agreement. I further certify that there were no deviations between the installed and contracted Credit Generating Practices, other than those noted herein.

Signature _____ Date: 5/1/2023

7. **Attachments:**

1. Location of Kraft cropland fields.
2. Crop Certification Report (SNAP+ - PTP Report): Date April 2021.
3. Photo Documentation – April 2023