Permit Fact Sheet

General Information

Permit Number:	WI-0067041-01-0
Permittee Name:	Cambrian Innovation
Address:	Complete Filtration Resources 1900 E 24th Street
City/State/Zip:	Marshfield WI 54449
Discharge Location:	Near 1052 6th Street, Almena Wisconsin. Approximately 165 feet west of 6th Street and 1,220 feet north of 10 ½ Avenue., as measured from the road edge. (NE¼ SE¼ of section 12 T33N:R14W)
Receiving Water:	An unnamed tributary to the Hay River within the Hay River watershed in the Lower Chippewa River basin in Barron County
StreamFlow ($Q_{7,10}$):	Zero
Stream Classification:	Warm Water Sport Fish (WWSF) community, non-public water supply and in the ceded territory.
Wild Rice Impacts: *(no specific wild rice standards exist at this time)*	No impacts identified at this location. There are no wild rice beds identified on the receiving water. (Evaluation completed September 2024)
Discharge Type:	New continuous discharger

Facility Description

Saputo Cheese USA, Inc in Almena, WI (SCUSA – Almena) processes milk into blue cheese and hard Italian cheeses. Process wastewater generated by these operations enters lift stations where the wastewater is pumped to Cambrian's wastewater treatment plant owned and operated by Cambrian Almena LLC. Wastewater will be actively managed and treated based upon the influent characteristics. High strength wastewater will be diverted to the anaerobic membrane bioreactor (AnMBR) system. Low strength wastewater will be sent to the aerobic membrane bioreactor system (AeMBR). AnMBR permeate requires further aerobic treatment that is accomplished by sending the AnMBR permeate to the AeMBR system. The AeMBR process removes biodegradable organics and oxidizes ammonia, as well as capturing phosphorus using an enhanced biological phosphorus removal (EBPR) technique integrated into the AeMBR process. The AeMBR permeate contains minimal residual phosphorus which must be chemically precipitated and separated with the phosphorus ultrafiltration (P-UF) process. This wastewater is then cooled prior to discharge. Effluent is discharged on a continuous basis via Outfall 001 to an unnamed tributary (UT) to the Hay River. Generated industrial sludge residuals are stored in slurry form and dewatered via a screw press prior to disposal.

Substantial Compliance Determination

N/A - This is a new permittee.

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)**
701	HIGH STRENGTH FROM SAPUTO	High strength wastewater from Saputo Cheese USA - Almena

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, Waste Type/Sample Contents and Treatment Description (as applicable)**
	This is a new sample point.	will be diverted to the anaerobic membrane bioreactor (AnMBR) system.
702	LOW STRENGTH FROM SAPUTO This is a new sample point.	Low strength wastewater from Saputo Cheese USA - Almena will be diverted to the aerobic membrane bioreactor system (AeMBR).
001	EFFLUENT This is a new sample point. The application estimates 0.28 MGD	Representative effluent samples shall be taken from the effluent pipe directly after the oxygen enrichment tank.
002	SLUDGE – LIQUID	Representative samples shall be collected from the liquid sludge storage tank that is composited for analysis.
003	SLUDGE - CAKE	Representative samples shall be collected after the screw press prior to disposal that is composited for analysis.

1 Influent – Monitoring Requirements

Sample Point Number: 701- Saputo High Strength Waste and 702- Saputo Low Strength Waste

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	

Changes from Previous Permit:

This is the first permit term for this facility.

Explanation of Limits and Monitoring Requirements

The facility will treat the wastewater based upon the influent characteristics of either high strength or low strength wastewater. Each waste type will be diverted to either the anaerobic membrane bioreactor (AnMBR) system (high strength) or the aerobic membrane bioreactor system (AeMBR) (low strength).

2 Surface Water - Monitoring and Limitations

Sample Point Number: 001- Effluent Discharge

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
BOD5, Total	Daily Max	8.2 mg/L	3/Week	24-Hr Flow Prop Comp	Limit is effective May through October.
BOD5, Total	Daily Max	16 mg/L	3/Week	24-Hr Flow Prop Comp	Limit is effective November through April.
BOD5, Total	Weekly Avg	5.0 mg/L	3/Week	24-Hr Flow Prop Comp	Limit is effective May through October.
BOD5, Total	Weekly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	Limit is effective November through April.
BOD5, Total	Monthly Avg	5.0 mg/L	3/Week	24-Hr Flow Prop Comp	Limit is effective May through October.
BOD5, Total	Monthly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	Limit is effective November through April.
BOD5, Total	Daily Max	130 lbs/day	3/Week	Calculated	
BOD5, Total	Monthly Avg	51 lbs/day	3/Week	Calculated	
Suspended Solids, Total	Daily Max	16 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Weekly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Monthly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total	Daily Max	190 lbs/day	3/Week	Calculated	
Suspended Solids, Total	Monthly Avg	78 lbs/day	3/Week	Calculated	
pH Field	Daily Max	9.0 su	Daily	Grab	
pH Field	Daily Min	6.0 su	Daily	Grab	
Dissolved Oxygen	Daily Min	7.0 mg/L	3/Week	Grab	
Phosphorus, Total		mg/L	3/Week	24-Hr Flow Prop Comp	
Phosphorus, Total		lbs/day	3/Week	Calculated	Report daily mass discharged using Equation 1a, in the Water Quality

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
					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 the "Total Maximum Daily Load (TMDL) Limitations" subsection.
Phosphorus, Total		lbs/yr	Monthly	Calculated	Beginning January 2026, calculate the 12-month rolling sum of total monthly mass of phosphorus discharged. See the "Total Maximum Daily Load (TMDL) Limitations" subsection for more information.
WQT Credits Used (TP)		lbs/month	Monthly	Calculated	Report WQT TP Credits used per month using Equation 2c. in the Water Quality Trading (WQT) section. Available TP Credits are specified in Table 2 and in the approved Water Quality Trading Plan.
WQT Computed Compliance (TP)	Monthly Avg	0.225 mg/L	Monthly	Calculated	Report the WQT TP Computed Compliance value using Equation 3a. in the Water Quality Trading (WQT) section. Value entered on the last day of the month.
WQT Computed Compliance (TP)	6-Month Avg	0.075 mg/L	Monthly	Calculated	Compliance with the six-month average limit is evaluated at the end of the six-month period on June 30 and Dec 31.
WQT Computed Compliance (TP)	Monthly Avg	0.013 lbs/day	Monthly	Calculated	Report the WQT TP Computed Compliance value using Equation 3b. in the Water Quality Trading

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
					(WQT) section.
WQT Computed Compliance (TP)	6-Month Avg	0.18 lbs/day	Monthly	Calculated	Compliance with the six-month average limit is evaluated at the end of the six-month period on June 30 and Dec 31.
WQT Credits Used (TP)		lbs/yr	Annual	Calculated	The sum of total monthly credits used may not exceed Table 2 values listed below.
Chloride		mg/L	4/Month	24-Hr Flow Prop Comp	Monitoring shall occur at frequency of 4 times per month on consecutive days.
Nitrogen, Ammonia (NH3-N) Total		mg/L	3/Week	24-Hr Flow Prop Comp	
Additive- Biogas1	Daily Max	230 mg/L	Weekly	Calculated	See the Additives section for more information.
Nitrogen, Total Kjeldahl		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Nitrite + Nitrate Total		mg/L	Quarterly	24-Hr Flow Prop Comp	
Nitrogen, Total		mg/L	Quarterly	Calculated	
Temperature		deg F	3/Week	Multiple Grab	Limits begin at the end of the Temperature Limits schedule. See the Effluent Temperature Limitations section for more information.
Acute WET		TUa	Quarterly	24-Hr Flow Prop Comp	See the Whole Effluent Toxicity (WET) testing section for more information.
Chronic WET		TUc	Quarterly	24-Hr Flow Prop Comp	See the Whole Effluent Toxicity (WET) testing section for more information.

Changes from Previous Permit

This is the first permit term for this facility.

Explanation of Limits and Monitoring Requirements

More information on categorical and water quality based limits (WQBEL) is found in the "Water Quality-Based Effluent Limitations for Cambrian Innovation (WI-0067041-01-0)" memo dated July 9, 2024 and "Technology-Based Effluent Limitations for Cambrian Innovation (WI-0067041-01-0)" memo dated July 9, 2024.

BOD_5, **Total Suspended Solids (TSS)**, **pH** and **Dissolved Oxygen (DO)** – Water quality-based Limits are required per NR 102.04 Wis. Adm. Code for a WWSF community and technology-based limits for "Natural and Processed Cheese" subcategory as defined in NR. 240.02 Wis. Adm. Code.

Phosphorus – Phosphorus requirements are based on the Phosphorus Rules as detailed in NR 102 (water quality standards) and NR 217, Wis. Adm. Code (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 three types of limit calculations used to determine if a phosphorus limit is needed: a technology based effluent limit (TBEL), a water quality-based effluent limit (WQBEL) determined by stream criteria and a WQBEL based on a Total Daily Maximum Daily Load (TMDL) allocation.

In the case of Cambrian Innovation:

- A TBEL of 1.0 mg/L is needed if a facility discharges more than the threshold of 60 pounds per month (NR 217 Wis. Adm. Code). This is a new permittee and there is no concentration or flow data to determine if a TBEL is needed. The need for a limit will be re-evaluated a permit reissuance.
- Based on the size and classification of the stream, the categorical water quality criterion for the Unnamed Tributary to Hay River is 75 ug/L. This criterion and instream background phosphorus data are used to calculate the stream criteria-based WQBELs. The calculated WQBELs are .225 mg/L (monthly average), 0.075 mg/L (six month average)
- The facility lies within the boundaries of the Tainter Lake and Lake Menomin total maximum daily load (TMDL) area. The TMDL was developed to address phosphorus water quality impairments. The Tainter Lake and Lake Menomin TMDL for total phosphorus was approved by the U.S. Environmental Protection Agency on September 14, 2012. More information about the TMDL can be found at https://dnr.wisconsin.gov/topic/TMDLs/TMDLReports.html

  Based on current criteria, the approved TMDL Waste Load Allocation (WLA) for Total Phosphorus for Saputo Cheese USA is 2.5 lbs per year, which equates to 0.013 lbs/day monthly average. Cambrian Innovation will be inheriting the WLA from Saputo Cheese USA because they will be treating the factory process wastestream.

  Calculation and reporting of the total mass of phosphorus discharged over the past 12 months is required to track progress in meeting the overall TMDL requirements. The 12-month rolling sum equals the sum of the most recent 12 consecutive months of total monthly discharge phosphorus values (in pounds). This value should be reported on the eDMR on the last day of each month.

  Calculations needed to determine compliance with the wasteload allocation are:

    - **Total Monthly Discharge (lbs/month)** = monthly average concentration (mg/L) x total flow for the month (MG/month) x 8.34.
    - **12-Month Rolling Sum of Total Monthly Discharge (lbs/year)** = the sum of the most recent 12 consecutive months of total monthly discharges (in pounds). This value should be reported on the eDMR on the last day of each month. Recording will begin after 12-months (January 2026).

The wastewater treatment facility is not able to meet the WQBEL and TMDL WLA. 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-2024-00023) or approved amendments thereof. The total 'WQT TP Credits' available are designated in the approved WQT Plan. The facility has discontinued wastewater spray irrigation to nearby fields and has established perennial vegetation on fields previously used for row-crop agriculture. The WQT Plan proposes the generation of a range of 66.5-441.8 lbs/yr of phosphorus credits for the next five years as further outlined in the permit.

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

Chloride – This is a new facility without available data. Monitoring at a frequency of 4 times a month on consecutive days is required through the permit term in preparation for the next permit reissuance.

Ammonia – This is a new facility without available data. Monitoring at a frequency of 3 times a week is required through the permit term in preparation for the next permit reissuance.

Additives – There are 11 additives approved for use at the facility. Only one, Biogas 1, required a daily maximum limit included in the permit monitoring table. Compliance determination for the other additives is through standard operating procedures and/or pH limits. The permittee is required to maintain a record of the dosage rate of all additives used monthly and will be available upon request. The additives may be changed during the term of the permit following procedures in the 'Additives' subsection of the permit Standard Requirements.

Nitrogen Series - (nitrate +nitrite, total Kjeldahl nitrogen and total nitrogen) – In 2011, the Upper Mississippi River Basin Association (UMRBA) completed the report "Upper Mississippi River Nutrient Monitoring, Occurrence, and Local Impacts: A Clean Water Act Perspective". Among the many recommendations of this report was that the states should expand their NPDES discharge monitoring requirements to include both phosphorus and nitrogen as they have important impacts on the mainstem upper Mississippi River as well as in the Gulf of Mexico. Consequently, the department developed the "Guidance for Total Nitrogen Monitoring in WPDES Permits" document dated October 2019, where quarterly effluent monitoring for total nitrogen (total nitrogen = total Kjeldahl + (nitrite+nitrate)) is required for industrial facilities discharging to surface waters. Section 283.55(1)(e) Wis. Stats. 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 s. NR 200.065 (1)(h) Wis. Adm. Code allows for this monitoring to be collected during the permit term.

Temperature – Daily maximum and weekly average limits based on the month are required. The permit also includes a schedule to allow the permittee time to become compliant with all limits.

Effluent Limitations for 'Temperature Maximum' (Effective per the Schedules section):

Month	Weekly Average Limitation (°F)	Daily Maximum Limitation (°F)
January	49	76
February	50	76
March	52	77
April	55	79
May	65	82
June	76	84
July	81	85
August	81	84
September	73	82
October	61	80
November	49	77
December	49	76

WET Tests – Whole effluent toxicity (WET) testing requirements and limits (if applicable) are determined in accordance with ss. NR 106.08 and NR 106.09 Wis. Adm. Code, as revised August 2016. (See the current version of the Whole

Effluent Toxicity Program Guidance Document and checklist and WET information, guidance and test methods at http://dnr.wi.gov/topic/wastewater/wet.html.

The number and the need for limits are based on historical WET test data and reasonable potential factor (RPF) calculations. In the case of Cambrian Innovation, a new facility, data is not available therefore quarterly monitoring for both Acute and Chronic WET tests are required for one year. After that point the permittee may request a reduced sampling schedule. A reduced schedule or the need for limits will be determined by:

- **Acute WET Testing -** If all tests are passed during the year, the permit can be modified to reduce the number of tests to twice a year and a WET limit is not be required. If any Acute WET tests fail during the year, monitoring will remain quarterly, the permit will be modified to include a schedule to complete a toxicity reduction evaluation (TRE), and a daily maximum acute WET limit of 1.0 TUa will become effective.
- **Chronic WET Testing -** If all tests pass during the year, a chronic WET limit will not be required. If any Chronic WET tests fail during the year the permit will be modified to include a schedule to complete a TRE, followed by the imposition of a monthly average chronic WET limit 1.0 TUc.

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 taking into consideration the presence of potential PFOS or PFOA industrial wastes, remediation sites and other potential sources of PFOS or PFOA. 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 re-evaluate 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.

Sample Frequency - The "**Monitoring Frequencies for Individual Wastewater Permits**" guidance document (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 fairness and 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 department has determined at this time that the facility meets the guidance and no changes in the monitoring frequency is required this permit term.

3 Land Application - Sludge/By-Product Solids (industrial only)

Sample Point Number: 002- Liquid Sludge and 003- Cake Sludge

Monitoring Requirements and Limitations

Parameter	Limit Type	Limit and Units	Sample Frequency	Sample Type	Notes
Solids, Total		Percent	Monthly	Grab	
Nitrogen, Total Kjeldahl		Percent	Monthly	Grab	
Chloride		Percent	Monthly	Grab	
pH Field		su	Annual	Grab	
Nitrogen, Ammonium (NH4-N) Total		Percent	Annual	Grab	
Phosphorus, Total		Percent	Annual	Grab	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Phosphorus, Water Extractable		% of Tot P	Annual	Grab	
Potassium, Total Recoverable		Percent	Annual	Grab	
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:

This is the first permit term for this facility.

Explanation of Limits and Monitoring Requirements

The permittee has stated they will transfer sludge to a licensed landfill until sludge can be land applied per requirements found in ch. NR 214 Wis. Adm. Code.

There are three reports that will be required for sludge discharges:

- Land Application Characteristic Report (Form 3400 49) records required analysis.
- Annual Land Application Report (Form 3400 55) records all non-exceptional quality sludge that is land applied.
- Other Methods of Disposal or Distribution Report (Form 3400 52) records all sludge that is hauled, landfilled, incinerated, or exceptional quality sludge is distributed or land applied.

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 of Biosolids 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 Land Application Management Plan

A management plan is required for the land application system.

Required Action	Due Date
Land Application Management Plan: Submit a management plan to optimize the land application system performance and demonstrate compliance with Wisconsin Administrative Code NR 214.	03/31/2025

4.2 Temperature Limits

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

Required Action	Due Date
Report on Effluent Discharges: Submit a report on effluent temperature with conclusions regarding compliance. If the Department determines that because of data variability, 24 months of monitoring data is required to determine the need for temperature limits, the Department will so notify the permittee in writing and all dates in the permit schedule will be extended by 12 months. Informational Note - Refer to the Surface Water subsection regarding 'Determination of Need for Effluent Limits' for information concerning a Department determination on the need for limits and pursuing re-evaluation of limits per NR 106 Subchapters V & VI or NR 102.26, Wis. Adm. Code.	01/15/2026
Action Plan: Submit an action plan for complying with all effluent temperature limits that remain following the Department's review for necessity.	06/30/2026
Construction Plans: Submit construction plans (if construction is required for complying with effluent temperature limits) and include plans and specifications with the submittal.	12/31/2026
Initiate Actions: Initiate actions identified in the plan.	06/30/2027
Complete Actions: Complete actions necessary to achieve compliance with effluent temperature limits.	12/31/2027

4.3 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.	01/31/2026

Annual WQT Report #2: Submit an annual WQT report that shall cover the previous year.	01/31/2027
Annual WQT Report #3: Submit an annual WQT report that shall cover the previous year.	01/31/2028
Annual WQT Report #4: Submit the 4th annual WQT report. If the permittee wishes to continue to comply with phosphorus limits through WQT in subsequent permit terms, the permittee shall submit a 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 trading plan for the previous calendar year.	

Explanation of Schedules

Land Application Management Plan – Per NR 214 Wis. Adm. Code, all land application of industrial sludge must follow an approved management plan.

Temperature Limits – At this time it is not know if the permittee can meet all temperature limits. The schedule allows time to come into compliance with all limitations.

Annual Water Quality Trading (WQT) Reports - Reports are required that include the following information:
- Verification that site inspections occurred;
- Results 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

Attachments:

"Water Quality-Based Effluent Limitations for Cambrian Innovation (WI-0067041-01-0)" memo dated July 9, 2024
"Technology-Based Effluent Limitations for Cambrian Innovation (WI-0067041-01-0)" memo dated July 9, 2024

WQT Plan dated 8/30/2024

WQT approval letter dated 9/23/2024

Expiration Date:

December 31, 2029

Justification Of Any Waivers From Permit Application Requirements

N/A

Prepared By: Sheri A. Snowbank Wastewater Specialist
Date: September 13, 2024
Date updated based on Factcheck comments: October 14, 2024 (A number of comments were received October 11, 2024 correcting process and sampling information at the new facility.)
Date updated based on public notice comments:

Notice of issuance was published in the Barron News-Shield, PO Box 100, Barron, WI 54812-0100.

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: July 9, 2024

TO: Sheri Snowbank – NOR/Spooner Service Center

FROM: Michael Polkinghorn – NOR/Rhinelander Service Center Michael Polkinghorn

SUBJECT: Water Quality-Based Effluent Limitations for Cambrian Innovation
WPDES Permit No. WI-0067041-01-0

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 Cambrian Innovation in Barron County. This industrial facility discharges to an unnamed tributary to the Hay River, located in the located in the Hay River Watershed in the Lower Chippewa Basin. This discharge is included in the Tainter Lake/Lake Menomin total maximum daily load report as approved by EPA. 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	6-Month Average	Footnotes
Flow Rate						1
BOD$_5$ May – October November – April	 **8.2 mg/L** **16 mg/L**		 5.0 mg/L 10 mg/L	 **5.0 mg/L** **10 mg/L**		2, 3, 4
TSS	**16 mg/L**		10 mg/L	**10 mg/L**		2, 3, 4
pH	9.0 s.u.	6.0 s.u.				2, 5
Dissolved Oxygen		7.0 mg/L				2
Phosphorus				0.225 mg/L 0.013 lbs/day	0.075 mg/L 0.18 lbs/day	6
Chloride						7
Ammonia Nitrogen						8
Additives – Multiple						9
TKN, Nitrate+Nitrite, and Total Nitrogen						10
Temperature	Variable		Variable			11
Acute WET						12, 13
Chronic WET						14, 15

Footnotes:

1. Monitor whenever the discharge occurs.
2. These limits are based on the protection of the WWSF community of the UT.
3. Additional mass limits based on ch. NR 240, Wis. Adm. Code, will be addressed in a separate evaluation based on current production.
4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
5. These limits are required to control the discharge of the citric, nitric, and sulfuric acids additives

in the discharge.

6. A water quality trading plan has been submitted as an alternative compliance option to offset any total phosphorus discharged from this outfall that exceed the phosphorus WQBELs. The phosphorus WQBELs may be expressed as computed compliance limits. Cambrian Innovation is considered a "new discharger" as described in s. NR 217.11(3), Wis. Adm. Code, and cannot receive a compliance schedule as described in section NR 217.17(4), Wis. Adm. Code. Therefore, any phosphorus limits would need to be met upon commencing discharge to the UT.
7. Chloride monitoring at a frequency of 4x/month on consecutive days is recommended during the first permit term to determine the need of chloride limits at the next permit reissuance.
8. Ammonia nitrogen monitoring at a frequency of 3x/week is recommended during the first permit term to determine the need of ammonia nitrogen limits at the next permit reissuance.
9. All additives are approved for use at their requested maximum dosages and use frequencies during the reissued permit term in the table below. The Department should be notified if the facility wishes to use any new additive, any approved additive at a greater dosage rate(s) or use frequency(ies) than currently approved, or if updated toxicity information for an additive is available from the chemical manufacturer. An additional additive review evaluation will be needed in any case.

Approved Additives

Additive	Max Dosage	Max Use Frequency (days/wk)
Alum	65 GPD	7
Cationic Polymer (A-1090T-GR)	14 GPD	6
Sodium Hydroxide 50%	1 GPD	2
Citric Acid	1.5 lbs/day	1
Nitric Acid	0.5 GPD	1
Biogas1	9 GPD	1
Ferric Sulfate 60%	110 GPD	7
Rare Earth (RE300)	8 GPD	7
Sodium Bisulfite 38%	1 GPD	1
Sulfuric Acid 93%	40 GPD	7

10. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen monitoring is recommended for class A cheese plants. Total nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total Kjeldahl nitrogen (TKN) (all expressed as N).
11. In accordance with s. NR 106.56(12), Wis. Adm. Code, when representative effluent temperature data is not available at the time of permit reissuance, the proposed permit shall include effluent temperature monitoring (for at least one year), WQBELs for temperature, and a compliance schedule to meet the temperature limits.

Monthly Temperature Limits

Month	Calculated Effluent Limit	
	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	49	76
FEB	50	76
MAR	52	77
APR	55	79
MAY	65	82
JUN	76	84
JUL	81	85
AUG	81	84
SEP	73	82
OCT	61	80
NOV	49	77
DEC	49	76

12. An acute WET limit trigger is recommended in the reissued permit. Acute WET tests should be performed quarterly for 12 months. If all tests pass during that period, acute WET monitoring can be reduced to 2x/yr for the remainder of the permit term, but an acute WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule should be initiated which requires a toxicity reduction evaluation (TRE) to be completed, followed by the imposition of an acute WET limit and quarterly acute testing for the remainder of the permit term. The acute WET limit shall be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit.
13. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Acute tests should be done in rotating quarters to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).
14. A chronic WET limit trigger is recommended in the reissued permit. Chronic WET tests should be performed quarterly for 12 months. If all tests pass during that period, quarterly chronic WET monitoring shall continue for the remainder of the permit term, but a chronic WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule shall be initiated which requires a TRE to be completed, followed by the imposition of a chronic WET limit and quarterly chronic testing for the remainder of the permit term. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.
15. The Instream Waste Concentration (IWC) to assess chronic test results is 100%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 75%, 50%, 25% & 12.5% and the dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the unnamed tributary (UT) upstream of the confluence with Outfall 001. If flow is not present in the UT, then dilution water may be collected from the Hay River upstream of the confluence with the UT. Sampling WET concurrently with any chemical-specific toxic substances

is recommended and should continue after the permit expiration date (until the permit is reissued).

Antidegradation
The proposed discharge is considered a "new discharge" under chapter NR 207, Wis. Adm. Code and is subject to the antidegradation requirements in NR 207.04, Wis. Adm. Code. To receive permit coverage for the discharge of any pollutant, the facility must submit a demonstration that one or more of the important economic or social development conditions listed in NR 207.04(c), Wis. Adm. Code, will be accommodated by the new discharger:

a. The discharger will be increasing its employment.
b. The discharger will be increasing its production level.
c. The discharger will be avoiding a reduction in its employment level.
d. The discharger will be increasing its efficiency.
e. There will be industrial, commercial, or residential growth in the community.
f. The discharger will be providing economic or social benefit to the community.
g. The discharger will be correcting an environmental or public health problem.

The proposed discharge will not result in a significant lowering of water quality as defined in NR 207.05, Wis. Adm. Code, because the receiving water does not have any assimilative capacity and limits are set equal to criteria. Therefore NR 207.04(d), Wis. Adm. Code, also does not apply in this case.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Michael Polkinghorn at (715) 360-3379 or Michael.Polkinghorn@wisconsin.gov and Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, discharge area map, & thermal table.

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Attachment #1

Water Quality-Based Effluent Limitations for Cambrian Innovation

WPDES Permit No. WI-0067041-01-0

Prepared by: Michael A. Polkinghorn

PART 1 – BACKGROUND INFORMATION

Facility Description

Saputo Cheese USA, Inc in Almena, WI (SCUSA – Almena) processes milk into blue cheese and hard Italian cheeses. Process wastewater generated by these operations enters lift stations where the wastewater is pumped to Cambrian's wastewater treatment plant owned and operated by Cambrian Almena LLC. Wastewater will be actively managed and treated based upon the influent characteristics. High strength wastewater will be isolated and actively diverted to the anaerobic membrane bioreactor (AnMBR) system. Low strength wastewater will also be isolated and sent to the aerobic membrane bioreactor system (AeMBR). AnMBR permeate requires further aerobic treatment that is accomplished by sending the AnMBR permeate to the AeMBR system. The AeMBR process removes biodegradable organics and oxidizes ammonia, as well as capturing phosphorus using an enhanced biological phosphorus removal (EBPR) technique integrated into the AeMBR process. The AeMBR permeate contains minimal residual phosphorus which must be chemically precipitated and separated with the phosphorus ultrafiltration (P-UF) process. This wastewater is then cooled prior to discharge. Effluent is discharged on a continuous basis via Outfall 001 to an unnamed tributary (UT) to the Hay River, approx. 170 ft west of 6th St./CTH P and 1,625 ft north of the 10 ½ Ave./CTH P intersection. Generated industrial sludge residuals are stored in slurry form and dewatered via a screw press prior to disposal.

A limit evaluation (June 2020) for facility planning purposes was prepared for Outfall 002 of SCUSA – Almena (WPDES permit #: 0050725) evaluating the potential limits for both the discharge of condensate of whey (COW) water only and the combination of COW water and process wastewater. This discharge shares similarities with Outfall 001 such as sharing the same discharge location and influent wastewater characterization (process wastewater). The differences include being regulated under a new permit, new permittee, and new effluent characterization achieved via the new treatment process described earlier. Therefore, this evaluation will consider the limits determined from the June 2020 limit evaluation, in addition to, the limits in the current permit for SCUSA – Almena (below).

Attachment #2 is a discharge area map of Outfall 001.

Existing Permit Limitations

This is the first permit issuance for Outfall 001 of Cambrian Innovation so there are no currently effective limits in the permit. SCUSA – Almena's current permit, expiring on 06/30/2026, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Monthly Average	Footnotes
Flow Rate				1

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Monthly Average	Footnotes
BOD_5	**40 mg/L**		20 mg/L	2, 3
TSS	**40 mg/L**		20 mg/L	2, 3
pH	9.0 s.u.	6.0 s.u.		2
Dissolved Oxygen		4.0 mg/L		2
Ammonia Nitrogen				1
Phosphorus				1
Temperature	100 °F			4
Conductivity				1
Acute WET				5
Chronic WET				5

Footnotes:

1. Monitoring only.
2. These limits are based on the Limited Aquatic Life (LAL) community of the immediate receiving water as described in s. NR 104.02(3)(b), Wis. Adm. Code.
3. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
4. This is a best profession judgment-based limit as described in subch. 3 of NR 220, Wis. Adm. Code.
5. Acute and chronic tests shall be conducted during periods of discharge. Testing periods shall be at least 30 days apart and testing will not exceed twice a year. The permittee is required to notify the department prior to a discharge from Outfall 002, the department compliance engineer will develop an appropriate Acute and Chronic WET testing schedule. The IWC for chronic WET was 100%.

Receiving Water Information

- Name: UT to the Hay River
- Waterbody Identification Code (WBIC): 3000238 for UT. 2068600 for Hay River.
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply for both UT and Hay River.
  - Limits in the current permit for SCUSA – Almena was based on an LAL community classification. This classification is not in ch. NR 104 and has been included in the latest rule revision proposal to ch. NR 104 dated April 2003. There is no use designation survey documentation that support this classification from SE ¼, NE ¼, Section 12; T33N – R14W (Outfall 001 location) downstream to the NE ¼, Section 8; T33N – R13W (Town road crossing – 10 ½ avenue), just upstream of the confluence of the Hay River. A preliminary assessment to determine the receiving water's natural biological community status was conducted in September 2019 and was inconclusive due to the excessive growth of reed canary grass and cattails throughout the survey area. An additional fish survey was planned in 2020 but did not happen due to the COVID pandemic. After consultation with the Department Water Quality Specialist and regional Stream Biologist, the UT is likely to support a WWSF community considering the continuous discharge of Outfall 001 (0.28 MGD = 0.43 cfs). Therefore, the WWSF community classification will be utilized in this evaluation.
  - Downstream impacts to the Hay River are not considered in this evaluation since the UT has the

same RW classification with less assimilative capacity.

- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The low flows for the UT are zero.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: Not applicable where the receiving water low flows are zero.
- Source of background concentration data: Background concentrations are not included because they do not impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: None.
- Impaired water status: There are no known impairments to the UT. Approx. 3.5 mi downstream of Outfall 001, the Hay River is on the Clean Water Act Section 303d list for a phosphorus impairment. This discharge is included in the Tainter Lake/Lake Menomin TMDL to address phosphorus impairments within the TMDL area.

Effluent Information

- Flow rate(s):
  Maximum annual average = 0.28 million gallons per day (MGD)
  For reference, the flow rate estimate used for process wastewater in the previous limit evaluation (June 2020) was 0.485 MGD.
- 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: Water supply from private wells.
- Total phosphorus wasteload allocation (WLA): 2.5 lbs/year = 0.007 lbs/day (see Table 5 of the TMDL report document, "*Phosphorus Total Maximum Daily Loads (TMDLs) Tainter Lake and Lake Menomin Dunn County, Wisconsin, May 2012,* page 15*"*).
- Additives: The facility has included 10 additives in the permit application that will be used in the process waste stream to Outfall 001. These additives are listed below:
  - PRO Chemical & Dye Alum – Chemical phosphorus treatment.
  - Aquablue Cationic Polymer (A-1090T-GR) – Sludge dewatering conditioner.
  - MilliporeSigma Sodium Hydroxide 50% – Cleaning-in-place (CIP) and alkalinity addition to digester.
  - MilliporeSigma Citric Acid – CIP.
  - Fisher Scientific Nitric Acid – CIP.
  - Aquafix Biogas1 – Correct nutrient deficiency.
  - Chemtrade Logistics Ferric Sulfate 60% – Sludge coagulant.
  - Hill Brothers Chemical Ferric Chloride – Address nutrient deficiency in digester.
  - Neo Chemicals & Oxides Rare Earth (RE300) – Phosphorus precipitation.
  - PVS Chemical Solutions Sodium Bisulfite 38% – Membrane preservative.
  - Univar Solutions Sulfuric Acid 93% – pH adjuster.
  - The need for any limits or use restrictions for these additives is evaluated in Part 8 of this evaluation.
- Effluent characterization: This facility is categorized as a secondary industry and could not provide standard monitoring requirement samples since Outfall 001 is not yet active. In this case, effluent information from similar discharges will be used to determine the need for monitoring for substances when appropriate to further determine the need for limits at the next permit reissuance.

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)

Chloride – A review of limit evaluations for other discharges of dairy process wastewaters have shown effluent chloride concentrations can be at levels of concern to the point chloride WQBELs are needed. The applicable chloride WQBELs for Outfall 001 should reasonable potential be demonstrated are 760 mg/L as a daily maximum and 400 mg/L as a weekly average for informational purposes. **Therefore, chloride monitoring at a frequency of 4x/month on consecutive days is recommended during the first permit term to determine the need of chloride limits at the next permit reissuance.**

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Based on the type of discharge and the lack of available PFOS/PFOA effluent and source water monitoring data, **PFOS and PFOA monitoring is not recommended during the permit term.** The Department may re-evaluate 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.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR CONVENTIONAL POLLUTANTS

In establishing BOD_5 limitations, the primary intent is to prevent a lowering of dissolved oxygen levels in the receiving water below water quality standards as specified in ss. NR 102.04(4)(a) and (b). The 26-lb method is the most frequently used approach for calculating BOD_5 limits when resources are not available to develop a detailed water quality model. This simplified model was developed in the 1970's by the Wisconsin Committee on Water Pollution on the Fox, Wisconsin, Oconto, and Flambeau Rivers. Further studies throughout the 1970's proved this model to be relatively accurate. The model has since then been used by the Department on many occasions when resources are not available to perform a site-specific model. The "26” value stems from the following equation:

$$\frac{26\ {}^{\text{lbs}}\!/_{\text{day}}}{{}^{\text{ft}^3}\!/_{\text{sec}}} * \frac{1\,\text{day}}{86{,}400\,\text{sec}} * \frac{454{,}000\,\text{mg}}{\text{lbs}} * \frac{1\,\text{ft}^3}{28.32\,\text{L}} = 4.8 = 2.4 * 2\ {}^{\text{mg}}\!/_{\text{L}}$$

The 4.8 mg/L has been calculated by taking 2.4 mg/L which is the number one receives when converting 26 lbs. of BOD/day/cfs into mg/L, multiplied by 2.0 which is the change in the DO level. A typical background DO level for Wisconsin waters is 7 mg/L, so a 2 mg/L decrease is allowed to meet the 5 mg/L standard for warm water streams. The above relationship is temperature dependent and an appropriate temperature correction factor is applied. The 26-lb method is based on a typical 24°C summer value for warm water streams. Adjustments for temperature are made using the following equation:

$$k_t = k_{24}\left(0.967^{(T-24)}\right)$$

Where k_{24} = 26 lbs. of BOD/day/cfs

Calculations based on Full Assimilative Capacity at 7-Q_{10} Conditions:

$$Limitation(mg/L) = 2.4\left(DO_{stream} - DO_{std}\right)\left(\frac{\left({}_7Q_{10} + Q_{eff}\right)}{Q_{eff}}\right)\left(0.967^{(T-24)}\right)$$

Where:

Q_{eff} = effluent flow = 0.28 MGD
DO_{stream} = background dissolved oxygen = 7.0 mg/L
DO_{std} = dissolved oxygen criteria from s. NR 102.04(4), Wis. Adm. Code = 5.0 mg/L
7-Q_{10} = 0 cfs
T = Receiving water temperature from s. NR 102.25, Wis. Adm. Code

Because no dilution is available in the receiving water, the calculated limits would be the lowest that the Department typically gives to facilities per standing policy. **These effluent limitations are 5.0 mg/L during May – October and 10 mg/L during November – April, expressed as weekly average limits. A dissolved oxygen limit of 7.0 mg/L as a daily minimum is also recommended.** This is consistent with the assumed dissolved oxygen effluent concentration in the calculation of the BOD_5 limitations. Mass limits for BOD_5 are not required because the receiving water will be effluent dominated.

Revisions to chs. NR 106 and 205, Wis. Adm. Code, align Wisconsin's WQBELs with 40 CFR 122.45(d), which requires WPDES permits to contain daily maximum and monthly average limits for industrial discharges. In this case, whenever a weekly average limitation is determined necessary to protect water quality:

- A monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
- A daily maximum limitation shall also be included in the permit and set equal to the daily maximum WQBEL calculated under s. NR 106.06, Wis. Adm. Code, or a daily maximum limitation calculated using the following procedure, whichever is more restrictive:

Daily Maximum Limitation = Weekly average WQBEL × DMF

Where:

DMF = Daily Multiplication Factor as defined in Table 2
CV = coefficient of variation (CV) as calculated in s. NR 106.07(5m), Wis. Adm. Code.
= 0.6 due to lack of effluent BOD_5 data.

s. NR 106.07 (4) (e). Table 2 — Daily Multiplication Factor

CV	0.1	0.2	0.3	0.4	0.5	**0.6**	0.7	0.8	0.9	1.0
DMF	1.114	1.235	1.359	1.460	1.557	**1.639**	1.712	1.764	1.802	1.828

CV	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
DMF	1.842	1.849	1.851	1.843	1.830	1.815	1.801	1.781	1.751	1.744

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

Therefore, the daily maximum and monthly average BOD_5 limits of 8.2 and 5.0 mg/L, respectively,

are required during May – October. The daily maximum and monthly average BOD_5 limits of 16 and 10 mg/L, respectively, are required during November – April.

Total Suspended Solids (TSS)

Total suspended solids (TSS) effluent limits are regulated via narrative standards described in NR 102.04(1), Wis. Adm. Code. TSS effluent limits are included whenever BOD_5 WQBELs are needed and are set equal to the BOD_5 limits but no lower than 10 mg/L per Department policy. **Because BOD_5 WQBELs are recommended, the weekly average TSS limit of 10 mg/L is also recommended during the reissued permit term.**

Similar to BOD_5, daily maximum and monthly average TSS limits are also needed to satisfy expression of limits requirements. **Therefore, the daily maximum and monthly average TSS limits of 16 and 10 mg/L, respectively, are required during the reissued permit term.**

pH

The current permit for SCUSA – Almena has the daily minimum and daily maximum limit range of 6.0 – 9.0 s.u. which are categorical limits for a discharge to an LAL community receiving water. Cambrian Innovation will also be utilizing citric, nitric, and sulfuric acids in the process waste stream to Outfall 001. These existing pH limits will control the discharge of these additives to meet the pH water quality standards as described in s. NR 102.04(4)(c), Wis. Adm. Code. **Therefore, the pH limits are recommended during the first permit term.**

PART 4 – 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. Given the fact that the Cambrian Innovation does not currently have ammonia nitrogen limits, the need for limits is evaluated at this time.

A review of limit evaluations for similar discharges of dairy process wastewaters have shown effluent ammonia nitrogen concentrations can be at levels of concern to the point ammonia nitrogen WQBELs are needed. **Therefore, ammonia nitrogen monitoring at a frequency of 3x/week is recommended during the first permit term to determine the need of ammonia nitrogen limits at the next permit reissuance.**

PART 5 – PHOSPHORUS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires industrial facilities that discharge greater than 60 pounds of total phosphorus per month to comply with a 12-month rolling average limit of 1.0 mg/L, or an approved alternative concentration limit. There is currently no effluent phosphorus concentration or flow rate data to determine the need of a technology-based limit. For informational purposes, the technology-based limit would be needed at an effluent concentration of 0.856 mg/L based on an effluent flow of 0.28 MGD.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

The TL/LM TMDL report was written to ensure that phosphorus water quality criteria are attained in Tainter Lake and Lake Menomin and are not necessarily protective of phosphorus water quality of other surface waterbodies in the TMDL area. Therefore, the need for a phosphorus WQBEL as described in s. NR 217.13, Wis. Adm. Code, must be considered in addition to any limits required by the TMDL report.

Section NR 102.06(3)(a), Wis. Adm. Code, specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), Wis. Adm. Code, s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.075 mg/L applies for the UT.

The conservation of mass equation is described in s. NR 217.13(2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs) provided below.

$$\text{Limitation} = [(WQC)(Qs+(1-f)\ Qe) - (Qs-f\ Qe)\ (Cs)]/Qe$$

Where:

WQC = 0.075 mg/L for the UT.
Qs = 100% of the 7-Q_2 of 0 cfs.
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code
Qe = effluent flow rate = 0.28 MGD = 0.43 cfs.
f = the fraction of effluent withdrawn from the receiving water = 0.

The effluent limit is set equal to criteria because the receiving water flow is equal to zero.

Reasonable Potential Determination

Cambrian Innovation is considered a “new discharger” as described in s. NR 217.11(3), Wis. Adm. Code. Section NR 217.15(1)(e), Wis. Adm. Code, states the department shall include a phosphorus WQBEL in a permit for a new discharger if the Department determines the new discharger will discharge phosphorus at concentrations or loadings which may cause or contribute to exceedances of the water quality criteria in either the receiving water or downstream waters. To estimate the amount of phosphorus discharged by a new discharger, the department may consider projected discharge information from the permit applicant and phosphorus discharge information from similar sources.

A review of limit evaluations for similar discharges of dairy process wastewaters have shown effluent phosphorus concentrations can be at levels of concern to the point phosphorus WQBELs are needed. **Therefore, a phosphorus WQBEL based on s. NR 217.13, Wis. Adm. Code, is required.**

Limit Expression

According to s. NR 217.14(2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, **the effluent limit of 0.075 mg/L may be expressed as a six-month average.** If a concentration limitation expressed as a six-month average is included in the permit, **a monthly average concentration limitation of 0.225 mg/L, equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code shall also be included in the permit.** The six-month average should be averaged during the months of May – October and November – April.

Mass Limits
A mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code, because the Hay River has a phosphorus impairment, approx. 3.5 mi downstream of Outfall 001. **This final mass limit shall be 0.075 mg/L × 8.34 × 0.28 MGD = 0.18 lbs/day expressed as a 6-month average.**

TMDL Limit
The TL/LM TMDL expresses WLAs for TP as maximum annual loads (pounds per year) and maximum daily loads (pounds per day), which equal the maximum annual loads divided by the number of days in the year. For Cambrian Innovation, these phosphorus WLAs are 2.5 lbs/yr and 0.007 lbs/day. These WLAs were originally allocated to SCUSA – Alema facility but will be utilized for Cambrian Innovation since they will be treating the surface water discharge from the SCUSA – Almena facility.

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 the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL. Therefore, limits given to facilities included in the TL/LM TMDL are given monthly average mass limits since the TL/LM TMDL WLAs are derived on an effluent concentration of 1 mg/L or greater. The monthly average limit of 0.013 lbs/day was determined in the previous facility planning limit evaluation (June 2020). The multiplier of 1.90 was chosen utilizing the parameters of CV = 0.6 and a weekly or less effluent monitoring scheme as described in the Department guidance document, "*TMDL Implementation Guidance for Wastewater Permits Edition No. 6, (March 2024)*". **Therefore, the monthly average limit of 0.013 lbs/day should be included in the reissued permit regardless of reasonable potential.**

Cambrian Innovation is considered a "new discharger" as described in s. NR 217.11(3), Wis. Adm. Code, and cannot receive a compliance schedule as described in section NR 217.17(4), Wis. Adm. Code. Therefore, any phosphorus limits would need to be met upon commencing discharge to the UT.

Water Quality Trading Minimum Control Level
A WQT plan has been submitted as an alternative compliance option to offset any total phosphorus discharged from Outfall 001 that exceed the phosphorus WQBELs. The phosphorus WQBELs may be expressed as computed compliance limits, but a maximum control level (MCL) must be set as a limit not to be exceeded at the outfall location. In this case an MCL cannot be determined at this time because Outfall 001 is a new discharge with no available effluent phosphorus data. **Therefore, an MCL is not recommended during the reissued permit term.**

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. Calculated limits are set equal to criteria based on a WWSF classification due to estimated zero low-flow in the receiving water. The complete thermal table used for calculations is included as attachment #3.

Monthly Temperature Limits

Month	Calculated Effluent Limit	
	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	49	76
FEB	50	76
MAR	52	77
APR	55	79
MAY	65	82
JUN	76	84
JUL	81	85
AUG	81	84
SEP	73	82
OCT	61	80
NOV	49	77
DEC	49	76

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

In accordance with s. NR 106.56(12), Wis. Adm. Code, when representative effluent temperature data is not available at the time of permit reissuance, **the proposed permit shall include effluent temperature monitoring (for at least one year), WQBELs for temperature, and a compliance schedule to meet the temperature limits.**

The following general options are available for a facility to explore potential relief from the temperature limits:

- Effluent monitoring data: Verification or additional effluent monitoring (flow and/or temperature) may be appropriate if there were questions on the representativeness of the current effluent data.
- Collection of site-specific ambient temperature: default background temperatures for streams in Wisconsin, so actual data from the direct receiving water may provide for relaxed thermal limits but only if the site-specific temperatures are lower than the small stream defaults used in the above tables
- A variance to the water quality standard: This is typically considered to be the least preferable and most complex option as it requires the evaluation of the other alternatives.

These options are explained in additional detail in the August 15, 2013 Department *Guidance for Implementation of Wisconsin's Thermal Water Quality Standards*.

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).*

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.

- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09(3)(b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 100% shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

$$\text{IWC (as \%)} = Q_e \div \{(1 - f)\, Q_e + Q_s\} \times 100$$

  Where:

  Q_e = annual average flow = 0.28 MGD = 0.43 cfs.
  f = fraction of the Q_e withdrawn from the receiving water = 0.
  Q_s = ¼ of the 7-Q_{10} = 0 cfs ÷ 4 = 0 cfs.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.

Attachment #1

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.

- Shown below is a tabulation of all available WET data for Outfall 002 of SCUSA – Almena's permit and will be used to make WET-based decisions for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

WET Data History

Date Test Initiated	Acute Results LC_{50} % (% survival in 100% effluent)				Chronic Results IC_{25} %				Footnotes or Comments
	C. dubia	Fathead minnow	Pass or Fail?	Used in RP?	*C. dubia*	Fathead Minnow	Pass or Fail?	Use in RP?	
10/26/1995	68.7	>100	Fail	Yes	4.2	12.3	Fail	Yes	
12/07/1995	>100	>100	Pass	Yes	95	NA	Fail	No	1
03/26/1996	>100	>100	Pass	Yes					
09/24/1996	>100	>100	Pass	Yes	>100	NA	NA	No	1
09/23/1997	>100	>100	Pass	Yes	60.6	75.7	Fail	Yes	
09/25/1997	0	>100	Fail	Yes	14.7	82.8	Fail	Yes	
12/09/1997					68.4	>100	Fail	Yes	
12/16/1997					65.2	>100	Fail	Yes	
03/11/1998	>100	>100	Pass	Yes					
08/04/1998	70.7	>100	Fail	Yes	47.9	NA	Fail	No	1
09/22/1998	74.2	>100	Fail	Yes	58.5	>100	Fail	Yes	
12/15/1998	>100	>100	Pass	Yes	66.3	40	Fail	Yes	
06/08/1999					NA	NA	NA	No	1
12/01/1999	>100	>100	Pass	Yes	65.9	>100	Fail	Yes	

Footnotes:

1. *Qualified or Inconclusive Data.* Data quality concerns were noted during testing which calls into question the reliability of the test results.

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.

Acute Reasonable Potential = [(TUa effluent) (B)(AMZ)]

Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUc effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC_{50}, IC_{25} or $IC_{50} \geq 100\%$).

Acute Reasonable Potential = [(TUa effluent) (B)]

The lowest LC_{50} value is zero (09/25/1997) which results in an undefined TU_a. The next lowest value of 68.7 (10/26/1995) is used for the reasonable potential calculation.

Acute WET Limit Parameters

TUa (maximum) 100/LC_{50}	**B** (multiplication factor from s. NR 106.08(5)(c), Wis. Adm. Code, Table 4)
100/68.7 = 1.5	2.6 Based on 4 detects

[(TUa effluent) (B)] = 3.8 > 1.0

Chronic Reasonable Potential = [(TU_c effluent) (B)(IWC)]

Chronic WET Limit Parameters

TUc (maximum) 100/IC_{25}	**B** (multiplication factor from s. NR 106.08(6)(c), Wis. Adm. Code, Table 4)	IWC
100/4.2 = 24	1.9 Based on 8 detects	100%

[(TUc effluent) (B)(IWC)] = 45 > 1.0

Therefore, reasonable potential is shown acute and chronic WET using the procedures in s. NR 106.08(6), Wis. Adm. Code, and representative data from October 1995 – December 1999.

Expression of WET limits

Acute WET limit = 1.0 TU_a as a daily maximum.

Chronic WET limit = [100/IWC] TU_c = 1.0 TU_c as a monthly average.

The WET checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET checklist, see Chapter 1.3 of the WET Guidance

Attachment #1

Document: https://dnr.wisconsin.gov/topic/Wastewater/WET.html.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not applicable. **0 Points**	IWC = 100%. **15 Points**
Historical Data	11 tests used to calculate RP. 4 tests failed. No data available for the past 5 years. **5 Points**	8 tests used to calculate RP. 8 tests failed. No data available for the past 5 years. **5 Points**
Effluent Variability	Discharge not active. **0 Points**	Discharge not active. **0 Points**
Receiving Water Classification	WWSF community. **5 Points**	Same as acute. **5 Points**
Chemical-Specific Data	Dairy process wastewater will likely have at least detectable amounts of ammonia nitrogen and chloride. **2 Points**	Dairy process wastewater will likely have at least detectable amounts of ammonia nitrogen and chloride. **2 Points**
Additives	No biocides and 11 water quality conditioners added. Permittee has proper P chemical SOPs in place: No. **26 Points**	All additives used more than once per 4 days. **26 Points**
Discharge Category	Dairy/cheesemaker. **20 Points**	Same as acute. **20 Points**
Wastewater Treatment	Secondary or better. **0 Points**	Same as acute. **0 Points**
Downstream Impacts	No impacts known. **0 Points**	Same as acute. **0 Points**
Total Checklist Points:	**58 Points**	**73 Points**
Recommended Monitoring Frequency (from Checklist):	2x/yr acute tests.	Quarterly chronic tests.
Limit Required?	Limit = 1.0 TU_a	Limit = 1.0 TU_c
TRE Recommended? (from Checklist)	Yes.	Yes.

- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, both acute and chronic WET limits are required. The acute WET limit shall be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.

- A minimum of annual acute and chronic monitoring is required because acute and chronic WET limits are required. Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present. In this case, after consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, 2x/yr acute and quarterly chronic WET tests are recommended instead in the reissued permit. Acute tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).

- The available WET data suggests a potential concern for acute and chronic toxicity represented by the prior stated recommendations. However, it is questionable whether this available WET data is representative of the current or future discharges. The existing WET data is based on discharge scenarios where the wastewater in question was both untreated process wastewater (including COW water) and treated in the previous aerated lagoon system WWTF. The new WWTF is expected to have significantly greater treatment capability treating process wastewater but the degree of the effect it will have on removing acute and chronic WET is uncertain. **Therefore, it is recommended that acute and chronic WET limit triggers be placed in the reissued permit**.

- **Acute WET Limit Trigger: Acute WET tests should be performed quarterly for 12 months. If all tests pass during that period, acute WET monitoring can be reduced to 2x/yr for the remainder of the permit term, but an acute WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule should be initiated which requires a toxicity reduction evaluation (TRE) to be completed, followed by the imposition of an acute WET limit and quarterly acute testing for the remainder of the permit term. The acute WET limit shall be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit.**

- **Chronic WET Limit Trigger: Chronic WET tests should be performed quarterly for 12 months. If all tests pass during that period, quarterly chronic WET monitoring shall continue for the remainder of the permit term, but a chronic WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule shall be initiated which requires a TRE to be completed, followed by the imposition of a chronic WET limit and quarterly chronic testing for the remainder of the permit term. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.**

PART 8 – ADDITIVE REVIEW

Unlike the metals and toxic substances evaluated in Part 2, most additives have not undergone the amount of toxicity testing needed to calculate water quality criteria. Instead, in cases where the minimum data requirements necessary to calculate a WQC are not met, a secondary value can be used to regulate the substance, according to s. NR 105.05, Wis. Adm. Code. Whenever an additive is discharged directly into a surface water without receiving treatment or an additive is used in the treatment process and is not expected to be removed before discharge, a review of the additive is needed. Secondary values should be derived according to s. NR 105.05, Wis. Adm. Code. Guidance related to conducting an additive review can be found in *Water Quality Review Procedures for Additives* (2019) (http://dnr.wi.gov/topic/wastewater/Guidance.html).

Additive Parameters

Additive Name	Manufacturer	Purpose of Additive including where added	Use Frequency (days/wk)	Max Quantity Used	Equivalent Effluent Conc. (mg/L)	Potential Use Restriction
Alum[1]	PRO Chemical & Dye	Chemical phosphorus treatment	7	65 GPD	NA	SOP
Cationic Polymer (A-1090T-GR)[2]	Aquablue	Sludge dewatering conditioner	6	14 GPD	NA	Not expected in discharge.

Attachment #1

Additive Name	Manufacturer	Purpose of Additive including where added	Use Frequency (days/wk)	Max Quantity Used	Equivalent Effluent Conc. (mg/L)	Potential Use Restriction
Sodium Hydroxide 50%[2]	MilliporeSigma	Cure-in-place (CIP) and digester alkalinity adjuster	2	1 GPD	NA	Toxicity documented/understood.
Citric Acid[2]	MilliporeSigma	CIP	1	1.5 lbs/day	NA	pH WQBELs
Nitric Acid[2]	Fisher Scientific	CIP	1	0.5 GPD	NA	pH WQBELs
Biogas1[3]	Aquafix	Nutrient deficiency correction	1	9 GPD	32 mg/L	DM = 230 mg/L
Ferric Sulfate 60%[1]	Chemtrade Logistics	Nutrient deficiency and sludge coagulant	7	110 GPD	NA	SOP
Rare Earth (RE300)[1]	Neo Chemicals & Oxides	Phosphorus precipitation	7	8 GPD	NA	SOP
Sodium Bisulfite 38%[2]	PVS Chemical Solutions	Membrane preservative	1	1 GPD	NA	Toxicity documented/understood.
Sulfuric Acid 93%	Univar Solutions	pH adjuster	7	40 GPD	NA	pH WQBELs

1. Potential toxicity caused by additives utilized for chemical phosphorus treatment are evaluated in Part 7 of this evaluation instead of an additive review.
2. An additive review is not necessary for any additives where either the toxicity is well documented and understood, can be controlled by a WQBEL, or are not believed to be present in the discharge.
3. Calculated based on toxicity data provided.

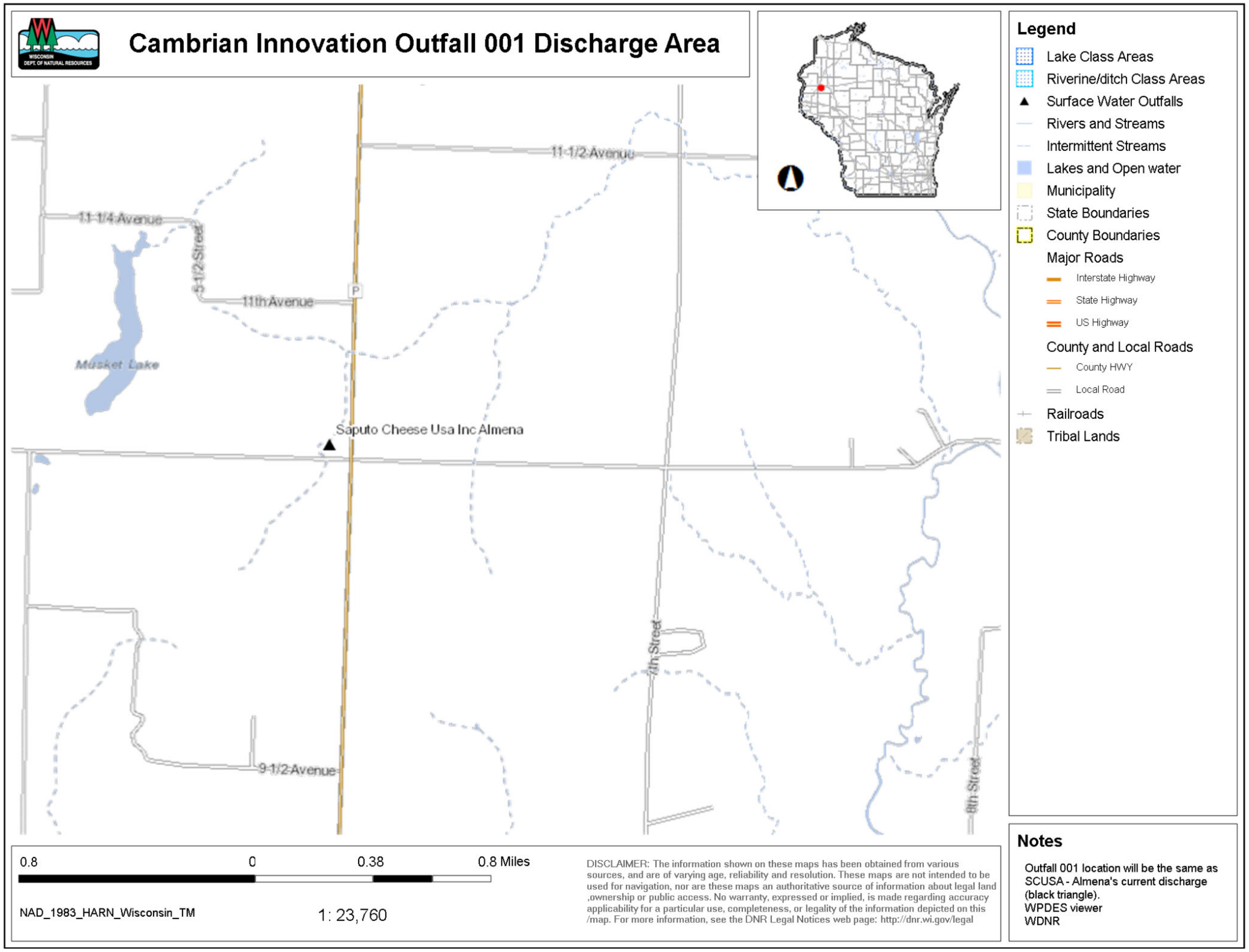
Biogas1 – This additive is used to correct a nutrient deficiency presumably in the anaerobic digester in the process waste stream to Outfall 001. Secondary acute and chronic values are determined based on acute toxicity test data provided by Cambrian Innovation. The secondary acute value is 229.29 mg/L and is set directly as a daily maximum limit of 230 mg/L using two significant figures. The secondary chronic value is 12.74 mg/L based on the default secondary acute to chronic ratio of 18 and is set equal as a weekly average limit of 13 mg/L rounded to two significant figures with no assimilative capacity in the receiving water. The weekly average limit is not needed because the discharge of effluent containing Biogas1 would be less than 4 consecutive days/wk (1x day/wk).

Cambrian Innovation has requested the use of this additive at a maximum dosage rate of 9 GPD. Assuming none of the additive is lost to the environment from the application point to Outfall 006, an additive density of 1 g/cm^3, and an effluent flow of 0.28 MGD, the equivalent effluent concentration is approx. 32 mg/L. This effluent concentration is below 1/5th of the daily maximum limit (46 mg/L). At the requested maximum dosage rate, limits or use restrictions are not recommended. **Therefore, this additive is approved at the requested maximum dosage rate and use frequency of 9 GPD and 1x day/wk for Outfall 001.**

Attachment #2

The Department should be notified if the facility wishes to use any new additive, any approved additive at a greater dosage rate(s) or use frequency(ies) than currently approved, or if updated toxicity information for an additive is available from the chemical manufacturer. An additional additive review evaluation will be needed in any case.

Attachment #2



Cambrian Innovation Outfall 001 Discharge Area

Notes

Outfall 001 location will be the same as SCUSA - Almena's current discharge (black triangle).
WPDES viewer
WDNR

Attachment #3

Temperature Limits for Receiving Waters with Unidirectional Flow

(calculation using default ambient temperature data)

Facility: Outfall 001
Outfall(s): 001
Date Prepared: 4/9/2024
Design Flow (Qe): 0.28 MGD
Storm Sewer Dist. 0 ft

7-Q$_{10}$: 0.00 cfs
Dilution: 25%
f: 0
Stream type: Small warm water sport or forage fis ▼
Qs:Qe ratio: 0.0 :1
Calculation Needed? YES

	Temp Dates	**Flow Dates**
Start:	NA	NA
End:	NA	NA

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	0	0	0			49	76
FEB	34	50	76	0	0	0	0			50	76
MAR	38	52	77	0	0	0	0			52	77
APR	48	55	79	0	0	0	0			55	79
MAY	58	65	82	0	0	0	0			65	82
JUN	66	76	84	0	0	0	0			76	84
JUL	69	81	85	0	0	0	0			81	85
AUG	67	81	84	0	0	0	0			81	84
SEP	60	73	82	0	0	0	0			73	82
OCT	50	61	80	0	0	0	0			61	80
NOV	40	49	77	0	0	0	0			49	77
DEC	35	49	76	0	0	0	0			49	76

COMPLETE
FILTRATION RESOURCES

8/30/2024

Cambrian Innovation and Saputo Cheese Water Quality Trading Plan - Almena

Complete Filtration Resources
1900 East 24th Street / PO Box 253
Marshfield, WI 54449
800.301.3254

ABBREVIATION LIST

AeMBR - Aerobic Membrane Bioreactor

AnMBR - Anaerobic Membrane Bioreactor

CIP - Cean In Place

COW - Condensate of Whey

DMR - Discharge Monitoring Report

EBPR - Enhanced Biological Phosphorus Removal

GPD - Gallons Per Day

HSWW - High Strength Wastewater

L6 - Lagoon 6

LSWW - Low Strength Wastewater

MG - Million Gallons

MGY - Million Gallons Per Year

PI - Phosphorus Index

PPY - Pounds Per Year

P-UF - Phosphorus Ultrafiltration

RNG - Renewable Natural Gas

SSRF - Sidestream RAS Fermentation

TMDL - Total Maximum Daily Load

UF - Ultrafiltration

WPDES - Wisconsin Pollutant Discharge Elimination System

WQBEL - Water Quality Based Effluent Limitations

WQT - Wastewater Quality Trading

WWTS - Wastewater Treatment System

1. INTRODUCTION

Cambrian Innovation (Cambrian) and Saputo Cheese USA, Inc. (Saputo) located in Almena, WI intend to develop an integrated wastewater treatment project which requires that the parties enter a Water Quality Trading (WQT) plan summarized herein. Water quality trading will be used to comply with the phosphorus discharge limit within the new Cambrian Wisconsin Pollutant Discharge Elimination System (WPDES) permit and the Tainter Lake and Lake Menomin area Total Maximum Daily Load (TMDL) which is part of the Red Cedar River basin.

The proposed trade will be between Saputo's spray irrigation and row crop fields and Cambrian's new Wastewater Treatment System (WWTS). The anticipated start of the trade is fall 2024. Ultimately, Saputo will discontinue spray irrigation of their nearby fields with biologically treated low strength wastewater effluent and terminate hauling out high strength wastewater for land application in other surrounding WDNR approved fields. All high and low strength wastewater from the Saputo production facility will be treated within the new Cambrian WWTS. The Cambrian facility will produce high quality effluent for direct discharge and generate renewable natural gas (RNG) through anaerobic treatment of the high strength stream. The treated wastewater will be discharged as shown later in this document, to the unnamed tributary of the Hay River located in the Hay River Watershed in the Lower Chippewa Basin.

2. BACKGROUND

Saputo was investigating methods to reduce hauling fees, eliminate spray irrigation, reduce odor and decrease the overall environmental impact of wastewater produced from their Almena facility. Complete Filtration Resources (Complete Filtration) developed a feasibility study to achieve these goals and allow direct discharge to an unnamed tributary feeding the Hay River. Cambrian entered the analysis as an owner, operator and discharge permit holder accepting all of Saputo's high and low strength wastewater under an extended operating contract allowing Saputo to focus on cheese production.

The selected solution is an advanced WWTS which generates RNG for injection into a nearby natural gas pipeline. Anaerobic digester effluent and remaining low strength wastewater will be polished with an aerobic membrane biological reactor system.

Currently, Saputo implements the following methods to hold and dispose of their high and low strength wastewater, brine and biosolids:

- High strength wastewater is hauled out of the facility to approved land application sites.
- Low strength wastewater is treated onsite with an equalization lagoon, aerated lagoon, gravity clarifier, partial mix lagoon and ultimately contained in a series of storage lagoons (L3, L4, L5 and L6) for a total capacity of 22 MG. The aerated lagoon utilizes floating aerators/mixers.
    - After lagoon treatment, the wastewater is spray irrigated to a total of 172 acres (129 circular acres) in the vicinity of the Saputo site over the months of May through October.
    - When spraying cannot be completed due to weather or time of year, the wastewater is stored in lagoons L3-L6.
- Brine is collected and shipped offsite for treatment.
- Biosolids collected from the gravity clarifier are directed to a sludge storage lagoon and land applied to WDNR approved fields by a licensed hauler on a quarterly basis.

Attachment A depicts the Saputo facility location, existing infrastructure and provides a map of all 5 spray fields in addition to 2 Saputo-contracted row crop fields within HUC-12 Sub-watershed 070500070605. The discharge point is also identified as approximately 45.3631 N and 92.0334 W.

- The spray fields: A, B, C and F are a nominal 37 acres (~29 circular acres), while field E is a nominal 24 acres (~13 circular acres). All fields, except for approximately half of Field F, are within the HUC-12 noted above. The southern portion of Field F is excluded from this trade.

    - Approximately 114.5 spray field acres (circular acres) are proposed in this trade.
- The row crop fields: G and H are owned by Saputo and contracted to a farmer running a corn and soy rotation. Field G is 15.9 acres and H is 9.1 acres.
    - Approximately 25 acres of row crop fields are proposed in this trade.

Total field area proposed in this trade is approximately 139.5 acres.

3. PURPOSE OF THE WATER QUALITY TRADE

Saputo currently has a WPDES permit (No WI-0050725-09-0) to allow emergency discharge (upon receiving approval from the WDNR) of condensate of whey (COW) water from their process to the unnamed tributary of the Hay River (Outfall 002), located at approximately 45.3608 N, 92.0344 W. However, this discharge hasn't been used during recent permit terms. From discussions with local and regional WDNR staff, Outfall 002 could be utilized for permanent continuous discharge. As this option was investigated further, stringent phosphorus limitations were discovered that could not be achieved with the WWTS process plan.

Concentration and mass limits are defined within the WDNR Memorandum dated July 9th, 2024 (Attachment B). A stringent mass limit of 0.013 lbs/day total phosphorus is defined as a monthly limit. To achieve this mass loading with the total average flow from the Saputo production facility to the Cambrian WWTS at 280,000 GPD, the total phosphorus concentration would need to be <0.0056 mg/L. Such concentrations are not feasible with any available advanced phosphorus removal technology, especially with dairy wastewater.

With the advanced phosphorus technology proposed, Complete Filtration expects the total effluent phosphorus to be <0.1 mg/L or <85 lbs/year, at the average flow. Saputo is allocated 2.5 lbs/year of total phosphorus per the Tainter Lake and Lake Menomin TMDL. Per the WDNR's WQBEL memo to Saputo, a CV multiplier of 1.9 was used resulting in a load allocation of 4.75 lbs/year. Therefore, the total credits required to offset WWTS discharge is approximately 80 lbs/year.

Under this proposed trade, Saputo will cease spray irrigation to all five (5) spray fields (A, B, C, E and F) and terminate row cropping practices on Fields G and H. All fields will be managed as whole field perennial vegetation. Spray Fields A, E, and F and row crop Fields G and H will be converted to harvested perennial vegetation (hay) to draw down soil phosphorus levels. Spray Fields B & C will be converted to non-harvested perennial vegetation with prescribed beef cattle grazing (pasture) to manage vegetation. Cambrian, the credit user and discharge permit holder, will enter an agreement with Saputo, the credit generator to enable Cambrian direct discharge to the unnamed tributary of the Hay River.

An important concept to note is that there are other fields in the same watershed and surrounding northern and southern areas, not listed in this report, that are approved by the WDNR to accept high strength waste. Such sites will no longer be used by Saputo once the new Cambrian WWTS is in operation. A comparison of the phosphorus distribution between current practices and the WWTS is included in Section 9. If the high strength application was included in this analysis, it is reasonable to project that a greater net phosphorus trade value would result.

4. WASTEWATER TREATMENT SYSTEM OVERVIEW

Cambrian shall, under contract with Saputo and Complete Filtration, build, own, and operate the WWTS on the property Cambrian is leasing from Saputo adjacent to the unnamed tributary of the Hay River. Attachment A indicates the WWTS location and outfall location. The plans and specifications for the WWTS design were submitted electronically to the WDNR and approved on October 17th, 2023. The following is a brief description of the overall treatment process.

Wastewater will be actively managed and treated based upon the influent characteristics. High Strength Wastewater (HSWW) will be isolated and actively diverted to the Anaerobic Membrane Bioreactor (AnMBR) system. Low Strength Wastewater (LSWW) will be isolated and sent to the aerobic system. AnMBR permeate requires further aerobic treatment that is accomplished by sending the AnMBR permeate to the aerobic MBR (AeMBR) system. The AeMBR process removes biodegradable organics as well as phosphorus using an Enhanced Biological Phosphorus Removal (EBPR) technique, integrated into the AeMBR process.

The AeMBR permeate contains minimal residual phosphorus which must be chemically precipitated and separated with the P-UF process to achieve ultra-low surface water discharge limits noted above. Finally, the effluent is cooled prior to discharge. Generated solids are dewatered via a screw press.

The largest existing storage lagoon, L6, shall be utilized for up to two months during startup and commissioning of the WWTS. This lagoon may also be utilized for emergency purposes such as a power outage, major mechanical or structural deficiency during the same period. All lagoons are to be managed through the decommissioning process, led by Saputo.

The digester process is completed in above ground stainless steel tanks and the aerobic processes are completed in above ground precast concrete tanks that have a common wall approach. This allows for footprint optimization, reduced piping and pumping requirements and limited heat tracing. An adjacent pre-engineered steel building will house all the processing equipment, dewatering area, digester specific equipment, electrical control systems and a small laboratory.

4.1. RAW WASTEWATER LIFT STATIONS

The facility has 3 existing lift station areas: brine, low and high strength of which only the high and low strength will deliver feed for the new WWTS. Brine is hauled offsite for alternative treatment.

4.2. LOW STRENGTH WASTEWATER SYSTEMS

The aerobic biological process will incorporate the following key processes:

- High strength flow and concentration detection with targeted diversion to high strength equalization
- Raw low strength wastewater flow equalization
- Biological partial denitrification with microbial selection
- Aerobic biological treatment with membrane separation, AeMBR
- Enhanced Biological Phosphorus Removal (EBPR)
    - Utilizes a two-step biological process that incorporates Sidestream RAS Fermentation (SSRF)
- Effluent polishing with a physical chemical phosphorus ultrafiltration (P-UF) process
- Final cooling prior to discharge.

4.3. HIGH STRENGTH WASTEWATER SYSTEMS

The anaerobic biological process has its own unique key processes:

- High strength flow concentration monitoring
- Raw high strength wastewater flow equalization
- Anaerobic digestion and complete internal mixing without moving components
- Anaerobic biological treatment with membrane separation, AnMBR
- Biogas clean-up and RNG unit to purify the biogas and injected into a nearby pipeline.

4.4. ANCILLARY SYSTEMS

The HSWW and LSWW systems are accompanied by accessory systems:

- Recovery heat exchanger for the anaerobic process
- Chemical dosing pumps for nutrients, pH adjustment and precipitation
- Tank large bubble mixing systems and diffusers and blowers
- Membrane clean in place (CIP) process
- Wasted aerobic sludge storage as a slurry
- Campaigned membrane sludge concentration and dewatering via a screw press
- Drilled potable well for building services

4.5. SLUDGE MANAGEMENT

Dewatered sludge is hauled off-site by an approved and licensed hauler in compliance with local application rates and practices. Final sludge disposal is at the discretion of Cambrian where a contracted 3rd party hauling company will dispose of the sludge via incineration, landfill, or land application in accordance with NR214. No storage of sludge cake is planned onsite. Sludge will not be applied to any of Saputo's spray or crop fields outlined in this document used to generate the phosphorus trade credits. Per an approved WPDES permit, sludge will be sampled and reported as directed by the WDNR.

5. SOIL SAMPLING FOR MASS LOADING ASSESSMENT

A detailed sampling protocol was undertaken in late 2020 to investigate the phosphorus within the soil of the 5 spray irrigation fields and 2 copped fields. On November 29th, 2020 fields A and B were sampled and fields C, E and F were sampled later in December 8th/9th, 2020. On the 4th week of March 2021, fields G and H were sampled. These results were input into the SnapPlus modeling program outlined in the next section.

The sampling soils for testing method A2100 (Peters and Laboski, 2013) was used to collect all samples. Each of the sampled fields were divided into five-acre sections. Fields A, B, C, and F were divided into six sections. Field E was divided into 3 sections. Fields G and H were divided into 3 and 2 sections, respectively. Each composite sample was comprised of soil cores (approximately 2 cups of soil). The soil cores were obtained using a soil probe. The sampling depth was six inches. Soil cores were collected in a "W" pattern across each identified section. The soil cores were placed in a small bucket and combined as one composite sample. Utilizing the A2100 sampling method allowed for adequate soil volume for each composite sample and provided a representative sample for each section.

Prior to commencing sampling for another section, all equipment used to collect the soil sample was cleaned and rinsed with deionized water. This ensured that samples were not cross contaminated. Tire tracks from the sprayer were avoided in all fields sampled as those particular areas were not representative of the overall productivity of the fields. Manure, compacted areas from cattle traffic, and low wetland sites were avoided to collect representative samples.
Upon further discussions with the WDNR, an evaluation of the potential stratification of phosphorus was conducted on the 4th week of March, 2021 for the 5 sprayed fields. The sampling protocol followed the above testing procedure, except the top 0-2" and bottom 5"-6" were segregated. These segregated samples were composited per identified sample section to evaluate any phosphorus stratification. In collaboration with UW staff, the WDNR concluded SnapPlus is handling the phosphorus modeling appropriately. Attachment C contains the stratification correspondence from the WDNR, all soil sampling results, field soil sample maps, and soil type identification maps.

6. MODELING USING SNAPPLUS

SnapPlus V20.4 was used to model all 7 fields (A, B, C, E, F, G, H) evaluated in this trade. A baseline model extending from 2017-2030 was developed based on historical and current conditions. The baseline file was duplicated, and nutrient load reduction practices (management practices) were applied during the 2024 crop year for the row crop fields and 2025 crop year for the spray fields. This allows credit generation to be sequenced in a manner that allows the WWTS to begin discharging in early 2025 (using credits generated on the row crop fields) while Saputo spray irrigates for part of 2025 to draw down wastewater effluent storage pond volume.

6.1. BASELINE MODEL

The following parameters define the conditions entered into the baseline model. The SnapPlus 590 assessment report (NM3) for all field's baseline modeling is included in Attachment S:

Spray Fields (A, B, C, E, F)

- Spray field irrigation was modeled as liquid manure nutrient applications as approved by WDNR staff.
- Historical Spray Irrigation Data:
  - 2015-2023 spray irrigation volume data, provided by Saputo, was imported directly into the model. Over this period, all 5 fields were utilized on a rotation basis with wastewater applied from May through October. Irrigation was modeled on only the circular portion of each field.
    - Refer to Attachment D or the "Records" screen of baseline model for this data.
- Anticipated Irrigation Applications (2024 - 2030):
  - Saputo estimates, should spray irrigation continue, total annual irrigation flows to the spray fields would be 70 - 75 MGY due to increasing wastewater production.
  - However, 60.4 MGY is the historical 3 year (2021, 2022, 2023) average irrigation to the fields proposed in this trade. Therefore, 60.4 MGY was used to conservatively estimate future irrigation applications in the baseline model.
  - Approximately 43 irrigation applications were made per field during the same 3 year period.
    - The historical distribution of applications between spring, summer, and fall seasons is summarized below and can be found in the SnapPlus "Nutrient System Editor" of the "Nutrients" screen.
      - 12 Spring Applications
      - 18 Summer Applications
      - 13 Fall Applications
    - Refer to Attachment F for further details on the analysis of historical seasonal distributions.
  - To be conservative and ensure the modeled irrigation to the fields in the proposed trade do not exceed the historical average of 60.4 MGY, future irrigation applications (2024 - 2030) were modeled at 12,267 gal/ac/app in SnapPlus with a total of 43 applications per field (see seasonal distribution above).
    - 12,267 gal/ac/app = 60.4 MGY / 114.5 field acres / 43 applications per field per year
    - Refer to SnapPlus "Nutrient System Editor" of the "Nutrients" screen and Attachment E.
- Spray Irrigation Nutrient Concentrations:
  - Lagoon 6 (L6) is the typical source for spray operations. This lagoon was sampled in 2020 and 2023 in the cardinal directions using a sample dipper with a 4-foot handle at a depth approximately 2 feet below the surface. Note the lagoons have no method of mixing.
  - The average concentration of the L6 samples was 34.9 mg/L total phosphorus. This concentration was converted to 0.67 lb P_2O_5/1,000 gallons and entered into SnapPlus.
    - Note SnapPlus rounded to 0.7 lb P_2O_5/1,000 gallons.

  - Additional nitrogen and potassium concentrations were averaged from 2021-2023 periodic lagoon sampling and entered into the model as 0.76 lb N/1,000 gallons and 0.86 lb K2O/1,000 gallons.
    - Note SnapPlus rounded to 0.80 lb N/1,000 gallons and 0.90 lb K2O/1,000 gallons.
  - Refer to SnapPlus "Nutrient Sources" table found on the "Nutrients" screen and Attachments G & H for additional details.
- Cropping Parameters – Fields A, E, F:
  - Existing Vegetation Conditions:
    - Perennial grass mixture harvested for hay production
    - Medium density
    - Full coverage
  - SnapPlus Cropping Entries:
    - Crop – Grass Hay
    - Yield Goal – 2 to 3 units/acre
    - Tillage – None
    - Irrigated – Yes (see details above)
    - Refer to Attachment I for additional details.
- Cropping Parameters – Fields B & C:
  - Existing Vegetation Conditions:
    - Perennial grass mixture grazed by beef cattle herd instead of harvesting
    - Medium density
    - Full coverage
  - SnapPlus Cropping Entries:
    - Crop – Pasture, continuous stocking, low density
    - Yield Goal – 2.1 to 3 units/acre
    - Tillage – None
    - Irrigated – Yes (see details above)
    - Refer to Attachment I for additional details
- Pastured Cattle – Fields B & C:
  - The rocky nature of Fields B & C is ill-suited for conventional cutting/mowing equipment. Rather than harvest the existing hay, Fields B and C use prescribed beef cattle grazing. The herd totals approximately 50 adults and 40 calves. The total combined grazing area of Fields B & C (circular spray irrigated portion included in this trade and non-irrigated portion excluded from this trade) is approximately 100 acres.
  - Herd details for the beef cattle grazing on Fields B & C were added in the "Grazing herd setup" tab of the "Nutrients" Screen. Grazing details (below) for the herd were populated using the "Grazing Estimator" found in the same tab. The "Grazing Estimator" calculated the estimated manure application rate of 3.8 tons/ac for the herd for each year.
    - Total Daily Herd Manure Production – 2.1 tons/day
    - Field Pasture Size – 100 acres
    - Days on Pasture – 180 days
    - Percent of Each Day Spend Grazing – 100%
    - Estimated Application Rate – 3.8 tons/acre
  - Next, the grazing herd was added to the sources table in the "Nutrient sources" tab. In doing so, SnapPlus populated typical N, P2O5, K2O, and S values when selecting "Beef, grazing" manure source type.
  - Finally, the grazing herd was added as a nutrient source in the "Cropping" screen using the 3.8 tons/ac application rate from the "Grazing Estimator". This process was repeated for all Field B & C crop years.

Row Crop Fields (G & H)

- Fields G and H are contracted out to a third-party farmer who operates a corn and soy rotation. Prior to 2021 the farmer only planted corn.
- The farmer was interviewed and provided his rotation fertilization and cultivation practices. A summary of those practices is provided in Attachment I.
- SnapPlus Cropping Entries:
    - Crop – Corn / Soy
    - Yield Goal – 151 to 170 (corn) units/acre; 46 to 55 (soy) units/acre
    - Tillage – Fall Chisel, no disk
    - Irrigated – No

6.2. REDUCTION MODEL

The following outlines the conditions changed from baseline model to produce the reduction model. Note, field management practices for phosphorus reduction were modeled beginning in 2024 crop year for the row crop fields and 2025 crop year for the spray fields. The management practices for both field groups extend through 2030. Greater detail descriptions of the proposed management practices are available in Section 10. The SnapPlus 590 assessment (NM3) for all fields' reduction modeling is included in Attachment T:

Spray Fields (A, B, C, E, F)

- All spray irrigation applications (modeled as liquid manure) terminated – Crop Year 2025 (Fall)
- Note: Existing whole field perennial vegetation to be maintained. No substantial reseeding anticipated.

Row Crop Fields (G & H)

- Row crops terminated – Crop Year 2024 (Fall)
    - Existing corn crop cut early for silage or offsite compost – Fall 2024
    - Seed long term alfalfa-grass hay mix with temporary winter rye – Fall 2024.
        - Note: The third-party farmer operating these fields indicated that herbicide carry-over from the existing corn crop may inhibit alfalfa and grass establishment in Fall 2024. The farmer recommended incorporating winter rye into the alfalfa-grass hay mix (long term crop) in Fall 2024. The rye will provide temporary supplementary cover and redundancy should any herbicide carry-over slow initial establishment of the alfalfa-grass hay. The rye will be clipped in spring 2025 with additional alfalfa and grass seeding needs (no-till broadcasting) assessed at that time. This approach was modeled as "Corn Silage to annual cover crop" in crop year 2024, although "Corn silage to Late Summer Direct Seeded Legume Forage" could also be used.
- Tillage terminated – Crop Year 2024 (Fall)
- All manure/fertilizer applications terminated – Crop Year 2024 (Fall)
    - Note: Managing the proposed alfalfa-grass hay mix with no additional fertilizer/manure application has been reviewed and approved by the third-party farmer operating these fields. As it stands, reoccurring soil sampling is not needed. However, if nutrient applications are desired to maintain hay production those nutrient applications must be incorporated into the WQT Plan and the reduction model.
- Cropping to alfalfa-grass hay mix (timothy, alfalfa, orchard grass) – Crop Year 2025 & Beyond

6.3. MODELING RESULTS

The P trade 2025-2030 results for the baseline and reduction files are summarized below in Table 1. The complete reports for both models are provided in Attachments J and K.

Table 1 – Baseline and Reduction Potentially Tradable Phosphorus (lbs/year)

Case	Field	2025	2026	2027	2028	2029	2030
Baseline	A	114.2	117.5	120.9	124.3	127.7	131.1
	B	148.8	153.2	157.6	162.0	166.4	170.8
	C	157.6	162.0	166.4	170.9	175.3	179.8
	E	51.9	53.4	55.0	56.5	58.1	59.6
	F	55.5	57.1	58.7	60.3	61.9	63.5
	G	62.9	77.8	63.7	79.5	64.5	81.2
	H	40.6	52.6	41.1	53.7	41.6	54.7
	Total	631.4	673.6	663.4	707.1	695.5	740.7
Reduction	A	100.4	49.3	49.3	49.3	49.2	49.0
	B	120.7	61.7	61.4	61.1	60.8	60.6
	C	129.7	70.7	70.4	70.1	69.9	69.6
	E	45.7	22.7	22.7	22.7	22.6	22.6
	F	49.1	25.2	25.2	25.3	25.2	25.2
	G	27.9	6.3	3.5	1.6	0.9	0.5
	H	23.3	8.8	6.6	5.0	4.2	3.7
	Total	496.7	244.7	239.1	235.0	232.8	231.2
DIFFERENCE		**134.7**	**428.9**	**424.3**	**472.1**	**462.7**	**509.4**

7. TRADE RATIO CALCULATION

The potentially tradable phosphorus generated by SnapPlus and summarized within the difference row of Table 1 is adjusted by the applicable trade ratio to determine the amount of credits Cambrian can receive from implementing phosphorus reducing management practices on the Saputo owned fields. Within the June 2020, Edition 2, Guidance for Implementing Water Quality Trading in WPDES Permits, the trade ratio is defined as the following equation:

Trade Ratio = (Delivery + Downstream + Equivalency + Uncertainty) : 1

7.1. DELIVERY FACTOR

The delivery factor is zero (0) as the proposed fields and the outfall point are located in the same 12-digit hydrological unit (HUC-12). Note, only the Northern portion of Field F is used in this trade.

7.2. DOWNSTREAM FACTOR

The downstream factor is not applicable and hence zero (0) since the proposed fields are located within adjacent catchments as shown within Attachment A.

7.3. EQUIVALENCY FACTOR

An equivalency factor is not needed and set equal to zero (0) since phosphorus reductions are being used to generate phosphorus credits.

7.4. UNCERTAINTY FACTOR

The proposed fields will be converted to either harvested perennial vegetation managed as hay or non-harvested perennial vegetation managed with prescribed grazing. Both of these practices represent whole field management practices. Termination of wastewater effluent spray irrigation, row cropping, and the associated manure/fertilizer applications will remove the primary source of nutrients to the Saputo owned fields. Overtime, this will result in drawdown of excessive soil phosphorus levels and the rehabilitation of native soils. Any extreme weather events that could impact the certainty of the proposed management would have likely already occurred in the 35+ years these fields have been utilized.

Based on the whole field management practices outlined above and additional soil testing showing infiltration and stratification of nutrients in accordance with SnapPlus's modeling assumptions, WDNR has authorized using an uncertainty factor of one (1). See Attachment C for correspondence with WDNR staff.

7.5. CALCULATION OF TRADE RATIO

From the above factors, the trade ratio formula results in a ratio of 1:1.
Trade Ratio = (0 + 0 + 0 + 1):1 = 1:1

The minimum trade ratio allowed by the WDNR is 1.2:1, Cambrian will use a 1.2:1 trade ratio for generating credits.

8. CALCULATION OF CREDITS

The proposed trade is in the Red Cedar River TMDL area which requires nonpoint source reductions to achieve prescribed water quality standards. The Red Cedar River TMDL requires a 65% reduction of the "Baseline TP Loss Condition" to generate long-term credits. To develop the "Baseline TP Loss Condition", first, WDNR supplied a Tainter SnapPlus program pre-loaded with the following: a soil P value of 60 ppm, fertilizer of 10,000 gal of unincorporated manure in the spring on corn years and 3,500 gallons with oats. A rotation of corn grain-corn silage-oats-hay-hay-hay was modeled together with spring tillage after each corn year and the final hay year. Spring chisel plow with disc.

Next, the soil type and slope for each of the 7 fields was entered into the provided template. The phosphorus index (PI) rotational average was 2 lbs P/year/acre, representing the "Baseline TP Loss Condition". Then a 65% reduction was applied to the "Baseline TP Loss Condition" resulting in a PI value of 0.7 lbs P/year/acre. This value represents the long-term credit generation threshold. However, in compliance with the WDNR flexible baseline policy, the 0.7 value was rounded up to a 1 lb P/year/acre long-term generation credit threshold. Any reductions that achieve a TP loss condition on a lb P/year/acre basis below this threshold result in long-term credits. Reductions that achieve a TP loss condition on a lb P/year/acre basis above this threshold only result in interim credits over the first 10 years.

The following tables summarize the long-term credit and interim credits for each field utilizing the TMDL calculation guidelines and trade ratio of 1.2 summarized above. Refer to Attachment L for individual field credit totals, sample calculations, and prorating calculations.

Table 2 – Interim Credit Balance

Parameter	Units	2025	2026	2027	2028	2029	2030
Total Spray Fields P Credits	P lbs	22.9[1]	261.3	274.7	287.9	301.4	314.8
Total Row Crop Fields P Credits	P lbs	43.6[2]	96.1	78.9	105.5	84.2	109.7
Total Interim Credits	**P lbs**	**66.5**	**357.4**	**353.5**	**393.4**	**385.6**	**424.5**
Credits Required	P lbs	59.5[3]	80.5	80.5	80.5	80.5	80.5
Credit Balance (NET)	**P lbs**	**7.0**	**277.0**	**273.1**	**313.0**	**305.1**	**344.0**

Table Notes:

1. Monthly credit prorating applied to spray field credits in 2025 based on anticipated establishment of credit generating practices by late Summer 2025 (August 31st). Therefore, 33% (4 of 12 months) of calculated annual credit value is available (WWTS allocated credits generated in Sept, Oct, Nov, Dec). Refer to Section 11 for additional implementation schedule details.
2. No monthly prorating applied due to anticipated establishment of credit generating practices in Fall 2024. Full annual credit value available January 1st, 2025. Refer to Section 11 for additional implementation schedule details.
3. Assumes WWTS discharge to unnamed tributary outfall beginning April 1st, 2025.

Table 3 – Long Term Credit Balance

Parameter	Units	2025	2026	2027	2028	2029	2030
Total Spray Fields P Credits	P lbs	0.0[1]	0.0	0.0	0.0	0.0	0.0
Total Row Crop Fields P Credits	P lbs	0.0[2]	8.2	12.4	15.4	16.6	17.3
Total Interim Credits	**P lbs**	**0.0**	**8.2**	**12.4**	**15.4**	**16.6**	**17.3**
Credits Required	P lbs	59.5[3]	80.5	80.5	80.5	80.5	80.5
Credit Balance (NET)	**P lbs**	**-59.5**	**-72.2**	**-68.1**	**-65.1**	**-63.9**	**-63.2**

Table Notes:

1. Monthly prorating applies in 2025 however no long-term credits are generated on the spray fields due to stringent TMDL long-term credit threshold.
2. No monthly prorating applied due to anticipated establishment of credit generating practices in Fall 2024. Full annual credit value available January 1st, 2025. Refer to Section 11 for additional implementation schedule details.
3. Assumes WWTS discharge to unnamed tributary outfall beginning April 1st, 2025.

Given the stringent TMDL long-term credit threshold, the proposed management practices do not provide sufficient long-term credits to meet the needs of the WWTS long term. However, a plethora of interim credits are available to support the operation of the WWTS in the first 10 years (2025-2035) as well as the ability to sell to other potential credit users. Saputo and Cambrian will consider future operational strategies to address the long-term credit deficit, including approaching nearby landowners to participate in the trade. A long-term operations plan will be addressed within the next permit cycle.

9. SLUDGE MANAGEMENT AND PHOSPHORUS MASS BALANCE

This section outlines the mass balance of phosphorus for the existing operations compared to the WWTS.

Sludge generated from the aerated lagoon treatment of low strength wastewater and concentrated by the clarifier is stored in an adjacent lagoon and hauled out by a licensed hauler on a quarterly basis. This sludge is applied to WDNR approved fields following their specific management practices. Under current practices, all high strength and a portion of the low strength is hauled off, 6-7 days per week, and applied to WDNR approved land application sites throughout the region.

In the WWTS, all high and low strength wastewater is treated, and the resulting sludge cake will be disposed at the discretion of Cambrian where a contracted 3rd party hauling company will dispose of the sludge via incineration, landfill, or land application in accordance with NR214. Some of the key differences between the existing operations and the WWTS are:

- The WWTS sludge will be a cake at 16±2 dwt% rather than a slurry at 1-2.7 dwt%.
- The concentration of TKN will likely be lower as the sludge is composed of approximately 50%, by dry weight, anaerobic sludge which is lower in TKN than aerobic sludge.
- The WWTS sludge will contain a higher percent of phosphorus as noted in Table 4 below.
- The overall sludge volume applied throughout the year will be approximately the same; however, instead of being stored in a lagoon and hauled quarterly, the sludge is dewatered and transferred directly to a rolloff. The frequency of disposal will increase to approximately 4.5-9.5, 20 yd rolloffs per week rather than 60+ trucks every quarter.

Table 4 below attempts to quantify a mass balance of phosphorus comparing the current practices against the WWTS. The table represents average data from 2018-2022 and utilizes the average total phosphorus concentration for lagoon 6.

Table 4 – Phosphorus Mass Balance

Parameter	Current Practices	WWTS
High and Low Strength Haulout applied to WDNR approved fields (1,300-1,700 acres)	Average Flow: 29 MGY Average TP: 46,489 PPY	NA
Sludge Haulout applied to WDNR approved fields (currently 195-350 acres)	Average Flow: 1.1 MGY Average TP: 3,260 PPY	NA
Sludge Haulout to landfill, incineration or applied to WDNR approved fields	NA	Average Flow: 1.0 MGY Average TP: 70,912 PPY
Spray Irrigation to 5 fields	Average flow 73 MGY P: 21,248 PPY	NA
Direct discharge to unnamed tributary of the Hay River	NA	Average Flow 102 MGY Average TP: 85 PPY

The final forms of phosphorus generated from the current practices compared to the WWTS will have the following differences:

- The composition of total phosphorus for the high and low strength haulout practices are approximately 60-90% orthophosphate with the remainder as organic phosphorus in soluble or particulate forms.
- The current sludge haulout practices are majority composed of soluble orthophosphate, particulate phosphorus, biologically assimilated phosphorus and likely a small fraction of polyphosphate within biological cells from the lagoon operation practices.
- Within the WWTS, the anaerobic derived sludge will be composed of mostly calcium phosphate in the form of brushite and vivianite due to the addition of ferric salts to the digester and natural precipitation of phosphorus with the available calcium.
- Due to the incorporation of EBPR within the AeMBR, the phosphorus in the low strength system will mostly be in the form of polyphosphate stored in the biological cells.
- The final polishing of phosphorus occurs in the P-UF where precipitating agents are added to form insoluble phosphate metal salts.
- The majority of the mass of phosphorus discharged from a dairy facility is located in the high strength streams and therefore the majority of the phosphorus will be anaerobically digested and retained in mineral or metal salt form.

As indicated in Table 4, the majority of phosphorus previously applied to thousands of acres as a liquid, is planned to be applied in cake form with a higher percentage of total phosphorus. While the percentage of phosphorus in the sludge is higher for the WWTS, the forms are significantly different. The mineral and metal salt forms contained within the cake are presumed to be less mobile as the phosphorus is tightly bound to a metal salt or contained in a complex mineral. The current practices of land applying high and low strength liquid contain mostly orthophosphate and organically bound phosphorus.

The concern of shifting phosphorus from one area to another is managed from a qualitative and quantitative standpoint from the above discussion on the transformation of phosphorus to more stable forms and application of cake over liquid and slurry forms. Review of the currently WDNR approved land application locations will be analyzed by the licensed hauler to comply with the latest codes.

10. DESCRIPTION OF MANAGEMENT PRACTICE

A description of the proposed management practices is outlined below:

Spray Fields (A, B, C, E, F)

- <u>Terminate Spray Irrigation</u>:
    - Spray irrigation operations permanently ceased, eliminating nutrient load to spray fields and initiating credit generation. The discharge of the two spray irrigation pumps providing flow to the irrigation equipment will be cut and capped for redundancy.
- <u>Abandon Existing Irrigation Equipment</u>:
    - WDNR staff verbally approved in place abandonment of existing spray field center pivot irrigation equipment.
    - WDNR staff verbally confirmed no field remediation is required for the minor center pivot wheel tracks left in spray fields.
    - Current access ways to existing irrigation equipment shall be maintained to facilitate field inspections.
- <u>Maintain Pastured Cattle</u>:
    - The rocky nature of Fields B & C makes it difficult to operate conventional cutting/mowing equipment. Therefore, the existing beef cattle herd and its associated manure applications will be maintained. The herd will help manage vegetation growth and control weeds.
- <u>Maintain Perennial Vegetation</u>:
    - Fields A, E, F – Harvested
        - Management of these fields will change from spray field to whole field perennial vegetation with harvesting.
        - Existing perennial grass hay mixture shall be maintained and existing hay harvesting operations shall continue. No substantial reseeding is anticipated.
            - Minimum density requirement – four (4) stems and/or seedlings per ft^2
        - Existing vegetation will be inspected, reseeded (as needed), and maintained according to NRCS's Conservation Practice Standards for "Forage and Biomass Planting" (NRCS Code 512) and WI Agronomy Technical Note 6 – see Attachment M and R, respectively.
    - Field B & C – Prescribed Grazing
        - Management of these fields will change from spray field to whole field perennial vegetation with prescribed grazing. No substantial reseeding is anticipated.
        - Existing perennial grass hay mixture shall be maintained along with prescribed grazing beef cattle herd.
            - Minimum density requirement – four (4) stems and/or seedlings per ft^2
        - Existing perennial vegetation will be inspected, reseeded (as needed), and maintained according to NRCS's Conservation Practice Standards for "Forage and Biomass Plantings" (NRCS Code 512), "Prescribed Grazing" (NRCS Code 528), and WI Agronomy Technical Note 6 – see Attachment M, N and R respectively.

Row Crop Fields (G & H)

- Terminate Row Crops:
    - Harvest final corn crop early (silage or composted).
    - Field cultivation and prep for seeding winter rye cover crop and alfalfa-grass hay mix (perennial harvested vegetation).
- Temporary Winter Cover Crop:
    - The third-party farmer operating these fields indicated that herbicide carry-over from the existing corn crop may inhibit alfalfa and grass establishment in Fall 2024. The farmer recommended seeding winter rye with the long-term alfalfa-grass hay mix in Fall 2024. The rye will provide temporary cover and redundancy should any herbicide inhibition occur. This strategy has been incorporated in the model as a winter rye cover crop in crop year 2024. The rye will be clipped in spring 2025 with additional alfalfa and grass seeding needs (no-till broadcasting) assessed at that time.
- Establish Perennial Vegetation – Harvested:
    - Proposed seed mix – timothy grass, alfalfa, orchard grass.
    - Alfalfa-grass hay mix will be seeded, established, and maintained in accordance with NRCS's Conservation Practice Standards for "Forage and Biomass Planting" (NRCS Code 512) and WI Agronomy Technical Note 6 – see Attachment M and R, respectively.
        - Minimum seeding requirement – 60 seeds per ft^2.
        - Vegetative establishment criteria indicating successful practice implementation – minimum of four (4) seedlings per ft^2 after four to six weeks have passed following initial seed germination.

11. MANAGEMENT PRACTICE IMPLEMENTATION SCHEDULE

Management practice implementation and credit generation will be sequenced during 2024 and 2025 to allow the WWTS to begin discharging in early 2025 and Saputo to continue spray operations for most of their normal 2025 irrigation season. Management practices will first be implemented on the row crop fields in 2024 followed by the spray fields in 2025. The following outlines the schedule for management practice implementation. The dates provided below represent end date goals for task completion.

Row Crop Fields (G & H)

1. September 9th, 2024 – Early harvest existing corn crop (silage or composted).
2. September 11th, 2024 – Light field disking and seed bed prep.
3. September 13th, 2024 – Seed winter rye and alfalfa-grass hay mixture.
4. October 31st, 2024 – Achieve vegetative establishment criteria of 4 seedlings per sq ft (4 – 6 weeks from germination).
    a. Credit generation begins:
        i. Credits prorated monthly for the remainder of 2024.
            1. Note: No plans for credit use in 2024 since WWTS will not be operational.
        ii. Full annual credit value available January 1st, 2025.
5. November 15th, 2024 – Submit Form 3400-207 (Management Practice Registration) to WDNR.
6. May 1st, 2025 – Clip winter rye and broadcast additional alfalfa and grass seed if needed.

Spray Fields (A, B, C, E, F)

1. August 1st, 2025 – Saputo inspects fields for consistent vegetation and density, reseeding as needed.
2. August 31th, 2025 – Saputo terminates spray operations.
    a. Credit generation begins:
        i. Annual credit value prorated monthly for remaining months of 2025.
        ii. Full annual credit value available January 1st, 2026.
3. September 12th – Submit Form 3400-207 (Management Practice Registration) to WDNR.
4. October 31st, 2025 – Discharge line of spray irrigation pumps cut and capped for redundancy. Remaining irrigation equipment decommissioned and abandoned in place as approved by WDNR.

a. Note: This task may be completed sooner, but a date has been selected that aligns with the historical shut down period of Saputo's irrigation season.

12. CERTIFICATION, INSPECTION, AND REPORTING

12.1. CERTIFICATION

WDNR requires certification from the WQT plan preparer and authorized representative in Form 3400-208 (WQT Checklist). This checklist also summarizes the WQT plan and streamlines WDNR plan review and public participation. Refer to Attachment O.

Upon completion of work necessary to implement management practices described in this plan. Form 3400-207 (Management Practice Registration) will be completed and submitted to WDNR to certify that the practices in the trading plan have been successfully installed. Refer to Attachment P.

12.2. INSPECTION AND REPORTING

Inspection protocols shall ensure compliance with this WQT plan, applicable NRCS technical standards, and applicable USDA Wisconsin Agronomy Technical Notes. Inspection protocols will confirm field conditions do not result in greater phosphorus losses than modeled and shall check routinely for rill or gully erosion formation.

On a monthly basis, Cambrian will visually inspect the perennial vegetation to confirm that the anticipated management practices are still in place and operating as intended. These inspections will include field notes, representative photos of field condition, and photos of any areas with insufficient vegetation establishment/density. These inspections will be used to supplement the annual inspections described below. Non-harvested fields will be monitored for vegetation community shift to invasive species, including undesirable woody shrubs. Control measures such as mowing, burning, or herbicides will be considered on an as-needed basis to maintain intended vegetative cover. Should inspection results indicate areas of compromised vegetation or erosion, WDNR will be notified within 24 hours and supporting documentation of field conditions will be provided. With approval from WDNR, revegetation and/or mitigation efforts for impacted areas shall commence as soon as possible in accordance with the relevant NRCS technical standards and USDA Wisconsin Agronomy Technical Notes.

As a part of the monthly inspections, Cambrian shall also certify that the perennial vegetation in place to generate credits is being operated and maintained in a manner consistent with this plan or will note noncompliance. This certification will be made as a comment on the monthly discharge monitoring report (DMR). Usage and reporting of phosphorus credits will also be submitted on the DMRs.

Once per year, Cambrian will conduct more formal annual inspections of the perennial vegetation to confirm implementation and management practices are in accordance with this plan. This annual inspection shall occur between the months of May and September each year, include at least two photographs describing the conditions of each field and management practices, one overall field photo, and one close-up representative photo of field vegetation.

Cambrian shall report to the WDNR on an annual basis, by January 31st, the quantity of phosphorus reduction credits used each month of the previous year to demonstrate compliance.

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

The WDNR has the right to inspect the perennial vegetation management practice at any time given reasonable notice to Saputo to ensure the fields are in compliance with this plan.

ATTACHMENTS

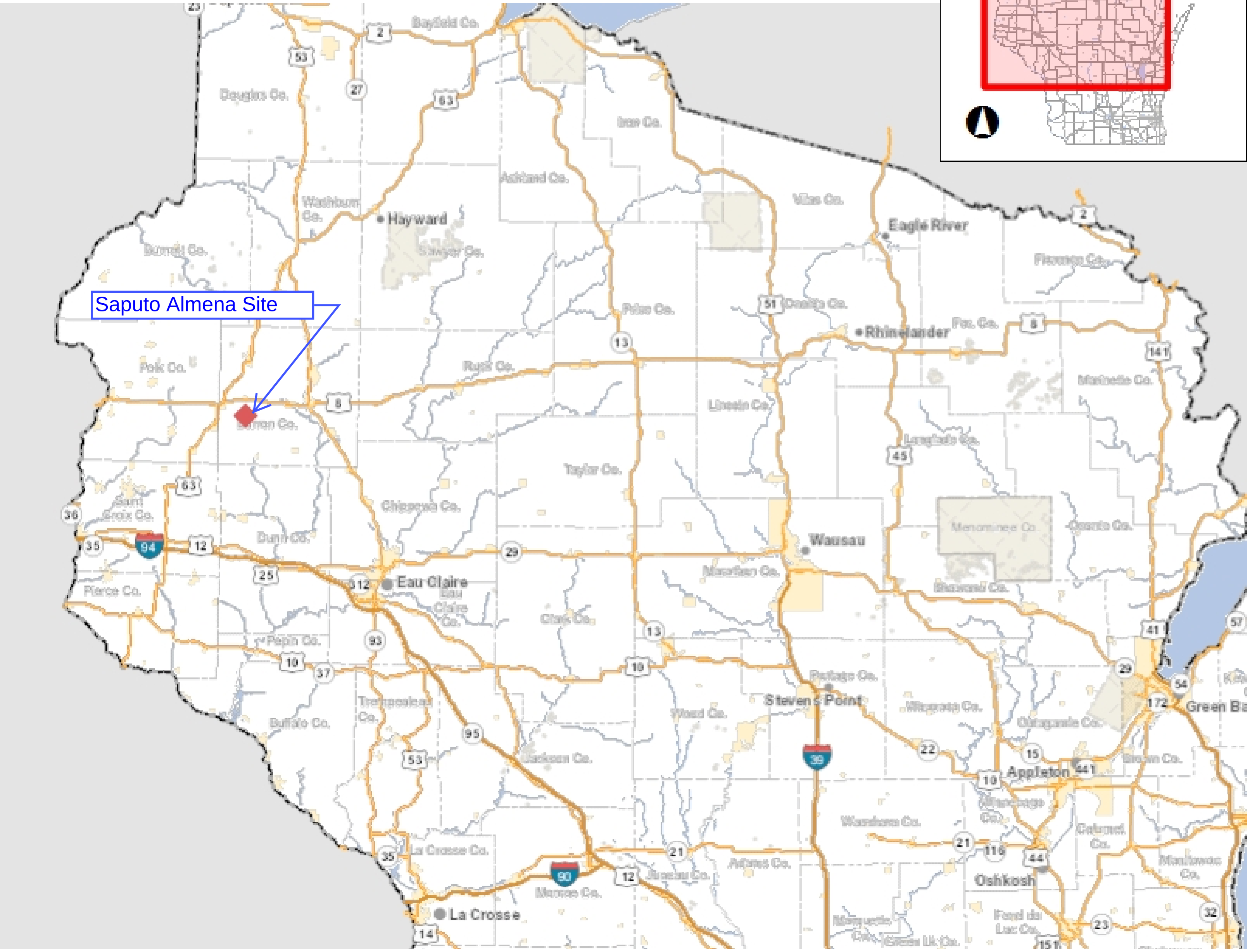
A - Watershed and Outfall Map
B - WDNR WQBEL Memo
C - Field Soil Maps, Soil Testing Results, including Stratification Results
D - Raw Irrigation Data Imported to SnapPlus
E - Irrigation Summary & Analysis
F - Historical Irrigation Seasonal Distribution-Fall-Spring-Summer
G - Phosphorus Testing Results Lagoons 5 and 6
H - SnapPlus N & K2O Calcs (Lagoon Samples)
I - SnapPlus Field Details and Crop Parameters
J - SnapPlus Baseline P Trade Reports
K - SnapPlus Reduction P Trade Reports
L - Credit Dashboard Calc and Sample Calc
M - NRCS CPS - Forage and Biomass Planting (Code 512)
N - NRCS CPS – Prescribed Grazing (Code 528)
O - Form 3400-208 WQT Checklist
P - Form 3400-207 Management Practice Registration
Q - Form 3400-206 Notice of Intent to Conduct Water Trading
R – WI Agronomy Technical Note 6 – Introduced Grasses and Legumes
S – Baseline SnapPlus 590 Assessment Report (NM3)
T – Reduction SnapPlus 590 Assessment Report (NM3)

NATIVE FILES INCLUDED:

-Saputo Fields A, B, C, E, F_BASELINE (WW, B & C Grazing Cows, Other Fields Grass Hay).snapDb
-Saputo Fields A, B, C, E, F_REDUCTION (No WW Apps).snapDb
-Saputo Fields G & H_BASELINE (Corn Soy Row Crop and Nutrient Apps).snapDb
-Saputo Fields G & H_REDUCTION (No Row Crops, No Nutrient Apps, Rye & Alfalfa-Grass Hay).snapDb
-Saputo - Tainter_TMDL_template.snapDb

A - WATERSHED AND OUTFALL MAP

Surface Water Data Viewer Map



Legend

⬚ State Boundaries

⬚ County Boundaries

▨ Tribal Lands

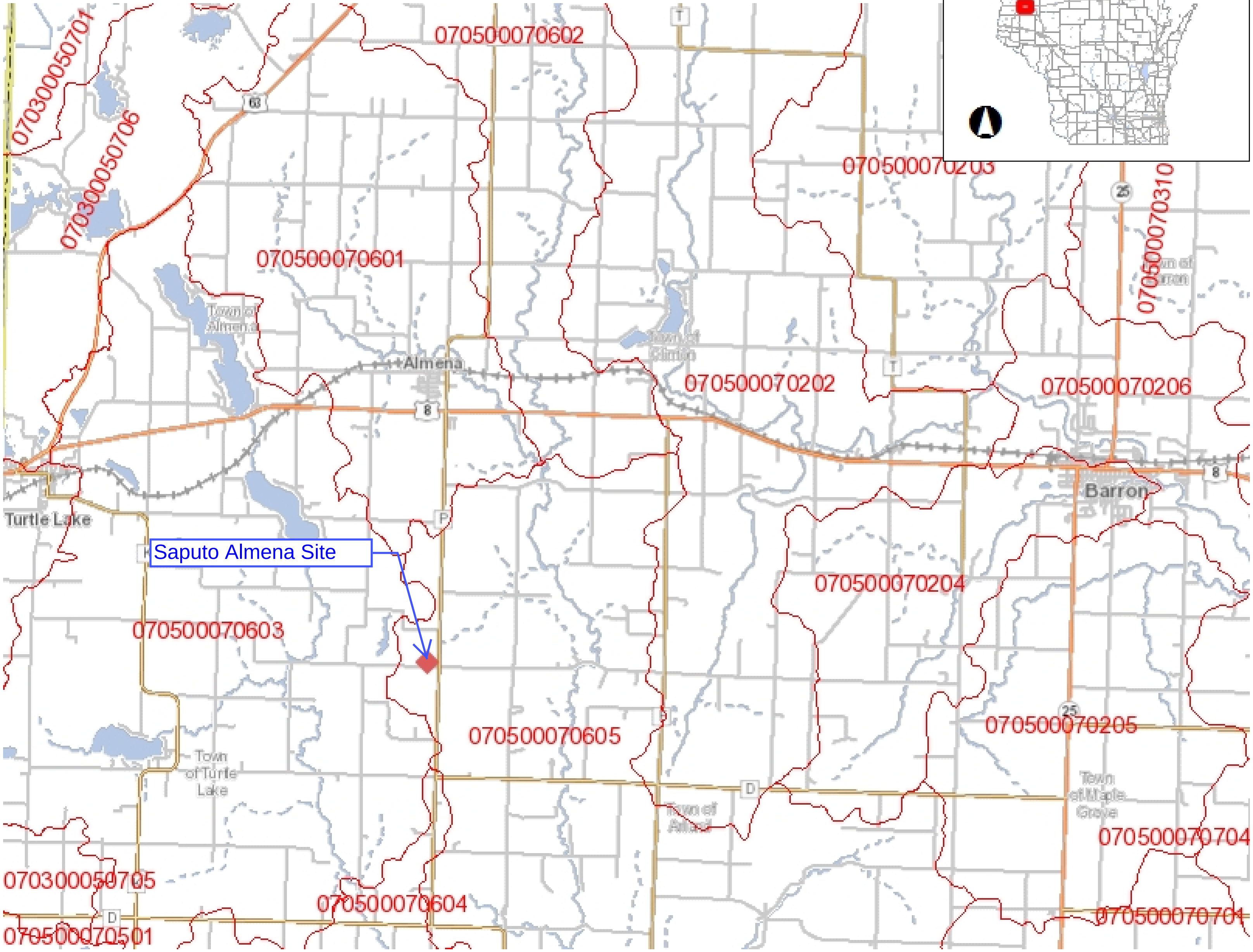
Notes

64.0 0 32.00 64.0 Miles

NAD_1983_HARN_Wisconsin_TM

1: 2,027,520

Surface Water Data Viewer Map



Legend

- ▢ 12-digit HUCs (Subwatersheds)
- ▢ Municipality
- ▢ State Boundaries
- ▢ County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- ▨ Tribal Lands
- Rivers and Streams
- Intermittent Streams
- ▢ Lakes and Open water

Notes

4.0 0 2.00 4.0 Miles

NAD_1983_HARN_Wisconsin_TM

1: 126,720

Surface Water Data Viewer Map

Legend

- ☐ WHD-Plus Catchments
- 🟥 12-digit HUCs (Subwatersheds)
- ■ Municipality
- ☐ State Boundaries
- ☐ County Boundaries
- Major Roads
  - ▬ Interstate Highway
  - ▬ State Highway
  - ▬ US Highway
- County and Local Roads
  - — County HWY
  - ═ Local Road
- ┼ Railroads
- ▨ Tribal Lands
- — Rivers and Streams
- - - Intermittent Streams
- ■ Lakes and Open water
- ☐ Index to EN_Image_Basemap_Leaf_Off

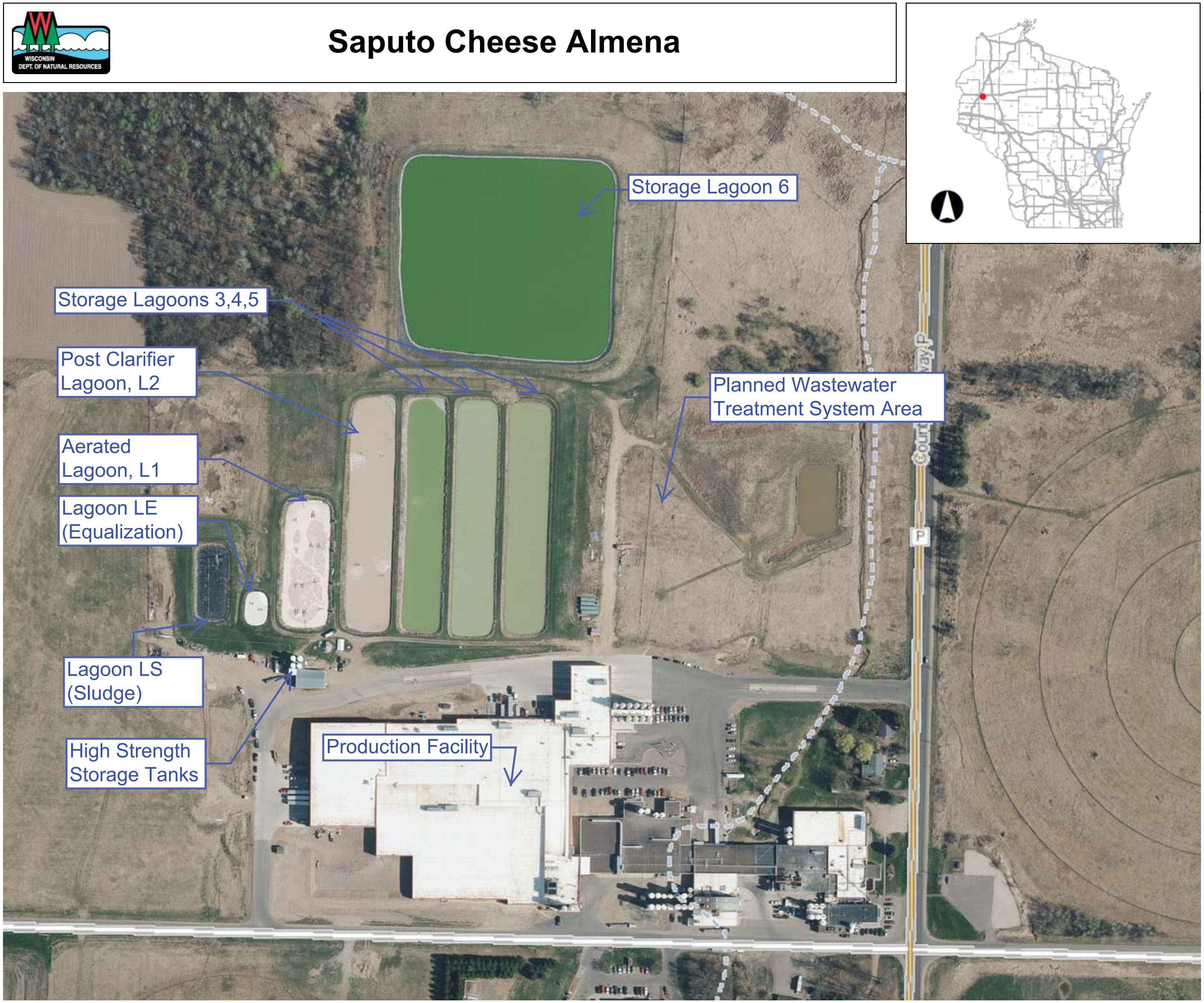
Notes

0.8 0 0.38 0.8 Miles

NAD_1983_HARN_Wisconsin_TM

1: 23,760

Saputo Cheese Almena



Legend

- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Railroads
- Rivers and Streams
- Intermittent Streams
- Lakes and Open water

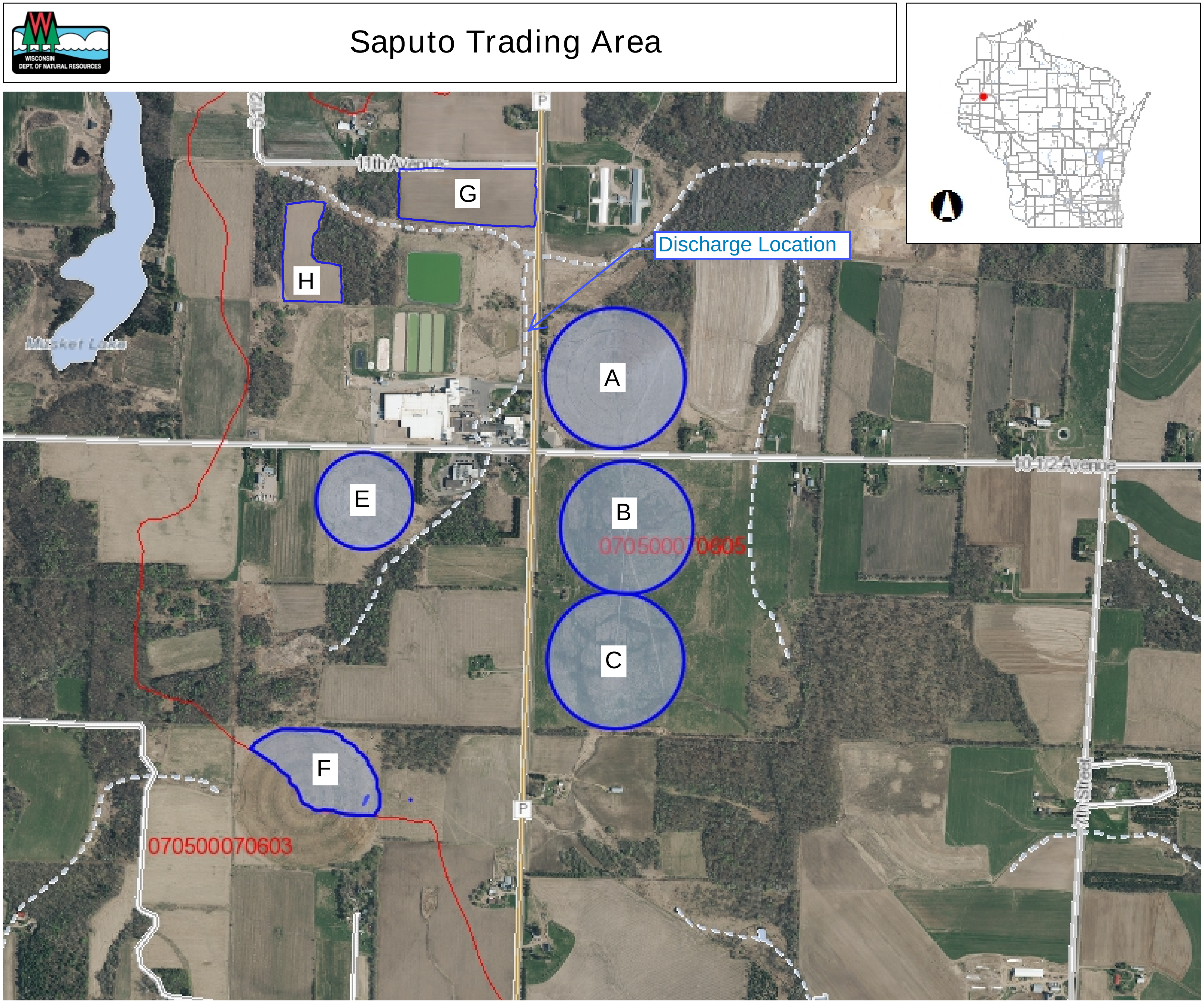
Notes

0.1 0 0.06 0.1 Miles

NAD_1983_HARN_Wisconsin_TM

1: 3,960

Saputo Trading Area



Legend

- ☐ 12-digit HUCs (Subwatersheds)
- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Lakes and Open water

0.5 0 0.25 0.5 Miles

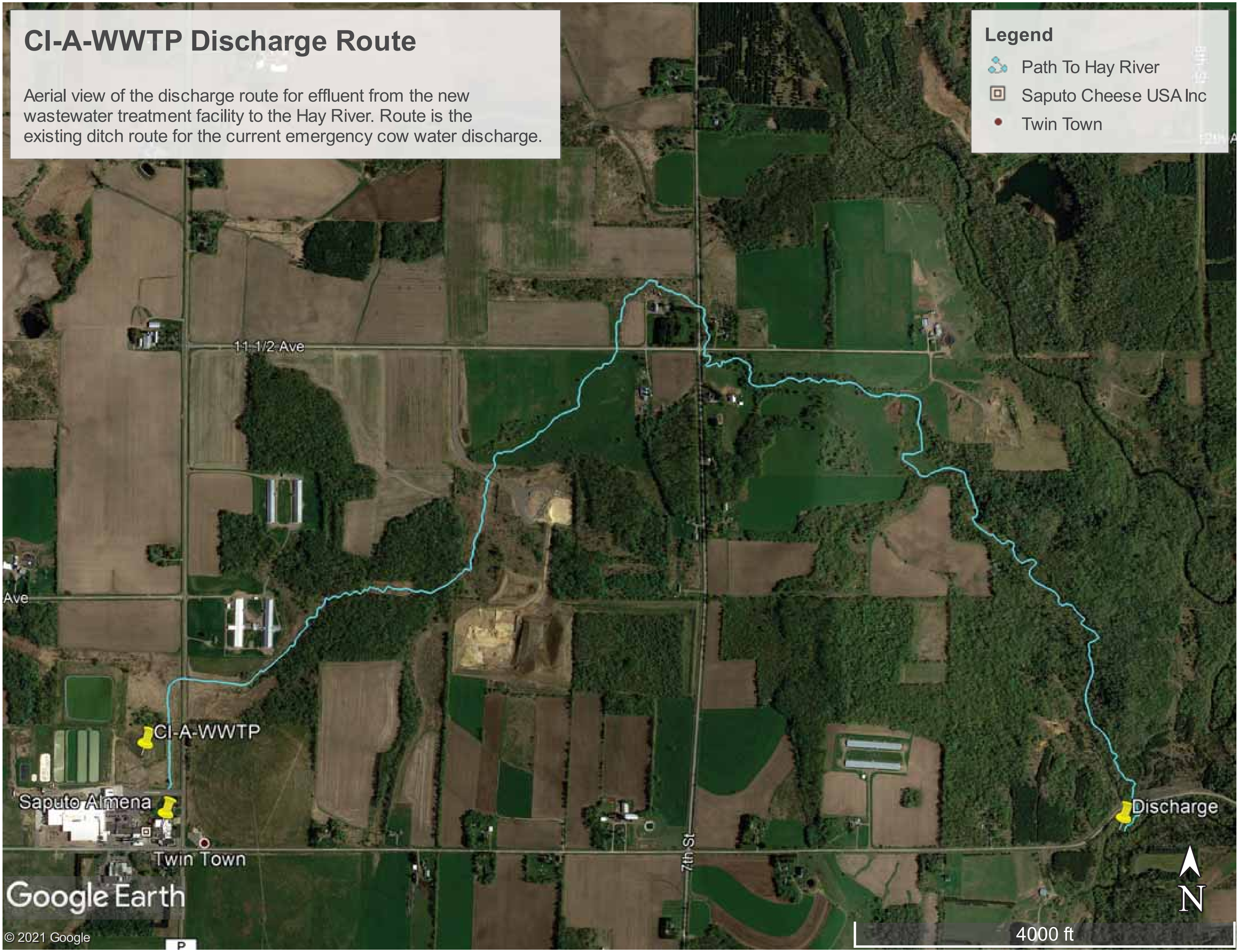
NAD_1983_HARN_Wisconsin_TM

1: 15,840

Notes

CI-A-WWTP Discharge Route

Aerial view of the discharge route for effluent from the new wastewater treatment facility to the Hay River. Route is the existing ditch route for the current emergency cow water discharge.



B - WDNR WQBEL MEMO

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: July 9, 2024

TO: Sheri Snowbank – NOR/Spooner Service Center

FROM: Michael Polkinghorn – NOR/Rhinelander Service Center Michael Polkinghorn

SUBJECT: Water Quality-Based Effluent Limitations for Cambrian Innovation
WPDES Permit No. WI-0067041-01-0

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 Cambrian Innovation in Barron County. This industrial facility discharges to an unnamed tributary to the Hay River, located in the located in the Hay River Watershed in the Lower Chippewa Basin. This discharge is included in the Tainter Lake/Lake Menomin total maximum daily load report as approved by EPA. 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	6-Month Average	Footnotes
Flow Rate						1
BOD$_5$						
May – October	**8.2 mg/L**		5.0 mg/L	**5.0 mg/L**		2, 3, 4
November – April	**16 mg/L**		10 mg/L	**10 mg/L**		
TSS	**16 mg/L**		10 mg/L	**10 mg/L**		2, 3, 4
pH	9.0 s.u.	6.0 s.u.				2, 5
Dissolved Oxygen		7.0 mg/L				2
Phosphorus				0.225 mg/L 0.013 lbs/day	0.075 mg/L 0.18 lbs/day	6
Chloride						7
Ammonia Nitrogen						8
Additives – Multiple						9
TKN, Nitrate+Nitrite, and Total Nitrogen						10
Temperature	Variable		Variable			11
Acute WET						12, 13
Chronic WET						14, 15

Footnotes:

1. Monitor whenever the discharge occurs.
2. These limits are based on the protection of the WWSF community of the UT.
3. Additional mass limits based on ch. NR 240, Wis. Adm. Code, will be addressed in a separate evaluation based on current production.
4. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.

5. These limits are required to control the discharge of the citric, nitric, and sulfuric acids additives in the discharge.
6. A water quality trading plan has been submitted as an alternative compliance option to offset any total phosphorus discharged from this outfall that exceed the phosphorus WQBELs. The phosphorus WQBELs may be expressed as computed compliance limits. Cambrian Innovation is considered a "new discharger" as described in s. NR 217.11(3), Wis. Adm. Code, and cannot receive a compliance schedule as described in section NR 217.17(4), Wis. Adm. Code. Therefore, any phosphorus limits would need to be met upon commencing discharge to the UT.
7. Chloride monitoring at a frequency of 4x/month on consecutive days is recommended during the first permit term to determine the need of chloride limits at the next permit reissuance.
8. Ammonia nitrogen monitoring at a frequency of 3x/week is recommended during the first permit term to determine the need of ammonia nitrogen limits at the next permit reissuance.
9. All additives are approved for use at their requested maximum dosages and use frequencies during the reissued permit term in the table below. The Department should be notified if the facility wishes to use any new additive, any approved additive at a greater dosage rate(s) or use frequency(ies) than currently approved, or if updated toxicity information for an additive is available from the chemical manufacturer. An additional additive review evaluation will be needed in any case.

Approved Additives

Additive	Max Dosage	Max Use Frequency (days/wk)
Alum	65 GPD	7
Cationic Polymer (A-1090T-GR)	14 GPD	6
Sodium Hydroxide 50%	1 GPD	2
Citric Acid	1.5 lbs/day	1
Nitric Acid	0.5 GPD	1
Biogas1	9 GPD	1
Ferric Sulfate 60%	110 GPD	7
Rare Earth (RE300)	8 GPD	7
Sodium Bisulfite 38%	1 GPD	1
Sulfuric Acid 93%	40 GPD	7

10. As recommended in the Department's October 1, 2019 Guidance for Total Nitrogen Monitoring in Wastewater Permits, quarterly total nitrogen monitoring is recommended for class A cheese plants. Total nitrogen is the sum of nitrate (NO_3), nitrite (NO_2), and total Kjeldahl nitrogen (TKN) (all expressed as N).
11. In accordance with s. NR 106.56(12), Wis. Adm. Code, when representative effluent temperature data is not available at the time of permit reissuance, the proposed permit shall include effluent temperature monitoring (for at least one year), WQBELs for temperature, and a compliance schedule to meet the temperature limits.

Monthly Temperature Limits

Month	Calculated Effluent Limit	
	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	49	76
FEB	50	76
MAR	52	77
APR	55	79
MAY	65	82
JUN	76	84
JUL	81	85
AUG	81	84
SEP	73	82
OCT	61	80
NOV	49	77
DEC	49	76

12. An acute WET limit trigger is recommended in the reissued permit. Acute WET tests should be performed quarterly for 12 months. If all tests pass during that period, acute WET monitoring can be reduced to 2x/yr for the remainder of the permit term, but an acute WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule should be initiated which requires a toxicity reduction evaluation (TRE) to be completed, followed by the imposition of an acute WET limit and quarterly acute testing for the remainder of the permit term. The acute WET limit shall be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit.
13. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests. Sampling WET concurrently with any chemical-specific toxic substances is recommended. Acute tests should be done in rotating quarters to collect seasonal information about this discharge and should continue after the permit expiration date (until the permit is reissued).
14. A chronic WET limit trigger is recommended in the reissued permit. Chronic WET tests should be performed quarterly for 12 months. If all tests pass during that period, quarterly chronic WET monitoring shall continue for the remainder of the permit term, but a chronic WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule shall be initiated which requires a TRE to be completed, followed by the imposition of a chronic WET limit and quarterly chronic testing for the remainder of the permit term. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.
15. The Instream Waste Concentration (IWC) to assess chronic test results is 100%. According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), chronic testing shall be performed using a dilution series of 100%, 75%, 50%, 25% & 12.5% and the dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the unnamed tributary (UT) upstream of the confluence with Outfall 001. If flow is not present in the UT, then dilution water may be collected from the Hay River upstream of the confluence with the UT. Sampling WET concurrently with any chemical-specific toxic substances

is recommended and should continue after the permit expiration date (until the permit is reissued).

Antidegradation

The proposed discharge is considered a "new discharge" under chapter NR 207, Wis. Adm. Code and is subject to the antidegradation requirements in NR 207.04, Wis. Adm. Code. To receive permit coverage for the discharge of any pollutant, the facility must submit a demonstration that one or more of the important economic or social development conditions listed in NR 207.04(c), Wis. Adm. Code, will be accommodated by the new discharger:

a. The discharger will be increasing its employment.
b. The discharger will be increasing its production level.
c. The discharger will be avoiding a reduction in its employment level.
d. The discharger will be increasing its efficiency.
e. There will be industrial, commercial, or residential growth in the community.
f. The discharger will be providing economic or social benefit to the community.
g. The discharger will be correcting an environmental or public health problem.

The proposed discharge will not result in a significant lowering of water quality as defined in NR 207.05, Wis. Adm. Code, because the receiving water does not have any assimilative capacity and limits are set equal to criteria. Therefore NR 207.04(d), Wis. Adm. Code, also does not apply in this case.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Michael Polkinghorn at (715) 360-3379 or Michael.Polkinghorn@wisconsin.gov and Diane Figiel at Diane.Figiel@wisconsin.gov.

Attachments (3) – Narrative, discharge area map, & thermal table.

PREPARED BY: Michael A. Polkinghorn – Water Resources Engineer

E-cc: Carson Johnson, Wastewater Engineer – NOR/Spooner Service Center
Michelle BalkLudwig, Regional Wastewater Supervisor – NOR/Spooner Service Center
Diane Figiel, Water Resources Engineer – WY/3
Kari Fleming, Environmental Toxicologist – WY/3
Nathaniel Willis, Wastewater Engineer – WY/3
Madeline Roberts, Regional Stream Biologist – NOR/Spooner Service Center

Attachment #1

Water Quality-Based Effluent Limitations for Cambrian Innovation

WPDES Permit No. WI-0067041-01-0

Prepared by: Michael A. Polkinghorn

PART 1 – BACKGROUND INFORMATION

Facility Description

Saputo Cheese USA, Inc in Almena, WI (SCUSA – Almena) processes milk into blue cheese and hard Italian cheeses. Process wastewater generated by these operations enters lift stations where the wastewater is pumped to Cambrian's wastewater treatment plant owned and operated by Cambrian Almena LLC. Wastewater will be actively managed and treated based upon the influent characteristics. High strength wastewater will be isolated and actively diverted to the anaerobic membrane bioreactor (AnMBR) system. Low strength wastewater will also be isolated and sent to the aerobic membrane bioreactor system (AeMBR). AnMBR permeate requires further aerobic treatment that is accomplished by sending the AnMBR permeate to the AeMBR system. The AeMBR process removes biodegradable organics and oxidizes ammonia, as well as capturing phosphorus using an enhanced biological phosphorus removal (EBPR) technique integrated into the AeMBR process. The AeMBR permeate contains minimal residual phosphorus which must be chemically precipitated and separated with the phosphorus ultrafiltration (P-UF) process. This wastewater is then cooled prior to discharge. Effluent is discharged on a continuous basis via Outfall 001 to an unnamed tributary (UT) to the Hay River, approx. 170 ft west of 6th St./CTH P and 1,625 ft north of the 10 ½ Ave./CTH P intersection. Generated industrial sludge residuals are stored in slurry form and dewatered via a screw press prior to disposal.

A limit evaluation (June 2020) for facility planning purposes was prepared for Outfall 002 of SCUSA – Almena (WPDES permit #: 0050725) evaluating the potential limits for both the discharge of condensate of whey (COW) water only and the combination of COW water and process wastewater. This discharge shares similarities with Outfall 001 such as sharing the same discharge location and influent wastewater characterization (process wastewater). The differences include being regulated under a new permit, new permittee, and new effluent characterization achieved via the new treatment process described earlier. Therefore, this evaluation will consider the limits determined from the June 2020 limit evaluation, in addition to, the limits in the current permit for SCUSA – Almena (below).

Attachment #2 is a discharge area map of Outfall 001.

Existing Permit Limitations

This is the first permit issuance for Outfall 001 of Cambrian Innovation so there are no currently effective limits in the permit. SCUSA – Almena's current permit, expiring on 06/30/2026, includes the following effluent limitations and monitoring requirements.

Parameter	Daily Maximum	Daily Minimum	Monthly Average	Footnotes
Flow Rate				1

Attachment #1

Parameter	Daily Maximum	Daily Minimum	Monthly Average	Footnotes
BOD_5	**40 mg/L**		20 mg/L	2, 3
TSS	**40 mg/L**		20 mg/L	2, 3
pH	9.0 s.u.	6.0 s.u.		2
Dissolved Oxygen		4.0 mg/L		2
Ammonia Nitrogen				1
Phosphorus				1
Temperature	100 °F			4
Conductivity				1
Acute WET				5
Chronic WET				5

Footnotes:

1. Monitoring only.
2. These limits are based on the Limited Aquatic Life (LAL) community of the immediate receiving water as described in s. NR 104.02(3)(b), Wis. Adm. Code.
3. Additional limits to comply with the expression of limits requirements in ss. NR 106.07 and NR 205.065(7), Wis. Adm. Codes, are included in bold.
4. This is a best profession judgment-based limit as described in subch. 3 of NR 220, Wis. Adm. Code.
5. Acute and chronic tests shall be conducted during periods of discharge. Testing periods shall be at least 30 days apart and testing will not exceed twice a year. The permittee is required to notify the department prior to a discharge from Outfall 002, the department compliance engineer will develop an appropriate Acute and Chronic WET testing schedule. The IWC for chronic WET was 100%.

Receiving Water Information

- Name: UT to the Hay River
- Waterbody Identification Code (WBIC): 3000238 for UT. 2068600 for Hay River.
- Classification used in accordance with chs. NR 102 and 104, Wis. Adm. Code: Warm Water Sport Fish (WWSF) community, non-public water supply for both UT and Hay River.
  - Limits in the current permit for SCUSA – Almena was based on an LAL community classification. This classification is not in ch. NR 104 and has been included in the latest rule revision proposal to ch. NR 104 dated April 2003. There is no use designation survey documentation that support this classification from SE ¼, NE ¼, Section 12; T33N – R14W (Outfall 001 location) downstream to the NE ¼, Section 8; T33N – R13W (Town road crossing – 10 ½ avenue), just upstream of the confluence of the Hay River. A preliminary assessment to determine the receiving water's natural biological community status was conducted in September 2019 and was inconclusive due to the excessive growth of reed canary grass and cattails throughout the survey area. An additional fish survey was planned in 2020 but did not happen due to the COVID pandemic. After consultation with the Department Water Quality Specialist and regional Stream Biologist, the UT is likely to support a WWSF community considering the continuous discharge of Outfall 001 (0.28 MGD = 0.43 cfs). Therefore, the WWSF community classification will be utilized in this evaluation.
  - Downstream impacts to the Hay River are not considered in this evaluation since the UT has the

same RW classification with less assimilative capacity.

- Low flows used in accordance with chs. NR 106 and 217, Wis. Adm. Code: The low flows for the UT are zero.
- % of low flow used to calculate limits in accordance with s. NR 106.06(4)(c)5., Wis. Adm. Code: Not applicable where the receiving water low flows are zero.
- Source of background concentration data: Background concentrations are not included because they do not impact the calculated WQBEL when the receiving water low flows are equal to zero.
- Multiple dischargers: None.
- Impaired water status: There are no known impairments to the UT. Approx. 3.5 mi downstream of Outfall 001, the Hay River is on the Clean Water Act Section 303d list for a phosphorus impairment. This discharge is included in the Tainter Lake/Lake Menomin TMDL to address phosphorus impairments within the TMDL area.

Effluent Information

- Flow rate(s):
  Maximum annual average = 0.28 million gallons per day (MGD)
  For reference, the flow rate estimate used for process wastewater in the previous limit evaluation (June 2020) was 0.485 MGD.
- 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: Water supply from private wells.
- Total phosphorus wasteload allocation (WLA): 2.5 lbs/year = 0.007 lbs/day (see Table 5 of the TMDL report document, "*Phosphorus Total Maximum Daily Loads (TMDLs) Tainter Lake and Lake Menomin Dunn County, Wisconsin, May 2012,* page 15*"*).
- Additives: The facility has included 10 additives in the permit application that will be used in the process waste stream to Outfall 001. These additives are listed below:
  - PRO Chemical & Dye Alum – Chemical phosphorus treatment.
  - Aquablue Cationic Polymer (A-1090T-GR) – Sludge dewatering conditioner.
  - MilliporeSigma Sodium Hydroxide 50% – Cleaning-in-place (CIP) and alkalinity addition to digester.
  - MilliporeSigma Citric Acid – CIP.
  - Fisher Scientific Nitric Acid – CIP.
  - Aquafix Biogas1 – Correct nutrient deficiency.
  - Chemtrade Logistics Ferric Sulfate 60% – Sludge coagulant.
  - Hill Brothers Chemical Ferric Chloride – Address nutrient deficiency in digester.
  - Neo Chemicals & Oxides Rare Earth (RE300) – Phosphorus precipitation.
  - PVS Chemical Solutions Sodium Bisulfite 38% – Membrane preservative.
  - Univar Solutions Sulfuric Acid 93% – pH adjuster.
  - The need for any limits or use restrictions for these additives is evaluated in Part 8 of this evaluation.
- Effluent characterization: This facility is categorized as a secondary industry and could not provide standard monitoring requirement samples since Outfall 001 is not yet active. In this case, effluent information from similar discharges will be used to determine the need for monitoring for substances when appropriate to further determine the need for limits at the next permit reissuance.

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)

Chloride – A review of limit evaluations for other discharges of dairy process wastewaters have shown effluent chloride concentrations can be at levels of concern to the point chloride WQBELs are needed. The applicable chloride WQBELs for Outfall 001 should reasonable potential be demonstrated are 760 mg/L as a daily maximum and 400 mg/L as a weekly average for informational purposes. **Therefore, chloride monitoring at a frequency of 4x/month on consecutive days is recommended during the first permit term to determine the need of chloride limits at the next permit reissuance.**

PFOS and PFOA – The need for PFOS and PFOA monitoring is evaluated in accordance with s. NR 106.98(2), Wis. Adm. Code. Based on the type of discharge and the lack of available PFOS/PFOA effluent and source water monitoring data, **PFOS and PFOA monitoring is not recommended during the permit term.** The Department may re-evaluate 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.

PART 3 – WATER QUALITY-BASED EFFLUENT LIMITATIONS FOR CONVENTIONAL POLLUTANTS

In establishing BOD_5 limitations, the primary intent is to prevent a lowering of dissolved oxygen levels in the receiving water below water quality standards as specified in ss. NR 102.04(4)(a) and (b). The 26-lb method is the most frequently used approach for calculating BOD_5 limits when resources are not available to develop a detailed water quality model. This simplified model was developed in the 1970's by the Wisconsin Committee on Water Pollution on the Fox, Wisconsin, Oconto, and Flambeau Rivers. Further studies throughout the 1970's proved this model to be relatively accurate. The model has since then been used by the Department on many occasions when resources are not available to perform a site-specific model. The "26" value stems from the following equation:

$$\frac{26\,{}^{\text{lbs}}\!/_{\text{day}}}{{}^{\text{ft}^3}\!/_{\text{sec}}} * \frac{1\,\text{day}}{86{,}400\,\text{sec}} * \frac{454{,}000\,\text{mg}}{\text{lbs}} * \frac{1\,\text{ft}^3}{28.32\,\text{L}} = 4.8 = 2.4 * 2\,{}^{\text{mg}}\!/_{\text{L}}$$

The 4.8 mg/L has been calculated by taking 2.4 mg/L which is the number one receives when converting 26 lbs. of BOD/day/cfs into mg/L, multiplied by 2.0 which is the change in the DO level. A typical background DO level for Wisconsin waters is 7 mg/L, so a 2 mg/L decrease is allowed to meet the 5 mg/L standard for warm water streams. The above relationship is temperature dependent and an appropriate temperature correction factor is applied. The 26-lb method is based on a typical 24°C summer value for warm water streams. Adjustments for temperature are made using the following equation:

$$k_t = k_{24}\left(0.967^{(T-24)}\right)$$

Where k_{24} = 26 lbs. of BOD/day/cfs

Calculations based on Full Assimilative Capacity at 7-Q_{10} Conditions:

$$Limitation(mg/L) = 2.4\left(DO_{stream} - DO_{std}\right)\left(\frac{\left({}_7Q_{10} + Q_{eff}\right)}{Q_{eff}}\right)\left(0.967^{(T-24)}\right)$$

Where:

Q_{eff} = effluent flow = 0.28 MGD
DO_{stream} = background dissolved oxygen = 7.0 mg/L
DO_{std} = dissolved oxygen criteria from s. NR 102.04(4), Wis. Adm. Code = 5.0 mg/L
7-Q_{10} = 0 cfs
T = Receiving water temperature from s. NR 102.25, Wis. Adm. Code

Because no dilution is available in the receiving water, the calculated limits would be the lowest that the Department typically gives to facilities per standing policy. **These effluent limitations are 5.0 mg/L during May – October and 10 mg/L during November – April, expressed as weekly average limits. A dissolved oxygen limit of 7.0 mg/L as a daily minimum is also recommended.** This is consistent with the assumed dissolved oxygen effluent concentration in the calculation of the BOD_5 limitations. Mass limits for BOD_5 are not required because the receiving water will be effluent dominated.

Revisions to chs. NR 106 and 205, Wis. Adm. Code, align Wisconsin's WQBELs with 40 CFR 122.45(d), which requires WPDES permits to contain daily maximum and monthly average limits for industrial discharges. In this case, whenever a weekly average limitation is determined necessary to protect water quality:

- A monthly average limitation shall also be included in the permit and set equal to the weekly average limit unless a more restrictive limit is already determined necessary to protect water quality.
- A daily maximum limitation shall also be included in the permit and set equal to the daily maximum WQBEL calculated under s. NR 106.06, Wis. Adm. Code, or a daily maximum limitation calculated using the following procedure, whichever is more restrictive:

Daily Maximum Limitation = Weekly average WQBEL × DMF

Where:

DMF = Daily Multiplication Factor as defined in Table 2
CV = coefficient of variation (CV) as calculated in s. NR 106.07(5m), Wis. Adm. Code.
= 0.6 due to lack of effluent BOD_5 data.

s. NR 106.07 (4) (e). Table 2 — Daily Multiplication Factor

CV	0.1	0.2	0.3	0.4	0.5	**0.6**	0.7	0.8	0.9	1.0
DMF	1.114	1.235	1.359	1.460	1.557	**1.639**	1.712	1.764	1.802	1.828

CV	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0
DMF	1.842	1.849	1.851	1.843	1.830	1.815	1.801	1.781	1.751	1.744

Note: This methodology is based on the *Technical Support Document for Water Quality-based Toxics Control* (March 1991). PB91-127415.

Therefore, the daily maximum and monthly average BOD_5 limits of 8.2 and 5.0 mg/L, respectively,

are required during May – October. The daily maximum and monthly average BOD_5 limits of 16 and 10 mg/L, respectively, are required during November – April.

Total Suspended Solids (TSS)

Total suspended solids (TSS) effluent limits are regulated via narrative standards described in NR 102.04(1), Wis. Adm. Code. TSS effluent limits are included whenever BOD_5 WQBELs are needed and are set equal to the BOD_5 limits but no lower than 10 mg/L per Department policy. **Because BOD_5 WQBELs are recommended, the weekly average TSS limit of 10 mg/L is also recommended during the reissued permit term.**

Similar to BOD_5, daily maximum and monthly average TSS limits are also needed to satisfy expression of limits requirements. **Therefore, the daily maximum and monthly average TSS limits of 16 and 10 mg/L, respectively, are required during the reissued permit term.**

pH

The current permit for SCUSA – Almena has the daily minimum and daily maximum limit range of 6.0 – 9.0 s.u. which are categorical limits for a discharge to an LAL community receiving water. Cambrian Innovation will also be utilizing citric, nitric, and sulfuric acids in the process waste stream to Outfall 001. These existing pH limits will control the discharge of these additives to meet the pH water quality standards as described in s. NR 102.04(4)(c), Wis. Adm. Code. **Therefore, the pH limits are recommended during the first permit term.**

PART 4 – 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. Given the fact that the Cambrian Innovation does not currently have ammonia nitrogen limits, the need for limits is evaluated at this time.

A review of limit evaluations for similar discharges of dairy process wastewaters have shown effluent ammonia nitrogen concentrations can be at levels of concern to the point ammonia nitrogen WQBELs are needed. **Therefore, ammonia nitrogen monitoring at a frequency of 3x/week is recommended during the first permit term to determine the need of ammonia nitrogen limits at the next permit reissuance.**

PART 5 – PHOSPHORUS

Technology-Based Effluent Limit

Subchapter II of Chapter NR 217, Wis. Adm. Code, requires industrial facilities that discharge greater than 60 pounds of total phosphorus per month to comply with a 12-month rolling average limit of 1.0 mg/L, or an approved alternative concentration limit. There is currently no effluent phosphorus concentration or flow rate data to determine the need of a technology-based limit. For informational purposes, the technology-based limit would be needed at an effluent concentration of 0.856 mg/L based on an effluent flow of 0.28 MGD.

Water Quality-Based Effluent Limits (WQBEL)

Revisions to administrative rules regulating phosphorus took effect on December 1, 2010. These rule revisions include additions to s. NR 102.06, Wis. Adm. Code, which establish phosphorus standards for surface waters. Subchapter III of NR 217, Wis. Adm. Code, establishes procedures for determining WQBELs for phosphorus, based on the applicable standards in ch. NR 102, Wis. Adm. Code.

The TL/LM TMDL report was written to ensure that phosphorus water quality criteria are attained in Tainter Lake and Lake Menomin and are not necessarily protective of phosphorus water quality of other surface waterbodies in the TMDL area. Therefore, the need for a phosphorus WQBEL as described in s. NR 217.13, Wis. Adm. Code, must be considered in addition to any limits required by the TMDL report.

Section NR 102.06(3)(a), Wis. Adm. Code, specifically names river segments for which a phosphorus criterion of 0.100 mg/L applies. For other stream segments that are not specified in s. NR 102.06(3)(a), Wis. Adm. Code, s. NR 102.06(3)(b), Wis. Adm. Code, specifies a phosphorus criterion of 0.075 mg/L. The phosphorus criterion of 0.075 mg/L applies for the UT.

The conservation of mass equation is described in s. NR 217.13(2)(a), Wis. Adm. Code, for phosphorus WQBELs and includes variables of water quality criterion (WQC), receiving water flow rate (Qs), effluent flow rate (Qe), and upstream phosphorus concentrations (Cs) provided below.

$$\text{Limitation} = [(WQC)(Qs+(1-f)\ Qe) - (Qs-f\ Qe)\ (Cs)]/Qe$$

Where:

WQC = 0.075 mg/L for the UT.
Qs = 100% of the 7-Q_2 of 0 cfs.
Cs = background concentration of phosphorus in the receiving water pursuant to s. NR 217.13(2)(d), Wis. Adm. Code
Qe = effluent flow rate = 0.28 MGD = 0.43 cfs.
f = the fraction of effluent withdrawn from the receiving water = 0.

The effluent limit is set equal to criteria because the receiving water flow is equal to zero.

Reasonable Potential Determination

Cambrian Innovation is considered a “new discharger” as described in s. NR 217.11(3), Wis. Adm. Code. Section NR 217.15(1)(e), Wis. Adm. Code, states the department shall include a phosphorus WQBEL in a permit for a new discharger if the Department determines the new discharger will discharge phosphorus at concentrations or loadings which may cause or contribute to exceedances of the water quality criteria in either the receiving water or downstream waters. To estimate the amount of phosphorus discharged by a new discharger, the department may consider projected discharge information from the permit applicant and phosphorus discharge information from similar sources.

A review of limit evaluations for similar discharges of dairy process wastewaters have shown effluent phosphorus concentrations can be at levels of concern to the point phosphorus WQBELs are needed. **Therefore, a phosphorus WQBEL based on s. NR 217.13, Wis. Adm. Code, is required.**

Limit Expression

According to s. NR 217.14(2), Wis. Adm. Code, because the calculated WQBEL is less than or equal to 0.3 mg/L, **the effluent limit of 0.075 mg/L may be expressed as a six-month average.** If a concentration limitation expressed as a six-month average is included in the permit, **a monthly average concentration limitation of 0.225 mg/L, equal to three times the WQBEL calculated under s. NR 217.13, Wis. Adm. Code shall also be included in the permit.** The six-month average should be averaged during the months of May – October and November – April.

Mass Limits
A mass limit is also required, pursuant to s. NR 217.14(1)(a), Wis. Adm. Code, because the Hay River has a phosphorus impairment, approx. 3.5 mi downstream of Outfall 001. **This final mass limit shall be 0.075 mg/L × 8.34 × 0.28 MGD = 0.18 lbs/day expressed as a 6-month average.**

TMDL Limit
The TL/LM TMDL expresses WLAs for TP as maximum annual loads (pounds per year) and maximum daily loads (pounds per day), which equal the maximum annual loads divided by the number of days in the year. For Cambrian Innovation, these phosphorus WLAs are 2.5 lbs/yr and 0.007 lbs/day. These WLAs were originally allocated to SCUSA – Alema facility but will be utilized for Cambrian Innovation since they will be treating the surface water discharge from the SCUSA – Almena facility.

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 the phosphorus WQBELs set equal to WLAs would not be consistent with the assumptions and requirements of the TMDL. Therefore, limits given to facilities included in the TL/LM TMDL are given monthly average mass limits since the TL/LM TMDL WLAs are derived on an effluent concentration of 1 mg/L or greater. The monthly average limit of 0.013 lbs/day was determined in the previous facility planning limit evaluation (June 2020). The multiplier of 1.90 was chosen utilizing the parameters of CV = 0.6 and a weekly or less effluent monitoring scheme as described in the Department guidance document, "*TMDL Implementation Guidance for Wastewater Permits Edition No. 6, (March 2024)"*. **Therefore, the monthly average limit of 0.013 lbs/day should be included in the reissued permit regardless of reasonable potential.**

Cambrian Innovation is considered a "new discharger" as described in s. NR 217.11(3), Wis. Adm. Code, and cannot receive a compliance schedule as described in section NR 217.17(4), Wis. Adm. Code. Therefore, any phosphorus limits would need to be met upon commencing discharge to the UT.

Water Quality Trading Minimum Control Level
A WQT plan has been submitted as an alternative compliance option to offset any total phosphorus discharged from Outfall 001 that exceed the phosphorus WQBELs. The phosphorus WQBELs may be expressed as computed compliance limits, but a maximum control level (MCL) must be set as a limit not to be exceeded at the outfall location. In this case an MCL cannot be determined at this time because Outfall 001 is a new discharge with no available effluent phosphorus data. **Therefore, an MCL is not recommended during the reissued permit term.**

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. Calculated limits are set equal to criteria based on a WWSF classification due to estimated zero low-flow in the receiving water. The complete thermal table used for calculations is included as attachment #3.

Monthly Temperature Limits

Month	Calculated Effluent Limit	
	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	49	76
FEB	50	76
MAR	52	77
APR	55	79
MAY	65	82
JUN	76	84
JUL	81	85
AUG	81	84
SEP	73	82
OCT	61	80
NOV	49	77
DEC	49	76

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

In accordance with s. NR 106.56(12), Wis. Adm. Code, when representative effluent temperature data is not available at the time of permit reissuance, **the proposed permit shall include effluent temperature monitoring (for at least one year), WQBELs for temperature, and a compliance schedule to meet the temperature limits.**

The following general options are available for a facility to explore potential relief from the temperature limits:

- Effluent monitoring data: Verification or additional effluent monitoring (flow and/or temperature) may be appropriate if there were questions on the representativeness of the current effluent data.
- Collection of site-specific ambient temperature: default background temperatures for streams in Wisconsin, so actual data from the direct receiving water may provide for relaxed thermal limits but only if the site-specific temperatures are lower than the small stream defaults used in the above tables
- A variance to the water quality standard: This is typically considered to be the least preferable and most complex option as it requires the evaluation of the other alternatives.

These options are explained in additional detail in the August 15, 2013 Department *Guidance for Implementation of Wisconsin's Thermal Water Quality Standards*.

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).*

- Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. To assure that a discharge is not acutely toxic to organisms in the receiving water, WET tests must produce a statistically valid LC_{50} (Lethal Concentration to 50% of the test organisms) greater than 100% effluent, according to s. NR 106.09(2)(b), Wis. Adm Code.

- Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure. To assure that a discharge is not chronically toxic to organisms in the receiving water, WET tests must produce a statistically valid IC_{25} (Inhibition Concentration) greater than the instream waste concentration (IWC), according to s. NR 106.09(3)(b), Wis. Adm Code. The IWC is an estimate of the proportion of effluent to total volume of water (receiving water + effluent). The IWC of 100% shown in the WET Checklist summary below was calculated according to the following equation, as specified in s. NR 106.03(6), Wis. Adm Code:

$$\text{IWC (as \%)} = Q_e \div \{(1 - f)\, Q_e + Q_s\} \times 100$$

Where:

Q_e = annual average flow = 0.28 MGD = 0.43 cfs.
f = fraction of the Q_e withdrawn from the receiving water = 0.
Q_s = ¼ of the 7-Q_{10} = 0 cfs ÷ 4 = 0 cfs.

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), a synthetic (standard) laboratory water may be used as the dilution water and primary control in acute WET tests, unless the use of different dilution water is approved by the Department prior to use. The primary control water must be specified in the WPDES permit.

Attachment #1

- According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Table A, Wis. Adm. Code), receiving water must be used as the dilution water and primary control in chronic WET tests, unless the use of different dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on Outfall 001 shall be a grab sample collected from the receiving water location, upstream and out of the influence of the mixing zone and any other known discharge. The specific receiving water location must be specified in the WPDES permit.

- Shown below is a tabulation of all available WET data for Outfall 002 of SCUSA – Almena's permit and will be used to make WET-based decisions for Outfall 001. Efforts are made to ensure that decisions about WET monitoring and limits are made based on representative data, as specified in s. NR 106.08(3), Wis. Adm Code. Data which is not believed to be representative of the discharge was not included in reasonable potential calculations. The table below differentiates between tests used and not used when making WET determinations.

WET Data History

Date Test Initiated	Acute Results LC_{50} % (% survival in 100% effluent)				Chronic Results IC_{25} %				Footnotes or Comments
	C. dubia	Fathead minnow	Pass or Fail?	Used in RP?	*C. dubia*	Fathead Minnow	Pass or Fail?	Use in RP?	
10/26/1995	68.7	>100	Fail	Yes	4.2	12.3	Fail	Yes	
12/07/1995	>100	>100	Pass	Yes	95	NA	Fail	No	1
03/26/1996	>100	>100	Pass	Yes					
09/24/1996	>100	>100	Pass	Yes	>100	NA	NA	No	1
09/23/1997	>100	>100	Pass	Yes	60.6	75.7	Fail	Yes	
09/25/1997	0	>100	Fail	Yes	14.7	82.8	Fail	Yes	
12/09/1997					68.4	>100	Fail	Yes	
12/16/1997					65.2	>100	Fail	Yes	
03/11/1998	>100	>100	Pass	Yes					
08/04/1998	70.7	>100	Fail	Yes	47.9	NA	Fail	No	1
09/22/1998	74.2	>100	Fail	Yes	58.5	>100	Fail	Yes	
12/15/1998	>100	>100	Pass	Yes	66.3	40	Fail	Yes	
06/08/1999					NA	NA	NA	No	1
12/01/1999	>100	>100	Pass	Yes	65.9	>100	Fail	Yes	

Footnotes:

1. *Qualified or Inconclusive Data.* Data quality concerns were noted during testing which calls into question the reliability of the test results.

- According to s. NR 106.08, Wis. Adm. Code, WET reasonable potential is determined by multiplying the highest toxicity value that has been measured in the effluent by a safety factor, to predict the likelihood (95% probability) of toxicity occurring in the effluent above the applicable WET limit. The safety factor used in the equation changes based on the number of toxicity detects in the dataset. The fewer detects present, the higher the safety factor, because there is more uncertainty surrounding the predicted value. WET limits must be given, according to s. NR 106.08(6), Wis. Adm. Code, whenever the applicable Reasonable Potential equation results in a value greater than 1.0.

Acute Reasonable Potential = [(TUa effluent) (B)(AMZ)]

Chronic Reasonable Potential = [(TUc effluent) (B)(IWC)]

According to s. NR 106.08(6)(d), Wis. Adm. Code, TUa and TUc effluent values are equal to zero whenever toxicity is not detected (i.e. when the LC_{50}, IC_{25} or $IC_{50} \geq 100\%$).

Acute Reasonable Potential = [(TUa effluent) (B)]

The lowest LC_{50} value is zero (09/25/1997) which results in an undefined TU_a. The next lowest value of 68.7 (10/26/1995) is used for the reasonable potential calculation.

Acute WET Limit Parameters

TUa (maximum) $100/LC_{50}$	**B** (multiplication factor from s. NR 106.08(5)(c), Wis. Adm. Code, Table 4)
100/68.7 = 1.5	2.6 Based on 4 detects

[(TUa effluent) (B)] = 3.8 > 1.0

Chronic Reasonable Potential = [(TU_c effluent) (B)(IWC)]

Chronic WET Limit Parameters

TUc (maximum) $100/IC_{25}$	**B** (multiplication factor from s. NR 106.08(6)(c), Wis. Adm. Code, Table 4)	IWC
100/4.2 = 24	1.9 Based on 8 detects	100%

[(TUc effluent) (B)(IWC)] = 45 > 1.0

Therefore, reasonable potential is shown acute and chronic WET using the procedures in s. NR 106.08(6), Wis. Adm. Code, and representative data from October 1995 – December 1999.

Expression of WET limits

Acute WET limit = 1.0 TU_a as a daily maximum.

Chronic WET limit = [100/IWC] TU_c = 1.0 TU_c as a monthly average.

The WET checklist was developed to help DNR staff make recommendations regarding WET limits, monitoring, and other related permit conditions. The checklist indicates whether acute and chronic WET limits are needed, based on requirements specified in s. NR 106.08, Wis. Adm. Code. The checklist steps the user through a series of questions, assesses points based on the potential for effluent toxicity, and suggests monitoring frequencies based on points accumulated during the checklist analysis. As toxicity potential increases, more points accumulate, and more monitoring is recommended to ensure that toxicity is not occurring. A summary of the WET checklist analysis completed for this permittee is shown in the table below. Staff recommendations based on best professional judgment are provided below the summary table. For guidance related to reasonable potential and the WET checklist, see Chapter 1.3 of the WET Guidance

Attachment #1

Document: https://dnr.wisconsin.gov/topic/Wastewater/WET.html.

WET Checklist Summary

	Acute	Chronic
AMZ/IWC	Not applicable. **0 Points**	IWC = 100%. **15 Points**
Historical Data	11 tests used to calculate RP. 4 tests failed. No data available for the past 5 years. **5 Points**	8 tests used to calculate RP. 8 tests failed. No data available for the past 5 years. **5 Points**
Effluent Variability	Discharge not active. **0 Points**	Discharge not active. **0 Points**
Receiving Water Classification	WWSF community. **5 Points**	Same as acute. **5 Points**
Chemical-Specific Data	Dairy process wastewater will likely have at least detectable amounts of ammonia nitrogen and chloride. **2 Points**	Dairy process wastewater will likely have at least detectable amounts of ammonia nitrogen and chloride. **2 Points**
Additives	No biocides and 11 water quality conditioners added. Permittee has proper P chemical SOPs in place: No. **26 Points**	All additives used more than once per 4 days. **26 Points**
Discharge Category	Dairy/cheesemaker. **20 Points**	Same as acute. **20 Points**
Wastewater Treatment	Secondary or better. **0 Points**	Same as acute. **0 Points**
Downstream Impacts	No impacts known. **0 Points**	Same as acute. **0 Points**
Total Checklist Points:	**58 Points**	**73 Points**
Recommended Monitoring Frequency (from Checklist):	2x/yr acute tests.	Quarterly chronic tests.
Limit Required?	Limit = 1.0 TU_a	Limit = 1.0 TU_c
TRE Recommended? (from Checklist)	Yes.	Yes.

- According to the requirements specified in s. NR 106.08, Wis. Adm. Code, both acute and chronic WET limits are required. The acute WET limit shall be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.

- A minimum of annual acute and chronic monitoring is required because acute and chronic WET limits are required. Federal regulations in 40 CFR Part 122.44(i) require that monitoring occur at least once per year when a limit is present. In this case, after consideration of the guidance provided in the Department's WET Program Guidance Document (2022) and other information described above, 2x/yr acute and quarterly chronic WET tests are recommended instead in the reissued permit. Acute tests should be done in rotating quarters to collect seasonal information about this discharge. WET testing should continue after the permit expiration date (until the permit is reissued).

- The available WET data suggests a potential concern for acute and chronic toxicity represented by the prior stated recommendations. However, it is questionable whether this available WET data is representative of the current or future discharges. The existing WET data is based on discharge scenarios where the wastewater in question was both untreated process wastewater (including COW water) and treated in the previous aerated lagoon system WWTF. The new WWTF is expected to have significantly greater treatment capability treating process wastewater but the degree of the effect it will have on removing acute and chronic WET is uncertain. **Therefore, it is recommended that acute and chronic WET limit triggers be placed in the reissued permit**.

- **Acute WET Limit Trigger: Acute WET tests should be performed quarterly for 12 months. If all tests pass during that period, acute WET monitoring can be reduced to 2x/yr for the remainder of the permit term, but an acute WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule should be initiated which requires a toxicity reduction evaluation (TRE) to be completed, followed by the imposition of an acute WET limit and quarterly acute testing for the remainder of the permit term. The acute WET limit shall be expressed as 1.0 TUa as a daily maximum in the effluent limits table of the permit.**

- **Chronic WET Limit Trigger: Chronic WET tests should be performed quarterly for 12 months. If all tests pass during that period, quarterly chronic WET monitoring shall continue for the remainder of the permit term, but a chronic WET limit and TRE will not be required. If any WET tests fail in the first 12 months, a compliance schedule shall be initiated which requires a TRE to be completed, followed by the imposition of a chronic WET limit and quarterly chronic testing for the remainder of the permit term. The chronic WET limit shall be expressed as 1.0 TUc as a monthly average in the effluent limits table of the permit.**

PART 8 – ADDITIVE REVIEW

Unlike the metals and toxic substances evaluated in Part 2, most additives have not undergone the amount of toxicity testing needed to calculate water quality criteria. Instead, in cases where the minimum data requirements necessary to calculate a WQC are not met, a secondary value can be used to regulate the substance, according to s. NR 105.05, Wis. Adm. Code. Whenever an additive is discharged directly into a surface water without receiving treatment or an additive is used in the treatment process and is not expected to be removed before discharge, a review of the additive is needed. Secondary values should be derived according to s. NR 105.05, Wis. Adm. Code. Guidance related to conducting an additive review can be found in *Water Quality Review Procedures for Additives* (2019) (http://dnr.wi.gov/topic/wastewater/Guidance.html).

Additive Parameters

Additive Name	Manufacturer	Purpose of Additive including where added	Use Frequency (days/wk)	Max Quantity Used	Equivalent Effluent Conc. (mg/L)	Potential Use Restriction
Alum[1]	PRO Chemical & Dye	Chemical phosphorus treatment	7	65 GPD	NA	SOP
Cationic Polymer (A-1090T-GR)[2]	Aquablue	Sludge dewatering conditioner	6	14 GPD	NA	Not expected in discharge.

Attachment #1

Additive Name	Manufacturer	Purpose of Additive including where added	Use Frequency (days/wk)	Max Quantity Used	Equivalent Effluent Conc. (mg/L)	Potential Use Restriction
Sodium Hydroxide 50%[2]	MilliporeSigma	Cure-in-place (CIP) and digester alkalinity adjuster	2	1 GPD	NA	Toxicity documented/understood.
Citric Acid[2]	MilliporeSigma	CIP	1	1.5 lbs/day	NA	pH WQBELs
Nitric Acid[2]	Fisher Scientific	CIP	1	0.5 GPD	NA	pH WQBELs
Biogas1[3]	Aquafix	Nutrient deficiency correction	1	9 GPD	32 mg/L	DM = 230 mg/L
Ferric Sulfate 60%[1]	Chemtrade Logistics	Nutrient deficiency and sludge coagulant	7	110 GPD	NA	SOP
Rare Earth (RE300)[1]	Neo Chemicals & Oxides	Phosphorus precipitation	7	8 GPD	NA	SOP
Sodium Bisulfite 38%[2]	PVS Chemical Solutions	Membrane preservative	1	1 GPD	NA	Toxicity documented/understood.
Sulfuric Acid 93%	Univar Solutions	pH adjuster	7	40 GPD	NA	pH WQBELs

1. Potential toxicity caused by additives utilized for chemical phosphorus treatment are evaluated in Part 7 of this evaluation instead of an additive review.
2. An additive review is not necessary for any additives where either the toxicity is well documented and understood, can be controlled by a WQBEL, or are not believed to be present in the discharge.
3. Calculated based on toxicity data provided.

Biogas1 – This additive is used to correct a nutrient deficiency presumably in the anaerobic digester in the process waste stream to Outfall 001. Secondary acute and chronic values are determined based on acute toxicity test data provided by Cambrian Innovation. The secondary acute value is 229.29 mg/L and is set directly as a daily maximum limit of 230 mg/L using two significant figures. The secondary chronic value is 12.74 mg/L based on the default secondary acute to chronic ratio of 18 and is set equal as a weekly average limit of 13 mg/L rounded to two significant figures with no assimilative capacity in the receiving water. The weekly average limit is not needed because the discharge of effluent containing Biogas1 would be less than 4 consecutive days/wk (1x day/wk).

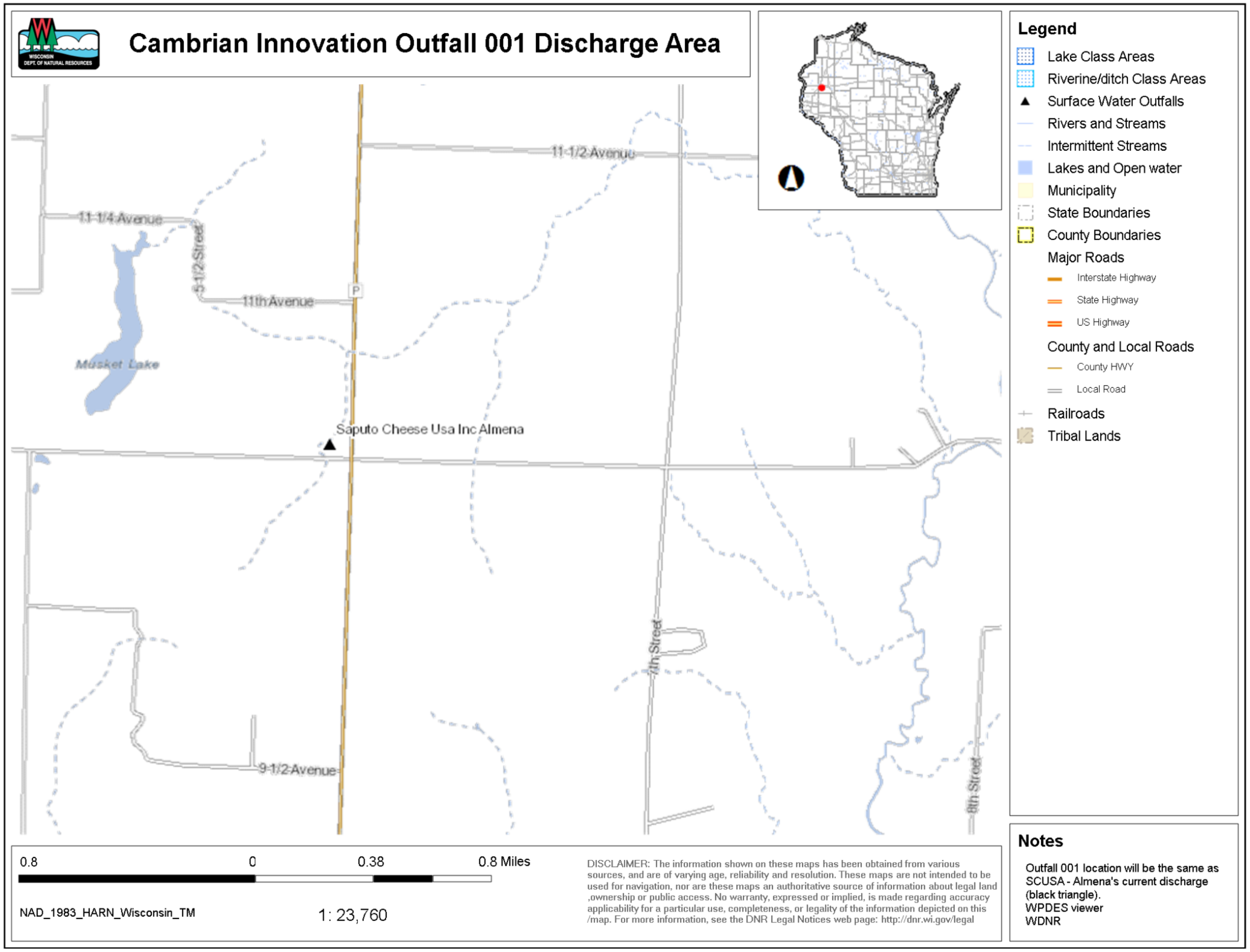
Cambrian Innovation has requested the use of this additive at a maximum dosage rate of 9 GPD. Assuming none of the additive is lost to the environment from the application point to Outfall 006, an additive density of 1 g/cm^3, and an effluent flow of 0.28 MGD, the equivalent effluent concentration is approx. 32 mg/L. This effluent concentration is below 1/5th of the daily maximum limit (46 mg/L). At the requested maximum dosage rate, limits or use restrictions are not recommended. **Therefore, this additive is approved at the requested maximum dosage rate and use frequency of 9 GPD and 1x day/wk for Outfall 001.**

Attachment #2

The Department should be notified if the facility wishes to use any new additive, any approved additive at a greater dosage rate(s) or use frequency(ies) than currently approved, or if updated toxicity information for an additive is available from the chemical manufacturer. An additional additive review evaluation will be needed in any case.

Attachment #2

Cambrian Innovation Outfall 001 Discharge Area



Notes

Outfall 001 location will be the same as SCUSA - Almena's current discharge (black triangle).
WPDES viewer
WDNR

Attachment #3

Temperature Limits for Receiving Waters with Unidirectional Flow

(calculation using default ambient temperature data)

Facility: Outfall 001

Outfall(s): 001

Date Prepared: 4/9/2024

Design Flow (Qe): 0.28 MGD

Storm Sewer Dist. 0 ft

7-Q10: 0.00 cfs

Dilution: 25%

f: 0

Stream type: Small warm water sport or forage fis ▼

Qs:Qe ratio: 0.0 :1

Calculation Needed? YES

	Temp Dates	**Flow Dates**
Start:	NA	NA
End:	NA	NA

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) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)	(cfs)	7-day Rolling Average (Qesl) (MGD)	Daily Maximum Flow Rate (Qea) (MGD)		Weekly Average (°F)	Daily Maximum (°F)	Weekly Average Effluent Limitation (°F)	Daily Maximum Effluent Limitation (°F)
JAN	33	49	76	0	0	0	0			49	76
FEB	34	50	76	0	0	0	0			50	76
MAR	38	52	77	0	0	0	0			52	77
APR	48	55	79	0	0	0	0			55	79
MAY	58	65	82	0	0	0	0			65	82
JUN	66	76	84	0	0	0	0			76	84
JUL	69	81	85	0	0	0	0			81	85
AUG	67	81	84	0	0	0	0			81	84
SEP	60	73	82	0	0	0	0			73	82
OCT	50	61	80	0	0	0	0			61	80
NOV	40	49	77	0	0	0	0			49	77
DEC	35	49	76	0	0	0	0			49	76

C - FIELD SOIL MAPS, SOIL TESTING RESULTS, INCLUDING STRATIFICATION RESULTS

Field A

92° 2' 4" W

Map Scale: 1:3,120 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 45, 90, 180, 270

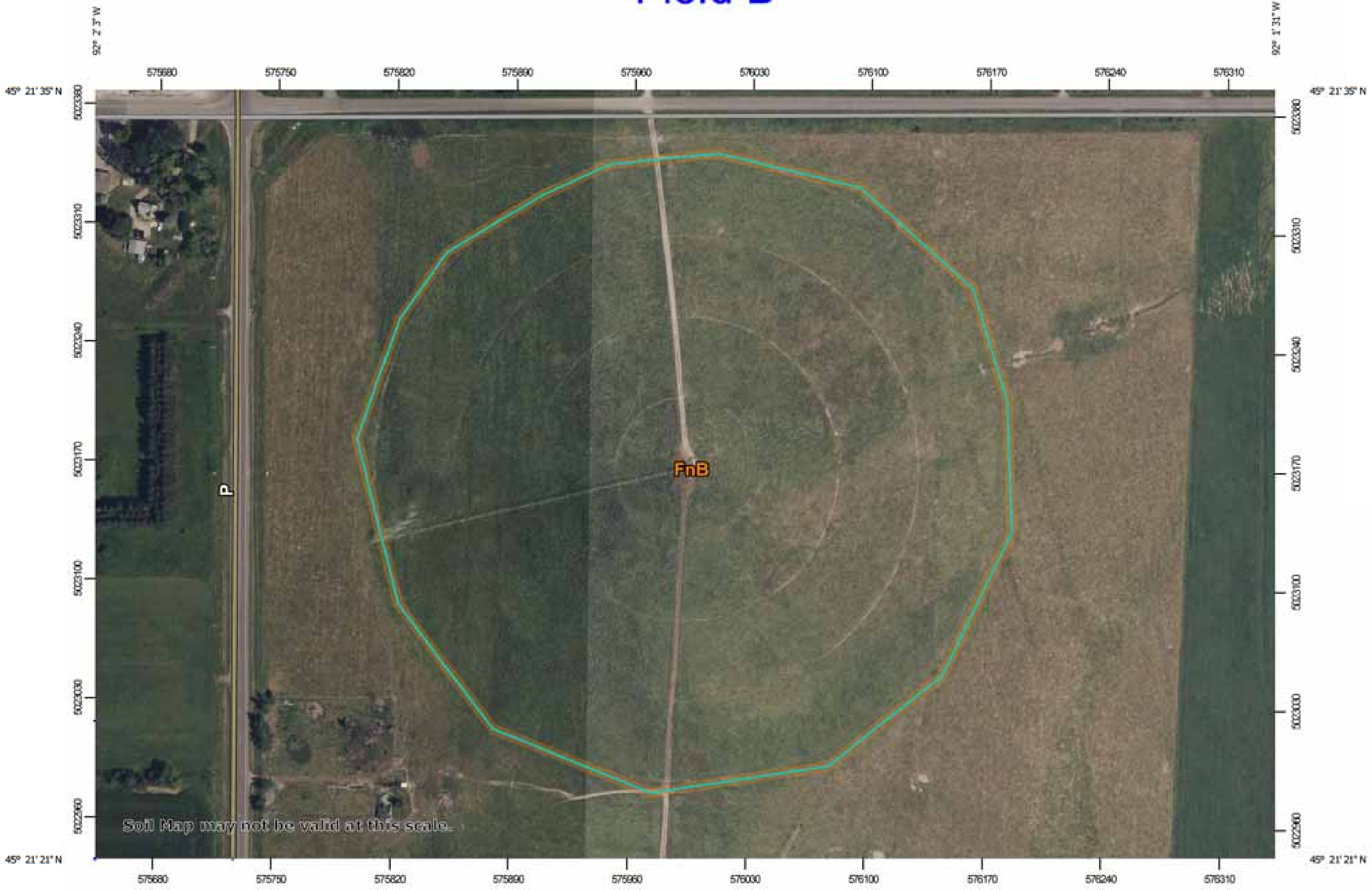
Feet: 0, 150, 300, 600, 900

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	23.9	89.9%
SaB	Santiago silt loam, 2 to 6 percent slopes	1.4	5.2%
SaC2	Santiago silt loam, 6 to 12 percent slopes, eroded	1.3	4.9%
Totals for Area of Interest		**26.6**	**100.0%**

Field B

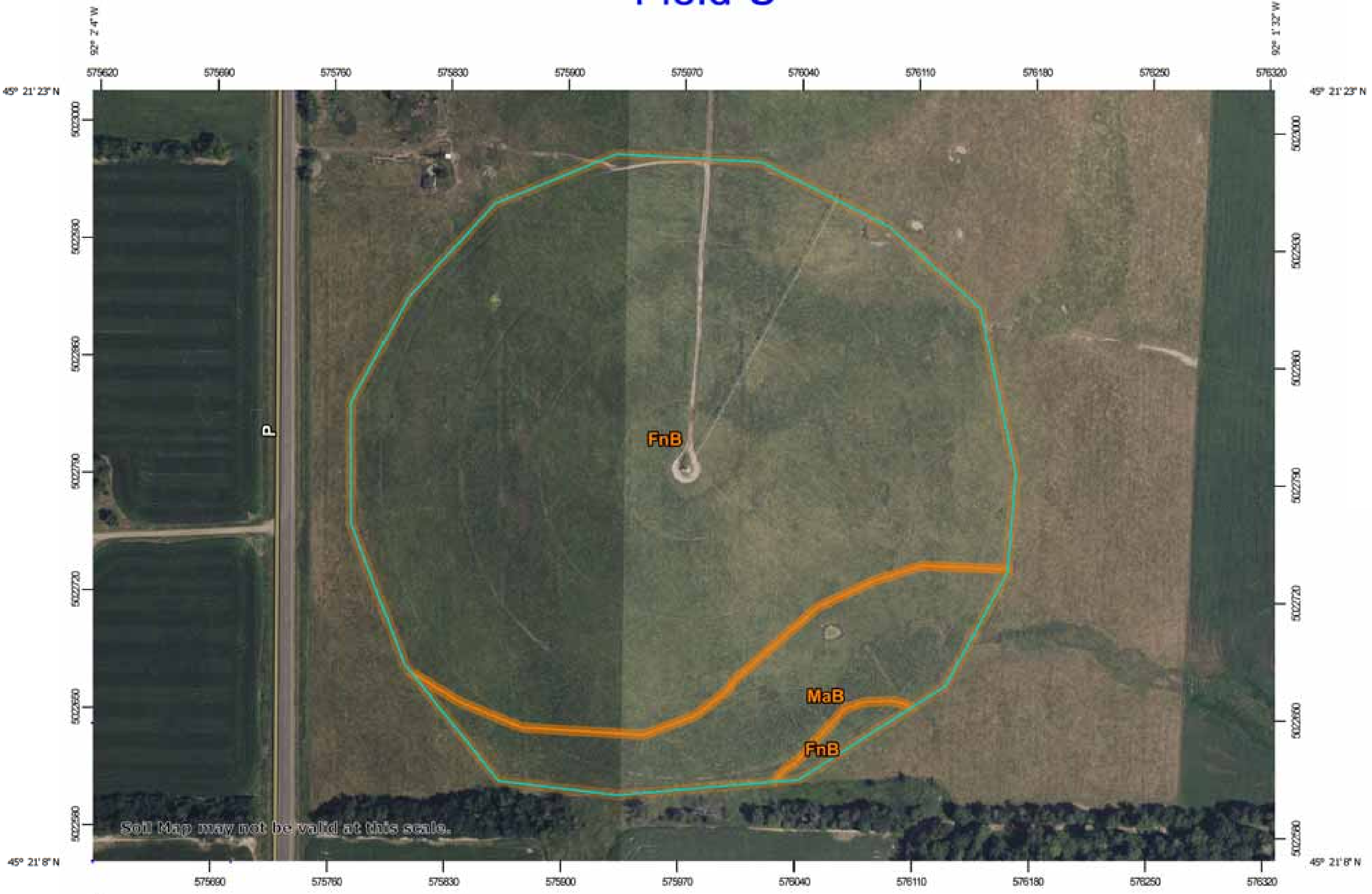


Map Scale: 1:3,190 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	27.8	100.0%
Totals for Area of Interest		**27.8**	**100.0%**

Field C



Map Scale: 1:3,240 if printed on A landscape (11" x 8.5") sheet.

0 45 90 180 270 Meters

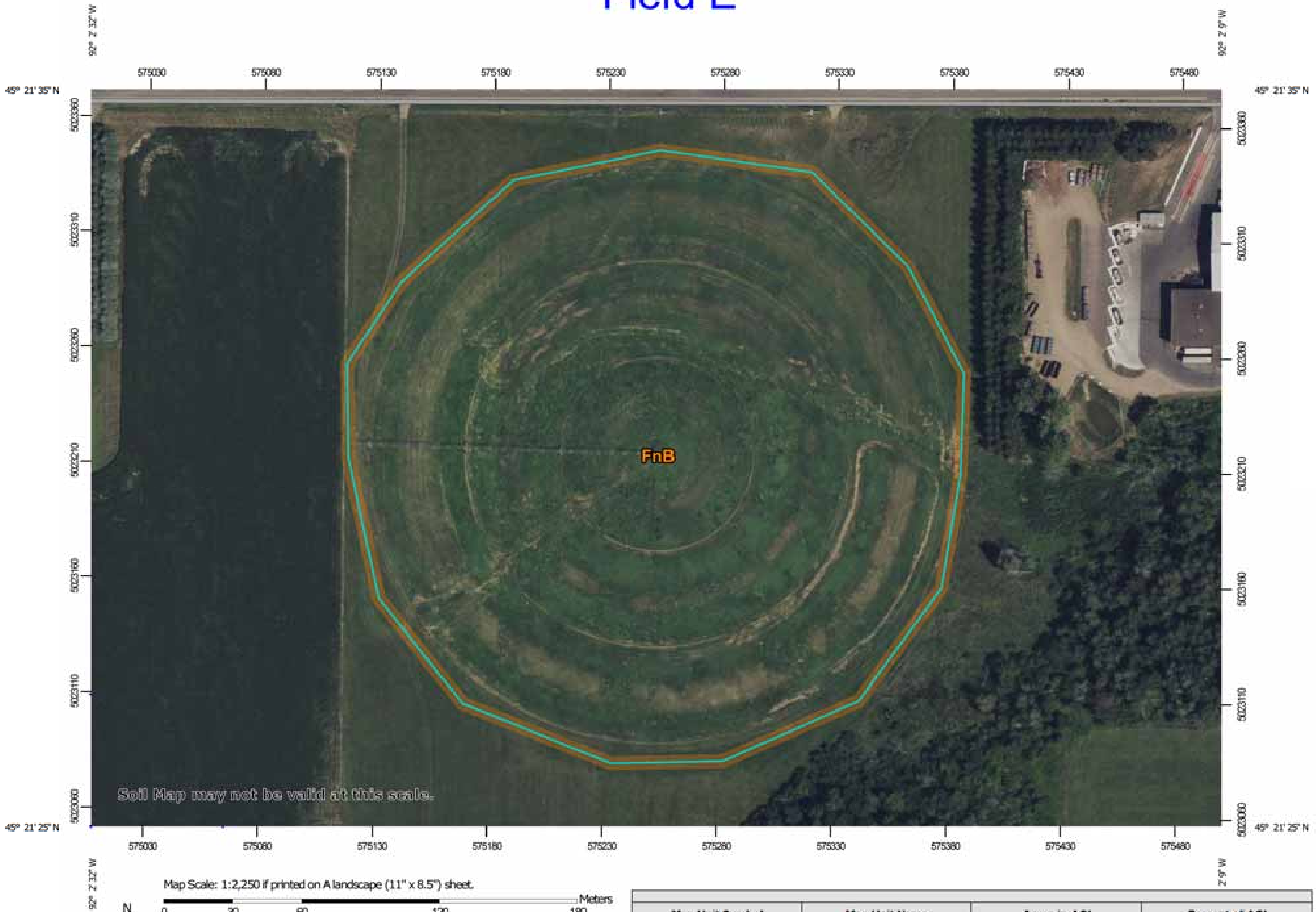
0 150 300 600 900 Feet

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	25.6	85.7%
MaB	Magnor silt loam, 0 to 4 percent slopes	4.3	14.3%
Totals for Area of Interest		**29.9**	**100.0%**

Field E



Map Scale: 1:2,250 if printed on A landscape (11" x 8.5") sheet.

0 30 60 120 180 Meters

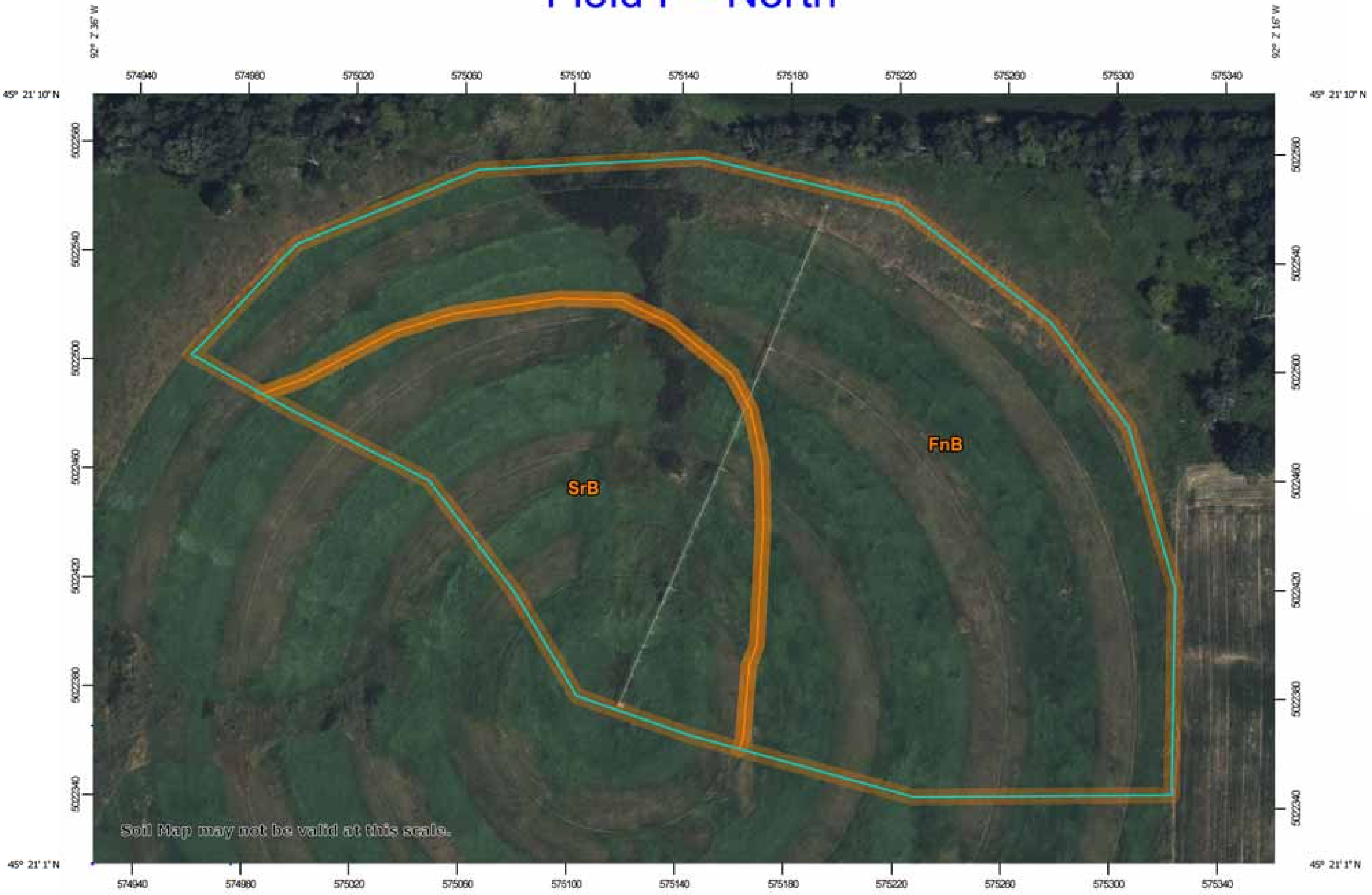
0 100 200 400 600 Feet

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	14.0	100.0%
Totals for Area of Interest		**14.0**	**100.0%**

Field F - North



Map Scale: 1:1,990 if printed on A landscape (11" x 8.5") sheet.

N

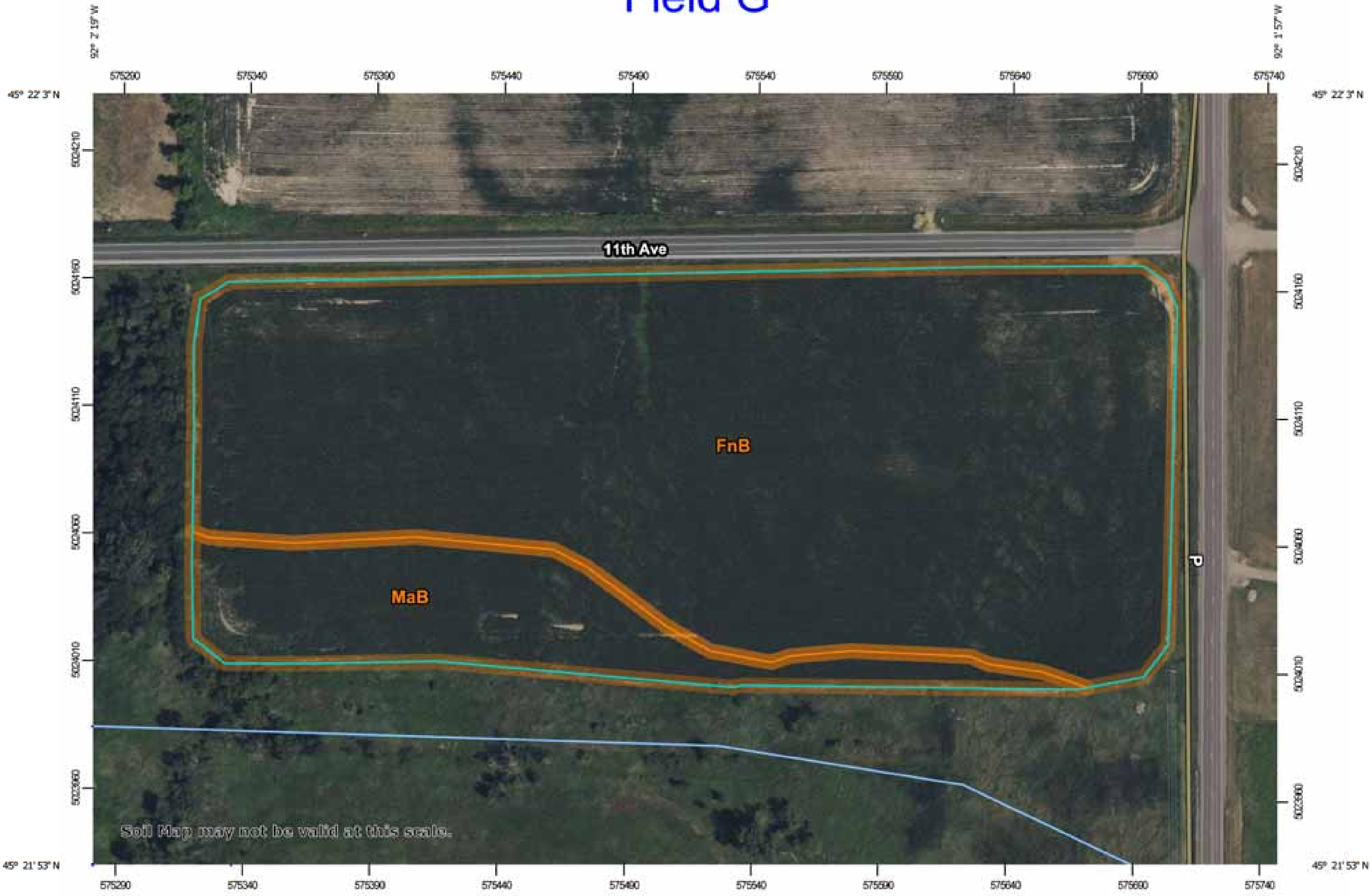
Meters
0 25 50 100 150

Feet
0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS

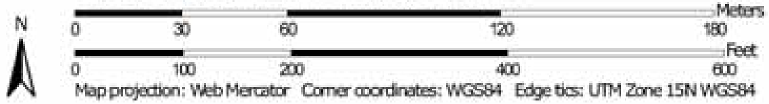
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	9.6	69.7%
SrB	Spencer silt loam, 2 to 6 percent slopes	4.2	30.3%
Totals for Area of Interest		**13.8**	**100.0%**

Field G



Soil Map may not be valid at this scale.

Map Scale: 1:2,130 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	12.5	83.1%
MaB	Magnor silt loam, 0 to 4 percent slopes	2.5	16.9%
Totals for Area of Interest		**15.1**	**100.0%**

Field H

Map Scale: 1:1,690 if printed on A portrait (8.5" x 11") sheet.

Map projection: Web Mercator   Corner coordinates: WGS84   Edge t

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FnB	Freeon silt loam, 2 to 6 percent slopes	8.0	89.8%
MaB	Magnor silt loam, 0 to 4 percent slopes	0.9	10.2%
Totals for Area of Interest		**8.9**	**100.0%**

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

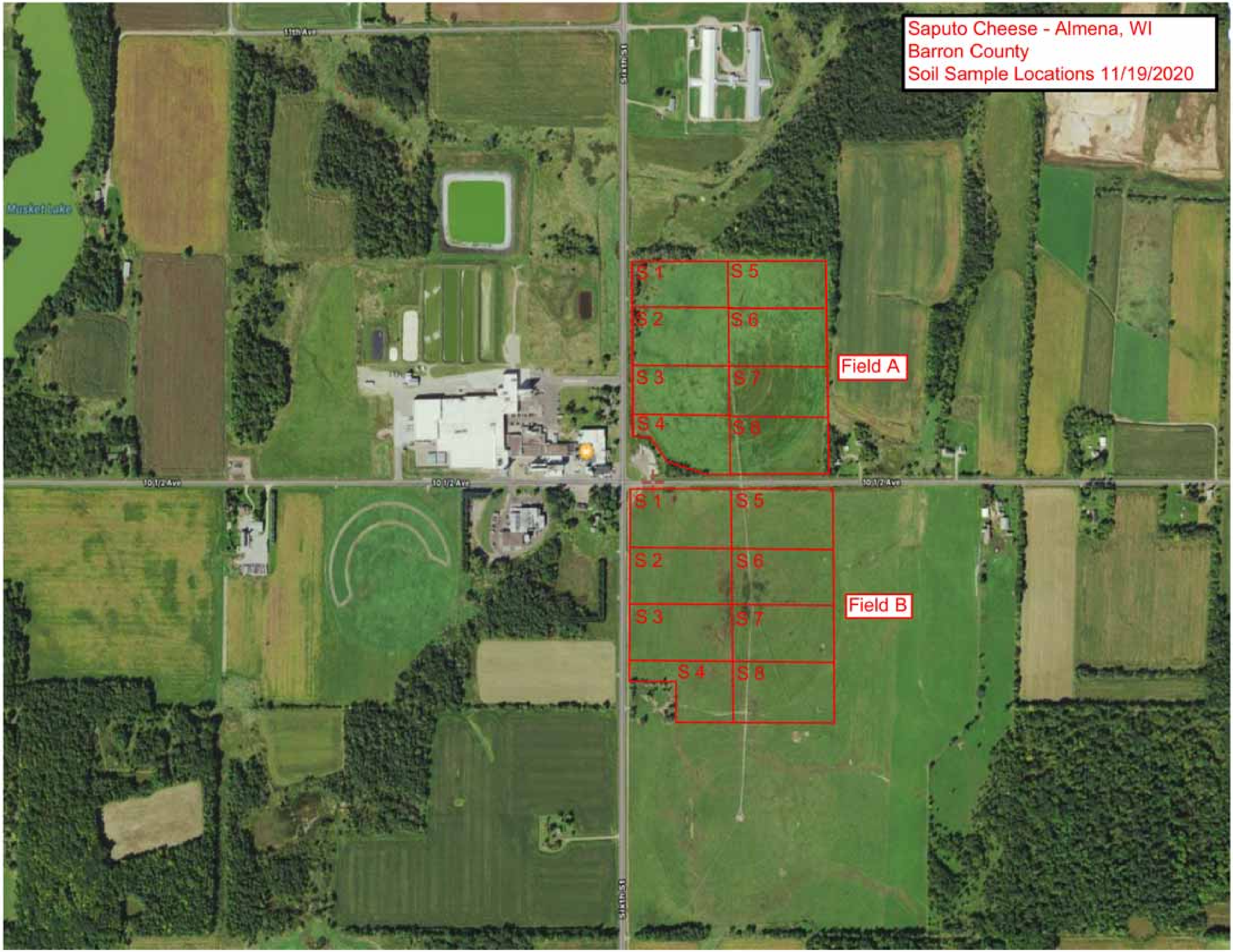
This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barron County, Wisconsin
Survey Area Data: Version 23, Sep 7, 2023

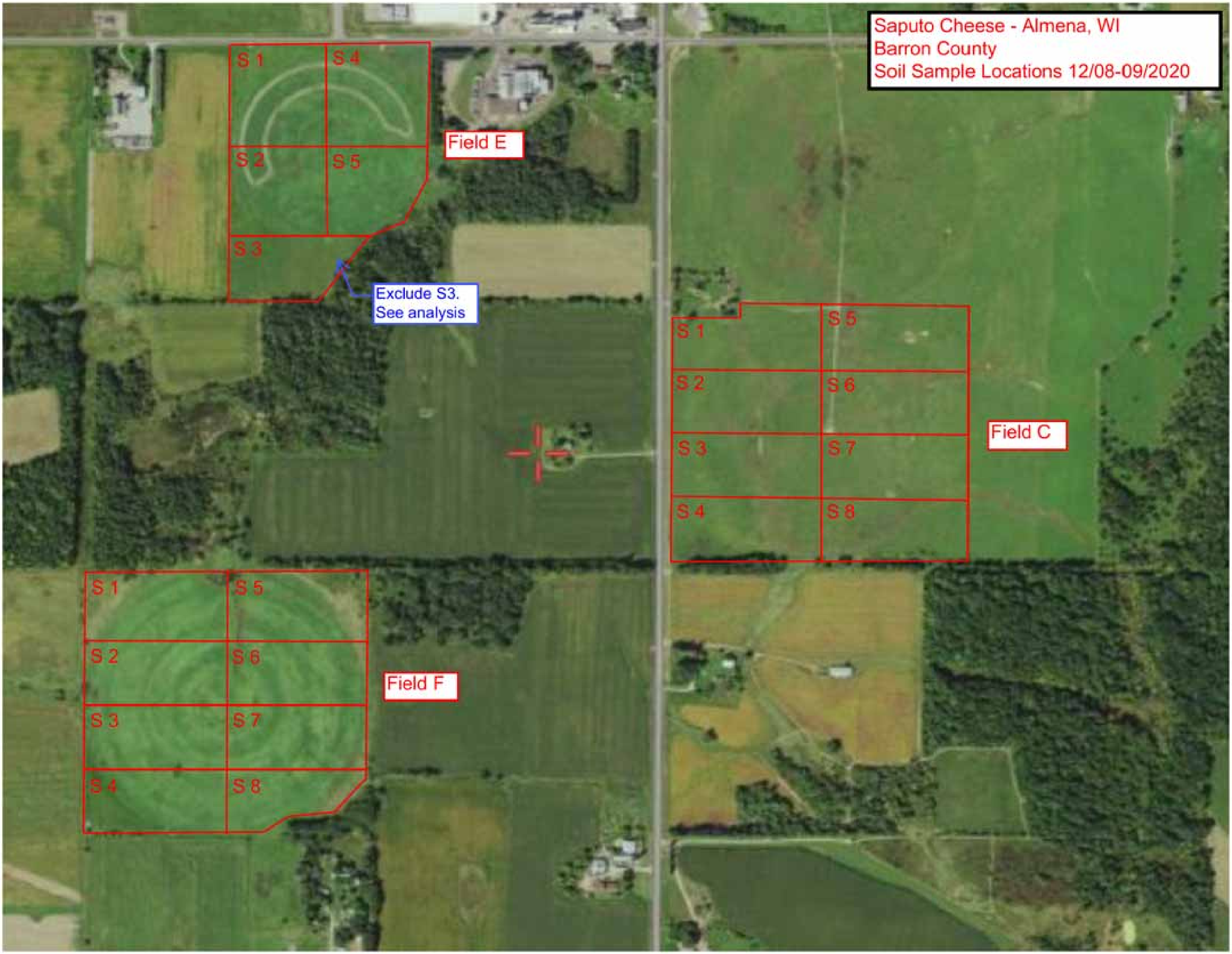
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 30, 2022—Sep 1, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.



Saputo Cheese - Almena, WI
Barron County
Soil Sample Locations 11/19/2020


Saputo Cheese - Almena, WI
Barron County
Soil Sample Locations 12/08-09/2020
S 1
S 4
Field E
S 2
S 5
S 3
Exclude S3.
See analysis
S 1
S 5
S 2
S 6
Field C
S 3
S 7
S 4
S 8
S 1
S 5
S 2
S 6
Field F
S 3
S 7
S 4
S 8

SYNERGY COOPERATIVE

Dairyland Laboratories, Inc.
117609 Forward St.
Stratford, WI 54484
Telephone: 715-687-9997
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Email: info@dairylandlabs.com

Lab No. 8S2351
State: WI
County: 3
Account: 9220
Date Received: 11/25/2020
Date Processed: 12/1/2020

Submitted By:
Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: FIELD. A
Acres: 37.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: Y
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
S.1	2		7.9	4.4	274	272							0.91	N.R.	0.0
S.2	2		8.1	4.9	216	318							0.84	N.R.	0.0
S.3	2		8.3	4.8	192	294							0.85	N.R.	0.0
S.4	2		7.9	5.2	209	257							0.79	N.R.	0.0
S.5	2		8.3	3.5	281	275							0.95	N.R.	0.0
S.6	2		8.3	4.0	274	285							0.85	N.R.	0.0
S.7	2		8.1	3.6	261	225							0.86	N.R.	0.0
S.8	2		7.8	3.6	169	175							0.83	N.R.	0.0
Adj. Avg:			8.1	4.3	235	263									

Interpretation

	Very Low	Low	Medium	Optimum	High	Very High	Excessive
Phosphorus							Excessive
Potassium							Excessive
Soil pH							Excessive

Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
This field is irrigated. Fertilizer recommendations for irrigated fields made for top yield potentials. Retest every 2 years.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

SYNERGY COOPERATIVE

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117609 Forward St.
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Email: info@dairylandlabs.com

Lab No. 8S2351
State: WI
County: 3
Account: 9220
Date Received: 11/25/2020
Date Processed: 12/1/2020

Submitted By:
Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: FIELD. B
Acres: 37.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: Y
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
S.1	2		7.9	3.6	234	310							0.83	N.R.	0.0
S.2	2		8.5	3.1	256	446							0.83	N.R.	0.0
S.3	2		8.3	3.6	255	413							0.77	N.R.	0.0
S.4	2		8.5	2.9	216	346							0.91	N.R.	0.0
S.5	2		7.3	4.2	132	248							0.85	N.R.	0.0
S.6	2		8.1	4.7	154	349							0.83	N.R.	0.0
S.7	2		8.2	5.4	152	347							0.76	N.R.	0.0
S.8	2		8.6	3.0	177	347							0.93	N.R.	0.0
Adj. Avg:			8.2	3.8	197	351									

Interpretation

	Very Low	Low	Medium	Optimum	High	Very High	Excessive
Phosphorus	▨	▨	▨	▨	▨	▨	Excessive
Potassium	▨	▨	▨	▨	▨	▨	Excessive
Soil pH	▨	▨	▨	▨	▨	▨	Excessive

Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
This field is irrigated. Fertilizer recommendations for irrigated fields made for top yield potentials. Retest every 2 years.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

Dairyland Laboratories, Inc.
117609 Forward St.
Stratford, WI 54484
Telephone: 715-687-9997
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Email: info@dairylandlabs.com

Lab No. 8S3484
State: WI
County: 3
Account: 9220
Date Received: 12/18/2020
Date Processed: 12/21/2020

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

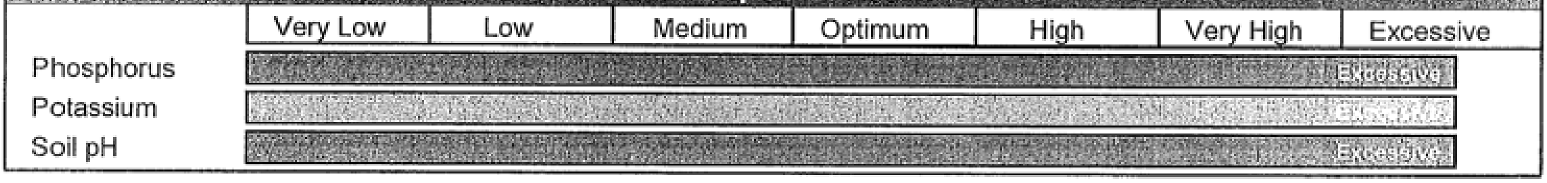
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54805

Field: FIELD.C
Acres: 37.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: Y
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
S1	2		7.6	4.2	194	385							0.97	N.R.	0.0
S2	2		8.3	3.8	268	550							0.93	N.R.	0.0
S3	2		8.0	4.2	294	537							0.96	N.R.	0.0
S4	2		7.6	8.1	238	497							0.77	N.R.	0.0
S5	2		8.3	4.4	237	550							0.93	N.R.	0.0
S6	2		7.9	6.9	260	633							0.83	N.R.	0.0
S7	2		8.1	5.1	222	569							0.90	N.R.	0.0
S8	2		6.7	5.8	135	322							0.84	N.R.	0.0
Adj. Avg:			7.8	5.3	231	505									

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
This field is irrigated. Fertilizer recommendations for irrigated fields made for top yield potentials. Retest every 2 years.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

SYNERGY
COOPERATIVE

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Lab No.	8S3484
State:	WI
County:	3
Account:	9220
Date Received:	12/18/2020
Date Processed:	12/21/2020

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54805

Field:	FIELD.E
Acres:	24.0
Slope:	6%
Soil Name	Freeon
Plow Depth:	6.5
Irrigated:	Y
Tiled:	N

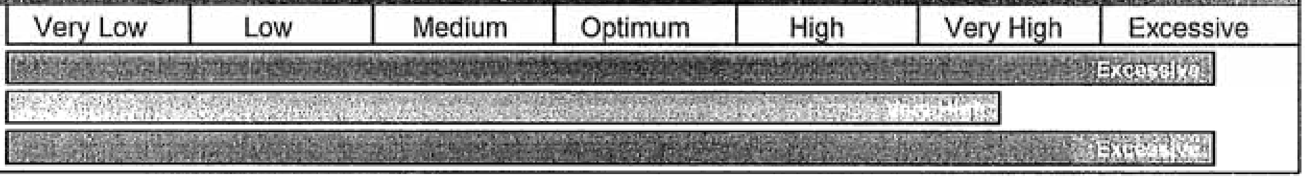
S3 not used -
not irrigated

Laboratory Analysis

Sample No	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
S1	2		7.8	4.7	198	297							0.93	N.R.	0.0
S2	2		8.1	5.0	231	368							0.93	N.R.	0.0
~~S3~~	~~2~~		~~6.6~~	~~3.8~~	38	51							0.96	N.R.	0.0
S4	2		7.7	4.2	182	217							0.96	N.R.	0.0
S5	2		8.3	3.9	248	248							1.02	N.R.	0.0
Adj. Avg:			7.7	4.3	179	236									

resultant average is
updated to 210

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs N	Nutrient Needs P2O5	Nutrient Needs K2O	Fertilizer Credits Leg. N	Fertilizer Credits Man. N	Fertilizer Credits P2O5	Fertilizer Credits K2O	Nutrients to Apply N	Nutrients to Apply P2O5	Nutrients to Apply K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
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- A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.
- Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.
- A soil nitrate test may better estimate actual corn N needs.
- If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Lab No. 8S3484
State: WI
County: 3
Account: 9220
Date Received: 12/18/2020
Date Processed: 12/21/2020

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

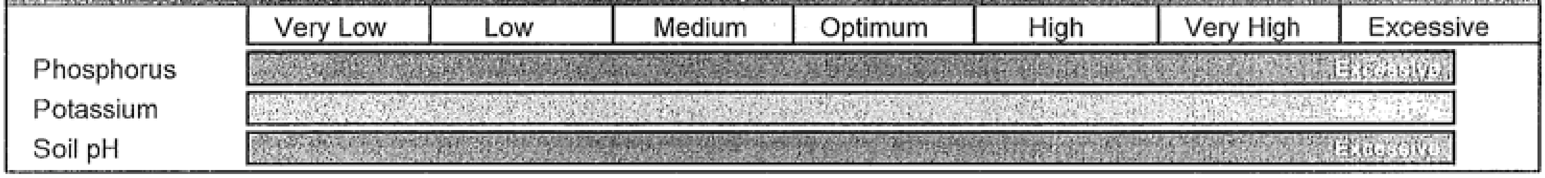
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54805

Field: FIELD.F
Acres: 37.0
Slope: 6%
Soil Name Spencer
Plow Depth: 6.5
Irrigated: Y
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
S1	2		8.2	5.6	307	441							0.90	N.R.	0.0
S2	2		7.9	6.5	291	424							0.87	N.R.	0.0
S3	2		8.1	7.0	294	471							0.84	N.R.	0.0
S4	2		7.7	6.4	292	392							0.83	N.R.	0.0
S5	2		8.0	6.6	238	534							0.88	N.R.	0.0
S6	2		8.2	6.3	222	501							0.87	N.R.	0.0
S7	2		8.3	6.3	281	507							0.88	N.R.	0.0
S8	2		7.6	5.9	246	362							0.85	N.R.	0.0
Adj. Avg:			8.0	6.3	271	454									

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

Spencer - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
This field is irrigated. Fertilizer recommendations for irrigated fields made for top yield potentials. Retest every 2 years.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

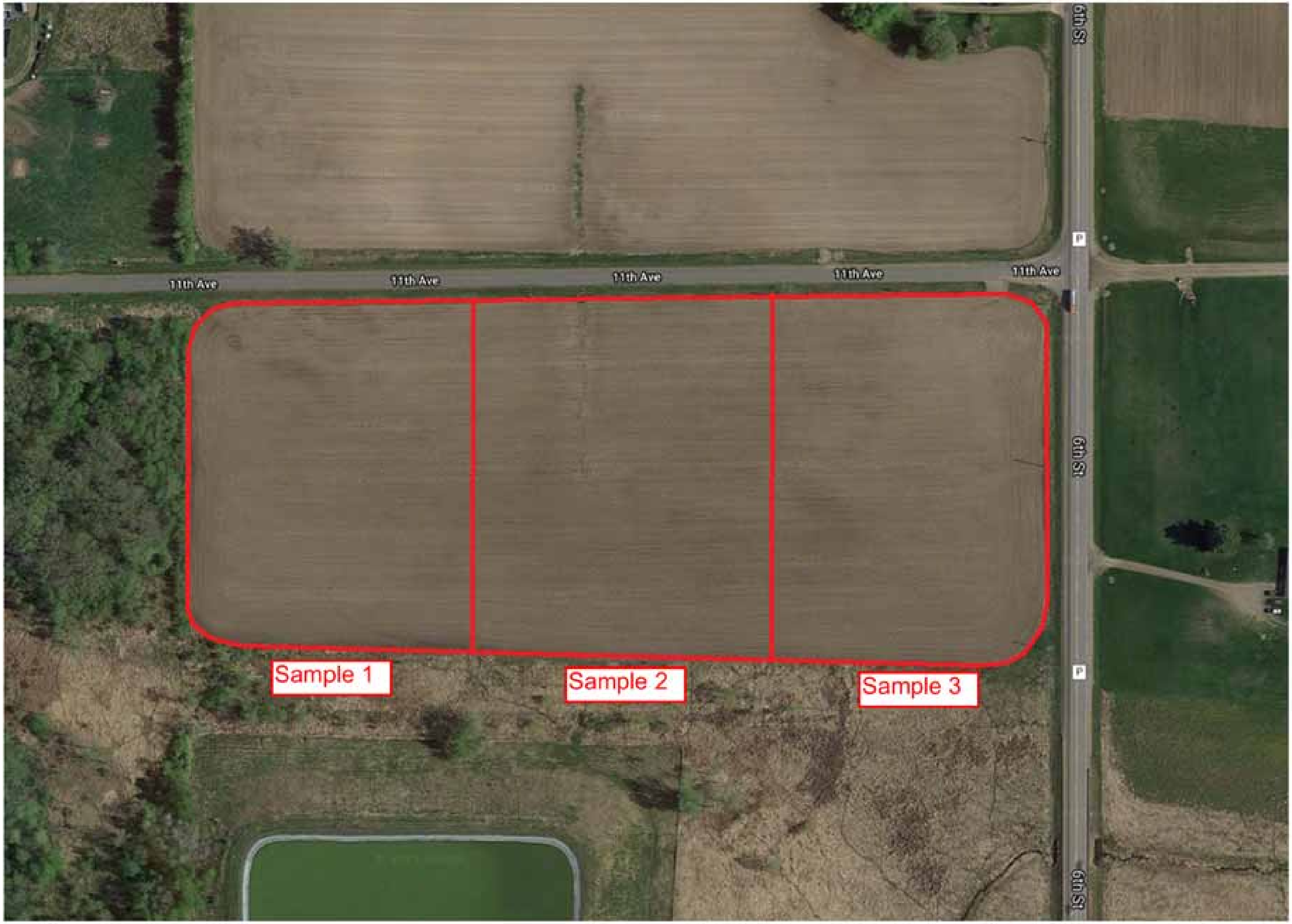
* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

Field G


11th Ave
11th Ave
11th Ave
11th Ave
11th Ave
6th St
6th St
6th St
P
P
Sample 1
Sample 2
Sample 3

Field H

SYNERGY
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Lab No. 8S4052
State: WI
County: 3
Account: 9220
Date Received: 3/26/2021
Date Processed: 3/29/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

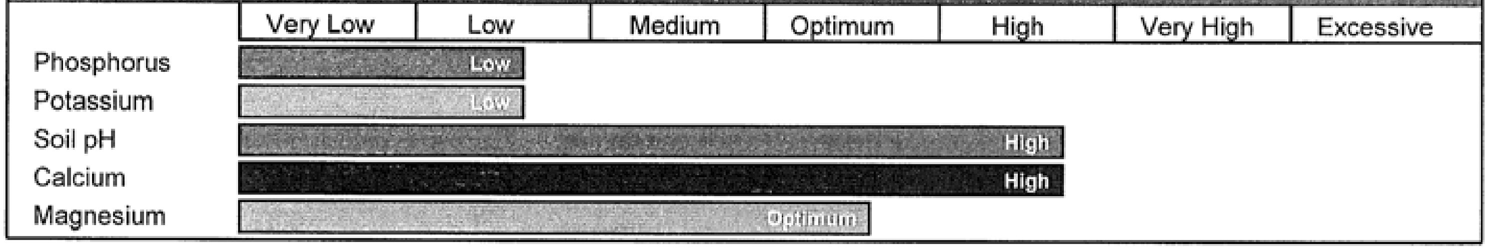
SAPUTO CHEESE
1052 6TH ST
ALMENA, WI 54805

Field: G
Acres: 15.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1	2	10	6.8	2.6	13	84	1240	320					0.99	N.R.	0.0
2	2	11	6.7	2.9	10	86	1320	350					0.96	N.R.	0.0
3	2	8	6.8	2.6	18	90	1080	240					1.02	N.R.	0.0
Adj. Avg:		10	6.8	2.7	14	87	1213	303							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs lbs/A N	Nutrient Needs lbs/A P2O5	Nutrient Needs lbs/A K2O	Fertilizer Credits lbs/A Leg. N	Fertilizer Credits lbs/A Man. N	Fertilizer Credits lbs/A P2O5	Fertilizer Credits lbs/A K2O	Nutrients to Apply lbs/A N	Nutrients to Apply lbs/A P2O5	Nutrients to Apply lbs/A K2O
Soybean, grain	56-65 bu		80	115						80	115
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 6.3 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

% BASE SATURATION (AVG): CA: 65.8 MG: 27.4 K: 2.4 %ACID SATURATION: 4.3
SAMPLE: 1 % BASE SATURATION: CA: 65.7 MG: 28.2 K: 2.3 %ACID SATURATION: 3.8
SAMPLE: 2 % BASE SATURATION: CA: 64.6 MG: 28.5 K: 2.2 %ACID SATURATION: 4.7
SAMPLE: 3 % BASE SATURATION: CA: 67.6 MG: 25.0 K: 2.9 %ACID SATURATION: 4.5
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Lab No.	8S4052
State:	WI
County:	3
Account:	9220
Date Received:	3/26/2021
Date Processed:	3/29/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

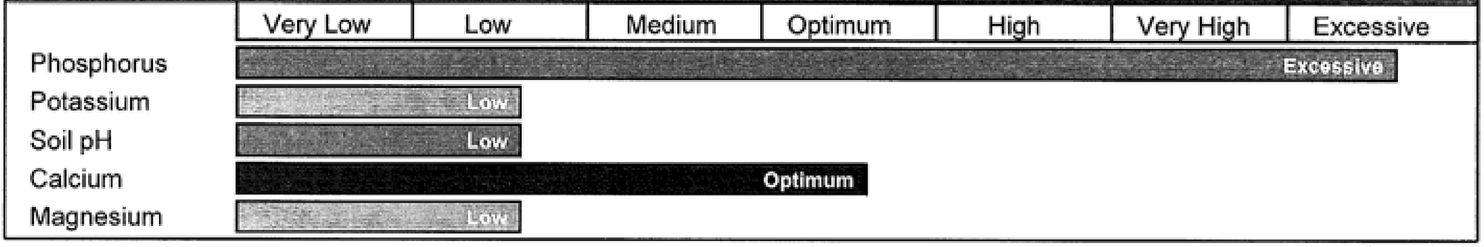
SAPUTO CHEESE
1052 6TH ST
ALMENA, WI 54805

Field:	H
Acres:	9.0
Slope:	6%
Soil Name	Freeon
Plow Depth:	6.5
Irrigated:	N
Tiled:	N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1	2	5	5.6	2.0	75	73	770	90					1.01	6.6	2.0
2	2	6	5.7	2.3	78	84	840	100					1.05	6.6	2.0
Adj. Avg:		6	5.7	2.2	77	79	805	95							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs N	Nutrient Needs P2O5	Nutrient Needs K2O	Fertilizer Credits Leg. N	Fertilizer Credits Man. N	Fertilizer Credits P2O5	Fertilizer Credits K2O	Nutrients to Apply N	Nutrients to Apply P2O5	Nutrients to Apply K2O
		lbs/A	lbs/A	lbs/A	lbs/A	lbs/A	lbs/A	lbs/A	lbs/A	lbs/A	lbs/A
Soybean, grain	56-65 bu			115							115
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 6.3 is 2.0 T/A of 60-69 lime or 1.5 T/A 80-89 lime.

Additional Information

% BASE SATURATION (AVG): CA: 71.6 MG: 14.1 K: 3.6 %ACID SATURATION: 10.7
SAMPLE: 1 % BASE SATURATION: CA: 71.5 MG: 13.9 K: 3.5 %ACID SATURATION: 11.1
SAMPLE: 2 % BASE SATURATION: CA: 71.8 MG: 14.2 K: 3.7 %ACID SATURATION: 10.3
Freeon - loamy soil/high yield potential
Because of very high P levels, P2O5 applications from fertilizer or manure should be reduced and crops with a high P removal should be grown.
If lime has been applied in the last two years, more lime may not be needed due to incomplete reaction.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Yr 1,2,3,4: Apply dolomitic lime to correct "low" Mg. If dolomitic liming is undesirable, use row application of 10-20 lbs Mg/a annually.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

Stratification Testing Results and Maps from this point to the end

Soil Sampling Method:

Soil samples were collected by Cooper Engineering for Saputo Cheese USA, located in Almena WI, for fields A, B, C, E, F, G and H. Fields G and H were collected on March 17, 2021. Fields A, B, C, E, and F were collected first March 25, 26, and 29, 2021. They were then re-collected when a larger sample volume was required on March 31 and April 1, 2021.

Fields G and H were divided into 3 section and 2 section areas, each section being 5 acres or less. Samples were then taken with a soil probe in a "W" pattern for each section as laid out by the A2100 soil sampling guidelines. Each core was taken to the depth of 6 inches, then added to a bucket and mixed. 8 cores were taken in each section for 1 sample. All equipment was then washed and rinsed with deionized water to prevent contamination between sample sections.

Samples for fields A, B, C, E and F were requested to be collected within the reach of the sprayers. Fields A, B, and C were divided into six sections being 5 acres or less, field E into three, and field F into two for the indicated part of the field. The samples were also to be done at two different depths, the top 2-inches of the soil, and the range from 5-inches to 6-inches below the surface. Samples were initially collected using the same A2100 method, but with a modification to collecting the samples. The top 2-inches were collected and mixed in one bucket, the 5-to-6-inch range was collected and mixed in a separate bucket. The fields were then indicated by a or b for the top 2-inches or 5-to-6-inch range to separate them when sent to the lab. For example, results for field Aa are for the top 2 inches of field A, where field Ab indicates the results for the 5-to-6-inch range of field A. All the equipment was washed and rinsed using deionized water between samples to prevent contamination.

All the samples were delivered to Synergy Cooperative in Cameron, WI to be sent to a certified lab for testing. Fields G and H were dropped off on March 18, 2021. Fields A, B, C, E, and F were initially dropped off on March 30, 2021, but were requested to be a larger volume as collecting only part of the core did not equate to enough for testing purposes.

Fields A, B, C, E, and F were then re-sampled using a larger soil probe. The collection method was the same as the first time, but 9 cores were used for one sample to ensure a large enough volume of soil was collected. The samples were then dropped off ay Synergy Cooperative on April 2, 2021.

SYNERGY COOPERATIVE

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Lab No. 8S4950
State: WI
County: 3
Account: 9220
Date Received: 4/6/2021
Date Processed: 4/7/2021

Submitted By:
Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

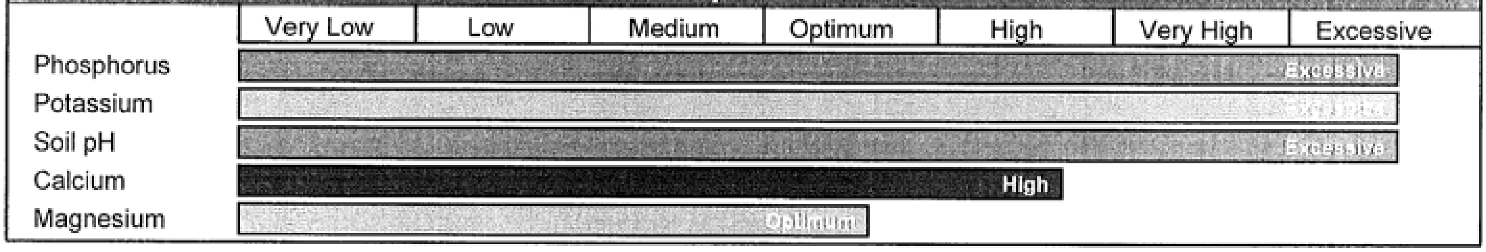
Grower:
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: AA
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1A	2	13	7.1	3.6	71	146	1090	150					0.61	N.R.	0.0
2A	2	21	8.0	6.5	169	301	1520	250					0.53	N.R.	0.0
3A	2	22	8.0	5.9	173	317	1380	230					0.49	N.R.	0.0
4A	2	22	7.9	6.4	198	267	1400	220					0.46	N.R.	0.0
5A	2	27	8.1	6.3	234	256	1820	210					0.47	N.R.	0.0
6A	2	20	8.2	5.1	267	312	1550	210					0.57	N.R.	0.0
Adj. Avg:		21	7.9	5.6	185	267	1460	212							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs N	Nutrient Needs P2O5	Nutrient Needs K2O	Fertilizer Credits Leg. N	Fertilizer Credits Man. N	Fertilizer Credits P2O5	Fertilizer Credits K2O	Nutrients to Apply N	Nutrients to Apply P2O5	Nutrients to Apply K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

SYNERGY
COOPERATIVE

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Lab No. 8S4950
State: WI
County: 3
Account: 9220
Date Received: 4/6/2021
Date Processed: 4/7/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: AA
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG): CA: 74.0 MG: 17.9 K: 6.9 %ACID SATURATION: 1.2
SAMPLE: 1A % BASE SATURATION: CA: 75.8 MG: 17.4 K: 5.2 %ACID SATURATION: 1.7
SAMPLE: 2A % BASE SATURATION: CA: 71.9 MG: 19.7 K: 7.3 %ACID SATURATION: 1.1
SAMPLE: 3A % BASE SATURATION: CA: 70.8 MG: 19.7 K: 8.3 %ACID SATURATION: 1.2
SAMPLE: 4A % BASE SATURATION: CA: 72.6 MG: 19.0 K: 7.1 %ACID SATURATION: 1.2
SAMPLE: 5A % BASE SATURATION: CA: 78.3 MG: 15.1 K: 5.6 %ACID SATURATION: 1.0
SAMPLE: 6A % BASE SATURATION: CA: 74.4 MG: 16.8 K: 7.7 %ACID SATURATION: 1.2
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Lab No. 8S4950
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Date Received: 4/6/2021
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Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

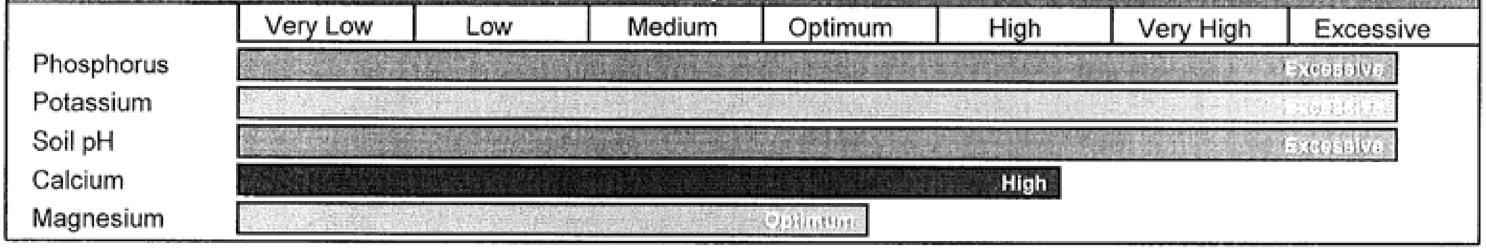
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: AB
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1B	2	12	8.5	2.7	158	373	1110	200					0.77	N.R.	0.0
2B	2	12	8.6	2.5	107	397	1090	200					0.80	N.R.	0.0
3B	2	12	8.6	2.5	105	385	1090	190					0.78	N.R.	0.0
4B	2	11	8.4	2.4	122	302	1100	170					0.77	N.R.	0.0
5B	2	16	8.6	1.7	128	398	2350	210					1.06	N.R.	0.0
6B	2	9	8.7	1.7	98	398	1130	190					1.05	N.R.	0.0
Adj. Avg:		12	8.6	2.3	120	376	1312	193							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs N	Nutrient Needs P2O5	Nutrient Needs K2O	Fertilizer Credits Leg. N	Fertilizer Credits Man. N	Fertilizer Credits P2O5	Fertilizer Credits K2O	Nutrients to Apply N	Nutrients to Apply P2O5	Nutrients to Apply K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: AB
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG): CA: 70.9 MG: 17.4 K: 10.4 %ACID SATURATION: 1.3
SAMPLE: 1B % BASE SATURATION: CA: 66.9 MG: 20.1 K: 11.5 %ACID SATURATION: 1.4
SAMPLE: 2B % BASE SATURATION: CA: 66.0 MG: 20.2 K: 12.3 %ACID SATURATION: 1.5
SAMPLE: 3B % BASE SATURATION: CA: 66.9 MG: 19.5 K: 12.1 %ACID SATURATION: 1.5
SAMPLE: 4B % BASE SATURATION: CA: 70.4 MG: 18.1 K: 9.9 %ACID SATURATION: 1.5
SAMPLE: 5B % BASE SATURATION: CA: 80.3 MG: 12.0 K: 7.0 %ACID SATURATION: 0.8
SAMPLE: 6B % BASE SATURATION: CA: 67.5 MG: 18.9 K: 12.2 %ACID SATURATION: 1.4
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Submitted By:
Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

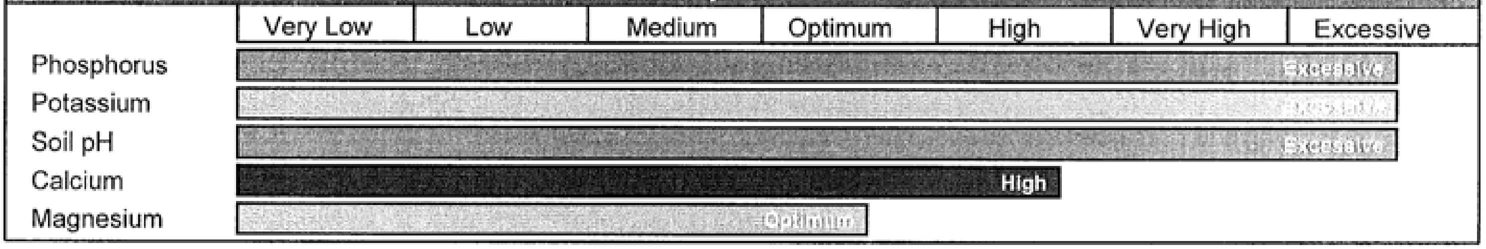
Grower:
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: BA
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1A	2	19	8.5	4.9	339	444	1100	180					0.48	N.R.	0.0
2A	2	18	8.6	4.5	410	497	1270	190					0.57	N.R.	0.0
3A	2	18	8.7	3.8	319	507	1200	190					0.56	N.R.	0.0
4A	2	19	8.7	4.4	220	434	1390	200					0.59	N.R.	0.0
5A	2	16	8.3	5.3	213	452	1270	210					0.63	N.R.	0.0
6A	2	17	8.2	6.6	203	391	1090	210					0.53	N.R.	0.0
Adj. Avg:		18	8.5	4.9	284	454	1220	197							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs lbs/A			Fertilizer Credits lbs/A				Nutrients to Apply lbs/A		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

Dairyland Laboratories, Inc.
117609 Forward St.
Stratford, WI 54484
Telephone: 715-687-9997
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Email: info@dairylandlabs.com

Lab No. 8S4950
State: WI
County: 3
Account: 9220
Date Received: 4/6/2021
Date Processed: 4/7/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: BA
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG): CA: 67.6 MG: 18.2 K: 12.9 %ACID SATURATION: 1.3

SAMPLE: 1A	% BASE SATURATION:	CA: 66.6	MG: 18.2	K: 13.8	%ACID SATURATION: 1.5
SAMPLE: 2A	% BASE SATURATION:	CA: 68.1	MG: 17.0	K: 13.7	%ACID SATURATION: 1.3
SAMPLE: 3A	% BASE SATURATION:	CA: 66.6	MG: 17.6	K: 14.4	%ACID SATURATION: 1.3
SAMPLE: 4A	% BASE SATURATION:	CA: 70.6	MG: 16.9	K: 11.3	%ACID SATURATION: 1.2
SAMPLE: 5A	% BASE SATURATION:	CA: 67.7	MG: 18.7	K: 12.4	%ACID SATURATION: 1.3
SAMPLE: 6A	% BASE SATURATION:	CA: 65.5	MG: 21.0	K: 12.0	%ACID SATURATION: 1.4

Freeon - loamy soil/high yield potential

N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.

Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.

Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.

For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* Note additional tests, as requested.

Response to added Ca is unlikely.

Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

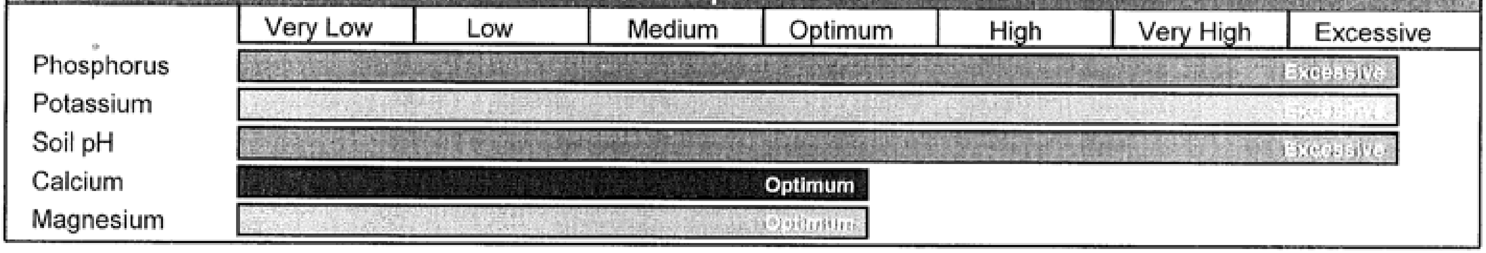
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field:	BB
Acres:	30.0
Slope:	6%
Soil Name	Freeon
Plow Depth:	6.5
Irrigated:	N
Tiled:	N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1B	2	8	8.2	1.7	100	500	770	170					1.00	N.R.	0.0
2B	2	11	8.1	2.8	146	545	1130	230					0.94	N.R.	0.0
3B	2	9	8.6	1.8	72	521	860	200					0.99	N.R.	0.0
4B	2	6	8.8	1.3	39	482	630	150					1.02	N.R.	0.0
5B	2	8	7.1	2.4	48	279	880	170					0.94	N.R.	0.0
6B	2	7	7.8	1.9	55	339	770	180					1.03	N.R.	0.0
Adj. Avg:		8	8.1	2.0	77	444	840	183							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: BB
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG): CA: 60.1 MG: 21.8 K: 16.3 %ACID SATURATION: 1.7
SAMPLE: 1B % BASE SATURATION: CA: 57.7 MG: 21.2 K: 19.2 %ACID SATURATION: 1.8
SAMPLE: 2B % BASE SATURATION: CA: 62.2 MG: 21.1 K: 15.4 %ACID SATURATION: 1.3
SAMPLE: 3B % BASE SATURATION: CA: 57.9 MG: 22.5 K: 18.0 %ACID SATURATION: 1.6
SAMPLE: 4B % BASE SATURATION: CA: 54.7 MG: 21.7 K: 21.5 %ACID SATURATION: 2.1
SAMPLE: 5B % BASE SATURATION: CA: 66.1 MG: 21.3 K: 10.8 %ACID SATURATION: 1.8
SAMPLE: 6B % BASE SATURATION: CA: 60.7 MG: 23.7 K: 13.7 %ACID SATURATION: 1.9
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of very high P levels, P2O5 applications from fertilizer or manure should be reduced and crops with a high P removal should be grown.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Cameron, WI 54822

Grower:

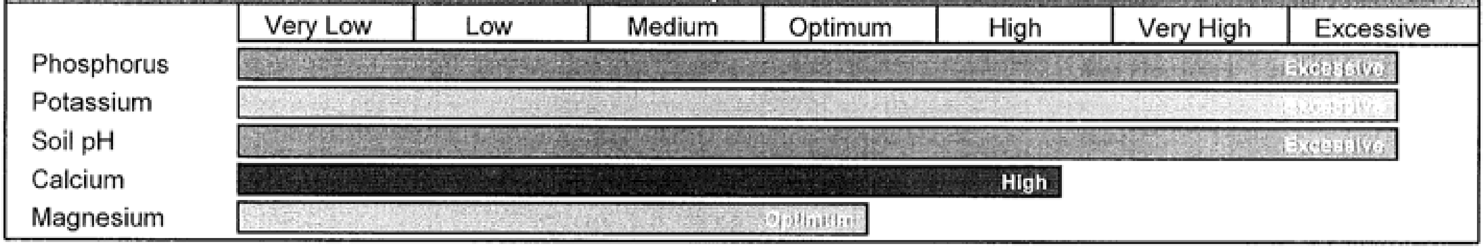
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: CA
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1A	2	17	8.2	5.1	310	370	1370	220					0.61	N.R.	0.0
2A	2	17	8.5	4.3	374	454	1380	220					0.65	N.R.	0.0
3A	2	18	8.5	4.5	346	434	1340	210					0.59	N.R.	0.0
4A	2	17	8.4	5.6	266	427	1460	240					0.68	N.R.	0.0
5A	2	19	8.2	6.4	213	391	1420	230					0.57	N.R.	0.0
6A	2	19	8.5	5.5	209	422	1410	230					0.59	N.R.	0.0
Adj. Avg:		18	8.4	5.2	286	416	1397	225							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
			lbs/A			lbs/A				lbs/A	
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Account: 9220
Date Received: 4/6/2021
Date Processed: 4/7/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: CA
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG):		CA: 69.5	MG: 18.7	K: 10.6	%ACID SATURATION: 1.2
SAMPLE: 1A	% BASE SATURATION:	CA: 70.2	MG: 18.8	K: 9.7	%ACID SATURATION: 1.2
SAMPLE: 2A	% BASE SATURATION:	CA: 68.9	MG: 18.3	K: 11.6	%ACID SATURATION: 1.2
SAMPLE: 3A	% BASE SATURATION:	CA: 69.2	MG: 18.1	K: 11.5	%ACID SATURATION: 1.2
SAMPLE: 4A	% BASE SATURATION:	CA: 69.4	MG: 19.0	K: 10.4	%ACID SATURATION: 1.1
SAMPLE: 5A	% BASE SATURATION:	CA: 70.0	MG: 18.9	K: 9.9	%ACID SATURATION: 1.2
SAMPLE: 6A	% BASE SATURATION:	CA: 69.3	MG: 18.8	K: 10.6	%ACID SATURATION: 1.2

Freeon - loamy soil/high yield potential

N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.

Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.

Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.

For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* Note additional tests, as requested.

Response to added Ca is unlikely.

Soil Mg is optimum. Maintain level with dolomitic lime.

---

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Account:	9220
Date Received:	4/6/2021
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Submitted By:
Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

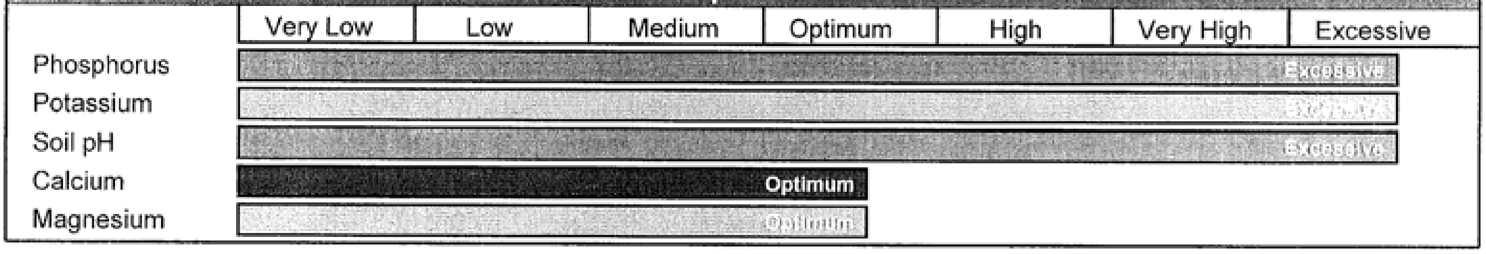
Grower:
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field:	CB
Acres:	30.0
Slope:	6%
Soil Name	Freeon
Plow Depth:	6.5
Irrigated:	N
Tiled:	N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1B	2	9	8.3	2.1	136	403	950	190					0.93	N.R.	0.0
2B	2	8	8.4	1.8	148	470	800	180					0.99	N.R.	0.0
3B	2	7	8.4	1.6	140	419	730	160					0.99	N.R.	0.0
4B	2	7	8.8	1.5	50	379	700	160					0.94	N.R.	0.0
5B	2	7	8.6	1.6	30	359	760	190					1.04	N.R.	0.0
6B	2	6	8.6	1.5	38	386	680	160					1.06	N.R.	0.0
Adj. Avg:		7	8.5	1.7	90	403	770	173							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs lbs/A			Fertilizer Credits lbs/A				Nutrients to Apply lbs/A		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

SYNERGY
COOPERATIVE

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Date Received: 4/6/2021
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Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: CB
Acres: 30.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG): CA: 59.7 MG: 22.4 K: 16.0 %ACID SATURATION: 1.9
SAMPLE: 1B % BASE SATURATION: CA: 63.4 MG: 21.1 K: 13.8 %ACID SATURATION: 1.6
SAMPLE: 2B % BASE SATURATION: CA: 58.6 MG: 22.0 K: 17.7 %ACID SATURATION: 1.8
SAMPLE: 3B % BASE SATURATION: CA: 59.1 MG: 21.6 K: 17.4 %ACID SATURATION: 1.9
SAMPLE: 4B % BASE SATURATION: CA: 59.1 MG: 22.5 K: 16.4 %ACID SATURATION: 2.0
SAMPLE: 5B % BASE SATURATION: CA: 59.2 MG: 24.6 K: 14.3 %ACID SATURATION: 1.9
SAMPLE: 6B % BASE SATURATION: CA: 58.2 MG: 22.8 K: 16.9 %ACID SATURATION: 2.1
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of very high P levels, P2O5 applications from fertilizer or manure should be reduced and crops with a high P removal should be grown.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

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2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

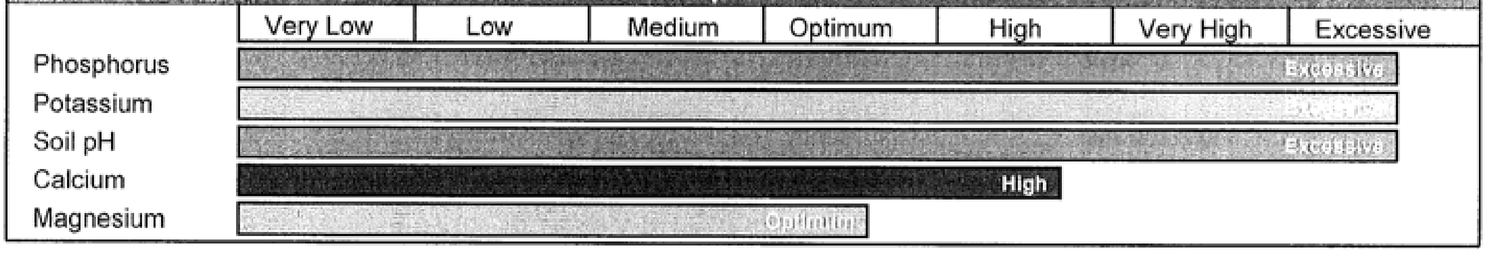
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: EA
Acres: 15.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1A	2	18	7.9	5.5	315	332	1570	250					0.66	N.R.	0.0
2A	2	19	8.2	5.1	409	315	1740	230					0.67	N.R.	0.0
3A	2	19	8.0	5.2	418	285	1750	250					0.67	N.R.	0.0
Adj. Avg:		19	8.0	5.3	381	311	1687	243							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

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Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: EA
Acres: 15.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Additional Information

% BASE SATURATION (AVG): CA: 74.1 MG: 17.8 K: 7.0 %ACID SATURATION: 1.1

SAMPLE: 1A % BASE SATURATION: CA: 72.0 MG: 19.1 K: 7.8 %ACID SATURATION: 1.1

SAMPLE: 2A % BASE SATURATION: CA: 75.4 MG: 16.6 K: 7.0 %ACID SATURATION: 1.0

SAMPLE: 3A % BASE SATURATION: CA: 74.9 MG: 17.8 K: 6.3 %ACID SATURATION: 1.0

Freeon - loamy soil/high yield potential

N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.

Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.

Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.

For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* Note additional tests, as requested.

Response to added Ca is unlikely.

Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

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Grower:

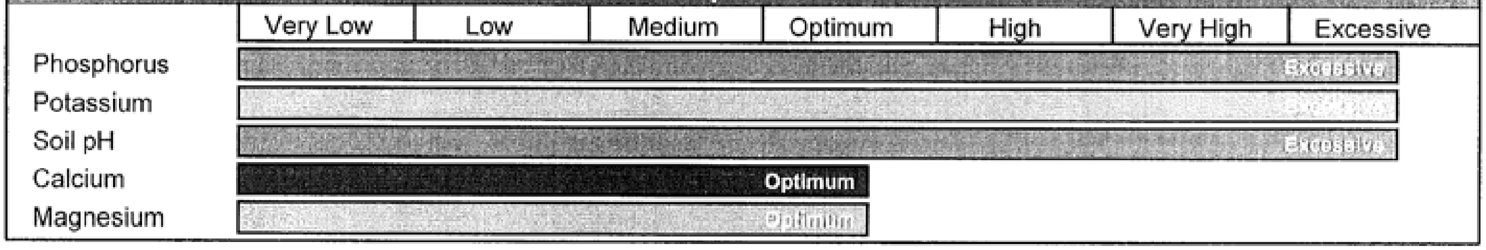
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: EB
Acres: 15.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1B	2	9	8.7	1.9	88	282	1010	230					1.03	N.R.	0.0
2B	2	8	8.5	1.9	117	300	940	200					0.98	N.R.	0.0
3B	2	7	8.4	1.8	73	270	840	190					1.03	N.R.	0.0
Adj. Avg:		8	8.5	1.9	93	284	930	207							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs			Fertilizer Credits				Nutrients to Apply		
		N	P2O5	K2O	Leg. N	Man. N	P2O5	K2O	N	P2O5	K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

Lab No.	8S4950
State:	WI
County:	3
Account:	9220
Date Received:	4/6/2021
Date Processed:	4/7/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field:	EB
Acres:	15.0
Slope:	6%
Soil Name	Freeon
Plow Depth:	6.5
Irrigated:	N
Tiled:	N

Additional Information

% BASE SATURATION (AVG): CA: 64.4 MG: 23.9 K: 10.1 %ACID SATURATION: 1.7

SAMPLE: 1B % BASE SATURATION: CA: 64.7 MG: 24.5 K: 9.3 %ACID SATURATION: 1.5

SAMPLE: 2B % BASE SATURATION: CA: 64.8 MG: 23.0 K: 10.6 %ACID SATURATION: 1.7

SAMPLE: 3B % BASE SATURATION: CA: 63.7 MG: 24.0 K: 10.5 %ACID SATURATION: 1.8

Freeon - loamy soil/high yield potential

N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.

Because of very high P levels, P2O5 applications from fertilizer or manure should be reduced and crops with a high P removal should be grown.

Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.

For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.

* Note additional tests, as requested.

Response to added Ca is unlikely.

Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

SYNERGY
COOPERATIVE

Dairyland Laboratories, Inc.
117609 Forward St.
Stratford, WI 54484
Telephone: 715-687-9997
Fax: 715-687-9907
Email: info@dairylandlabs.com

Lab No. 8S4950
State: WI
County: 3
Account: 9220
Date Received: 4/6/2021
Date Processed: 4/7/2021

Submitted By:
Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

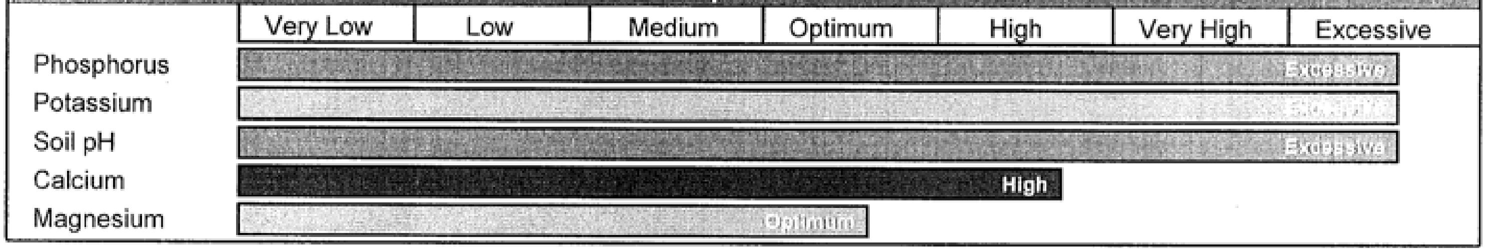
Grower:
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: FA
Acres: 10.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1A	2	24	8.1	6.8	396	376	2030	300					0.62	N.R.	0.0
2A	2	23	8.1	8.1	463	395	2110	330					0.66	N.R.	0.0
Adj. Avg:		24	8.1	7.5	430	386	2070	315							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs N	Nutrient Needs P2O5	Nutrient Needs K2O	Fertilizer Credits Leg. N	Fertilizer Credits Man. N	Fertilizer Credits P2O5	Fertilizer Credits K2O	Nutrients to Apply N	Nutrients to Apply P2O5	Nutrients to Apply K2O
		lbs/A			lbs/A				lbs/A		
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

% BASE SATURATION (AVG): CA: 73.5 MG: 18.6 K: 7.0 %ACID SATURATION: 0.9
SAMPLE: 1A % BASE SATURATION: CA: 73.9 MG: 18.2 K: 7.0 %ACID SATURATION: 0.9
SAMPLE: 2A % BASE SATURATION: CA: 73.1 MG: 19.1 K: 7.0 %ACID SATURATION: 0.8
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of excessively high P levels, no P2O5 fertilizer or manure is recommended on this field.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

* A soil nitrate test may better estimate actual corn N needs.

* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.

Dairyland Laboratories, Inc.
117609 Forward St.
Stratford, WI 54484
Telephone: 715-687-9997
Fax: 715-687-9907
Email: info@dairylandlabs.com

Lab No. 8S4950
State: WI
County: 3
Account: 9220
Date Received: 4/6/2021
Date Processed: 4/7/2021

Submitted By:

Synergy Coop - Central Soil
2031 13-12 1/2 Ave
Cameron, WI 54822

Grower:

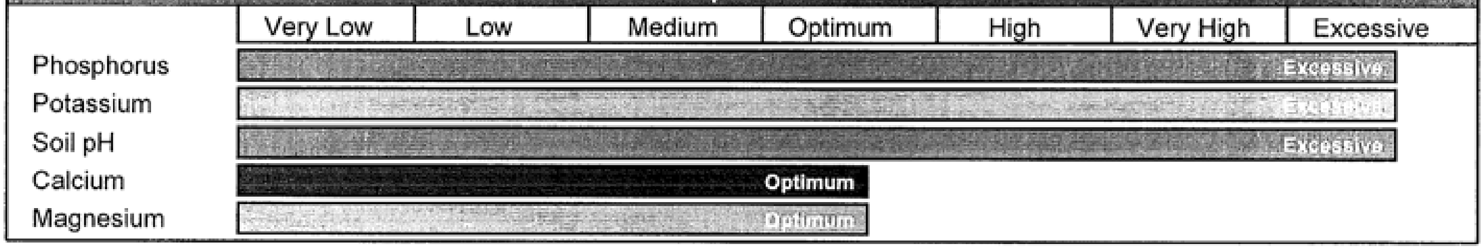
COOPER ENGINEERING
2600 COLLEGE DRIVE
RICE LAKE, WI 54868

Field: FB
Acres: 10.0
Slope: 6%
Soil Name Freeon
Plow Depth: 6.5
Irrigated: N
Tiled: N

Laboratory Analysis

Sample No.	Text Code	Est CEC	Soil pH	O.M. %	P ppm	K ppm	Ca ppm	Mg ppm	B ppm	Mn ppm	Zn ppm	SO4-S ppm	Density	Buffer pH	60-69 Lime
1B	2	9	8.4	2.1	80	347	930	210					0.95	N.R.	0.0
2B	2	5	8.9	1.4	60	298	670	150					1.13	N.R.	0.0
Adj. Avg:		7	8.7	1.8	70	323	800	180							

Interpretation



Wisconsin Nutrient Recommendations

Cropping Sequence	Yield Goal	Nutrient Needs N lbs/A	Nutrient Needs P2O5 lbs/A	Nutrient Needs K2O lbs/A	Fertilizer Credits Leg. N lbs/A	Fertilizer Credits Man. N lbs/A	Fertilizer Credits P2O5 lbs/A	Fertilizer Credits K2O lbs/A	Nutrients to Apply N lbs/A	Nutrients to Apply P2O5 lbs/A	Nutrients to Apply K2O lbs/A
CRP, grass	n/a										
(no crop)	n/a										
(no crop)	n/a										
(no crop)	n/a										

Lime required for this rotation to reach pH 5.6 is NO T/A of 60-69 lime or NO T/A 80-89 lime.

Additional Information

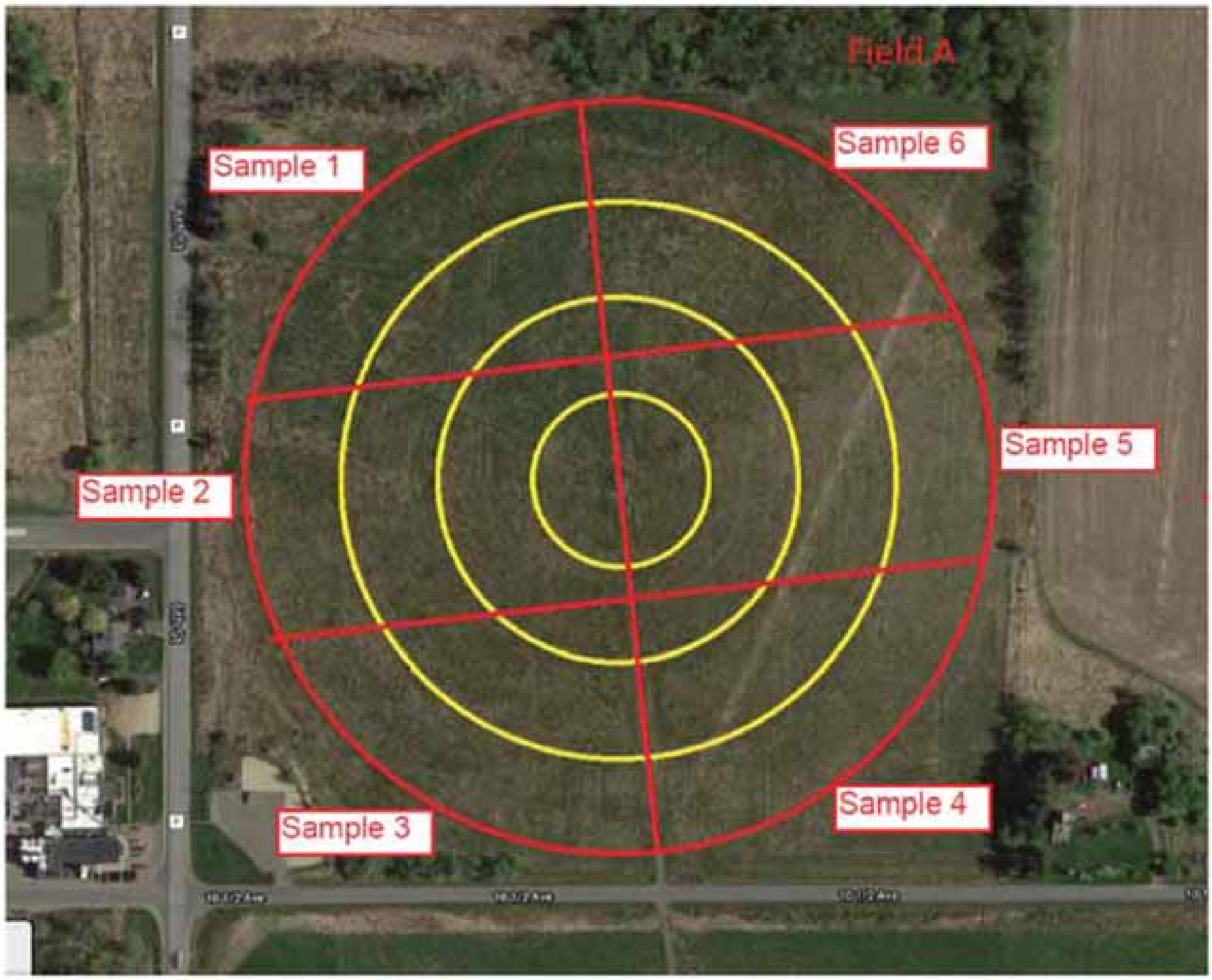
% BASE SATURATION (AVG): CA: 62.0 MG: 23.3 K: 12.8 %ACID SATURATION: 1.9
SAMPLE: 1B % BASE SATURATION: CA: 62.8 MG: 23.6 K: 12.0 %ACID SATURATION: 1.6
SAMPLE: 2B % BASE SATURATION: CA: 61.1 MG: 22.8 K: 13.9 %ACID SATURATION: 2.2
Freeon - loamy soil/high yield potential
N.R.=Not required for calculation of lime requirement when soil pH is 6.6 or higher.
Because of very high P levels, P2O5 applications from fertilizer or manure should be reduced and crops with a high P removal should be grown.
Recommended rates are the total amount of nutrients to apply (N-P-K), including starter fertilizer.
For CRP crops in the seeding year only, apply some nitrogen (15-30 lb N/a). See table 6.3 in publication A2809 for specific rates.
* Note additional tests, as requested.
Response to added Ca is unlikely.
Soil Mg is optimum. Maintain level with dolomitic lime.

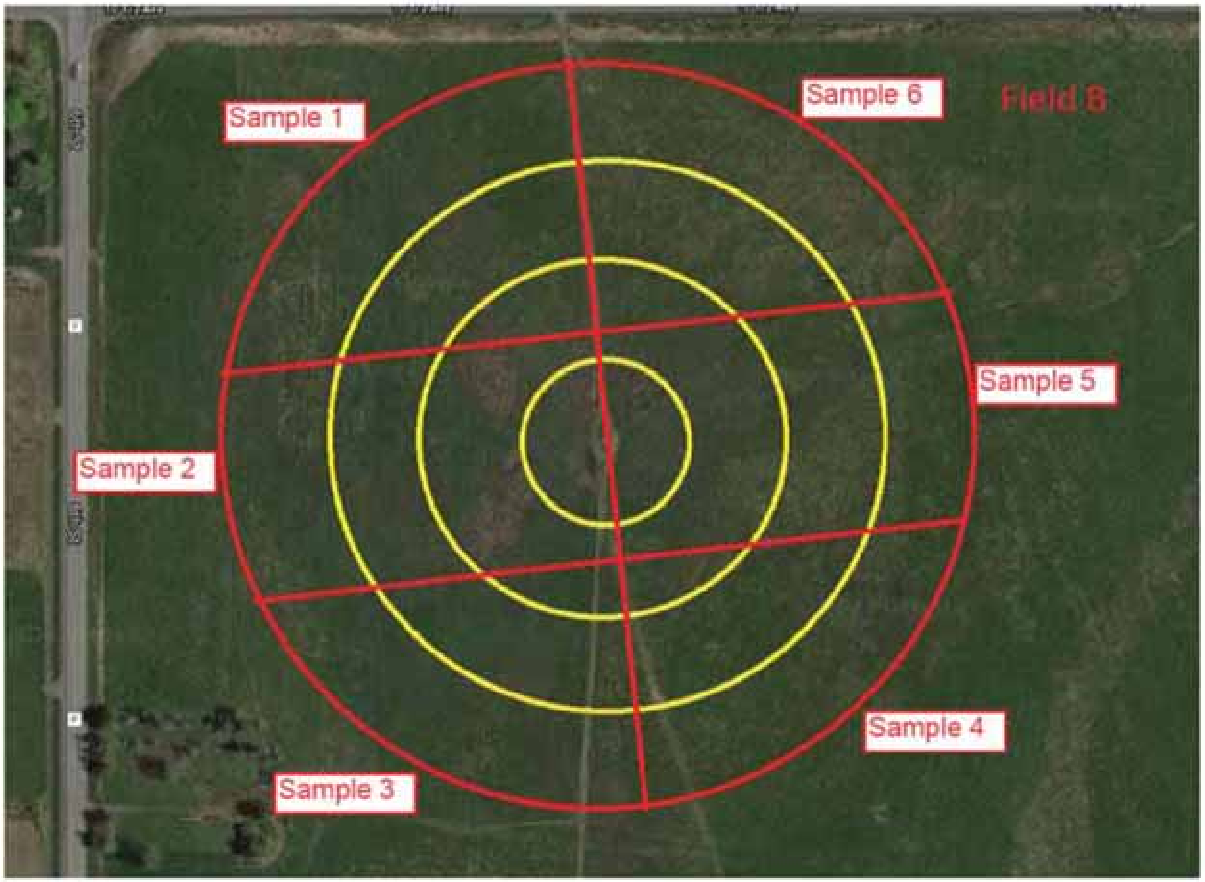
* A lime recommendation is calculated only when soil pH is more than 0.2 units below the optimum pH.

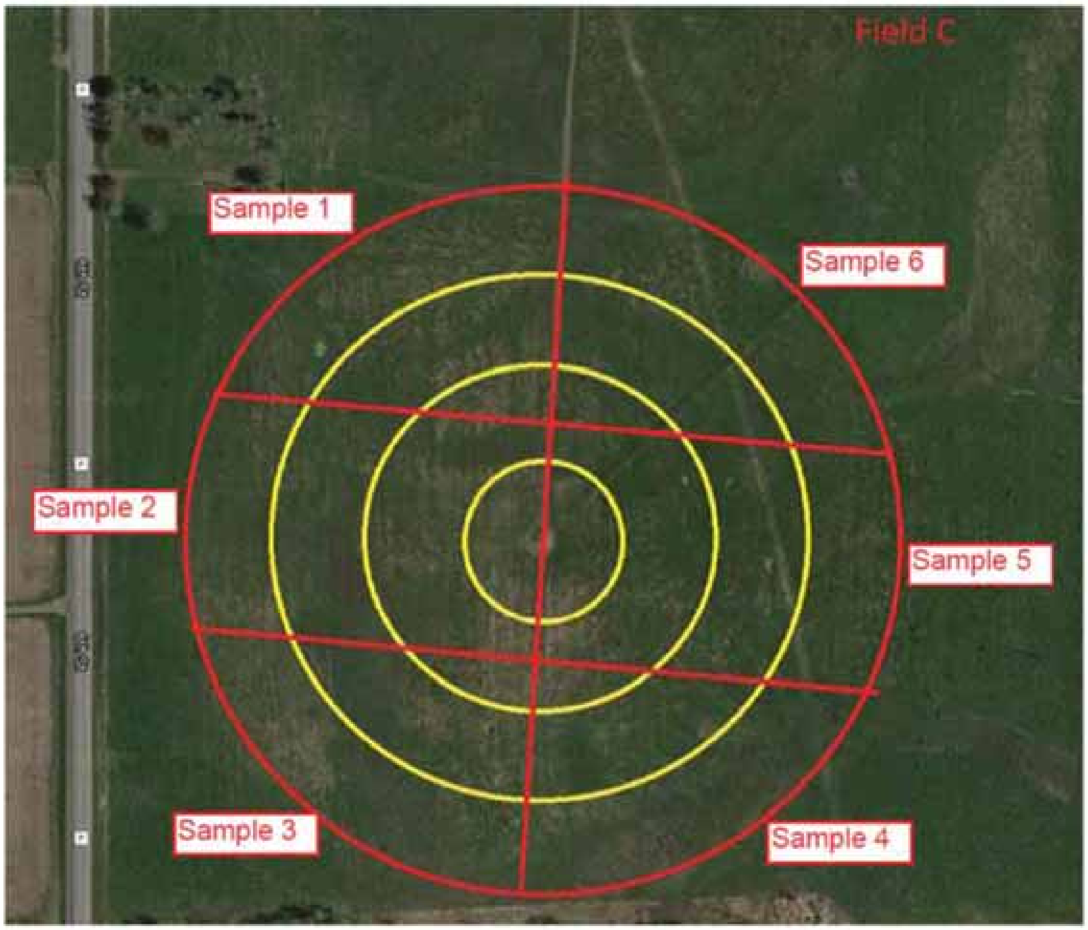
* Starter fertilizer (e.g. 10+20+20 lbs. N+P2O5+K2O/a) is advisable for row crops on soils slow to warm in the spring.

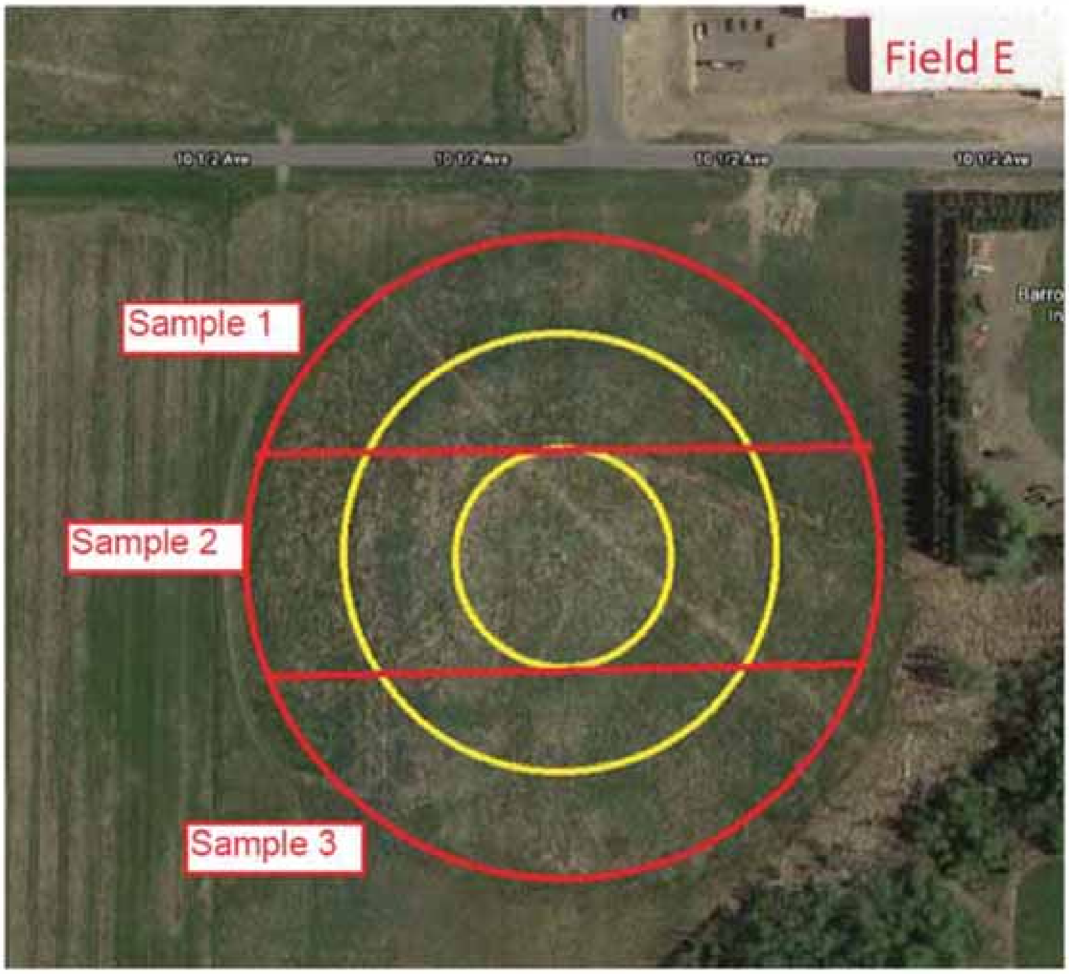
* A soil nitrate test may better estimate actual corn N needs.

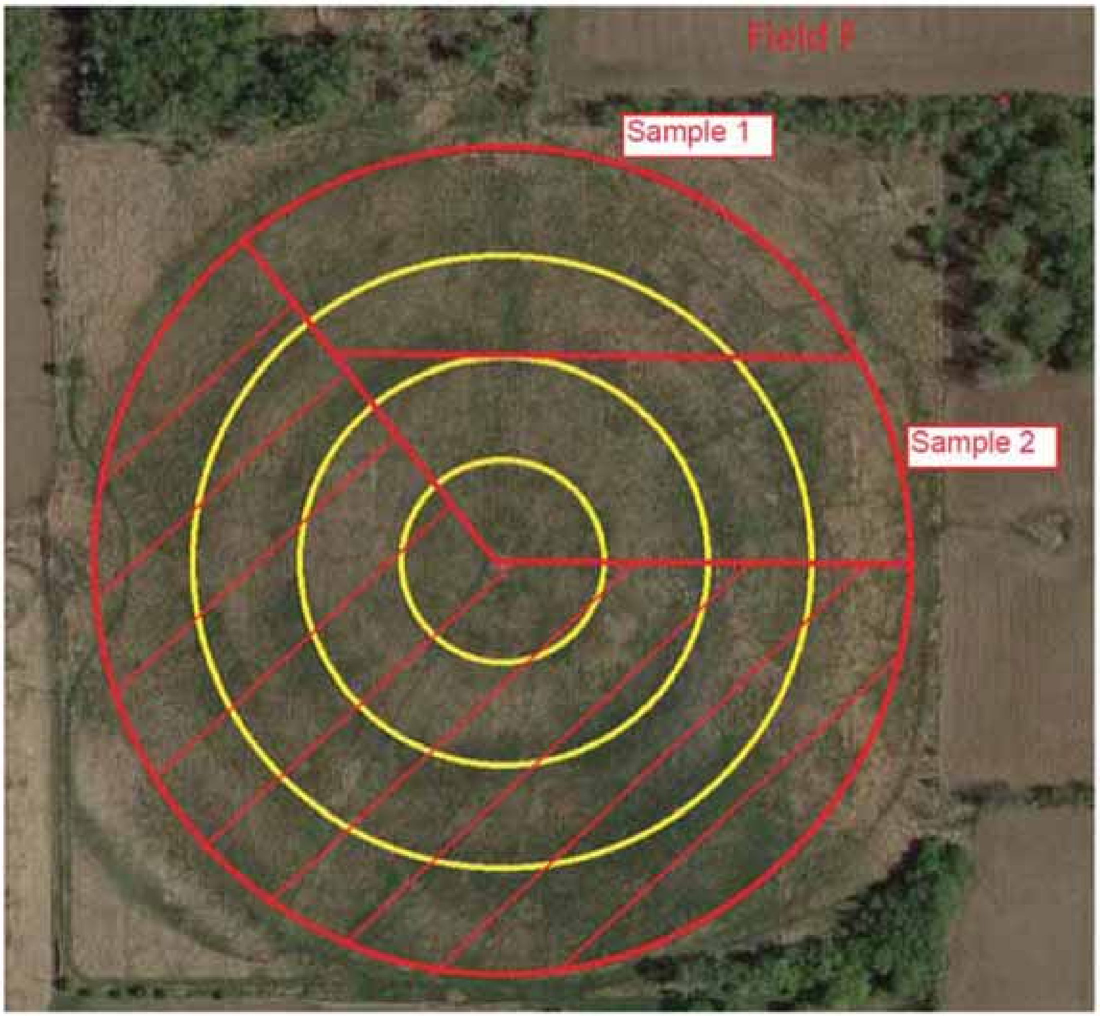
* If alfalfa will be maintained for more than three years, increase recommended K2O by 20% each year.


Field A
Sample 1
Sample 6
Sample 5
Sample 2
Sample 4
Sample 3


Sample 1
Sample 6
Field B
Sample 5
Sample 2
Sample 4
Sample 3


Field C
Sample 1
Sample 6
Sample 2
Sample 5
Sample 3
Sample 4


Field E
10 1/2 Ave
10 1/2 Ave
10 1/2 Ave
10 1/2 Ave
Sample 1
Sample 2
Sample 3


Field F
Sample 1
Sample 2

From: Claucherty, Matthew L - DNR <Matthew.Claucherty@wisconsin.gov>
Sent: Thursday, June 3, 2021 10:05 AM
To: Simon Larson; Shane Wiercinski
Cc: Balk, Michelle M - DNR; Kirsch, Kevin J - DNR; Englebert, Jordan J - DNR; Oldenburg, Patrick S - DNR
Subject: RE: Saputo Almena Permit

Hello Simon and Shane,

Thank you for being patient while DNR worked through points #1-3 below. We've had some further discussions with UW staff that help to inform our decisions surrounding Snap Plus modeling.

1. It is helpful to have more phosphorus data pertaining to the spray irrigation wastewater. What has been provided is a fairly coarse quantification, given that wastewater is applied April – November and sampling has been conducted in March and November only. Considering the variability in results obtained thus far, limited sampling regimen, and low trade ratio (see below) DNR requests a level of conservatism on this modeling input. Right now the recommendation is to continue using the current input of 28 mg/L.

2. Thank you for completing the stratification sampling. The data obtained through this process is useful in that it validates that Snap Plus's assumptions of infiltration and stratification are consistent with what is occurring on Saputo's fields. Based on information from UW staff who manage Snap Plus, Snap assumes a phosphorus concentration in the upper profile data at 1.4 – 1.6 times greater than the total profile for no-till systems. Saputo fields exhibited an average factor of 1.37 and maximum factor of 1.81 for this relationship. Therefore, we feel that Snap Plus is generally "handling" the situation well and an uncertainty factor of 1 can be authorized, minimizing the trade ratio. Continue to use the total profile (0 – 6" depth) data for Snap Plus modeling.

3. Based on information provided, these two fields could be good candidates for generating credits. We can discuss these further if you intend to include these in the water quality trading plan.

We're happy to set up a call to talk next steps if you would like, though it seems you have what you need to make progress on the water quality trading plan. If you have further questions, feel free to ask.

We are committed to service excellence.
Visit our survey at http://dnr.wi.gov/customersurvey to evaluate how I did.

Matt Claucherty
Phone: Currently teleworking due to COVID-19; available via Skype by appointment.
Matthew.Claucherty@wisconsin.gov

From: Simon Larson <simon.larson@gotocompletefiltration.com>
Sent: Thursday, April 22, 2021 10:21 AM
To: Claucherty, Matthew L - DNR <Matthew.Claucherty@wisconsin.gov>; Shane Wiercinski <shane.wiercinski@gotocompletefiltration.com>; Balk, Michelle M - DNR <Michelle.Balk@wisconsin.gov>; Oldenburg, Patrick S - DNR <Patrick.Oldenburg@wisconsin.gov>; Kirsch, Kevin J - DNR <Kevin.Kirsch@wisconsin.gov>; Englebert, Jordan J - DNR <jordan.englebert@wisconsin.gov>
Subject: RE: Saputo Almena Permit

Thanks Matt for these helpful comments.

D - RAW IRRIGATION DATA IMPORTED TO SNAPPLUS

Raw Irrigation Data (2015-2023) converted into gal/acre/field and imported to SnapPlus				
Date	Gal Total	Field	Acres	Gal/acre
4/14/2015	230,000	A	29.3	7,850
4/17/2015	295,000	A	29.3	10,068
4/30/2015	298,000	A	29.3	10,171
5/6/2015	322,000	A	29.3	10,990
5/13/2015	282,000	A	29.3	9,625
5/26/2015	221,000	A	29.3	7,543
6/2/2015	308,000	A	29.3	10,512
6/18/2015	310,000	A	29.3	10,580
6/23/2015	318,000	A	29.3	10,853
6/29/2015	318,000	A	29.3	10,853
7/2/2015	306,000	A	29.3	10,444
7/5/2015	271,000	A	29.3	9,249
7/10/2015	306,000	A	29.3	10,444
7/12/2015	240,000	A	29.3	8,191
7/20/2015	315,000	A	29.3	10,751
7/23/2015	329,000	A	29.3	11,229
7/27/2015	282,000	A	29.3	9,625
7/30/2015	376,000	A	29.3	12,833
8/3/2015	346,000	A	29.3	11,809
8/6/2015	297,000	A	29.3	10,137
8/13/2015	328,000	A	29.3	11,195
8/27/2015	361,000	A	29.3	12,321
9/1/2015	330,000	A	29.3	11,263
9/11/2015	313,000	A	29.3	10,683
9/13/2015	345,000	A	29.3	11,775
9/16/2015	315,000	A	29.3	10,751
9/23/2015	275,600	A	29.3	9,406
9/28/2015	323,000	A	29.3	11,024
10/1/2015	285,000	A	29.3	9,727
10/5/2015	318,000	A	29.3	10,853
10/9/2015	293,000	A	29.3	10,000
10/12/2015	309,000	A	29.3	10,546
10/15/2015	292,000	A	29.3	9,966
10/19/2015	320,000	A	29.3	10,922
10/22/2015	300,000	A	29.3	10,239
10/27/2015	307,000	A	29.3	10,478
11/3/2015	305,000	A	29.3	10,410

11/6/2015	301,000	A	29.3	10,273
11/9/2015	300,000	A	29.3	10,239
11/11/2015	303,000	A	29.3	10,341
11/16/2015	307,000	A	29.3	10,478
4/14/2016	283,000	A	29.3	9,659
5/3/2016	321,000	A	29.3	10,956
5/5/2016	299,000	A	29.3	10,205
5/9/2016	357,000	A	29.3	12,184
5/18/2016	443,000	A	29.3	15,119
5/22/2016	404,000	A	29.3	13,788
5/25/2016	278,000	A	29.3	9,488
5/27/2016	281,000	A	29.3	9,590
5/31/2016	63,000	A	29.3	2,150
6/2/2016	451,000	A	29.3	15,392
6/8/2016	474,000	A	29.3	16,177
6/13/2016	289,000	A	29.3	9,863
6/16/2016	230,000	A	29.3	7,850
6/19/2016	374,000	A	29.3	12,765
6/22/2016	502,000	A	29.3	17,133
6/25/2016	401,000	A	29.3	13,686
6/29/2016	442,000	A	29.3	15,085
7/2/2016	432,000	A	29.3	14,744
7/5/2016	398,000	A	29.3	13,584
7/13/2016	442,000	A	29.3	15,085
7/19/2016	431,000	A	29.3	14,710
7/21/2016	431,000	A	29.3	14,710
7/23/2016	149,000	A	29.3	5,085
7/26/2016	445,000	A	29.3	15,188
7/29/2016	454,000	A	29.3	15,495
7/31/2016	405,000	A	29.3	13,823
8/2/2016	441,000	A	29.3	15,051
8/6/2016	313,000	A	29.3	10,683
8/10/2016	479,000	A	29.3	16,348
8/25/2016	425,000	A	29.3	14,505
8/29/2016	442,000	A	29.3	15,085
9/2/2016	240,000	A	29.3	8,191
9/3/2016	368,000	A	29.3	12,560
9/11/2016	390,000	A	29.3	13,311
9/14/2016	389,000	A	29.3	13,276
9/18/2016	363,000	A	29.3	12,389

9/20/2016	376,000	A	29.3	12,833
9/27/2016	282,000	A	29.3	9,625
9/29/2016	397,000	A	29.3	13,549
10/3/2016	307,000	A	29.3	10,478
10/6/2016	296,000	A	29.3	10,102
10/10/2016	301,000	A	29.3	10,273
10/13/2016	257,000	A	29.3	8,771
10/19/2016	306,000	A	29.3	10,444
10/24/2016	210,000	A	29.3	7,167
10/31/2016	286,000	A	29.3	9,761
11/3/2016	141,000	A	29.3	4,812
11/9/2016	183,000	A	29.3	6,246
6/1/2017	135,000	A	29.3	4,608
6/2/2017	346,000	A	29.3	11,809
6/6/2017	284,000	A	29.3	9,693
6/8/2017	449,000	A	29.3	15,324
6/16/2017	316,000	A	29.3	10,785
6/27/2017	498,000	A	29.3	16,997
7/3/2017	449,000	A	29.3	15,324
7/6/2017	307,000	A	29.3	10,478
7/9/2017	464,000	A	29.3	15,836
7/11/2017	513,000	A	29.3	17,509
7/15/2017	508,000	A	29.3	17,338
7/18/2017	510,000	A	29.3	17,406
7/22/2017	451,000	A	29.3	15,392
8/2/2017	479,000	A	29.3	16,348
8/8/2017	474,000	A	29.3	16,177
8/13/2017	457,000	A	29.3	15,597
8/19/2017	530,000	A	29.3	18,089
8/22/2017	461,000	A	29.3	15,734
8/25/2017	212,000	A	29.3	7,235
8/30/2017	456,000	A	29.3	15,563
9/1/2017	453,000	A	29.3	15,461
9/6/2017	485,000	A	29.3	16,553
9/8/2017	274,000	A	29.3	9,352
9/11/2017	444,000	A	29.3	15,154
9/14/2017	445,000	A	29.3	15,188
9/18/2017	187,000	A	29.3	6,382
9/23/2017	372,000	A	29.3	12,696
9/28/2017	358,000	A	29.3	12,218

9/30/2017	284,000	A	29.3	9,693
10/5/2017	221,000	A	29.3	7,543
10/11/2017	277,000	A	29.3	9,454
10/13/2017	341,000	A	29.3	11,638
10/19/2017	287,000	A	29.3	9,795
10/23/2017	287,000	A	29.3	9,795
4/27/2018	290,000	A	29.3	9,898
5/1/2018	260,000	A	29.3	8,874
5/4/2018	350,000	A	29.3	11,945
5/7/2018	477,000	A	29.3	16,280
5/12/2018	385,000	A	29.3	13,140
5/16/2018	524,000	A	29.3	17,884
5/19/2018	316,000	A	29.3	10,785
5/22/2018	485,000	A	29.3	16,553
5/25/2018	459,000	A	29.3	15,666
6/6/2018	229,000	A	29.3	7,816
6/12/2018	359,000	A	29.3	12,253
6/15/2018	310,000	A	29.3	10,580
6/28/2018	445,000	A	29.3	15,188
6/30/2018	342,000	A	29.3	11,672
7/4/2018	219,000	A	29.3	7,474
7/8/2018	410,000	A	29.3	13,993
7/9/2018	388,000	A	29.3	13,242
7/11/2018	503,000	A	29.3	17,167
7/15/2018	382,000	A	29.3	13,038
7/18/2018	455,300	A	29.3	15,539
7/21/2018	353,000	A	29.3	12,048
7/23/2018	372,000	A	29.3	12,696
7/26/2018	376,000	A	29.3	12,833
7/29/2018	415,000	A	29.3	14,164
8/1/2018	468,000	A	29.3	15,973
8/7/2018	448,000	A	29.3	15,290
8/10/2018	311,000	A	29.3	10,614
8/13/2018	372,000	A	29.3	12,696
8/23/2018	336,000	A	29.3	11,468
9/7/2018	181,000	A	29.3	6,177
9/10/2018	265,000	A	29.3	9,044
9/13/2018	299,000	A	29.3	10,205
9/16/2018	324,000	A	29.3	11,058
9/26/2018	215,000	A	29.3	7,338

10/2/2018	176,000	A	29.3	6,007
10/18/2018	332,000	A	29.3	11,331
10/21/2018	265,000	A	29.3	9,044
10/24/2018	140,000	A	29.3	4,778
10/31/2018	303,000	A	29.3	10,341
11/2/2018	231,000	A	29.3	7,884
5/3/2019	284,000	A	29.3	9,693
5/5/2019	431,000	A	29.3	14,710
5/8/2019	112,000	A	29.3	3,823
5/14/2019	429,000	A	29.3	14,642
5/17/2019	435,000	A	29.3	14,846
5/27/2019	88,000	A	29.3	3,003
5/30/2019	220,000	A	29.3	7,509
6/4/2019	372,000	A	29.3	12,696
6/6/2019	536,000	A	29.3	18,294
6/11/2019	358,000	A	29.3	12,218
6/17/2019	241,000	A	29.3	8,225
6/19/2019	358,000	A	29.3	12,218
6/22/2019	295,000	A	29.3	10,068
6/26/2019	380,000	A	29.3	12,969
6/29/2019	304,000	A	29.3	10,375
7/8/2019	279,000	A	29.3	9,522
7/14/2019	379,000	A	29.3	12,935
7/18/2019	521,000	A	29.3	17,782
7/20/2019	321,000	A	29.3	10,956
7/25/2019	506,000	A	29.3	17,270
7/28/2019	478,000	A	29.3	16,314
7/31/2019	630,000	A	29.3	21,502
8/3/2019	446,000	A	29.3	15,222
8/7/2019	546,000	A	29.3	18,635
8/10/2019	420,000	A	29.3	14,334
8/13/2019	414,000	A	29.3	14,130
8/17/2019	392,000	A	29.3	13,379
8/20/2019	84,000	A	29.3	2,867
8/21/2019	542,000	A	29.3	18,498
8/24/2019	457,000	A	29.3	15,597
8/26/2019	211,000	A	29.3	7,201
9/5/2019	489,000	A	29.3	16,689
9/8/2019	386,000	A	29.3	13,174
9/19/2019	498,000	A	29.3	16,997

9/21/2019	301,000	A	29.3	10,273
9/24/2019	454,000	A	29.3	15,495
9/26/2019	413,000	A	29.3	14,096
10/9/2019	496,000	A	29.3	16,928
10/18/2019	456,000	A	29.3	15,563
10/20/2019	227,000	A	29.3	7,747
10/25/2019	276,000	A	29.3	9,420
4/22/2020	195,000	A	29.3	6,655
4/25/2020	474,000	A	29.3	16,177
4/30/2020	167,000	A	29.3	5,700
5/3/2020	437,000	A	29.3	14,915
5/5/2020	458,000	A	29.3	15,631
5/8/2020	196,000	A	29.3	6,689
5/13/2020	315,000	A	29.3	10,751
5/15/2020	490,000	A	29.3	16,724
5/20/2020	472,000	A	29.3	16,109
5/23/2020	199,000	A	29.3	6,792
5/31/2020	404,000	A	29.3	13,788
6/3/2020	422,000	A	29.3	14,403
6/6/2020	483,000	A	29.3	16,485
6/9/2020	582,000	A	29.3	19,863
6/13/2020	538,000	A	29.3	18,362
6/16/2020	530,000	A	29.3	18,089
6/19/2020	507,000	A	29.3	17,304
7/2/2020	298,000	A	29.3	10,171
7/5/2020	330,000	A	29.3	11,263
7/7/2020	518,000	A	29.3	17,679
7/12/2020	527,000	A	29.3	17,986
7/17/2020	529,000	A	29.3	18,055
7/29/2020	522,000	A	29.3	17,816
8/1/2020	422,000	A	29.3	14,403
8/6/2020	503,000	A	29.3	17,167
8/9/2020	657,000	A	29.3	22,423
8/12/2020	522,000	A	29.3	17,816
8/23/2020	293,000	A	29.3	10,000
8/25/2020	213,000	A	29.3	7,270
9/2/2020	467,000	A	29.3	15,939
9/6/2020	382,000	A	29.3	13,038
9/9/2020	191,000	A	29.3	6,519
9/15/2020	114,000	A	29.3	3,891

9/16/2020	319,000	A	29.3	10,887
9/21/2020	327,000	A	29.3	11,160
9/25/2020	311,000	A	29.3	10,614
10/6/2020	304,000	A	29.3	10,375
10/9/2020	293,000	A	29.3	10,000
4/16/2021	245,000	A	29.3	8,362
4/21/2021	32,000	A	29.3	1,092
4/22/2021	305,000	A	29.3	10,410
5/1/2021	577,000	A	29.3	19,693
5/4/2021	399,000	A	29.3	13,618
5/7/2021	393,000	A	29.3	13,413
5/10/2021	278,000	A	29.3	9,488
5/13/2021	425,000	A	29.3	14,505
5/17/2021	388,000	A	29.3	13,242
6/8/2021	532,000	A	29.3	18,157
6/11/2021	419,000	A	29.3	14,300
6/14/2021	441,000	A	29.3	15,051
6/17/2021	401,000	A	29.3	13,686
6/19/2021	333,000	A	29.3	11,365
6/23/2021	457,000	A	29.3	15,597
6/28/2021	286,000	A	29.3	9,761
7/1/2021	432,000	A	29.3	14,744
7/4/2021	373,000	A	29.3	12,730
7/10/2021	490,000	A	29.3	16,724
7/13/2021	442,000	A	29.3	15,085
7/17/2021	359,000	A	29.3	12,253
7/20/2021	456,000	A	29.3	15,563
7/23/2021	363,000	A	29.3	12,389
8/14/2021	465,000	A	29.3	15,870
8/16/2021	444,000	A	29.3	15,154
8/19/2021	440,000	A	29.3	15,017
8/23/2021	396,000	A	29.3	13,515
8/27/2021	291,000	A	29.3	9,932
9/2/2021	447,000	A	29.3	15,256
9/8/2021	436,000	A	29.3	14,881
9/10/2021	431,000	A	29.3	14,710
9/13/2021	441,000	A	29.3	15,051
9/19/2021	435,000	A	29.3	14,846
9/23/2021	441,000	A	29.3	15,051
9/26/2021	402,000	A	29.3	13,720

9/28/2021	392,000	A	29.3	13,379
10/1/2021	452,000	A	29.3	15,427
10/6/2021	398,000	A	29.3	13,584
10/11/2021	404,000	A	29.3	13,788
10/14/2021	429,000	A	29.3	14,642
10/19/2021	403,000	A	29.3	13,754
4/27/2022	218,000	A	29.3	7,440
4/28/2022	200,000	A	29.3	6,826
5/6/2022	340,000	A	29.3	11,604
5/9/2022	330,000	A	29.3	11,263
5/17/2022	497,000	A	29.3	16,962
5/22/2022	480,000	A	29.3	16,382
5/28/2022	517,000	A	29.3	17,645
5/31/2022	465,000	A	29.3	15,870
6/3/2022	517,000	A	29.3	17,645
6/6/2022	512,000	A	29.3	17,474
6/9/2022	485,000	A	29.3	16,553
6/12/2022	531,000	A	29.3	18,123
6/21/2022	354,000	A	29.3	12,082
6/24/2022	313,000	A	29.3	10,683
6/27/2022	417,000	A	29.3	14,232
7/1/2022	453,000	A	29.3	15,461
7/4/2022	181,000	A	29.3	6,177
7/7/2022	409,000	A	29.3	13,959
7/13/2022	271,000	A	29.3	9,249
7/18/2022	24,000	A	29.3	819
7/19/2022	418,000	A	29.3	14,266
7/30/2022	437,000	A	29.3	14,915
8/4/2022	382,000	A	29.3	13,038
8/10/2022	424,000	A	29.3	14,471
8/16/2022	391,000	A	29.3	13,345
8/20/2022	466,000	A	29.3	15,904
8/23/2022	410,000	A	29.3	13,993
8/31/2022	364,000	A	29.3	12,423
9/3/2022	469,000	A	29.3	16,007
9/6/2022	389,000	A	29.3	13,276
9/9/2022	84,000	A	29.3	2,867
9/11/2022	443,000	A	29.3	15,119
9/14/2022	415,000	A	29.3	14,164
9/17/2022	414,000	A	29.3	14,130

9/22/2022	391,000	A	29.3	13,345
9/27/2022	399,000	A	29.3	13,618
10/3/2022	294,000	A	29.3	10,034
10/7/2022	244,000	A	29.3	8,328
10/11/2022	258,000	A	29.3	8,805
10/21/2022	241,000	A	29.3	8,225
10/28/2022	259,000	A	29.3	8,840
11/3/2022	264,000	A	29.3	9,010
5/3/2023	161,000	A	29.3	5,495
5/9/2023	287,000	A	29.3	9,795
5/12/2023	281,000	A	29.3	9,590
5/15/2023	284,000	A	29.3	9,693
5/18/2023	271,000	A	29.3	9,249
5/22/2023	361,000	A	29.3	12,321
6/5/2023	398,000	A	29.3	13,584
6/8/2023	445,000	A	29.3	15,188
6/11/2023	552,000	A	29.3	18,840
6/14/2023	501,000	A	29.3	17,099
6/17/2023	431,000	A	29.3	14,710
6/20/2023	284,000	A	29.3	9,693
6/23/2023	399,000	A	29.3	13,618
6/28/2023	302,000	A	29.3	10,307
4/16/2015	315,000	B	29.2	10,788
4/23/2015	149,000	B	29.2	5,103
4/28/2015	489,000	B	29.2	16,747
5/4/2015	335,000	B	29.2	11,473
5/22/2015	327,000	B	29.2	11,199
6/1/2015	319,000	B	29.2	10,925
6/10/2015	337,000	B	29.2	11,541
6/15/2015	351,000	B	29.2	12,021
6/17/2015	325,000	B	29.2	11,130
6/25/2015	166,000	B	29.2	5,685
6/26/2015	260,000	B	29.2	8,904
7/1/2015	303,000	B	29.2	10,377
7/8/2015	278,000	B	29.2	9,521
7/15/2015	278,000	B	29.2	9,521
7/21/2015	285,000	B	29.2	9,760
7/24/2015	418,000	B	29.2	14,315
7/31/2015	319,000	B	29.2	10,925
8/4/2015	323,000	B	29.2	11,062

8/14/2015	309,000	B	29.2	10,582
8/18/2015	220,000	B	29.2	7,534
8/25/2015	286,000	B	29.2	9,795
8/31/2015	309,000	B	29.2	10,582
9/14/2015	292,000	B	29.2	10,000
9/22/2015	284,000	B	29.2	9,726
9/26/2015	323,000	B	29.2	11,062
9/29/2015	422,000	B	29.2	14,452
10/2/2015	319,000	B	29.2	10,925
10/4/2015	368,000	B	29.2	12,603
10/7/2015	423,000	B	29.2	14,486
10/11/2015	401,000	B	29.2	13,733
10/14/2015	267,000	B	29.2	9,144
10/16/2015	183,000	B	29.2	6,267
10/20/2015	274,000	B	29.2	9,384
11/4/2015	299,000	B	29.2	10,240
4/13/2016	186,000	B	29.2	6,370
4/18/2016	313,000	B	29.2	10,719
5/2/2016	265,000	B	29.2	9,075
5/12/2016	323,000	B	29.2	11,062
5/16/2016	473,000	B	29.2	16,199
5/19/2016	514,000	B	29.2	17,603
5/23/2016	341,000	B	29.2	11,678
6/3/2016	297,000	B	29.2	10,171
6/9/2016	477,000	B	29.2	16,336
6/14/2016	309,000	B	29.2	10,582
6/18/2016	462,000	B	29.2	15,822
6/21/2016	459,000	B	29.2	15,719
6/27/2016	271,000	B	29.2	9,281
6/30/2016	222,000	B	29.2	7,603
7/3/2016	439,000	B	29.2	15,034
7/9/2016	423,000	B	29.2	14,486
7/14/2016	327,000	B	29.2	11,199
7/20/2016	466,000	B	29.2	15,959
7/25/2016	484,000	B	29.2	16,575
7/30/2016	388,000	B	29.2	13,288
8/3/2016	452,000	B	29.2	15,479
8/8/2016	482,000	B	29.2	16,507
8/12/2016	454,000	B	29.2	15,548
8/15/2016	310,000	B	29.2	10,616

8/23/2016	436,000	B	29.2	14,932
8/31/2016	437,000	B	29.2	14,966
9/10/2016	359,000	B	29.2	12,295
9/13/2016	426,000	B	29.2	14,589
9/19/2016	292,000	B	29.2	10,000
10/2/2016	302,000	B	29.2	10,342
10/20/2016	215,000	B	29.2	7,363
10/25/2016	264,000	B	29.2	9,041
11/2/2016	128,000	B	29.2	4,384
11/11/2016	157,000	B	29.2	5,377
6/7/2017	546,000	B	29.2	18,699
6/9/2017	345,000	B	29.2	11,815
6/20/2017	455,000	B	29.2	15,582
6/23/2017	444,000	B	29.2	15,205
6/26/2017	478,000	B	29.2	16,370
6/30/2017	454,000	B	29.2	15,548
7/2/2017	490,000	B	29.2	16,781
7/5/2017	468,000	B	29.2	16,027
7/8/2017	413,000	B	29.2	14,144
7/13/2017	446,000	B	29.2	15,274
7/16/2017	499,000	B	29.2	17,089
7/19/2017	434,000	B	29.2	14,863
7/21/2017	500,000	B	29.2	17,123
7/23/2017	471,000	B	29.2	16,130
8/5/2017	428,000	B	29.2	14,658
8/9/2017	253,000	B	29.2	8,664
8/15/2017	235,000	B	29.2	8,048
8/21/2017	278,000	B	29.2	9,521
8/24/2017	255,000	B	29.2	8,733
8/31/2017	453,000	B	29.2	15,514
9/7/2017	404,000	B	29.2	13,836
9/12/2017	435,000	B	29.2	14,897
9/17/2017	442,000	B	29.2	15,137
9/22/2017	113,000	B	29.2	3,870
9/27/2017	279,000	B	29.2	9,555
10/6/2017	205,000	B	29.2	7,021
10/12/2017	416,000	B	29.2	14,247
10/18/2017	272,000	B	29.2	9,315
10/25/2017	301,000	B	29.2	10,308
4/26/2018	252,000	B	29.2	8,630

5/2/2018	306,000	B	29.2	10,479
5/6/2018	352,000	B	29.2	12,055
5/10/2018	370,000	B	29.2	12,671
5/13/2018	372,000	B	29.2	12,740
5/17/2018	482,000	B	29.2	16,507
5/20/2018	302,000	B	29.2	10,342
5/23/2018	342,000	B	29.2	11,712
6/4/2018	218,000	B	29.2	7,466
6/7/2018	319,000	B	29.2	10,925
6/10/2018	364,000	B	29.2	12,466
6/13/2018	511,000	B	29.2	17,500
6/25/2018	441,000	B	29.2	15,103
7/1/2018	177,000	B	29.2	6,062
7/6/2018	400,000	B	29.2	13,699
7/10/2018	434,000	B	29.2	14,863
7/16/2018	589,000	B	29.2	20,171
7/19/2018	534,000	B	29.2	18,288
7/24/2018	568,000	B	29.2	19,452
7/28/2018	535,000	B	29.2	18,322
7/30/2018	661,000	B	29.2	22,637
8/3/2018	433,000	B	29.2	14,829
8/8/2018	406,000	B	29.2	13,904
8/14/2018	458,000	B	29.2	15,685
8/17/2018	317,000	B	29.2	10,856
8/20/2018	104,000	B	29.2	3,562
9/8/2018	376,000	B	29.2	12,877
9/11/2018	339,000	B	29.2	11,610
9/14/2018	371,000	B	29.2	12,705
9/17/2018	318,000	B	29.2	10,890
10/1/2018	179,000	B	29.2	6,130
10/17/2018	332,000	B	29.2	11,370
10/22/2018	228,000	B	29.2	7,808
10/25/2018	245,000	B	29.2	8,390
10/30/2018	254,000	B	29.2	8,699
5/2/2019	221,000	B	29.2	7,568
5/6/2019	200,000	B	29.2	6,849
5/13/2019	274,000	B	29.2	9,384
5/16/2019	533,000	B	29.2	18,253
6/2/2019	163,000	B	29.2	5,582
6/5/2019	352,000	B	29.2	12,055

6/8/2019	453,000	B	29.2	15,514
6/12/2019	471,000	B	29.2	16,130
6/18/2019	431,000	B	29.2	14,760
6/21/2019	490,000	B	29.2	16,781
6/27/2019	148,000	B	29.2	5,068
7/4/2019	379,000	B	29.2	12,979
7/12/2019	533,000	B	29.2	18,253
7/15/2019	278,000	B	29.2	9,521
7/26/2019	556,000	B	29.2	19,041
7/29/2019	273,000	B	29.2	9,349
8/1/2019	493,000	B	29.2	16,884
8/4/2019	505,000	B	29.2	17,295
8/8/2019	523,000	B	29.2	17,911
8/12/2019	283,000	B	29.2	9,692
8/23/2019	511,000	B	29.2	17,500
8/30/2019	435,000	B	29.2	14,897
9/1/2019	349,000	B	29.2	11,952
9/6/2019	510,000	B	29.2	17,466
9/9/2019	206,000	B	29.2	7,055
9/20/2019	438,000	B	29.2	15,000
9/23/2019	287,000	B	29.2	9,829
9/27/2019	528,000	B	29.2	18,082
10/10/2019	453,000	B	29.2	15,514
4/23/2020	65,000	B	29.2	2,226
4/24/2020	375,000	B	29.2	12,842
5/2/2020	389,000	B	29.2	13,322
5/4/2020	342,000	B	29.2	11,712
5/7/2020	294,000	B	29.2	10,068
5/12/2020	400,000	B	29.2	13,699
5/21/2020	460,000	B	29.2	15,753
5/25/2020	192,000	B	29.2	6,575
6/1/2020	475,000	B	29.2	16,267
6/5/2020	482,000	B	29.2	16,507
6/7/2020	396,000	B	29.2	13,562
6/12/2020	490,000	B	29.2	16,781
6/15/2020	478,000	B	29.2	16,370
6/18/2020	474,000	B	29.2	16,233
6/21/2020	225,000	B	29.2	7,705
6/23/2020	502,000	B	29.2	17,192
6/25/2020	306,000	B	29.2	10,479

7/3/2020	352,000	B	29.2	12,055
7/6/2020	501,000	B	29.2	17,158
7/13/2020	497,000	B	29.2	17,021
7/24/2020	502,000	B	29.2	17,192
7/31/2020	502,000	B	29.2	17,192
8/4/2020	486,000	B	29.2	16,644
8/7/2020	483,000	B	29.2	16,541
8/10/2020	487,000	B	29.2	16,678
8/15/2020	312,000	B	29.2	10,685
8/17/2020	381,000	B	29.2	13,048
8/19/2020	474,000	B	29.2	16,233
8/21/2020	475,000	B	29.2	16,267
8/30/2020	452,000	B	29.2	15,479
9/4/2020	423,000	B	29.2	14,486
9/7/2020	395,000	B	29.2	13,527
9/11/2020	406,000	B	29.2	13,904
9/17/2020	314,000	B	29.2	10,753
9/22/2020	363,000	B	29.2	12,432
10/7/2020	343,000	B	29.2	11,747
10/10/2020	346,000	B	29.2	11,849
4/29/2021	290,000	B	29.2	9,932
5/2/2021	371,000	B	29.2	12,705
5/5/2021	271,000	B	29.2	9,281
5/8/2021	353,000	B	29.2	12,089
5/11/2021	368,000	B	29.2	12,603
5/14/2021	286,000	B	29.2	9,795
5/18/2021	364,000	B	29.2	12,466
5/26/2021	334,000	B	29.2	11,438
6/3/2021	355,000	B	29.2	12,158
6/5/2021	335,000	B	29.2	11,473
6/10/2021	446,000	B	29.2	15,274
6/13/2021	508,000	B	29.2	17,397
6/16/2021	594,000	B	29.2	20,342
6/24/2021	421,000	B	29.2	14,418
6/29/2021	434,000	B	29.2	14,863
7/2/2021	425,000	B	29.2	14,555
7/6/2021	257,000	B	29.2	8,801
7/11/2021	495,000	B	29.2	16,952
7/14/2021	230,000	B	29.2	7,877
7/18/2021	443,000	B	29.2	15,171

7/21/2021	462,000	B	29.2	15,822
8/1/2021	388,000	B	29.2	13,288
8/3/2021	379,000	B	29.2	12,979
8/5/2021	78,000	B	29.2	2,671
8/13/2021	397,000	B	29.2	13,596
8/17/2021	441,000	B	29.2	15,103
8/20/2021	433,000	B	29.2	14,829
9/1/2021	445,000	B	29.2	15,240
9/7/2021	436,000	B	29.2	14,932
9/11/2021	442,000	B	29.2	15,137
9/20/2021	232,000	B	29.2	7,945
9/25/2021	401,000	B	29.2	13,733
9/29/2021	418,000	B	29.2	14,315
10/4/2021	416,000	B	29.2	14,247
10/12/2021	390,000	B	29.2	13,356
10/15/2021	381,000	B	29.2	13,048
10/20/2021	276,000	B	29.2	9,452
10/25/2021	170,000	B	29.2	5,822
4/29/2022	219,000	B	29.2	7,500
5/4/2022	248,000	B	29.2	8,493
5/7/2022	362,000	B	29.2	12,397
5/11/2022	370,000	B	29.2	12,671
5/18/2022	443,000	B	29.2	15,171
5/24/2022	478,000	B	29.2	16,370
5/29/2022	407,000	B	29.2	13,938
6/1/2022	463,000	B	29.2	15,856
6/4/2022	488,000	B	29.2	16,712
6/7/2022	550,000	B	29.2	18,836
6/10/2022	497,000	B	29.2	17,021
6/13/2022	61,000	B	29.2	2,089
6/14/2022	484,000	B	29.2	16,575
6/18/2022	351,000	B	29.2	12,021
6/20/2022	376,000	B	29.2	12,877
6/25/2022	385,000	B	29.2	13,185
6/29/2022	224,000	B	29.2	7,671
7/2/2022	437,000	B	29.2	14,966
7/6/2022	443,000	B	29.2	15,171
7/8/2022	275,000	B	29.2	9,418
7/14/2022	381,000	B	29.2	13,048
7/22/2022	356,000	B	29.2	12,192

7/26/2022	259,000	B	29.2	8,870
7/28/2022	414,000	B	29.2	14,178
7/31/2022	385,000	B	29.2	13,185
8/2/2022	380,000	B	29.2	13,014
8/7/2022	424,000	B	29.2	14,521
8/15/2022	383,000	B	29.2	13,116
8/18/2022	385,000	B	29.2	13,185
8/22/2022	383,000	B	29.2	13,116
9/1/2022	394,000	B	29.2	13,493
9/4/2022	465,000	B	29.2	15,925
9/7/2022	447,000	B	29.2	15,308
9/12/2022	413,000	B	29.2	14,144
9/15/2022	441,000	B	29.2	15,103
9/18/2022	428,000	B	29.2	14,658
9/23/2022	384,000	B	29.2	13,151
9/28/2022	353,000	B	29.2	12,089
10/6/2022	280,000	B	29.2	9,589
10/12/2022	195,000	B	29.2	6,678
10/22/2022	259,000	B	29.2	8,870
10/29/2022	253,000	B	29.2	8,664
5/5/2023	282,000	B	29.2	9,658
5/11/2023	305,000	B	29.2	10,445
5/14/2023	505,000	B	29.2	17,295
5/17/2023	302,000	B	29.2	10,342
5/21/2023	351,000	B	29.2	12,021
5/23/2023	552,000	B	29.2	18,904
6/4/2023	398,000	B	29.2	13,630
6/7/2023	474,000	B	29.2	16,233
6/10/2023	443,000	B	29.2	15,171
6/13/2023	449,000	B	29.2	15,377
6/16/2023	277,000	B	29.2	9,486
6/19/2023	281,000	B	29.2	9,623
6/22/2023	436,000	B	29.2	14,932
6/27/2023	380,000	B	29.2	13,014
6/30/2023	376,000	B	29.2	12,877
4/15/2015	282,000	C	29.1	9,691
4/27/2015	247,000	C	29.1	8,488
4/29/2015	279,000	C	29.1	9,588
5/1/2015	278,000	C	29.1	9,553
5/5/2015	297,000	C	29.1	10,206

5/7/2015	276,000	C	29.1	9,485
5/14/2015	275,000	C	29.1	9,450
5/21/2015	274,000	C	29.1	9,416
6/3/2015	263,000	C	29.1	9,038
6/12/2015	270,000	C	29.1	9,278
6/16/2015	287,000	C	29.1	9,863
6/19/2015	291,000	C	29.1	10,000
6/24/2015	298,000	C	29.1	10,241
7/4/2015	190,000	C	29.1	6,529
7/9/2015	305,000	C	29.1	10,481
7/11/2015	283,000	C	29.1	9,725
7/16/2015	285,000	C	29.1	9,794
7/22/2015	290,000	C	29.1	9,966
7/26/2015	215,000	C	29.1	7,388
7/29/2015	288,000	C	29.1	9,897
8/1/2015	267,000	C	29.1	9,175
8/5/2015	496,000	C	29.1	17,045
8/12/2015	289,000	C	29.1	9,931
8/17/2015	296,000	C	29.1	10,172
8/21/2015	312,000	C	29.1	10,722
8/26/2015	301,000	C	29.1	10,344
8/28/2015	286,000	C	29.1	9,828
9/4/2015	243,000	C	29.1	8,351
9/9/2015	288,000	C	29.1	9,897
9/12/2015	321,000	C	29.1	11,031
9/15/2015	313,000	C	29.1	10,756
9/21/2015	289,000	C	29.1	9,931
9/27/2015	364,000	C	29.1	12,509
9/30/2015	399,000	C	29.1	13,711
10/3/2015	345,000	C	29.1	11,856
10/6/2015	378,000	C	29.1	12,990
10/10/2015	381,000	C	29.1	13,093
10/13/2015	274,000	C	29.1	9,416
10/17/2015	291,000	C	29.1	10,000
10/21/2015	425,000	C	29.1	14,605
10/25/2015	303,000	C	29.1	10,412
11/2/2015	329,000	C	29.1	11,306
11/5/2015	290,000	C	29.1	9,966
11/8/2015	307,000	C	29.1	10,550
11/10/2015	206,000	C	29.1	7,079

11/15/2015	291,000	C	29.1	10,000
4/15/2016	283,000	C	29.1	9,725
4/20/2016	291,000	C	29.1	10,000
5/4/2016	297,000	C	29.1	10,206
5/6/2016	301,000	C	29.1	10,344
5/11/2016	292,000	C	29.1	10,034
5/17/2016	542,000	C	29.1	18,625
5/20/2016	451,000	C	29.1	15,498
5/24/2016	569,000	C	29.1	19,553
5/26/2016	431,000	C	29.1	14,811
5/30/2016	420,000	C	29.1	14,433
6/7/2016	499,000	C	29.1	17,148
6/10/2016	393,000	C	29.1	13,505
6/15/2016	318,000	C	29.1	10,928
6/17/2016	406,000	C	29.1	13,952
6/20/2016	287,000	C	29.1	9,863
6/24/2016	321,000	C	29.1	11,031
6/28/2016	445,000	C	29.1	15,292
7/1/2016	449,000	C	29.1	15,430
7/4/2016	414,000	C	29.1	14,227
7/18/2016	434,000	C	29.1	14,914
7/22/2016	496,000	C	29.1	17,045
7/27/2016	270,000	C	29.1	9,278
8/1/2016	415,000	C	29.1	14,261
8/5/2016	315,000	C	29.1	10,825
8/9/2016	445,000	C	29.1	15,292
8/13/2016	219,000	C	29.1	7,526
8/18/2016	284,000	C	29.1	9,759
8/22/2016	430,000	C	29.1	14,777
8/26/2016	410,000	C	29.1	14,089
9/1/2016	415,000	C	29.1	14,261
9/12/2016	370,000	C	29.1	12,715
9/15/2016	343,000	C	29.1	11,787
9/26/2016	374,000	C	29.1	12,852
9/30/2016	356,000	C	29.1	12,234
10/4/2016	268,000	C	29.1	9,210
10/11/2016	346,000	C	29.1	11,890
10/14/2016	316,000	C	29.1	10,859
10/21/2016	234,000	C	29.1	8,041
11/1/2016	184,000	C	29.1	6,323

11/10/2016	167,000	C	29.1	5,739
6/5/2017	394,000	C	29.1	13,540
6/10/2017	268,000	C	29.1	9,210
6/19/2017	345,000	C	29.1	11,856
6/21/2017	319,000	C	29.1	10,962
6/29/2017	405,000	C	29.1	13,918
7/4/2017	361,000	C	29.1	12,405
7/7/2017	379,000	C	29.1	13,024
7/10/2017	363,000	C	29.1	12,474
7/14/2017	408,000	C	29.1	14,021
7/17/2017	410,000	C	29.1	14,089
7/20/2017	487,000	C	29.1	16,735
8/1/2017	473,000	C	29.1	16,254
8/7/2017	530,000	C	29.1	18,213
8/12/2017	480,000	C	29.1	16,495
8/23/2017	506,000	C	29.1	17,388
9/5/2017	459,000	C	29.1	15,773
9/9/2017	424,000	C	29.1	14,570
9/13/2017	470,000	C	29.1	16,151
9/15/2017	541,000	C	29.1	18,591
9/21/2017	461,000	C	29.1	15,842
9/24/2017	452,000	C	29.1	15,533
9/29/2017	463,000	C	29.1	15,911
10/10/2017	337,000	C	29.1	11,581
10/17/2017	417,000	C	29.1	14,330
10/20/2017	410,000	C	29.1	14,089
4/25/2018	158,000	C	29.1	5,430
4/30/2018	275,000	C	29.1	9,450
5/3/2018	374,000	C	29.1	12,852
5/5/2018	520,000	C	29.1	17,869
5/8/2018	404,000	C	29.1	13,883
5/11/2018	293,000	C	29.1	10,069
5/14/2018	363,000	C	29.1	12,474
5/18/2018	303,000	C	29.1	10,412
5/21/2018	474,000	C	29.1	16,289
5/24/2018	361,000	C	29.1	12,405
5/26/2018	521,000	C	29.1	17,904
6/5/2018	490,000	C	29.1	16,838
6/8/2018	470,000	C	29.1	16,151
6/11/2018	365,000	C	29.1	12,543

6/14/2018	468,000	C	29.1	16,082
6/24/2018	392,000	C	29.1	13,471
6/29/2018	337,000	C	29.1	11,581
7/3/2018	316,000	C	29.1	10,859
7/7/2018	455,000	C	29.1	15,636
7/12/2018	356,000	C	29.1	12,234
7/17/2018	514,000	C	29.1	17,663
7/20/2018	505,000	C	29.1	17,354
7/22/2018	376,000	C	29.1	12,921
7/25/2018	478,000	C	29.1	16,426
7/27/2018	344,000	C	29.1	11,821
7/31/2018	596,000	C	29.1	20,481
8/6/2018	396,000	C	29.1	13,608
8/15/2018	493,000	C	29.1	16,942
8/22/2018	324,000	C	29.1	11,134
8/30/2018	192,000	C	29.1	6,598
9/9/2018	256,000	C	29.1	8,797
9/12/2018	310,000	C	29.1	10,653
9/15/2018	271,000	C	29.1	9,313
9/18/2018	321,000	C	29.1	11,031
9/25/2018	182,000	C	29.1	6,254
9/28/2018	296,000	C	29.1	10,172
9/30/2018	215,000	C	29.1	7,388
10/16/2018	329,000	C	29.1	11,306
10/19/2018	355,000	C	29.1	12,199
10/23/2018	249,000	C	29.1	8,557
10/26/2018	280,000	C	29.1	9,622
11/1/2018	242,000	C	29.1	8,316
5/4/2019	610,000	C	29.1	20,962
5/7/2019	588,000	C	29.1	20,206
5/15/2019	360,000	C	29.1	12,371
5/18/2019	330,000	C	29.1	11,340
5/26/2019	307,000	C	29.1	10,550
5/31/2019	325,000	C	29.1	11,168
6/3/2019	512,000	C	29.1	17,595
6/7/2019	516,000	C	29.1	17,732
6/10/2019	289,000	C	29.1	9,931
6/13/2019	359,000	C	29.1	12,337
6/20/2019	148,000	C	29.1	5,086
6/25/2019	528,000	C	29.1	18,144

6/30/2019	58,000	C	29.1	1,993
7/6/2019	10,000	C	29.1	344
7/7/2019	335,000	C	29.1	11,512
7/9/2019	429,000	C	29.1	14,742
7/13/2019	393,000	C	29.1	13,505
7/19/2019	561,000	C	29.1	19,278
7/24/2019	457,000	C	29.1	15,704
7/27/2019	112,000	C	29.1	3,849
7/30/2019	518,000	C	29.1	17,801
8/2/2019	490,000	C	29.1	16,838
8/5/2019	146,000	C	29.1	5,017
8/9/2019	536,000	C	29.1	18,419
8/15/2019	491,000	C	29.1	16,873
8/19/2019	292,000	C	29.1	10,034
8/22/2019	409,000	C	29.1	14,055
8/25/2019	442,000	C	29.1	15,189
8/29/2019	28,000	C	29.1	962
8/31/2019	421,000	C	29.1	14,467
9/7/2019	263,000	C	29.1	9,038
9/18/2019	306,000	C	29.1	10,515
9/22/2019	261,000	C	29.1	8,969
9/25/2019	301,000	C	29.1	10,344
9/28/2019	298,000	C	29.1	10,241
10/8/2019	469,000	C	29.1	16,117
10/19/2019	233,000	C	29.1	8,007
4/26/2020	359,000	C	29.1	12,337
5/1/2020	272,000	C	29.1	9,347
5/6/2020	285,000	C	29.1	9,794
5/11/2020	377,000	C	29.1	12,955
5/14/2020	317,000	C	29.1	10,893
5/16/2020	314,000	C	29.1	10,790
5/22/2020	444,000	C	29.1	15,258
5/30/2020	400,000	C	29.1	13,746
6/2/2020	338,000	C	29.1	11,615
6/4/2020	472,000	C	29.1	16,220
6/8/2020	526,000	C	29.1	18,076
6/11/2020	426,000	C	29.1	14,639
6/14/2020	514,000	C	29.1	17,663
6/17/2020	475,000	C	29.1	16,323
6/20/2020	209,000	C	29.1	7,182

6/22/2020	485,000	C	29.1	16,667
6/24/2020	404,000	C	29.1	13,883
7/4/2020	308,000	C	29.1	10,584
7/8/2020	499,000	C	29.1	17,148
7/25/2020	622,000	C	29.1	21,375
7/30/2020	480,000	C	29.1	16,495
8/3/2020	452,000	C	29.1	15,533
8/5/2020	453,000	C	29.1	15,567
8/8/2020	479,000	C	29.1	16,460
8/11/2020	472,000	C	29.1	16,220
8/20/2020	516,000	C	29.1	17,732
8/24/2020	405,000	C	29.1	13,918
8/29/2020	68,000	C	29.1	2,337
9/3/2020	481,000	C	29.1	16,529
9/8/2020	444,000	C	29.1	15,258
9/14/2020	453,000	C	29.1	15,567
9/18/2020	278,000	C	29.1	9,553
9/23/2020	321,000	C	29.1	11,031
10/5/2020	325,000	C	29.1	11,168
10/8/2020	234,000	C	29.1	8,041
10/11/2020	306,000	C	29.1	10,515
4/24/2021	261,000	C	29.1	8,969
4/30/2021	499,000	C	29.1	17,148
5/3/2021	540,000	C	29.1	18,557
5/6/2021	319,000	C	29.1	10,962
5/9/2021	416,000	C	29.1	14,296
5/12/2021	451,000	C	29.1	15,498
5/16/2021	320,000	C	29.1	10,997
5/30/2021	333,000	C	29.1	11,443
6/2/2021	243,000	C	29.1	8,351
6/4/2021	374,000	C	29.1	12,852
6/6/2021	394,000	C	29.1	13,540
6/12/2021	475,000	C	29.1	16,323
6/15/2021	403,000	C	29.1	13,849
6/18/2021	430,000	C	29.1	14,777
6/22/2021	448,000	C	29.1	15,395
6/25/2021	432,000	C	29.1	14,845
6/30/2021	434,000	C	29.1	14,914
7/3/2021	381,000	C	29.1	13,093
7/5/2021	525,000	C	29.1	18,041

7/9/2021	461,000	C	29.1	15,842
7/12/2021	452,000	C	29.1	15,533
7/16/2021	458,000	C	29.1	15,739
7/19/2021	462,000	C	29.1	15,876
7/22/2021	474,000	C	29.1	16,289
7/31/2021	351,000	C	29.1	12,062
8/2/2021	420,000	C	29.1	14,433
8/4/2021	459,000	C	29.1	15,773
8/15/2021	247,000	C	29.1	8,488
8/18/2021	484,000	C	29.1	16,632
8/21/2021	483,000	C	29.1	16,598
9/6/2021	406,000	C	29.1	13,952
9/9/2021	469,000	C	29.1	16,117
9/12/2021	441,000	C	29.1	15,155
9/16/2021	472,000	C	29.1	16,220
9/24/2021	229,000	C	29.1	7,869
9/27/2021	419,000	C	29.1	14,399
9/30/2021	407,000	C	29.1	13,986
10/5/2021	439,000	C	29.1	15,086
10/10/2021	446,000	C	29.1	15,326
10/13/2021	429,000	C	29.1	14,742
10/18/2021	470,000	C	29.1	16,151
5/5/2022	362,000	C	29.1	12,440
5/8/2022	364,000	C	29.1	12,509
5/16/2022	483,000	C	29.1	16,598
5/19/2022	370,000	C	29.1	12,715
5/23/2022	474,000	C	29.1	16,289
5/27/2022	540,000	C	29.1	18,557
5/30/2022	433,000	C	29.1	14,880
6/2/2022	495,000	C	29.1	17,010
6/5/2022	527,000	C	29.1	18,110
6/8/2022	593,000	C	29.1	20,378
6/11/2022	465,000	C	29.1	15,979
6/19/2022	391,000	C	29.1	13,436
6/23/2022	474,000	C	29.1	16,289
6/26/2022	483,000	C	29.1	16,598
6/30/2022	405,000	C	29.1	13,918
7/3/2022	370,000	C	29.1	12,715
7/5/2022	450,000	C	29.1	15,464
7/12/2022	357,000	C	29.1	12,268

7/21/2022	477,000	C	29.1	16,392
7/23/2022	99,000	C	29.1	3,402
7/25/2022	449,000	C	29.1	15,430
7/27/2022	463,000	C	29.1	15,911
7/29/2022	290,000	C	29.1	9,966
8/5/2022	394,000	C	29.1	13,540
8/11/2022	440,000	C	29.1	15,120
8/17/2022	391,000	C	29.1	13,436
8/21/2022	372,000	C	29.1	12,784
8/24/2022	206,000	C	29.1	7,079
9/2/2022	500,000	C	29.1	17,182
9/5/2022	380,000	C	29.1	13,058
9/8/2022	412,000	C	29.1	14,158
9/13/2022	485,000	C	29.1	16,667
9/16/2022	419,000	C	29.1	14,399
9/19/2022	445,000	C	29.1	15,292
9/26/2022	484,000	C	29.1	16,632
9/29/2022	296,000	C	29.1	10,172
10/5/2022	282,000	C	29.1	9,691
10/10/2022	244,000	C	29.1	8,385
10/23/2022	222,000	C	29.1	7,629
10/30/2022	224,000	C	29.1	7,698
11/2/2022	283,000	C	29.1	9,725
5/4/2023	327,000	C	29.1	11,237
5/10/2023	324,000	C	29.1	11,134
5/13/2023	348,000	C	29.1	11,959
5/16/2023	327,000	C	29.1	11,237
5/20/2023	283,000	C	29.1	9,725
5/24/2023	359,000	C	29.1	12,337
6/3/2023	423,000	C	29.1	14,536
6/6/2023	478,000	C	29.1	16,426
6/9/2023	496,000	C	29.1	17,045
6/12/2023	483,000	C	29.1	16,598
6/15/2023	513,000	C	29.1	17,629
6/18/2023	416,000	C	29.1	14,296
6/21/2023	379,000	C	29.1	13,024
6/24/2023	428,000	C	29.1	14,708
4/15/2015	191,000	E	13.2	14,470
4/17/2015	198,000	E	13.2	15,000
4/26/2015	270,000	E	13.2	20,455

4/30/2015	225,000	E	13.2	17,045
5/5/2015	210,000	E	13.2	15,909
5/7/2015	196,000	E	13.2	14,848
5/14/2015	192,000	E	13.2	14,545
5/21/2015	206,000	E	13.2	15,606
5/23/2015	239,000	E	13.2	18,106
6/1/2015	59,000	E	13.2	4,470
6/16/2015	205,000	E	13.2	15,530
6/24/2015	202,000	E	13.2	15,303
6/27/2015	246,000	E	13.2	18,636
7/1/2015	184,000	E	13.2	13,939
7/3/2015	184,000	E	13.2	13,939
7/9/2015	216,000	E	13.2	16,364
7/16/2015	154,000	E	13.2	11,667
7/21/2015	189,000	E	13.2	14,318
7/23/2015	185,000	E	13.2	14,015
7/27/2015	202,000	E	13.2	15,303
7/30/2015	207,000	E	13.2	15,682
8/1/2015	147,000	E	13.2	11,136
8/3/2015	182,000	E	13.2	13,788
8/5/2015	292,000	E	13.2	22,121
8/12/2015	170,000	E	13.2	12,879
8/14/2015	169,000	E	13.2	12,803
8/17/2015	169,000	E	13.2	12,803
8/26/2015	173,000	E	13.2	13,106
8/27/2015	170,000	E	13.2	12,879
8/31/2015	175,000	E	13.2	13,258
9/4/2015	164,000	E	13.2	12,424
9/11/2015	140,000	E	13.2	10,606
9/13/2015	146,000	E	13.2	11,061
9/15/2015	145,000	E	13.2	10,985
9/21/2015	135,000	E	13.2	10,227
9/22/2015	132,000	E	13.2	10,000
9/26/2015	147,000	E	13.2	11,136
9/28/2015	134,000	E	13.2	10,152
9/29/2015	36,000	E	13.2	2,727
9/30/2015	134,000	E	13.2	10,152
10/2/2015	167,000	E	13.2	12,652
10/4/2015	221,000	E	13.2	16,742
10/8/2015	223,000	E	13.2	16,894

10/9/2015	213,000	E	13.2	16,136
10/12/2015	209,000	E	13.2	15,833
10/15/2015	199,000	E	13.2	15,076
10/16/2015	107,000	E	13.2	8,106
10/20/2015	210,000	E	13.2	15,909
10/22/2015	190,000	E	13.2	14,394
11/3/2015	107,000	E	13.2	8,106
11/5/2015	197,000	E	13.2	14,924
11/8/2015	251,000	E	13.2	19,015
11/10/2015	166,000	E	13.2	12,576
11/15/2015	229,000	E	13.2	17,348
5/3/2016	241,000	E	13.2	18,258
7/21/2016	185,000	E	13.2	14,015
7/26/2016	338,000	E	13.2	25,606
7/30/2016	283,000	E	13.2	21,439
8/2/2016	219,000	E	13.2	16,591
8/4/2016	38,000	E	13.2	2,879
8/6/2016	222,000	E	13.2	16,818
8/9/2016	116,000	E	13.2	8,788
8/12/2016	200,000	E	13.2	15,152
8/14/2016	251,000	E	13.2	19,015
8/23/2016	298,000	E	13.2	22,576
8/26/2016	277,000	E	13.2	20,985
8/30/2016	147,000	E	13.2	11,136
8/31/2016	265,000	E	13.2	20,076
9/2/2016	285,000	E	13.2	21,591
9/10/2016	233,000	E	13.2	17,652
9/13/2016	270,000	E	13.2	20,455
9/15/2016	249,000	E	13.2	18,864
9/19/2016	185,000	E	13.2	14,015
9/27/2016	176,000	E	13.2	13,333
9/30/2016	202,000	E	13.2	15,303
10/4/2016	291,000	E	13.2	22,045
10/6/2016	281,000	E	13.2	21,288
10/19/2016	254,000	E	13.2	19,242
10/24/2016	201,000	E	13.2	15,227
10/29/2016	129,000	E	13.2	9,773
11/8/2016	184,000	E	13.2	13,939
6/19/2017	405,000	E	13.2	30,682
6/26/2017	193,000	E	13.2	14,621

6/30/2017	60,000	E	13.2	4,545
7/3/2017	73,000	E	13.2	5,530
7/5/2017	97,000	E	13.2	7,348
7/6/2017	29,000	E	13.2	2,197
7/7/2017	85,000	E	13.2	6,439
7/10/2017	72,000	E	13.2	5,455
7/13/2017	325,000	E	13.2	24,621
7/17/2017	243,000	E	13.2	18,409
7/19/2017	212,000	E	13.2	16,061
7/21/2017	245,000	E	13.2	18,561
7/24/2017	250,000	E	13.2	18,939
7/28/2017	226,000	E	13.2	17,121
8/2/2017	206,000	E	13.2	15,606
8/8/2017	218,000	E	13.2	16,515
8/15/2017	185,000	E	13.2	14,015
8/21/2017	218,000	E	13.2	16,515
8/23/2017	220,000	E	13.2	16,667
8/31/2017	221,000	E	13.2	16,742
9/6/2017	222,000	E	13.2	16,818
9/8/2017	212,000	E	13.2	16,061
9/12/2017	221,000	E	13.2	16,742
9/14/2017	189,000	E	13.2	14,318
9/18/2017	148,000	E	13.2	11,212
9/22/2017	87,000	E	13.2	6,591
10/11/2017	166,000	E	13.2	12,576
10/13/2017	207,000	E	13.2	15,682
10/18/2017	209,000	E	13.2	15,833
10/23/2017	221,000	E	13.2	16,742
4/25/2018	105,000	E	13.2	7,955
4/27/2018	161,000	E	13.2	12,197
4/30/2018	176,000	E	13.2	13,333
5/2/2018	217,000	E	13.2	16,439
5/4/2018	254,000	E	13.2	19,242
5/8/2018	226,000	E	13.2	17,121
5/10/2018	264,000	E	13.2	20,000
5/12/2018	245,000	E	13.2	18,561
5/14/2018	200,000	E	13.2	15,152
5/17/2018	238,000	E	13.2	18,030
5/19/2018	201,000	E	13.2	15,227
5/21/2018	252,000	E	13.2	19,091

5/23/2018	199,000	E	13.2	15,076
5/27/2018	256,000	E	13.2	19,394
6/5/2018	246,000	E	13.2	18,636
6/7/2018	203,000	E	13.2	15,379
6/11/2018	216,000	E	13.2	16,364
6/13/2018	157,000	E	13.2	11,894
6/15/2018	155,000	E	13.2	11,742
7/9/2018	172,000	E	13.2	13,030
7/11/2018	153,000	E	13.2	11,591
7/14/2018	190,000	E	13.2	14,394
7/17/2018	149,000	E	13.2	11,288
7/19/2018	263,000	E	13.2	19,924
7/21/2018	158,000	E	13.2	11,970
7/23/2018	176,000	E	13.2	13,333
7/25/2018	201,000	E	13.2	15,227
7/27/2018	173,000	E	13.2	13,106
7/29/2018	80,000	E	13.2	6,061
7/30/2018	85,000	E	13.2	6,439
8/1/2018	255,000	E	13.2	19,318
8/3/2018	175,000	E	13.2	13,258
8/7/2018	251,000	E	13.2	19,015
8/9/2018	206,000	E	13.2	15,606
8/11/2018	168,000	E	13.2	12,727
8/13/2018	177,000	E	13.2	13,409
8/15/2018	200,000	E	13.2	15,152
8/18/2018	104,000	E	13.2	7,879
10/17/2018	250,000	E	13.2	18,939
10/19/2018	274,000	E	13.2	20,758
10/22/2018	235,000	E	13.2	17,803
10/24/2018	184,000	E	13.2	13,939
10/26/2018	214,000	E	13.2	16,212
10/30/2018	236,000	E	13.2	17,879
11/1/2018	115,000	E	13.2	8,712
11/4/2018	166,000	E	13.2	12,576
5/3/2019	159,000	E	13.2	12,045
5/5/2019	262,000	E	13.2	19,848
5/7/2019	363,000	E	13.2	27,500
5/14/2019	402,000	E	13.2	30,455
5/17/2019	471,000	E	13.2	35,682
5/27/2019	71,000	E	13.2	5,379

5/31/2019	259,000	E	13.2	19,621
6/3/2019	363,000	E	13.2	27,500
6/5/2019	308,000	E	13.2	23,333
6/7/2019	186,000	E	13.2	14,091
6/11/2019	299,000	E	13.2	22,652
6/13/2019	239,000	E	13.2	18,106
6/18/2019	331,000	E	13.2	25,076
6/20/2019	163,000	E	13.2	12,348
6/26/2019	375,000	E	13.2	28,409
6/30/2019	56,000	E	13.2	4,242
7/4/2019	356,000	E	13.2	26,970
7/7/2019	231,000	E	13.2	17,500
7/14/2019	259,000	E	13.2	19,621
7/17/2019	159,000	E	13.2	12,045
7/23/2019	287,000	E	13.2	21,742
7/25/2019	267,000	E	13.2	20,227
7/28/2019	230,000	E	13.2	17,424
7/30/2019	280,000	E	13.2	21,212
8/1/2019	169,000	E	13.2	12,803
8/3/2019	172,000	E	13.2	13,030
8/5/2019	68,000	E	13.2	5,152
8/8/2019	216,000	E	13.2	16,364
8/10/2019	196,000	E	13.2	14,848
8/15/2019	357,000	E	13.2	27,045
8/20/2019	53,000	E	13.2	4,015
8/22/2019	263,000	E	13.2	19,924
8/24/2019	242,000	E	13.2	18,333
8/29/2019	88,000	E	13.2	6,667
8/31/2019	133,000	E	13.2	10,076
9/6/2019	239,000	E	13.2	18,106
9/8/2019	238,000	E	13.2	18,030
9/19/2019	241,000	E	13.2	18,258
9/21/2019	239,000	E	13.2	18,106
9/23/2019	235,000	E	13.2	17,803
9/25/2019	191,000	E	13.2	14,470
9/28/2019	147,000	E	13.2	11,136
10/8/2019	370,000	E	13.2	28,030
10/10/2019	363,000	E	13.2	27,500
10/18/2019	347,000	E	13.2	26,288
10/20/2019	147,000	E	13.2	11,136

10/25/2019	229,000	E	13.2	17,348
4/22/2020	120,000	E	13.2	9,091
4/24/2020	252,000	E	13.2	19,091
4/26/2020	288,000	E	13.2	21,818
4/30/2020	173,000	E	13.2	13,106
5/2/2020	203,000	E	13.2	15,379
5/4/2020	193,000	E	13.2	14,621
5/6/2020	228,000	E	13.2	17,273
5/8/2020	157,000	E	13.2	11,894
5/11/2020	314,000	E	13.2	23,788
5/13/2020	239,000	E	13.2	18,106
5/15/2020	238,000	E	13.2	18,030
5/21/2020	236,000	E	13.2	17,879
5/23/2020	119,000	E	13.2	9,015
5/31/2020	212,000	E	13.2	16,061
6/2/2020	209,000	E	13.2	15,833
6/4/2020	189,000	E	13.2	14,318
6/6/2020	113,000	E	13.2	8,561
6/9/2020	232,000	E	13.2	17,576
6/11/2020	212,000	E	13.2	16,061
6/13/2020	175,000	E	13.2	13,258
6/15/2020	199,000	E	13.2	15,076
6/17/2020	214,000	E	13.2	16,212
6/19/2020	211,000	E	13.2	15,985
7/3/2020	270,000	E	13.2	20,455
7/7/2020	200,000	E	13.2	15,152
7/12/2020	207,000	E	13.2	15,682
7/17/2020	215,000	E	13.2	16,288
7/25/2020	222,000	E	13.2	16,818
7/29/2020	214,000	E	13.2	16,212
7/31/2020	229,000	E	13.2	17,348
8/3/2020	209,000	E	13.2	15,833
8/6/2020	216,000	E	13.2	16,364
8/8/2020	203,000	E	13.2	15,379
8/10/2020	186,000	E	13.2	14,091
8/12/2020	201,000	E	13.2	15,227
8/23/2020	190,000	E	13.2	14,394
8/25/2020	196,000	E	13.2	14,848
8/30/2020	217,000	E	13.2	16,439
9/2/2020	234,000	E	13.2	17,727

9/4/2020	213,000	E	13.2	16,136
9/9/2020	170,000	E	13.2	12,879
9/14/2020	226,000	E	13.2	17,121
4/22/2021	294,000	E	13.2	22,273
4/30/2021	222,000	E	13.2	16,818
5/2/2021	263,000	E	13.2	19,924
5/4/2021	200,000	E	13.2	15,152
5/6/2021	229,000	E	13.2	17,348
5/8/2021	213,000	E	13.2	16,136
5/10/2021	211,000	E	13.2	15,985
5/12/2021	214,000	E	13.2	16,212
5/16/2021	211,000	E	13.2	15,985
5/18/2021	172,000	E	13.2	13,030
6/2/2021	129,000	E	13.2	9,773
6/18/2021	285,000	E	13.2	21,591
6/22/2021	198,000	E	13.2	15,000
6/24/2021	187,000	E	13.2	14,167
6/28/2021	205,000	E	13.2	15,530
6/30/2021	197,000	E	13.2	14,924
7/2/2021	200,000	E	13.2	15,152
7/4/2021	149,000	E	13.2	11,288
7/6/2021	189,000	E	13.2	14,318
7/10/2021	210,000	E	13.2	15,909
7/12/2021	194,000	E	13.2	14,697
7/14/2021	161,000	E	13.2	12,197
7/17/2021	145,000	E	13.2	10,985
7/19/2021	307,000	E	13.2	23,258
7/21/2021	192,000	E	13.2	14,545
7/23/2021	133,000	E	13.2	10,076
8/2/2021	208,000	E	13.2	15,758
8/4/2021	229,000	E	13.2	17,348
8/13/2021	231,000	E	13.2	17,500
8/15/2021	178,000	E	13.2	13,485
8/17/2021	190,000	E	13.2	14,394
8/19/2021	185,000	E	13.2	14,015
8/21/2021	168,000	E	13.2	12,727
9/2/2021	313,000	E	13.2	23,712
9/10/2021	178,000	E	13.2	13,485
9/12/2021	293,000	E	13.2	22,197
9/20/2021	164,000	E	13.2	12,424

9/24/2021	156,000	E	13.2	11,818
9/26/2021	157,000	E	13.2	11,894
9/28/2021	219,000	E	13.2	16,591
9/30/2021	175,000	E	13.2	13,258
10/5/2021	195,000	E	13.2	14,773
10/7/2021	150,000	E	13.2	11,364
10/11/2021	184,000	E	13.2	13,939
10/13/2021	194,000	E	13.2	14,697
10/15/2021	225,000	E	13.2	17,045
10/19/2021	214,000	E	13.2	16,212
10/22/2021	206,000	E	13.2	15,606
10/24/2021	166,000	E	13.2	12,576
10/26/2021	191,000	E	13.2	14,470
4/29/2022	152,000	E	13.2	11,515
5/5/2022	231,000	E	13.2	17,500
5/7/2022	249,000	E	13.2	18,864
5/9/2022	241,000	E	13.2	18,258
5/16/2022	293,000	E	13.2	22,197
5/18/2022	274,000	E	13.2	20,758
5/22/2022	243,000	E	13.2	18,409
5/24/2022	201,000	E	13.2	15,227
5/28/2022	230,000	E	13.2	17,424
5/31/2022	302,000	E	13.2	22,879
6/2/2022	297,000	E	13.2	22,500
6/4/2022	254,000	E	13.2	19,242
6/6/2022	200,000	E	13.2	15,152
6/8/2022	302,000	E	13.2	22,879
6/10/2022	293,000	E	13.2	22,197
6/12/2022	285,000	E	13.2	21,591
7/19/2022	214,000	E	13.2	16,212
7/22/2022	221,000	E	13.2	16,742
7/26/2022	155,000	E	13.2	11,742
7/28/2022	264,000	E	13.2	20,000
7/30/2022	172,000	E	13.2	13,030
8/2/2022	270,000	E	13.2	20,455
8/5/2022	229,000	E	13.2	17,348
9/2/2022	243,000	E	13.2	18,409
9/4/2022	182,000	E	13.2	13,788
9/6/2022	250,000	E	13.2	18,939
9/8/2022	261,000	E	13.2	19,773

9/12/2022	270,000	E	13.2	20,455
9/14/2022	291,000	E	13.2	22,045
9/16/2022	269,000	E	13.2	20,379
9/18/2022	289,000	E	13.2	21,894
9/22/2022	229,000	E	13.2	17,348
9/27/2022	224,000	E	13.2	16,970
10/1/2022	286,000	E	13.2	21,667
10/3/2022	277,000	E	13.2	20,985
10/8/2022	156,000	E	13.2	11,818
10/15/2022	201,000	E	13.2	15,227
10/20/2022	229,000	E	13.2	17,348
10/27/2022	220,000	E	13.2	16,667
11/1/2022	240,000	E	13.2	18,182
5/4/2023	177,000	E	13.2	13,409
5/9/2023	203,000	E	13.2	15,379
5/11/2023	180,000	E	13.2	13,636
5/13/2023	120,000	E	13.2	9,091
5/15/2023	165,000	E	13.2	12,500
5/17/2023	174,000	E	13.2	13,182
5/20/2023	164,000	E	13.2	12,424
5/22/2023	209,000	E	13.2	15,833
5/24/2023	30,000	E	13.2	2,273
6/13/2023	299,000	E	13.2	22,652
6/15/2023	292,000	E	13.2	22,121
6/19/2023	167,000	E	13.2	12,652
6/21/2023	183,000	E	13.2	13,864
6/23/2023	202,000	E	13.2	15,303
6/28/2023	185,000	E	13.2	14,015
6/30/2023	176,000	E	13.2	13,333
4/14/2015	67,799	F-N	13.7	4,949
4/16/2015	91,177	F-N	13.7	6,655
4/18/2015	116,427	F-N	13.7	8,498
4/23/2015	43,485	F-N	13.7	3,174
4/25/2015	92,113	F-N	13.7	6,724
4/27/2015	76,683	F-N	13.7	5,597
4/28/2015	143,078	F-N	13.7	10,444
5/1/2015	92,113	F-N	13.7	6,724
5/4/2015	94,918	F-N	13.7	6,928
5/6/2015	93,515	F-N	13.7	6,826
5/9/2015	119,232	F-N	13.7	8,703

5/13/2015	82,294	F-N	13.7	6,007
5/22/2015	93,515	F-N	13.7	6,826
6/12/2015	130,922	F-N	13.7	9,556
6/15/2015	67,331	F-N	13.7	4,915
6/17/2015	63,123	F-N	13.7	4,608
6/19/2015	21,976	F-N	13.7	1,604
6/23/2015	92,580	F-N	13.7	6,758
6/26/2015	90,242	F-N	13.7	6,587
6/29/2015	98,191	F-N	13.7	7,167
7/2/2015	84,631	F-N	13.7	6,177
7/8/2015	93,048	F-N	13.7	6,792
7/10/2015	151,962	F-N	13.7	11,092
7/15/2015	66,863	F-N	13.7	4,881
7/20/2015	93,515	F-N	13.7	6,826
7/22/2015	57,044	F-N	13.7	4,164
7/24/2015	139,805	F-N	13.7	10,205
7/26/2015	138,870	F-N	13.7	10,137
7/29/2015	96,321	F-N	13.7	7,031
7/31/2015	94,451	F-N	13.7	6,894
8/9/2015	72,007	F-N	13.7	5,256
8/11/2015	154,768	F-N	13.7	11,297
8/13/2015	129,519	F-N	13.7	9,454
8/15/2015	167,860	F-N	13.7	12,253
8/18/2015	71,072	F-N	13.7	5,188
8/21/2015	109,413	F-N	13.7	7,986
8/25/2015	142,143	F-N	13.7	10,375
8/28/2015	86,969	F-N	13.7	6,348
8/30/2015	151,962	F-N	13.7	11,092
9/1/2015	141,676	F-N	13.7	10,341
9/5/2015	130,454	F-N	13.7	9,522
9/23/2015	62,655	F-N	13.7	4,573
10/3/2015	64,526	F-N	13.7	4,710
10/6/2015	98,659	F-N	13.7	7,201
10/7/2015	126,713	F-N	13.7	9,249
10/10/2015	133,259	F-N	13.7	9,727
10/11/2015	137,000	F-N	13.7	10,000
10/13/2015	90,242	F-N	13.7	6,587
10/14/2015	88,840	F-N	13.7	6,485
10/17/2015	100,529	F-N	13.7	7,338
10/19/2015	93,983	F-N	13.7	6,860

10/21/2015	132,324	F-N	13.7	9,659
10/25/2015	86,034	F-N	13.7	6,280
10/27/2015	100,529	F-N	13.7	7,338
11/1/2015	84,164	F-N	13.7	6,143
11/2/2015	48,628	F-N	13.7	3,549
11/4/2015	101,464	F-N	13.7	7,406
11/6/2015	103,802	F-N	13.7	7,577
11/9/2015	55,174	F-N	13.7	4,027
11/11/2015	103,802	F-N	13.7	7,577
11/16/2015	108,478	F-N	13.7	7,918
5/2/2016	6,546	F-N	13.7	478
5/4/2016	8,416	F-N	13.7	614
5/5/2016	38,341	F-N	13.7	2,799
5/6/2016	92,113	F-N	13.7	6,724
5/9/2016	3,741	F-N	13.7	273
7/19/2016	49,563	F-N	13.7	3,618
7/20/2016	90,242	F-N	13.7	6,587
7/22/2016	149,157	F-N	13.7	10,887
7/25/2016	134,195	F-N	13.7	9,795
7/27/2016	102,399	F-N	13.7	7,474
7/29/2016	158,976	F-N	13.7	11,604
7/31/2016	133,727	F-N	13.7	9,761
8/1/2016	133,259	F-N	13.7	9,727
8/3/2016	109,881	F-N	13.7	8,020
8/5/2016	104,270	F-N	13.7	7,611
8/8/2016	121,570	F-N	13.7	8,874
8/15/2016	83,696	F-N	13.7	6,109
8/18/2016	86,034	F-N	13.7	6,280
8/22/2016	149,625	F-N	13.7	10,922
8/25/2016	128,584	F-N	13.7	9,386
8/27/2016	99,594	F-N	13.7	7,270
8/29/2016	142,611	F-N	13.7	10,410
9/1/2016	144,481	F-N	13.7	10,546
9/3/2016	101,932	F-N	13.7	7,440
9/9/2016	93,515	F-N	13.7	6,826
9/11/2016	123,908	F-N	13.7	9,044
9/12/2016	126,713	F-N	13.7	9,249
9/14/2016	119,700	F-N	13.7	8,737
9/18/2016	123,908	F-N	13.7	9,044
9/20/2016	117,829	F-N	13.7	8,601

9/25/2016	108,945	F-N	13.7	7,952
9/26/2016	135,130	F-N	13.7	9,863
9/29/2016	129,519	F-N	13.7	9,454
10/1/2016	145,416	F-N	13.7	10,614
10/3/2016	143,546	F-N	13.7	10,478
10/10/2016	143,546	F-N	13.7	10,478
10/13/2016	131,857	F-N	13.7	9,625
10/16/2016	118,765	F-N	13.7	8,669
10/22/2016	108,010	F-N	13.7	7,884
10/28/2016	155,235	F-N	13.7	11,331
11/4/2016	69,669	F-N	13.7	5,085
11/7/2016	89,775	F-N	13.7	6,553
11/14/2016	55,174	F-N	13.7	4,027
11/15/2016	51,433	F-N	13.7	3,754
6/9/2017	158,976	F-N	13.7	11,604
6/18/2017	145,884	F-N	13.7	10,648
6/21/2017	165,055	F-N	13.7	12,048
6/23/2017	82,761	F-N	13.7	6,041
6/27/2017	82,294	F-N	13.7	6,007
7/11/2017	48,628	F-N	13.7	3,549
7/12/2017	52,836	F-N	13.7	3,857
7/14/2017	118,297	F-N	13.7	8,635
7/18/2017	120,635	F-N	13.7	8,805
7/20/2017	115,491	F-N	13.7	8,430
7/25/2017	119,700	F-N	13.7	8,737
7/27/2017	99,126	F-N	13.7	7,235
7/31/2017	141,676	F-N	13.7	10,341
8/1/2017	93,983	F-N	13.7	6,860
8/4/2017	105,205	F-N	13.7	7,679
8/7/2017	172,536	F-N	13.7	12,594
8/9/2017	101,464	F-N	13.7	7,406
8/13/2017	170,198	F-N	13.7	12,423
8/19/2017	194,044	F-N	13.7	14,164
8/22/2017	170,666	F-N	13.7	12,457
8/24/2017	78,553	F-N	13.7	5,734
8/25/2017	50,031	F-N	13.7	3,652
8/30/2017	168,328	F-N	13.7	12,287
9/1/2017	168,795	F-N	13.7	12,321
9/5/2017	159,911	F-N	13.7	11,672
9/7/2017	157,573	F-N	13.7	11,502

9/11/2017	169,263	F-N	13.7	12,355
9/13/2017	104,270	F-N	13.7	7,611
9/15/2017	170,198	F-N	13.7	12,423
9/17/2017	160,379	F-N	13.7	11,706
9/21/2017	156,638	F-N	13.7	11,433
9/24/2017	148,222	F-N	13.7	10,819
9/29/2017	142,143	F-N	13.7	10,375
10/10/2017	115,491	F-N	13.7	8,430
10/12/2017	138,403	F-N	13.7	10,102
10/17/2017	136,532	F-N	13.7	9,966
10/19/2017	108,478	F-N	13.7	7,918
10/20/2017	146,352	F-N	13.7	10,683
10/25/2017	66,396	F-N	13.7	4,846
10/26/2017	62,188	F-N	13.7	4,539
4/26/2018	59,850	F-N	13.7	4,369
5/1/2018	92,580	F-N	13.7	6,758
5/3/2018	118,765	F-N	13.7	8,669
5/5/2018	171,601	F-N	13.7	12,526
5/7/2018	131,389	F-N	13.7	9,590
5/11/2018	88,840	F-N	13.7	6,485
5/13/2018	128,584	F-N	13.7	9,386
5/16/2018	174,406	F-N	13.7	12,730
5/18/2018	108,945	F-N	13.7	7,952
5/20/2018	104,737	F-N	13.7	7,645
5/22/2018	176,744	F-N	13.7	12,901
5/24/2018	106,608	F-N	13.7	7,782
5/28/2018	111,283	F-N	13.7	8,123
6/1/2018	89,775	F-N	13.7	6,553
6/4/2018	129,051	F-N	13.7	9,420
6/6/2018	88,372	F-N	13.7	6,451
6/8/2018	111,283	F-N	13.7	8,123
6/10/2018	107,543	F-N	13.7	7,850
6/12/2018	95,526	F-N	13.7	6,973
6/14/2018	64,526	F-N	13.7	4,710
6/21/2018	89,775	F-N	13.7	6,553
6/23/2018	82,294	F-N	13.7	6,007
6/25/2018	86,034	F-N	13.7	6,280
6/28/2018	79,020	F-N	13.7	5,768
6/30/2018	136,065	F-N	13.7	9,932
7/3/2018	120,635	F-N	13.7	8,805

7/18/2018	141,208	F-N	13.7	10,307
7/20/2018	133,727	F-N	13.7	9,761
7/22/2018	108,478	F-N	13.7	7,918
7/24/2018	132,324	F-N	13.7	9,659
7/26/2018	118,765	F-N	13.7	8,669
7/28/2018	100,529	F-N	13.7	7,338
7/31/2018	121,570	F-N	13.7	8,874
8/2/2018	96,788	F-N	13.7	7,065
8/6/2018	109,413	F-N	13.7	7,986
8/8/2018	100,061	F-N	13.7	7,304
8/10/2018	138,870	F-N	13.7	10,137
8/12/2018	115,959	F-N	13.7	8,464
8/14/2018	137,468	F-N	13.7	10,034
8/16/2018	159,444	F-N	13.7	11,638
9/29/2018	108,945	F-N	13.7	7,952
10/3/2018	70,137	F-N	13.7	5,119
10/13/2018	88,372	F-N	13.7	6,451
10/16/2018	118,765	F-N	13.7	8,669
10/18/2018	107,075	F-N	13.7	7,816
10/21/2018	98,191	F-N	13.7	7,167
10/23/2018	90,242	F-N	13.7	6,587
10/25/2018	101,464	F-N	13.7	7,406
10/27/2018	104,270	F-N	13.7	7,611
10/31/2018	109,413	F-N	13.7	7,986
11/2/2018	83,696	F-N	13.7	6,109
5/2/2019	111,751	F-N	13.7	8,157
5/4/2019	143,078	F-N	13.7	10,444
5/6/2019	106,608	F-N	13.7	7,782
5/8/2019	54,239	F-N	13.7	3,959
5/13/2019	100,529	F-N	13.7	7,338
5/15/2019	205,734	F-N	13.7	15,017
5/26/2019	46,758	F-N	13.7	3,413
5/30/2019	103,334	F-N	13.7	7,543
6/2/2019	119,700	F-N	13.7	8,737
6/4/2019	126,713	F-N	13.7	9,249
6/6/2019	162,717	F-N	13.7	11,877
6/8/2019	127,181	F-N	13.7	9,283
6/10/2019	86,034	F-N	13.7	6,280
6/12/2019	143,546	F-N	13.7	10,478
6/17/2019	103,802	F-N	13.7	7,577

6/19/2019	158,976	F-N	13.7	11,604
6/21/2019	177,212	F-N	13.7	12,935
6/25/2019	149,625	F-N	13.7	10,922
6/27/2019	54,239	F-N	13.7	3,959
6/29/2019	120,635	F-N	13.7	8,805
7/3/2019	145,884	F-N	13.7	10,648
7/6/2019	118,297	F-N	13.7	8,635
7/8/2019	88,372	F-N	13.7	6,451
7/12/2019	169,730	F-N	13.7	12,389
8/4/2019	216,020	F-N	13.7	15,768
8/7/2019	158,509	F-N	13.7	11,570
8/9/2019	161,782	F-N	13.7	11,809
8/12/2019	85,567	F-N	13.7	6,246
8/13/2019	126,713	F-N	13.7	9,249
8/17/2019	114,089	F-N	13.7	8,328
8/19/2019	82,294	F-N	13.7	6,007
8/21/2019	70,604	F-N	13.7	5,154
8/23/2019	147,754	F-N	13.7	10,785
8/25/2019	135,130	F-N	13.7	9,863
8/26/2019	64,058	F-N	13.7	4,676
8/30/2019	174,874	F-N	13.7	12,765
9/1/2019	111,751	F-N	13.7	8,157
9/5/2019	121,102	F-N	13.7	8,840
9/7/2019	81,358	F-N	13.7	5,939
9/9/2019	69,201	F-N	13.7	5,051
9/18/2019	107,075	F-N	13.7	7,816
9/20/2019	163,184	F-N	13.7	11,911
9/22/2019	111,283	F-N	13.7	8,123
9/24/2019	106,140	F-N	13.7	7,747
10/9/2019	174,874	F-N	13.7	12,765
10/19/2019	65,461	F-N	13.7	4,778
4/23/2020	40,679	F-N	13.7	2,969
4/25/2020	168,795	F-N	13.7	12,321
5/1/2020	99,594	F-N	13.7	7,270
5/3/2020	146,352	F-N	13.7	10,683
5/5/2020	158,509	F-N	13.7	11,570
5/7/2020	103,334	F-N	13.7	7,543
5/12/2020	144,481	F-N	13.7	10,546
5/14/2020	117,362	F-N	13.7	8,567
5/16/2020	141,208	F-N	13.7	10,307

5/20/2020	174,406	F-N	13.7	12,730
5/22/2020	157,573	F-N	13.7	11,502
5/25/2020	75,280	F-N	13.7	5,495
5/30/2020	86,502	F-N	13.7	6,314
6/1/2020	125,778	F-N	13.7	9,181
6/3/2020	93,983	F-N	13.7	6,860
6/5/2020	122,505	F-N	13.7	8,942
6/8/2020	52,369	F-N	13.7	3,823
6/20/2020	83,696	F-N	13.7	6,109
6/22/2020	171,133	F-N	13.7	12,491
6/24/2020	170,666	F-N	13.7	12,457
6/26/2020	167,860	F-N	13.7	12,253
6/28/2020	128,584	F-N	13.7	9,386
7/2/2020	95,853	F-N	13.7	6,997
7/6/2020	140,741	F-N	13.7	10,273
7/8/2020	156,638	F-N	13.7	11,433
7/13/2020	169,263	F-N	13.7	12,355
7/24/2020	182,823	F-N	13.7	13,345
8/5/2020	171,133	F-N	13.7	12,491
8/7/2020	174,406	F-N	13.7	12,730
8/9/2020	224,904	F-N	13.7	16,416
8/11/2020	174,406	F-N	13.7	12,730
8/15/2020	123,908	F-N	13.7	9,044
8/17/2020	135,597	F-N	13.7	9,898
8/19/2020	164,119	F-N	13.7	11,980
8/21/2020	167,860	F-N	13.7	12,253
8/24/2020	144,949	F-N	13.7	10,580
8/27/2020	84,164	F-N	13.7	6,143
8/29/2020	92,580	F-N	13.7	6,758
9/3/2020	165,990	F-N	13.7	12,116
9/8/2020	157,106	F-N	13.7	11,468
9/11/2020	151,027	F-N	13.7	11,024
9/15/2020	174,406	F-N	13.7	12,730
4/16/2021	76,215	F-N	13.7	5,563
4/21/2021	131,857	F-N	13.7	9,625
4/24/2021	104,737	F-N	13.7	7,645
4/29/2021	175,809	F-N	13.7	12,833
5/1/2021	122,505	F-N	13.7	8,942
5/3/2021	171,133	F-N	13.7	12,491
5/5/2021	142,611	F-N	13.7	10,410

5/7/2021	114,089	F-N	13.7	8,328
5/9/2021	133,259	F-N	13.7	9,727
5/11/2021	121,570	F-N	13.7	8,874
5/13/2021	144,481	F-N	13.7	10,546
5/17/2021	142,143	F-N	13.7	10,375
5/26/2021	67,331	F-N	13.7	4,915
5/29/2021	110,348	F-N	13.7	8,055
6/12/2021	143,078	F-N	13.7	10,444
6/14/2021	129,519	F-N	13.7	9,454
6/16/2021	171,601	F-N	13.7	12,526
6/19/2021	123,440	F-N	13.7	9,010
6/23/2021	160,379	F-N	13.7	11,706
6/25/2021	155,703	F-N	13.7	11,365
6/29/2021	140,741	F-N	13.7	10,273
7/1/2021	129,986	F-N	13.7	9,488
7/3/2021	111,283	F-N	13.7	8,123
7/5/2021	137,935	F-N	13.7	10,068
7/9/2021	147,287	F-N	13.7	10,751
7/11/2021	164,119	F-N	13.7	11,980
7/13/2021	137,468	F-N	13.7	10,034
7/16/2021	136,065	F-N	13.7	9,932
7/18/2021	62,188	F-N	13.7	4,539
7/20/2021	139,338	F-N	13.7	10,171
7/22/2021	120,167	F-N	13.7	8,771
7/31/2021	14,027	F-N	13.7	1,024
8/1/2021	114,556	F-N	13.7	8,362
8/16/2021	124,843	F-N	13.7	9,113
8/18/2021	132,324	F-N	13.7	9,659
8/20/2021	142,611	F-N	13.7	10,410
8/23/2021	78,553	F-N	13.7	5,734
8/27/2021	79,488	F-N	13.7	5,802
9/1/2021	129,051	F-N	13.7	9,420
9/6/2021	100,061	F-N	13.7	7,304
9/7/2021	122,973	F-N	13.7	8,976
9/9/2021	111,751	F-N	13.7	8,157
9/11/2021	75,747	F-N	13.7	5,529
9/13/2021	131,389	F-N	13.7	9,590
9/16/2021	112,218	F-N	13.7	8,191
9/19/2021	149,625	F-N	13.7	10,922
9/23/2021	147,287	F-N	13.7	10,751

9/25/2021	124,843	F-N	13.7	9,113
9/27/2021	135,597	F-N	13.7	9,898
9/29/2021	147,287	F-N	13.7	10,751
10/1/2021	149,625	F-N	13.7	10,922
10/4/2021	129,986	F-N	13.7	9,488
10/6/2021	133,727	F-N	13.7	9,761
10/10/2021	86,969	F-N	13.7	6,348
10/12/2021	128,116	F-N	13.7	9,352
10/14/2021	144,949	F-N	13.7	10,580
10/18/2021	151,495	F-N	13.7	11,058
10/20/2021	125,778	F-N	13.7	9,181
10/23/2021	103,334	F-N	13.7	7,543
10/25/2021	103,334	F-N	13.7	7,543
4/28/2022	94,451	F-N	13.7	6,894
5/4/2022	80,891	F-N	13.7	5,904
5/6/2022	112,686	F-N	13.7	8,225
5/8/2022	89,775	F-N	13.7	6,553
5/11/2022	102,399	F-N	13.7	7,474
5/17/2022	142,143	F-N	13.7	10,375
5/19/2022	98,191	F-N	13.7	7,167
5/23/2022	109,881	F-N	13.7	8,020
5/27/2022	139,338	F-N	13.7	10,171
5/29/2022	177,679	F-N	13.7	12,969
6/1/2022	132,324	F-N	13.7	9,659
6/3/2022	126,246	F-N	13.7	9,215
6/5/2022	93,983	F-N	13.7	6,860
6/7/2022	135,130	F-N	13.7	9,863
6/9/2022	151,027	F-N	13.7	11,024
7/3/2022	91,177	F-N	13.7	6,655
7/5/2022	122,505	F-N	13.7	8,942
7/7/2022	102,399	F-N	13.7	7,474
7/12/2022	113,154	F-N	13.7	8,259
7/14/2022	108,478	F-N	13.7	7,918
7/21/2022	126,246	F-N	13.7	9,215
7/23/2022	33,666	F-N	13.7	2,457
7/25/2022	109,881	F-N	13.7	8,020
7/27/2022	129,519	F-N	13.7	9,454
7/29/2022	119,232	F-N	13.7	8,703
7/31/2022	104,737	F-N	13.7	7,645
8/4/2022	100,061	F-N	13.7	7,304

8/7/2022	134,662	F-N	13.7	9,829
8/10/2022	126,246	F-N	13.7	9,215
8/15/2022	117,829	F-N	13.7	8,601
8/17/2022	119,700	F-N	13.7	8,737
8/20/2022	36,471	F-N	13.7	2,662
9/11/2022	136,532	F-N	13.7	9,966
9/13/2022	135,130	F-N	13.7	9,863
9/15/2022	97,724	F-N	13.7	7,133
9/19/2022	117,829	F-N	13.7	8,601
9/23/2022	114,556	F-N	13.7	8,362
9/26/2022	129,051	F-N	13.7	9,420
9/28/2022	133,727	F-N	13.7	9,761
9/29/2022	100,061	F-N	13.7	7,304
10/2/2022	116,894	F-N	13.7	8,532
10/4/2022	135,130	F-N	13.7	9,863
10/9/2022	99,126	F-N	13.7	7,235
10/19/2022	78,553	F-N	13.7	5,734
10/24/2022	67,799	F-N	13.7	4,949
10/26/2022	111,751	F-N	13.7	8,157
10/31/2022	107,075	F-N	13.7	7,816
5/3/2023	34,133	F-N	13.7	2,491
5/5/2023	73,877	F-N	13.7	5,392
5/10/2023	82,761	F-N	13.7	6,041
5/12/2023	78,553	F-N	13.7	5,734
5/14/2023	116,427	F-N	13.7	8,498
5/16/2023	76,215	F-N	13.7	5,563
5/18/2023	78,085	F-N	13.7	5,700
5/21/2023	74,812	F-N	13.7	5,461
5/23/2023	149,625	F-N	13.7	10,922
5/25/2023	137,000	F-N	13.7	10,000
6/7/2023	88,372	F-N	13.7	6,451
6/8/2023	135,597	F-N	13.7	9,898
6/10/2023	117,829	F-N	13.7	8,601
6/12/2023	134,662	F-N	13.7	9,829
6/14/2023	139,805	F-N	13.7	10,205
6/16/2023	133,259	F-N	13.7	9,727
6/18/2023	100,997	F-N	13.7	7,372
6/20/2023	115,491	F-N	13.7	8,430
6/22/2023	124,843	F-N	13.7	9,113
6/24/2023	120,167	F-N	13.7	8,771

6/27/2023	122,038	F-N	13.7	8,908
6/29/2023	186,563	F-N	13.7	13,618
7/1/2023	341,000	A	29.3	11,638
7/6/2023	272,000	A	29.3	9,283
7/9/2023	457,000	A	29.3	15,597
7/13/2023	390,000	A	29.3	13,311
7/30/2023	374,000	A	29.3	12,765
8/2/2023	268,000	A	29.3	9,147
8/5/2023	358,000	A	29.3	12,218
8/9/2023	306,000	A	29.3	10,444
8/15/2023	354,000	A	29.3	12,082
8/19/2023	499,000	A	29.3	17,031
8/23/2023	295,000	A	29.3	10,068
8/27/2023	355,000	A	29.3	12,116
9/7/2023	221,000	A	29.3	7,543
9/10/2023	219,000	A	29.3	7,474
9/16/2023	239,000	A	29.3	8,157
9/20/2023	225,000	A	29.3	7,679
10/3/2023	257,000	A	29.3	8,771
10/6/2023	32,000	A	29.3	1,092
10/9/2023	307,000	A	29.3	10,478
10/12/2023	319,000	A	29.3	10,887
10/19/2023	252,000	A	29.3	8,601
7/3/2023	368,000	B	29.2	12,603
7/8/2023	464,000	B	29.2	15,890
7/11/2023	430,000	B	29.2	14,726
7/15/2023	450,000	B	29.2	15,411
7/18/2023	440,000	B	29.2	15,068
7/21/2023	432,000	B	29.2	14,795
7/24/2023	429,000	B	29.2	14,692
8/1/2023	391,000	B	29.2	13,390
8/7/2023	276,000	B	29.2	9,452
8/10/2023	444,000	B	29.2	15,205
8/18/2023	417,000	B	29.2	14,281
8/22/2023	312,000	B	29.2	10,685
8/25/2023	414,000	B	29.2	14,178
8/29/2023	425,000	B	29.2	14,555
9/1/2023	283,000	B	29.2	9,692
9/5/2023	240,000	B	29.2	8,219
9/9/2023	250,000	B	29.2	8,562

9/14/2023	263,000	B	29.2	9,007
9/22/2023	155,000	B	29.2	5,308
9/25/2023	223,000	B	29.2	7,637
10/4/2023	378,000	B	29.2	12,945
10/10/2023	288,000	B	29.2	9,863
10/21/2023	314,000	B	29.2	10,753
7/2/2023	441,000	C	29.1	15,155
7/7/2023	488,000	C	29.1	16,770
7/10/2023	464,000	C	29.1	15,945
7/14/2023	464,000	C	29.1	15,945
7/17/2023	464,000	C	29.1	15,945
7/20/2023	417,000	C	29.1	14,330
7/23/2023	453,000	C	29.1	15,567
7/25/2023	258,000	C	29.1	8,866
7/31/2023	461,000	C	29.1	15,842
8/3/2023	272,000	C	29.1	9,347
8/6/2023	391,000	C	29.1	13,436
8/8/2023	283,000	C	29.1	9,725
8/16/2023	458,000	C	29.1	15,739
8/20/2023	455,000	C	29.1	15,636
8/24/2023	470,000	C	29.1	16,151
8/28/2023	456,000	C	29.1	15,670
8/31/2023	275,000	C	29.1	9,450
9/3/2023	270,000	C	29.1	9,278
9/8/2023	246,000	C	29.1	8,454
9/12/2023	157,000	C	29.1	5,395
9/17/2023	212,000	C	29.1	7,285
9/19/2023	255,000	C	29.1	8,763
10/2/2023	252,000	C	29.1	8,660
10/5/2023	268,000	C	29.1	9,210
10/11/2023	405,000	C	29.1	13,918
10/16/2023	359,000	C	29.1	12,337
10/17/2023	230,000	C	29.1	7,904
10/20/2023	427,000	C	29.1	14,674
10/24/2023	186,000	C	29.1	6,392
7/2/2023	190,000	E	13.2	14,394
7/6/2023	198,000	E	13.2	15,000
7/8/2023	209,000	E	13.2	15,833
7/10/2023	173,000	E	13.2	13,106
7/13/2023	171,000	E	13.2	12,955

7/30/2023	198,000	E	13.2	15,000
8/1/2023	174,000	E	13.2	13,182
8/4/2023	177,000	E	13.2	13,409
8/6/2023	243,000	E	13.2	18,409
8/9/2023	239,000	E	13.2	18,106
8/16/2023	311,000	E	13.2	23,561
8/19/2023	316,000	E	13.2	23,939
8/21/2023	137,000	E	13.2	10,379
8/25/2023	184,000	E	13.2	13,939
8/27/2023	152,000	E	13.2	11,515
9/13/2023	256,000	E	13.2	19,394
9/18/2023	262,000	E	13.2	19,848
9/21/2023	208,000	E	13.2	15,758
10/4/2023	205,000	E	13.2	15,530
10/6/2023	29,000	E	13.2	2,197
10/9/2023	204,000	E	13.2	15,455
10/12/2023	205,000	E	13.2	15,530
7/1/2023	78,553	F-N	13.7	5,734
7/3/2023	106,608	F-N	13.7	7,782
7/7/2023	129,051	F-N	13.7	9,420
7/9/2023	141,676	F-N	13.7	10,341
7/11/2023	127,181	F-N	13.7	9,283
7/14/2023	128,584	F-N	13.7	9,386
7/16/2023	129,519	F-N	13.7	9,454
7/18/2023	128,584	F-N	13.7	9,386
7/20/2023	118,765	F-N	13.7	8,669
7/23/2023	106,140	F-N	13.7	7,747
8/10/2023	104,737	F-N	13.7	7,645
8/15/2023	128,584	F-N	13.7	9,386
8/18/2023	133,727	F-N	13.7	9,761
8/20/2023	138,403	F-N	13.7	10,102
8/24/2023	144,481	F-N	13.7	10,546
8/26/2023	127,648	F-N	13.7	9,317
8/28/2023	133,727	F-N	13.7	9,761
8/30/2023	143,078	F-N	13.7	10,444
10/11/2023	130,454	F-N	13.7	9,522
10/16/2023	131,389	F-N	13.7	9,590
10/18/2023	130,922	F-N	13.7	9,556
10/20/2023	62,188	F-N	13.7	4,539
10/22/2023	124,843	F-N	13.7	9,113

10/24/2023	55,642	F-N	13.7	4,061

E - IRRIGATION SUMMARY & ANALYSIS

SAPUTO SPRAY FIELD IRRIGATION SUMMARY

Total volume applied, MGY

Field	Field Area (ac)	2015 (MGY)	2016 (MGY)	2017 (MGY)	2018 (MGY)	2019 (MGY)	2020 (MGY)	2021 (MGY)	2022 (MGY)	2023 (MGY)	Complete Average (MGY)	Last 3yr average (MGY)
A	29.3	12.5	16.7	13.0	13.8	15.5	14.9	16.4	15.4	11.3	14.4	14.3
B	29.2	10.6	12.2	11.2	12.9	11.3	14.8	14.2	15.6	13.9	13.0	14.6
C	29.1	13.8	14.5	10.6	15.2	13.1	14.2	17.1	16.3	15.8	14.5	16.4
E	13.2	9.8	6.0	5.7	9.0	11.3	8.7	10.1	9.7	7.4	8.6	9.0
F (FULL)	29.3	13.0	10.0	10.8	12.1	11.9	12.4	16.0	11.3	11.3	12.1	12.9
F (North)	13.7	6.1	4.7	5.1	5.6	5.6	5.8	7.5	5.3	5.3	5.7	6.0
Total (Using F-N)	**114.5**	**52.7**	**54.0**	**45.5**	**56.5**	**56.8**	**58.5**	**65.2**	**62.2**	**53.7**	**56.1**	**60.4**
% F = F North	47%											

Alex Ciessau:
Last 2-3 years represent latest/most current operations.

Alex Ciessau:
Only Northern portion of Field F participating in Trade (~47% of Total Field F area)

IRRIGATION ANALYSIS - SNAPPLUS BASELINE MODELING

SNAPPLUS MODELING

Parameter	Value	Units
Anticipated Future Annual Irrigation To WQT Fields = Historical 3 YR AVG. Above	60.4	MGY
Anticipated Apps/Field/Yr (2024 - 2030)	**43**	**Apps/Field/Yr**
3 YR Historical AVG Irrigation Volume Per Acre Per App (WQT Fields 2023, 2022, 2021)	**12,267**	**Gal/Ac/App**

Alex Ciessau:
Note: Saputo estimates, should spray irrigation continue, Total Irrigation flows to spray fields would increase to 70 - 75 MGY due to increased WW flows...however using historical 3 YR above average to be conservative.

Alex Ciessau:
Historical number of irrigation applications per field. Calculated by summing the spring, summer, and fall historical applications found in the Season Based Pivot Table tabs.

The following data from the pivot table analysis was used in SnapPlus 2024 - 2030 baseline modeling:

12 - Spring Apps
18 - Summer Apps
13 - Fall Apps

All @ 12,267 gal/ac/app

Alex Ciessau:
3yr Historical AVG. (2021, 2022, 2023,) from "RAW_SnapPlus Entries" Tab = 12,507 gal/ac/app

However, to be conservative and ensure the modeled irrigation to the fields does not exceed the historical average of 60.4 MGY - future irrigation applications (2024 - 2030) were modeled in the baseline at 12,267 gal/ac/app in SnapPlus using the Spring, Summer, Fall Distribution of applicatious outlined in previous note above.

12,267 gal/ac/app = 60.4 MGY / 114.5 field ac / 43 apps per field per year

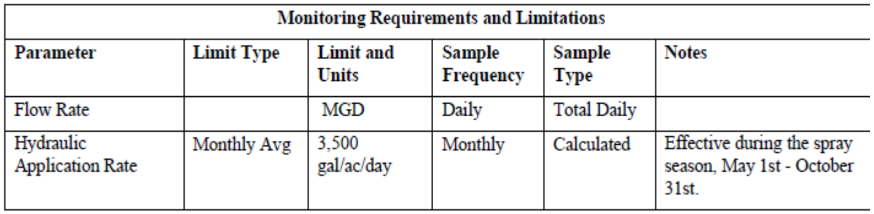
GENERAL PERMIT COMPLIANCE CHECK

PERMITTED IRRIGATION FLOWS VS. SNAPPLUS MODELING		
Parameter	**Value**	**Units**
Irrigation Season Length (May 1st - Oct 31st)	184	days
Permitted Irrigation Rate	3,500	gal/ac/day
Historical Irrigation Rate (WQT Fields 2015 - 2023)	2,865	gal/ac/day
Future Irrigation Rate Modeled in SnapPlus Baseline (WQT Fields 2024 - 2030)	2,865	Gal/ac/day
Max Permitted Annual Application Volume (WQT Fields)	73.7	MGY
3 YR Historical Annual Irrigation Volume (WQT Fields)	60.4	MGY
Future Annual Irrigation Volume Modeled in SnapPlus Baseline (WQT Fields 2024 - 2030)	60.4	MGY

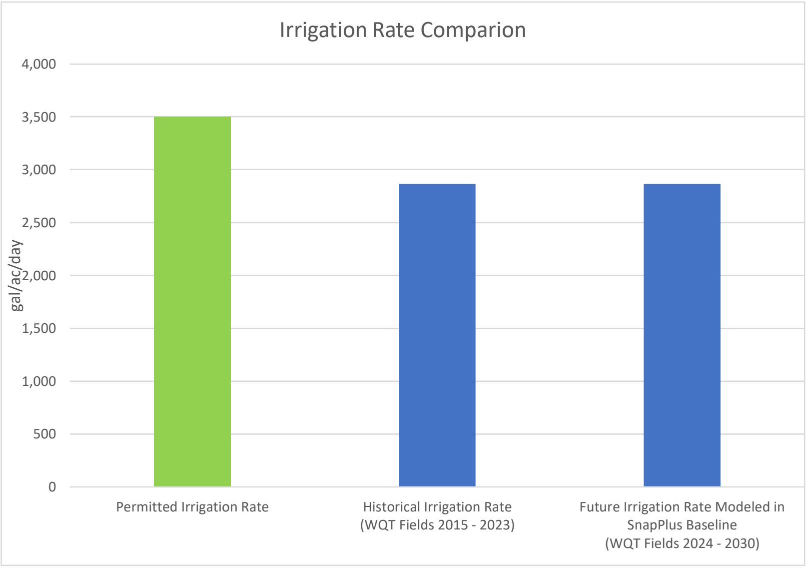
Alex Ciessau:
# of Days between May 1st - October 31st

Alex Ciessau:
Anticipated Irrigation Rate as modeled in SnapPlus Baseline (Gal/ac/day). Generally complies with Permit Limits.

Alex Ciessau:
Anticipated Irrigation Volume (MGY) as modeled in SnapPlus Baseline. Generally complies with Permit Volumes.



Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
Hydraulic Application Rate	Monthly Avg	3,500 gal/ac/day	Monthly	Calculated	Effective during the spray season, May 1st - October 31st.



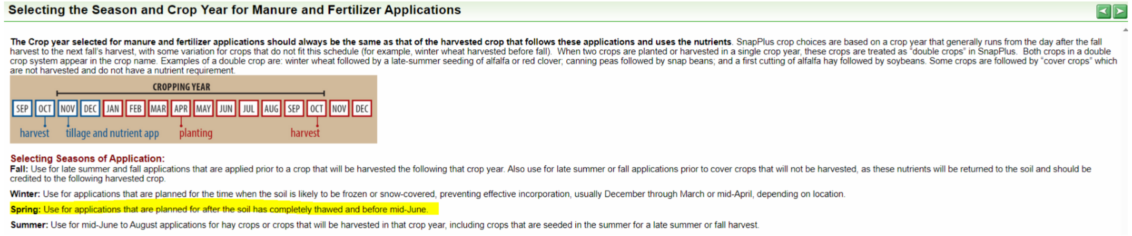
F - HISTORICAL IRRIGATION SEASONAL DISTRIBUTION-FALL-SPRING-SUMMER

2021 - 2023 Spring Irrigation Data
(Seasonal Spring Applications)

Date	Gal Total	Field	Acres	Gal/acre
4/16/2021	245,000	A	29.3	8,361.77
4/21/2021	32,000	A	29.3	1,092.15
4/22/2021	305,000	A	29.3	10,409.56
5/1/2021	577,000	A	29.3	19,692.83
5/4/2021	399,000	A	29.3	13,617.75
5/7/2021	393,000	A	29.3	13,412.97
5/10/2021	278,000	A	29.3	9,488.05
5/13/2021	425,000	A	29.3	14,505.12
5/17/2021	388,000	A	29.3	13,242.32
6/8/2021	532,000	A	29.3	18,157.00
6/11/2021	419,000	A	29.3	14,300.34
6/14/2021	441,000	A	29.3	15,051.19
4/27/2022	218,000	A	29.3	7,440.27
4/28/2022	200,000	A	29.3	6,825.94
5/6/2022	340,000	A	29.3	11,604.10
5/9/2022	330,000	A	29.3	11,262.80
5/17/2022	497,000	A	29.3	16,962.46
5/22/2022	480,000	A	29.3	16,382.25
5/28/2022	517,000	A	29.3	17,645.05
5/31/2022	465,000	A	29.3	15,870.31
6/3/2022	517,000	A	29.3	17,645.05
6/6/2022	512,000	A	29.3	17,474.40
6/9/2022	485,000	A	29.3	16,552.90
6/12/2022	531,000	A	29.3	18,122.87
5/3/2023	161,000	A	29.3	5,494.88
5/9/2023	287,000	A	29.3	9,795.22
5/12/2023	281,000	A	29.3	9,590.44
5/15/2023	284,000	A	29.3	9,692.83
5/18/2023	271,000	A	29.3	9,249.15
5/22/2023	361,000	A	29.3	12,320.82
6/5/2023	398,000	A	29.3	13,583.62
6/8/2023	445,000	A	29.3	15,187.71
6/11/2023	552,000	A	29.3	18,839.59
6/14/2023	501,000	A	29.3	17,098.98
4/29/2021	290,000	B	29.2	9,931.51
5/2/2021	371,000	B	29.2	12,705.48
5/5/2021	271,000	B	29.2	9,280.82
5/8/2021	353,000	B	29.2	12,089.04
5/11/2021	368,000	B	29.2	12,602.74
5/14/2021	286,000	B	29.2	9,794.52
5/18/2021	364,000	B	29.2	12,465.75
5/26/2021	334,000	B	29.2	11,438.36
6/3/2021	355,000	B	29.2	12,157.53
6/5/2021	335,000	B	29.2	11,472.60
6/10/2021	446,000	B	29.2	15,273.97
6/13/2021	508,000	B	29.2	17,397.26
4/29/2022	219,000	B	29.2	7,500.00
5/4/2022	248,000	B	29.2	8,493.15
5/7/2022	362,000	B	29.2	12,397.26
5/11/2022	370,000	B	29.2	12,671.23

Alex Ciessau:
SnapPlus defines **Spring** applications as those **on or before** June 14th of any given year.

Pivot Table Analysis Looks at 3 Most Recent Years (2023, 2022, 2021)



Selecting the Season and Crop Year for Manure and Fertilizer Applications

The Crop year selected for manure and fertilizer applications should always be the same as that of the harvested crop that follows these applications and uses the nutrients. SnapPlus crop choices are based on a crop year that generally runs from the day after the fall harvest to the next fall's harvest, with some variation for crops that do not fit this schedule (for example, winter wheat harvested before fall). When two crops are planted or harvested in a single crop year, these crops are treated as "double crops" in SnapPlus. Both crops in a double crop system appear in the crop name. Examples of a double crop are: winter wheat followed by a late-summer seeding of alfalfa or red clover; canning peas followed by snap beans; and a first cutting of alfalfa hay followed by soybeans. Some crops are followed by "cover crops" which are not harvested and do not have a nutrient requirement.

Selecting Seasons of Application:

Fall: Use for late summer and fall applications that are applied prior to a crop that will be harvested the following that crop year. Also use for late summer or fall applications prior to cover crops that will not be harvested, as these nutrients will be returned to the soil and should be credited to the following harvested crop.

Winter: Use for applications that are planned for the time when the soil is likely to be frozen or snow-covered, preventing effective incorporation, usually December through March or mid-April, depending on location.

Spring: Use for applications that are planned for after the soil has completely thawed and before mid-June.

Summer: Use for mid-June to August applications for hay crops or crops that will be harvested in that crop year, including crops that are seeded in the summer for a late summer or fall harvest.

Count of Gal/acre	Column Labels					
Row Labels	**A**	**B**	**C**	**E**	**F-N**	**Grand Total**
2021	12	12	12	11	16	63
2022	12	13	11	16	15	67
2023	10	10	10	10	15	55
Grand Total	34	35	33	37	46	185

AVERAGE # SPRING APPLICATIONS PER FIELD	12.3

5/18/2022	443,000	B	29.2	15,171.23
5/24/2022	478,000	B	29.2	16,369.86
5/29/2022	407,000	B	29.2	13,938.36
6/1/2022	463,000	B	29.2	15,856.16
6/4/2022	488,000	B	29.2	16,712.33
6/7/2022	550,000	B	29.2	18,835.62
6/10/2022	497,000	B	29.2	17,020.55
6/13/2022	61,000	B	29.2	2,089.04
6/14/2022	484,000	B	29.2	16,575.34
5/5/2023	282,000	B	29.2	9,657.53
5/11/2023	305,000	B	29.2	10,445.21
5/14/2023	505,000	B	29.2	17,294.52
5/17/2023	302,000	B	29.2	10,342.47
5/21/2023	351,000	B	29.2	12,020.55
5/23/2023	552,000	B	29.2	18,904.11
6/4/2023	398,000	B	29.2	13,630.14
6/7/2023	474,000	B	29.2	16,232.88
6/10/2023	443,000	B	29.2	15,171.23
6/13/2023	449,000	B	29.2	15,376.71
4/24/2021	261,000	C	29.1	8,969.07
4/30/2021	499,000	C	29.1	17,147.77
5/3/2021	540,000	C	29.1	18,556.70
5/6/2021	319,000	C	29.1	10,962.20
5/9/2021	416,000	C	29.1	14,295.53
5/12/2021	451,000	C	29.1	15,498.28
5/16/2021	320,000	C	29.1	10,996.56
5/30/2021	333,000	C	29.1	11,443.30
6/2/2021	243,000	C	29.1	8,350.52
6/4/2021	374,000	C	29.1	12,852.23
6/6/2021	394,000	C	29.1	13,539.52
6/12/2021	475,000	C	29.1	16,323.02
5/5/2022	362,000	C	29.1	12,439.86
5/8/2022	364,000	C	29.1	12,508.59
5/16/2022	483,000	C	29.1	16,597.94
5/19/2022	370,000	C	29.1	12,714.78
5/23/2022	474,000	C	29.1	16,288.66
5/27/2022	540,000	C	29.1	18,556.70
5/30/2022	433,000	C	29.1	14,879.73
6/2/2022	495,000	C	29.1	17,010.31
6/5/2022	527,000	C	29.1	18,109.97
6/8/2022	593,000	C	29.1	20,378.01
6/11/2022	465,000	C	29.1	15,979.38
5/4/2023	327,000	C	29.1	11,237.11
5/10/2023	324,000	C	29.1	11,134.02
5/13/2023	348,000	C	29.1	11,958.76
5/16/2023	327,000	C	29.1	11,237.11
5/20/2023	283,000	C	29.1	9,725.09
5/24/2023	359,000	C	29.1	12,336.77
6/3/2023	423,000	C	29.1	14,536.08
6/6/2023	478,000	C	29.1	16,426.12
6/9/2023	496,000	C	29.1	17,044.67
6/12/2023	483,000	C	29.1	16,597.94
4/22/2021	294,000	E	13.2	22,272.73

4/30/2021	222,000	E	13.2	16,818.18
5/2/2021	263,000	E	13.2	19,924.24
5/4/2021	200,000	E	13.2	15,151.52
5/6/2021	229,000	E	13.2	17,348.48
5/8/2021	213,000	E	13.2	16,136.36
5/10/2021	211,000	E	13.2	15,984.85
5/12/2021	214,000	E	13.2	16,212.12
5/16/2021	211,000	E	13.2	15,984.85
5/18/2021	172,000	E	13.2	13,030.30
6/2/2021	129,000	E	13.2	9,772.73
4/29/2022	152,000	E	13.2	11,515.15
5/5/2022	231,000	E	13.2	17,500.00
5/7/2022	249,000	E	13.2	18,863.64
5/9/2022	241,000	E	13.2	18,257.58
5/16/2022	293,000	E	13.2	22,196.97
5/18/2022	274,000	E	13.2	20,757.58
5/22/2022	243,000	E	13.2	18,409.09
5/24/2022	201,000	E	13.2	15,227.27
5/28/2022	230,000	E	13.2	17,424.24
5/31/2022	302,000	E	13.2	22,878.79
6/2/2022	297,000	E	13.2	22,500.00
6/4/2022	254,000	E	13.2	19,242.42
6/6/2022	200,000	E	13.2	15,151.52
6/8/2022	302,000	E	13.2	22,878.79
6/10/2022	293,000	E	13.2	22,196.97
6/12/2022	285,000	E	13.2	21,590.91
5/4/2023	177,000	E	13.2	13,409.09
5/9/2023	203,000	E	13.2	15,378.79
5/11/2023	180,000	E	13.2	13,636.36
5/13/2023	120,000	E	13.2	9,090.91
5/15/2023	165,000	E	13.2	12,500.00
5/17/2023	174,000	E	13.2	13,181.82
5/20/2023	164,000	E	13.2	12,424.24
5/22/2023	209,000	E	13.2	15,833.33
5/24/2023	30,000	E	13.2	2,272.73
6/13/2023	299,000	E	13.2	22,651.52
4/16/2021	76,215	F-N	13.7	5,563.14
4/21/2021	131,857	F-N	13.7	9,624.57
4/24/2021	104,737	F-N	13.7	7,645.05
4/29/2021	175,809	F-N	13.7	12,832.76
5/1/2021	122,505	F-N	13.7	8,941.98
5/3/2021	171,133	F-N	13.7	12,491.47
5/5/2021	142,611	F-N	13.7	10,409.56
5/7/2021	114,089	F-N	13.7	8,327.65
5/9/2021	133,259	F-N	13.7	9,726.96
5/11/2021	121,570	F-N	13.7	8,873.72
5/13/2021	144,481	F-N	13.7	10,546.08
5/17/2021	142,143	F-N	13.7	10,375.43
5/26/2021	67,331	F-N	13.7	4,914.68
5/29/2021	110,348	F-N	13.7	8,054.61
6/12/2021	143,078	F-N	13.7	10,443.69
6/14/2021	129,519	F-N	13.7	9,453.92
4/28/2022	94,451	F-N	13.7	6,894.20

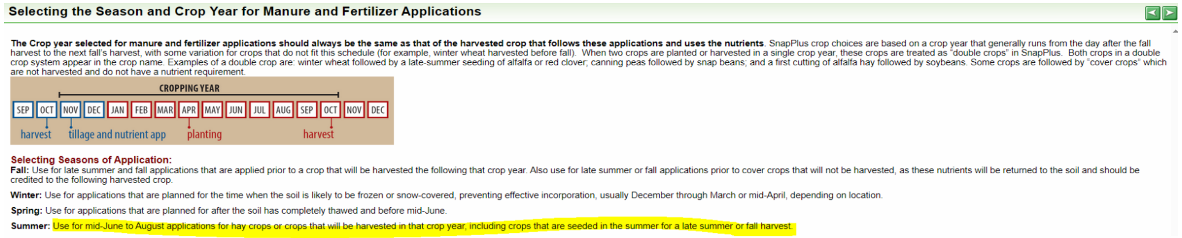
5/4/2022	80,891	F-N	13.7	5,904.44
5/6/2022	112,686	F-N	13.7	8,225.26
5/8/2022	89,775	F-N	13.7	6,552.90
5/11/2022	102,399	F-N	13.7	7,474.40
5/17/2022	142,143	F-N	13.7	10,375.43
5/19/2022	98,191	F-N	13.7	7,167.24
5/23/2022	109,881	F-N	13.7	8,020.48
5/27/2022	139,338	F-N	13.7	10,170.65
5/29/2022	177,679	F-N	13.7	12,969.28
6/1/2022	132,324	F-N	13.7	9,658.70
6/3/2022	126,246	F-N	13.7	9,215.02
6/5/2022	93,983	F-N	13.7	6,860.07
6/7/2022	135,130	F-N	13.7	9,863.48
6/9/2022	151,027	F-N	13.7	11,023.89
5/3/2023	34,133	F-N	13.7	2,491.47
5/5/2023	73,877	F-N	13.7	5,392.49
5/10/2023	82,761	F-N	13.7	6,040.96
5/12/2023	78,553	F-N	13.7	5,733.79
5/14/2023	116,427	F-N	13.7	8,498.29
5/16/2023	76,215	F-N	13.7	5,563.14
5/18/2023	78,085	F-N	13.7	5,699.66
5/21/2023	74,812	F-N	13.7	5,460.75
5/23/2023	149,625	F-N	13.7	10,921.50
5/25/2023	137,000	F-N	13.7	10,000.00
6/7/2023	88,372	F-N	13.7	6,450.51
6/8/2023	135,597	F-N	13.7	9,897.61
6/10/2023	117,829	F-N	13.7	8,600.68
6/12/2023	134,662	F-N	13.7	9,829.35
6/14/2023	139,805	F-N	13.7	10,204.78

2021 - 2023 Summer Irrigation Data (Seasonal Spring Applications)

Date	Gal Total	Field	Acres	Gal/acre
6/17/2021	401,000	A	29.3	13,686
6/19/2021	333,000	A	29.3	11,365
6/23/2021	457,000	A	29.3	15,597
6/28/2021	286,000	A	29.3	9,761
7/1/2021	432,000	A	29.3	14,744
7/4/2021	373,000	A	29.3	12,730
7/10/2021	490,000	A	29.3	16,724
7/13/2021	442,000	A	29.3	15,085
7/17/2021	359,000	A	29.3	12,253
7/20/2021	456,000	A	29.3	15,563
7/23/2021	363,000	A	29.3	12,389
8/14/2021	465,000	A	29.3	15,870
8/16/2021	444,000	A	29.3	15,154
8/19/2021	440,000	A	29.3	15,017
8/23/2021	396,000	A	29.3	13,515
8/27/2021	291,000	A	29.3	9,932
6/21/2022	354,000	A	29.3	12,082
6/24/2022	313,000	A	29.3	10,683
6/27/2022	417,000	A	29.3	14,232
7/1/2022	453,000	A	29.3	15,461
7/4/2022	181,000	A	29.3	6,177
7/7/2022	409,000	A	29.3	13,959
7/13/2022	271,000	A	29.3	9,249
7/18/2022	24,000	A	29.3	819
7/19/2022	418,000	A	29.3	14,266
7/30/2022	437,000	A	29.3	14,915
8/4/2022	382,000	A	29.3	13,038
8/10/2022	424,000	A	29.3	14,471
8/16/2022	391,000	A	29.3	13,345
8/20/2022	466,000	A	29.3	15,904
8/23/2022	410,000	A	29.3	13,993
8/31/2022	364,000	A	29.3	12,423
6/17/2023	431,000	A	29.3	14,710
6/20/2023	284,000	A	29.3	9,693
6/23/2023	399,000	A	29.3	13,618
6/28/2023	302,000	A	29.3	10,307
6/16/2021	594,000	B	29.2	20,342
6/24/2021	421,000	B	29.2	14,418
6/29/2021	434,000	B	29.2	14,863
7/2/2021	425,000	B	29.2	14,555
7/6/2021	257,000	B	29.2	8,801
7/11/2021	495,000	B	29.2	16,952
7/14/2021	230,000	B	29.2	7,877
7/18/2021	443,000	B	29.2	15,171
7/21/2021	462,000	B	29.2	15,822
8/1/2021	388,000	B	29.2	13,288
8/3/2021	379,000	B	29.2	12,979
8/5/2021	78,000	B	29.2	2,671
8/13/2021	397,000	B	29.2	13,596
8/17/2021	441,000	B	29.2	15,103

Alex Ciessau:
SnapPlus defines **Summer** applications as those **after** June 14th through August 31st of any given year.

Pivot Table Analysis Looks at 3 Most Recent Years (2023, 2022, 2021)



Selecting the Season and Crop Year for Manure and Fertilizer Applications

The Crop year selected for manure and fertilizer applications should always be the same as that of the harvested crop that follows these applications and uses the nutrients. SnapPlus crop choices are based on a crop year that generally runs from the day after the fall harvest to the next fall's harvest, with some variation for crops that do not fit this schedule (for example, winter wheat harvested before fall). When two crops are planted or harvested in a single crop year, these crops are treated as "double crops" in SnapPlus. Both crops in a double crop system appear in the crop name. Examples of a double crop are: winter wheat followed by a late-summer seeding of alfalfa or red clover; canning peas followed by snap beans; and a first cutting of alfalfa hay followed by soybeans. Some crops are followed by "cover crops" which are not harvested and do not have a nutrient requirement.

Selecting Seasons of Application:
Fall: Use for late summer and fall applications that are applied prior to a crop that will be harvested the following that crop year. Also use for late summer or fall applications prior to cover crops that will not be harvested, as these nutrients will be returned to the soil and should be credited to the following harvested crop.

Winter: Use for applications that are planned for the time when the soil is likely to be frozen or snow-covered, preventing effective incorporation, usually December through March or mid-April, depending on location.

Spring: Use for applications that are planned for after the soil has completely thawed and before mid-June.

Summer: Use for mid-June to August applications for hay crops or crops that will be harvested in that crop year, including crops that are seeded in the summer for a late summer or fall harvest.

Count of Gal/acre	Column Labels					
Row Labels	A	B	C	E	F-N	Grand Total
2021	16	15	18	22	22	93
2022	16	17	17	7	17	74
2023	16	19	21	21	25	102
Grand Total	48	51	56	50	64	269

AVERAGE # SUMMER APPLICATIONS PER FIELD	17.9

8/20/2021	433,000	B	29.2	14,829
6/18/2022	351,000	B	29.2	12,021
6/20/2022	376,000	B	29.2	12,877
6/25/2022	385,000	B	29.2	13,185
6/29/2022	224,000	B	29.2	7,671
7/2/2022	437,000	B	29.2	14,966
7/6/2022	443,000	B	29.2	15,171
7/8/2022	275,000	B	29.2	9,418
7/14/2022	381,000	B	29.2	13,048
7/22/2022	356,000	B	29.2	12,192
7/26/2022	259,000	B	29.2	8,870
7/28/2022	414,000	B	29.2	14,178
7/31/2022	385,000	B	29.2	13,185
8/2/2022	380,000	B	29.2	13,014
8/7/2022	424,000	B	29.2	14,521
8/15/2022	383,000	B	29.2	13,116
8/18/2022	385,000	B	29.2	13,185
8/22/2022	383,000	B	29.2	13,116
6/16/2023	277,000	B	29.2	9,486
6/19/2023	281,000	B	29.2	9,623
6/22/2023	436,000	B	29.2	14,932
6/27/2023	380,000	B	29.2	13,014
6/30/2023	376,000	B	29.2	12,877
6/15/2021	403,000	C	29.1	13,849
6/18/2021	430,000	C	29.1	14,777
6/22/2021	448,000	C	29.1	15,395
6/25/2021	432,000	C	29.1	14,845
6/30/2021	434,000	C	29.1	14,914
7/3/2021	381,000	C	29.1	13,093
7/5/2021	525,000	C	29.1	18,041
7/9/2021	461,000	C	29.1	15,842
7/12/2021	452,000	C	29.1	15,533
7/16/2021	458,000	C	29.1	15,739
7/19/2021	462,000	C	29.1	15,876
7/22/2021	474,000	C	29.1	16,289
7/31/2021	351,000	C	29.1	12,062
8/2/2021	420,000	C	29.1	14,433
8/4/2021	459,000	C	29.1	15,773
8/15/2021	247,000	C	29.1	8,488
8/18/2021	484,000	C	29.1	16,632
8/21/2021	483,000	C	29.1	16,598
6/19/2022	391,000	C	29.1	13,436
6/23/2022	474,000	C	29.1	16,289
6/26/2022	483,000	C	29.1	16,598
6/30/2022	405,000	C	29.1	13,918
7/3/2022	370,000	C	29.1	12,715
7/5/2022	450,000	C	29.1	15,464
7/12/2022	357,000	C	29.1	12,268
7/21/2022	477,000	C	29.1	16,392
7/23/2022	99,000	C	29.1	3,402
7/25/2022	449,000	C	29.1	15,430
7/27/2022	463,000	C	29.1	15,911
7/29/2022	290,000	C	29.1	9,966

8/5/2022	394,000	C	29.1	13,540
8/11/2022	440,000	C	29.1	15,120
8/17/2022	391,000	C	29.1	13,436
8/21/2022	372,000	C	29.1	12,784
8/24/2022	206,000	C	29.1	7,079
6/15/2023	513,000	C	29.1	17,629
6/18/2023	416,000	C	29.1	14,296
6/21/2023	379,000	C	29.1	13,024
6/24/2023	428,000	C	29.1	14,708
6/18/2021	285,000	E	13.2	21,591
6/22/2021	198,000	E	13.2	15,000
6/24/2021	187,000	E	13.2	14,167
6/28/2021	205,000	E	13.2	15,530
6/30/2021	197,000	E	13.2	14,924
7/2/2021	200,000	E	13.2	15,152
7/4/2021	149,000	E	13.2	11,288
7/6/2021	189,000	E	13.2	14,318
7/10/2021	210,000	E	13.2	15,909
7/12/2021	194,000	E	13.2	14,697
7/14/2021	161,000	E	13.2	12,197
7/17/2021	145,000	E	13.2	10,985
7/19/2021	307,000	E	13.2	23,258
7/21/2021	192,000	E	13.2	14,545
7/23/2021	133,000	E	13.2	10,076
8/2/2021	208,000	E	13.2	15,758
8/4/2021	229,000	E	13.2	17,348
8/13/2021	231,000	E	13.2	17,500
8/15/2021	178,000	E	13.2	13,485
8/17/2021	190,000	E	13.2	14,394
8/19/2021	185,000	E	13.2	14,015
8/21/2021	168,000	E	13.2	12,727
7/19/2022	214,000	E	13.2	16,212
7/22/2022	221,000	E	13.2	16,742
7/26/2022	155,000	E	13.2	11,742
7/28/2022	264,000	E	13.2	20,000
7/30/2022	172,000	E	13.2	13,030
8/2/2022	270,000	E	13.2	20,455
8/5/2022	229,000	E	13.2	17,348
6/15/2023	292,000	E	13.2	22,121
6/19/2023	167,000	E	13.2	12,652
6/21/2023	183,000	E	13.2	13,864
6/23/2023	202,000	E	13.2	15,303
6/28/2023	185,000	E	13.2	14,015
6/30/2023	176,000	E	13.2	13,333
6/16/2021	171,601	F-N	13.7	12,526
6/19/2021	123,440	F-N	13.7	9,010
6/23/2021	160,379	F-N	13.7	11,706
6/25/2021	155,703	F-N	13.7	11,365
6/29/2021	140,741	F-N	13.7	10,273
7/1/2021	129,986	F-N	13.7	9,488
7/3/2021	111,283	F-N	13.7	8,123
7/5/2021	137,935	F-N	13.7	10,068
7/9/2021	147,287	F-N	13.7	10,751

7/11/2021	164,119	F-N	13.7	11,980
7/13/2021	137,468	F-N	13.7	10,034
7/16/2021	136,065	F-N	13.7	9,932
7/18/2021	62,188	F-N	13.7	4,539
7/20/2021	139,338	F-N	13.7	10,171
7/22/2021	120,167	F-N	13.7	8,771
7/31/2021	14,027	F-N	13.7	1,024
8/1/2021	114,556	F-N	13.7	8,362
8/16/2021	124,843	F-N	13.7	9,113
8/18/2021	132,324	F-N	13.7	9,659
8/20/2021	142,611	F-N	13.7	10,410
8/23/2021	78,553	F-N	13.7	5,734
8/27/2021	79,488	F-N	13.7	5,802
7/3/2022	91,177	F-N	13.7	6,655
7/5/2022	122,505	F-N	13.7	8,942
7/7/2022	102,399	F-N	13.7	7,474
7/12/2022	113,154	F-N	13.7	8,259
7/14/2022	108,478	F-N	13.7	7,918
7/21/2022	126,246	F-N	13.7	9,215
7/23/2022	33,666	F-N	13.7	2,457
7/25/2022	109,881	F-N	13.7	8,020
7/27/2022	129,519	F-N	13.7	9,454
7/29/2022	119,232	F-N	13.7	8,703
7/31/2022	104,737	F-N	13.7	7,645
8/4/2022	100,061	F-N	13.7	7,304
8/7/2022	134,662	F-N	13.7	9,829
8/10/2022	126,246	F-N	13.7	9,215
8/15/2022	117,829	F-N	13.7	8,601
8/17/2022	119,700	F-N	13.7	8,737
8/20/2022	36,471	F-N	13.7	2,662
6/16/2023	133,259	F-N	13.7	9,727
6/18/2023	100,997	F-N	13.7	7,372
6/20/2023	115,491	F-N	13.7	8,430
6/22/2023	124,843	F-N	13.7	9,113
6/24/2023	120,167	F-N	13.7	8,771
6/27/2023	122,038	F-N	13.7	8,908
6/29/2023	186,563	F-N	13.7	13,618
7/1/2023	341,000	A	29.3	11,638
7/6/2023	272,000	A	29.3	9,283
7/9/2023	457,000	A	29.3	15,597
7/13/2023	390,000	A	29.3	13,311
7/30/2023	374,000	A	29.3	12,765
8/2/2023	268,000	A	29.3	9,147
8/5/2023	358,000	A	29.3	12,218
8/9/2023	306,000	A	29.3	10,444
8/15/2023	354,000	A	29.3	12,082
8/19/2023	499,000	A	29.3	17,031
8/23/2023	295,000	A	29.3	10,068
8/27/2023	355,000	A	29.3	12,116
7/3/2023	368,000	B	29.2	12,603
7/8/2023	464,000	B	29.2	15,890
7/11/2023	430,000	B	29.2	14,726
7/15/2023	450,000	B	29.2	15,411

7/18/2023	440,000	B	29.2	15,068
7/21/2023	432,000	B	29.2	14,795
7/24/2023	429,000	B	29.2	14,692
8/1/2023	391,000	B	29.2	13,390
8/7/2023	276,000	B	29.2	9,452
8/10/2023	444,000	B	29.2	15,205
8/18/2023	417,000	B	29.2	14,281
8/22/2023	312,000	B	29.2	10,685
8/25/2023	414,000	B	29.2	14,178
8/29/2023	425,000	B	29.2	14,555
7/2/2023	441,000	C	29.1	15,155
7/7/2023	488,000	C	29.1	16,770
7/10/2023	464,000	C	29.1	15,945
7/14/2023	464,000	C	29.1	15,945
7/17/2023	464,000	C	29.1	15,945
7/20/2023	417,000	C	29.1	14,330
7/23/2023	453,000	C	29.1	15,567
7/25/2023	258,000	C	29.1	8,866
7/31/2023	461,000	C	29.1	15,842
8/3/2023	272,000	C	29.1	9,347
8/6/2023	391,000	C	29.1	13,436
8/8/2023	283,000	C	29.1	9,725
8/16/2023	458,000	C	29.1	15,739
8/20/2023	455,000	C	29.1	15,636
8/24/2023	470,000	C	29.1	16,151
8/28/2023	456,000	C	29.1	15,670
8/31/2023	275,000	C	29.1	9,450
7/2/2023	190,000	E	13.2	14,394
7/6/2023	198,000	E	13.2	15,000
7/8/2023	209,000	E	13.2	15,833
7/10/2023	173,000	E	13.2	13,106
7/13/2023	171,000	E	13.2	12,955
7/30/2023	198,000	E	13.2	15,000
8/1/2023	174,000	E	13.2	13,182
8/4/2023	177,000	E	13.2	13,409
8/6/2023	243,000	E	13.2	18,409
8/9/2023	239,000	E	13.2	18,106
8/16/2023	311,000	E	13.2	23,561
8/19/2023	316,000	E	13.2	23,939
8/21/2023	137,000	E	13.2	10,379
8/25/2023	184,000	E	13.2	13,939
8/27/2023	152,000	E	13.2	11,515
7/1/2023	78,553	F-N	13.7	5,734
7/3/2023	106,608	F-N	13.7	7,782
7/7/2023	129,051	F-N	13.7	9,420
7/9/2023	141,676	F-N	13.7	10,341
7/11/2023	127,181	F-N	13.7	9,283
7/14/2023	128,584	F-N	13.7	9,386
7/16/2023	129,519	F-N	13.7	9,454
7/18/2023	128,584	F-N	13.7	9,386
7/20/2023	118,765	F-N	13.7	8,669
7/23/2023	106,140	F-N	13.7	7,747
8/10/2023	104,737	F-N	13.7	7,645

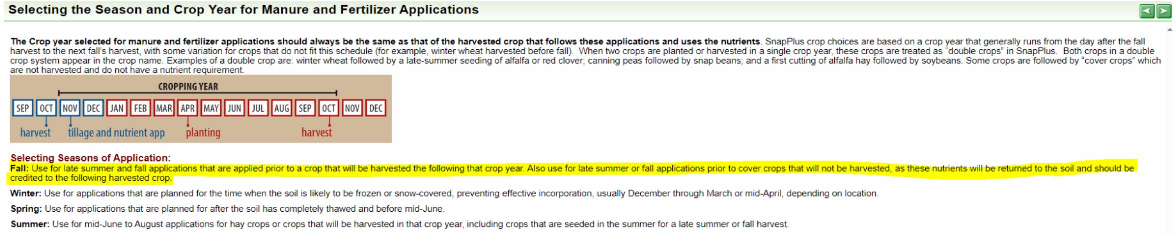
8/15/2023	128,584	F-N	13.7	9,386
8/18/2023	133,727	F-N	13.7	9,761
8/20/2023	138,403	F-N	13.7	10,102
8/24/2023	144,481	F-N	13.7	10,546
8/26/2023	127,648	F-N	13.7	9,317
8/28/2023	133,727	F-N	13.7	9,761
8/30/2023	143,078	F-N	13.7	10,444

2021 - 2023 Fall Irrigation Data
(Seasonal Spring Applications)

Date	Gal Total	Field	Acres	Gal/acre
9/2/2021	447,000	A	29.3	15,256
9/8/2021	436,000	A	29.3	14,881
9/10/2021	431,000	A	29.3	14,710
9/13/2021	441,000	A	29.3	15,051
9/19/2021	435,000	A	29.3	14,846
9/23/2021	441,000	A	29.3	15,051
9/26/2021	402,000	A	29.3	13,720
9/28/2021	392,000	A	29.3	13,379
10/1/2021	452,000	A	29.3	15,427
10/6/2021	398,000	A	29.3	13,584
10/11/2021	404,000	A	29.3	13,788
10/14/2021	429,000	A	29.3	14,642
10/19/2021	403,000	A	29.3	13,754
4/27/2022	218,000	A	29.3	7,440
4/28/2022	200,000	A	29.3	6,826
9/3/2022	469,000	A	29.3	16,007
9/6/2022	389,000	A	29.3	13,276
9/9/2022	84,000	A	29.3	2,867
9/11/2022	443,000	A	29.3	15,119
9/14/2022	415,000	A	29.3	14,164
9/17/2022	414,000	A	29.3	14,130
9/22/2022	391,000	A	29.3	13,345
9/27/2022	399,000	A	29.3	13,618
10/3/2022	294,000	A	29.3	10,034
10/7/2022	244,000	A	29.3	8,328
10/11/2022	258,000	A	29.3	8,805
10/21/2022	241,000	A	29.3	8,225
10/28/2022	259,000	A	29.3	8,840
11/3/2022	264,000	A	29.3	9,010
9/1/2021	445,000	B	29.2	15,240
9/7/2021	436,000	B	29.2	14,932
9/11/2021	442,000	B	29.2	15,137
9/20/2021	232,000	B	29.2	7,945
9/25/2021	401,000	B	29.2	13,733
9/29/2021	418,000	B	29.2	14,315
10/4/2021	416,000	B	29.2	14,247
10/12/2021	390,000	B	29.2	13,356
10/15/2021	381,000	B	29.2	13,048
10/20/2021	276,000	B	29.2	9,452
10/25/2021	170,000	B	29.2	5,822
4/29/2022	219,000	B	29.2	7,500
9/1/2022	394,000	B	29.2	13,493
9/4/2022	465,000	B	29.2	15,925
9/7/2022	447,000	B	29.2	15,308
9/12/2022	413,000	B	29.2	14,144
9/15/2022	441,000	B	29.2	15,103
9/18/2022	428,000	B	29.2	14,658
9/23/2022	384,000	B	29.2	13,151
9/28/2022	353,000	B	29.2	12,089
10/6/2022	280,000	B	29.2	9,589

Alex Ciessau:
SnapPlus defines **Fall** applications as those **after** August 31st of any given year.

Pivot Table Analysis Looks at 3 Most Recent Years (2023, 2022, 2021)



Selecting the Season and Crop Year for Manure and Fertilizer Applications

The Crop year selected for manure and fertilizer applications should always be the same as that of the harvested crop that follows these applications and uses the nutrients. SnapPlus crop choices are based on a crop year that generally runs from the day after the fall harvest to the next fall's harvest, with some variation for crops that do not fit this schedule (for example, winter wheat harvested before fall). When two crops are planted or harvested in a single crop year, these crops are treated as "double crops" in SnapPlus. Both crops in a double crop system appear in the crop name. Examples of a double crop are: winter wheat followed by a late-summer seeding of alfalfa or red clover; canning peas followed by snap beans; and a first cutting of alfalfa hay followed by soybeans. Some crops are followed by "cover crops" which are not harvested and do not have a nutrient requirement.

Selecting Seasons of Application:

Fall: Use for late summer and fall applications that are applied prior to a crop that will be harvested the following that crop year. Also use for late summer or fall applications prior to cover crops that will not be harvested, as these nutrients will be returned to the soil and should be credited to the following harvested crop.

Winter: Use for applications that are planned for the time when the soil is likely to be frozen or snow-covered, preventing effective incorporation, usually December through March or mid-April, depending on location.

Spring: Use for applications that are planned for after the soil has completely thawed and before mid-June.

Summer: Use for mid-June to August applications for hay crops or crops that will be harvested in that crop year, including crops that are seeded in the summer for a late summer or fall harvest.

Count of Gal/acre	Column Labels					
Row Labels	A	B	C	E	F-N	Grand Total
2021	13	11	11	17	22	74
2022	16	13	13	18	16	76
2023	9	9	12	7		37
Grand Total	38	33	36	42	38	187

AVERAGE # SUMMER APPLICATIONS PER FIELD	12.5

10/12/2022	195,000	B	29.2	6,678
10/22/2022	259,000	B	29.2	8,870
10/29/2022	253,000	B	29.2	8,664
9/6/2021	406,000	C	29.1	13,952
9/9/2021	469,000	C	29.1	16,117
9/12/2021	441,000	C	29.1	15,155
9/16/2021	472,000	C	29.1	16,220
9/24/2021	229,000	C	29.1	7,869
9/27/2021	419,000	C	29.1	14,399
9/30/2021	407,000	C	29.1	13,986
10/5/2021	439,000	C	29.1	15,086
10/10/2021	446,000	C	29.1	15,326
10/13/2021	429,000	C	29.1	14,742
10/18/2021	470,000	C	29.1	16,151
9/2/2022	500,000	C	29.1	17,182
9/5/2022	380,000	C	29.1	13,058
9/8/2022	412,000	C	29.1	14,158
9/13/2022	485,000	C	29.1	16,667
9/16/2022	419,000	C	29.1	14,399
9/19/2022	445,000	C	29.1	15,292
9/26/2022	484,000	C	29.1	16,632
9/29/2022	296,000	C	29.1	10,172
10/5/2022	282,000	C	29.1	9,691
10/10/2022	244,000	C	29.1	8,385
10/23/2022	222,000	C	29.1	7,629
10/30/2022	224,000	C	29.1	7,698
11/2/2022	283,000	C	29.1	9,725
9/2/2021	313,000	E	13.2	23,712
9/10/2021	178,000	E	13.2	13,485
9/12/2021	293,000	E	13.2	22,197
9/20/2021	164,000	E	13.2	12,424
9/24/2021	156,000	E	13.2	11,818
9/26/2021	157,000	E	13.2	11,894
9/28/2021	219,000	E	13.2	16,591
9/30/2021	175,000	E	13.2	13,258
10/5/2021	195,000	E	13.2	14,773
10/7/2021	150,000	E	13.2	11,364
10/11/2021	184,000	E	13.2	13,939
10/13/2021	194,000	E	13.2	14,697
10/15/2021	225,000	E	13.2	17,045
10/19/2021	214,000	E	13.2	16,212
10/22/2021	206,000	E	13.2	15,606
10/24/2021	166,000	E	13.2	12,576
10/26/2021	191,000	E	13.2	14,470
4/29/2022	152,000	E	13.2	11,515
9/2/2022	243,000	E	13.2	18,409
9/4/2022	182,000	E	13.2	13,788
9/6/2022	250,000	E	13.2	18,939
9/8/2022	261,000	E	13.2	19,773
9/12/2022	270,000	E	13.2	20,455
9/14/2022	291,000	E	13.2	22,045
9/16/2022	269,000	E	13.2	20,379
9/18/2022	289,000	E	13.2	21,894

9/22/2022	229,000	E	13.2	17,348
9/27/2022	224,000	E	13.2	16,970
10/1/2022	286,000	E	13.2	21,667
10/3/2022	277,000	E	13.2	20,985
10/8/2022	156,000	E	13.2	11,818
10/15/2022	201,000	E	13.2	15,227
10/20/2022	229,000	E	13.2	17,348
10/27/2022	220,000	E	13.2	16,667
11/1/2022	240,000	E	13.2	18,182
9/1/2021	129,051	F-N	13.7	9,420
9/6/2021	100,061	F-N	13.7	7,304
9/7/2021	122,973	F-N	13.7	8,976
9/9/2021	111,751	F-N	13.7	8,157
9/11/2021	75,747	F-N	13.7	5,529
9/13/2021	131,389	F-N	13.7	9,590
9/16/2021	112,218	F-N	13.7	8,191
9/19/2021	149,625	F-N	13.7	10,922
9/23/2021	147,287	F-N	13.7	10,751
9/25/2021	124,843	F-N	13.7	9,113
9/27/2021	135,597	F-N	13.7	9,898
9/29/2021	147,287	F-N	13.7	10,751
10/1/2021	149,625	F-N	13.7	10,922
10/4/2021	129,986	F-N	13.7	9,488
10/6/2021	133,727	F-N	13.7	9,761
10/10/2021	86,969	F-N	13.7	6,348
10/12/2021	128,116	F-N	13.7	9,352
10/14/2021	144,949	F-N	13.7	10,580
10/18/2021	151,495	F-N	13.7	11,058
10/20/2021	125,778	F-N	13.7	9,181
10/23/2021	103,334	F-N	13.7	7,543
10/25/2021	103,334	F-N	13.7	7,543
4/28/2022	94,451	F-N	13.7	6,894
9/11/2022	136,532	F-N	13.7	9,966
9/13/2022	135,130	F-N	13.7	9,863
9/15/2022	97,724	F-N	13.7	7,133
9/19/2022	117,829	F-N	13.7	8,601
9/23/2022	114,556	F-N	13.7	8,362
9/26/2022	129,051	F-N	13.7	9,420
9/28/2022	133,727	F-N	13.7	9,761
9/29/2022	100,061	F-N	13.7	7,304
10/2/2022	116,894	F-N	13.7	8,532
10/4/2022	135,130	F-N	13.7	9,863
10/9/2022	99,126	F-N	13.7	7,235
10/19/2022	78,553	F-N	13.7	5,734
10/24/2022	67,799	F-N	13.7	4,949
10/26/2022	111,751	F-N	13.7	8,157
10/31/2022	107,075	F-N	13.7	7,816
9/7/2023	221,000	A	29.3	7,543
9/10/2023	219,000	A	29.3	7,474
9/16/2023	239,000	A	29.3	8,157
9/20/2023	225,000	A	29.3	7,679
10/3/2023	257,000	A	29.3	8,771
10/6/2023	32,000	A	29.3	1,092

10/9/2023	307,000	A	29.3	10,478
10/12/2023	319,000	A	29.3	10,887
10/19/2023	252,000	A	29.3	8,601
9/1/2023	283,000	B	29.2	9,692
9/5/2023	240,000	B	29.2	8,219
9/9/2023	250,000	B	29.2	8,562
9/14/2023	263,000	B	29.2	9,007
9/22/2023	155,000	B	29.2	5,308
9/25/2023	223,000	B	29.2	7,637
10/4/2023	378,000	B	29.2	12,945
10/10/2023	288,000	B	29.2	9,863
10/21/2023	314,000	B	29.2	10,753
9/3/2023	270,000	C	29.1	9,278
9/8/2023	246,000	C	29.1	8,454
9/12/2023	157,000	C	29.1	5,395
9/17/2023	212,000	C	29.1	7,285
9/19/2023	255,000	C	29.1	8,763
10/2/2023	252,000	C	29.1	8,660
10/5/2023	268,000	C	29.1	9,210
10/11/2023	405,000	C	29.1	13,918
10/16/2023	359,000	C	29.1	12,337
10/17/2023	230,000	C	29.1	7,904
10/20/2023	427,000	C	29.1	14,674
10/24/2023	186,000	C	29.1	6,392
9/13/2023	256,000	E	13.2	19,394
9/18/2023	262,000	E	13.2	19,848
9/21/2023	208,000	E	13.2	15,758
10/4/2023	205,000	E	13.2	15,530
10/6/2023	29,000	E	13.2	2,197
10/9/2023	204,000	E	13.2	15,455
10/12/2023	205,000	E	13.2	15,530

G - PHOSPHORUS TESTING RESULTS LAGOONS 5 AND 6

Water Analysis

AgSource LABORATORIES

Submitted By: **MFS00038**

Saputo Cheese WW
1052 6th St
Almena, WI 54805-9563

Laboratory Sample #
BY95330 - BY95336
4664-63 - 4664-69

Date Received:
11/12/2020

Date Processed:
11/17/2020

Information Sheet #
WW111220-26

WDNR Lab Certification Number **737109450**
WDATCP Lab Certification Number **55-424**

Test Name	Method	Results	Units	LOD/LOQ	Dilution Factor	Prep Date	Test Date	Analyst
Sample #: BY95330 4664-63	**Type:** L5- East	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**64**	**mg/L**	**8.00/30**	**200**	**11/16/2020**	**11/16/2020**	**SS**
Sample #: BY95331 4664-64	**Type:** L5- West	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**65**	**mg/L**	**8.00/30**	**200**	**11/16/2020**	**11/16/2020**	**SS**
Sample #: BY95332 4664-65	**Type:** L5- North	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**70**	**mg/L**	**8.00/30**	**200**	**11/16/2020**	**11/16/2020**	**SS**
Sample #: BY95333 4664-66	**Type:** L5- South	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**65**	**mg/L**	**8.00/30**	**200**	**11/16/2020**	**11/16/2020**	**SS**
Sample #: BY95334 4664-67	**Type:** L6- North	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**27**	**mg/L**	**2.00/7.50**	**50**	**11/16/2020**	**11/16/2020**	**SS**
Sample #: BY95335 4664-68	**Type:** L6- South	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**28**	**mg/L**	**2.00/7.50**	**50**	**11/16/2020**	**11/16/2020**	**SS**
Sample #: BY95336 4664-69	**Type:** L6- East	**Collector:**		**Date/Time Collected:**	11/11/2020 10:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**28**	**mg/L**	**2.00/7.50**	**50**	**11/16/2020**	**11/16/2020**	**SS**

Report Authorized by:

Date: 11/17/2020

[Bracketed results] specify values greater than or equal to the LOD but less than or equal to the LOQ and are within a range of less-certain quantitation. Results greater than the LOQ are considered to be in the range of certain quantitation. LOD/LOQ units are the same as Result units.

LOD = Limit of Detection	**All LODs and LOQs are**	**RL = Reporting Limit**
LOQ = Limit of Quantitation	**adjusted to reflect dilution**	**NA = Not Applicable**

Water Analysis

AgSource LABORATORIES

Submitted By: MFS00038

Saputo Cheese WW
1052 6th St
Almena, WI 54805-9563

Laboratory Sample #
CP65775 - CP65778
5213-62 - 5213-65

Date Received: 08/01/2023

Date Reported: 08/01/2023

Information Sheet # WW080123-12

WDNR Lab Certification Number **737109450**
WDATCP Lab Certification Number **55-424**

Test Name	Method	Results	Units	LOD/LOQ	Dilution Factor	Prep Date	Test Date	Analyst
Sample #: CP65775 5213-62 **Type:** L6-S1		**Collector:**		**Date/Time Collected:**	07/31/2023 10:00 AM	**Sample Date:**		
Total Phosphorus	**SM4500 PB.5 & E**	**49**	**mg/L**	**1.100/3.700**	**100**	**8/1/2023**	**8/1/2023**	**SS**
Sample #: CP65776 5213-63 **Type:** L6-S2		**Collector:**		**Date/Time Collected:**	07/31/2023 10:00 AM	**Sample Date:**		
Total Phosphorus	**SM4500 PB.5 & E**	**38**	**mg/L**	**1.100/3.700**	**100**	**8/1/2023**	**8/1/2023**	**SS**
Sample #: CP65777 5213-64 **Type:** L6-S3		**Collector:**		**Date/Time Collected:**	07/31/2023 10:00 AM	**Sample Date:**		
Total Phosphorus	**SM4500 PB.5 & E**	**38**	**mg/L**	**1.100/3.700**	**100**	**8/1/2023**	**8/1/2023**	**SS**
Sample #: CP65778 5213-65 **Type:** L6-S4		**Collector:**		**Date/Time Collected:**	07/31/2023 10:00 AM	**Sample Date:**		
Total Phosphorus	**SM4500 PB.5 & E**	**36**	**mg/L**	**1.100/3.700**	**100**	**8/1/2023**	**8/1/2023**	**SS**

Report Authorized by:

Date: 08/01/2023

[Bracketed results] specify values greater than or equal to the LOD but less than or equal to the LOQ and are within a range of less-certain quantitation. Results greater than the LOQ are considered to be in the range of certain quantitation. LOD/LOQ units are the same as Result units.

LOD = Limit of Detection
LOQ = Limit of Quantitation

All LODs and LOQs are adjusted to reflect dilution

RL = Reporting Limit
NA = Not Applicable

Water Analysis

Submitted By: **MFS00038**

Saputo Cheese WW
1052 6th St
Almena, WI 54805-9563

Laboratory Sample #
CA86216 - CA86223
4722-44 - 4722-51

Date Received: **03/23/2021**

Date Processed: **03/25/2021**

Information Sheet # **WW032321-03**

WDNR Lab Certification Number **737109450**
WDATCP Lab Certification Number **55-424**

Test Name	Method	Results	Units	LOD/LOQ	Dilution Factor	Prep Date	Test Date	Analyst
Sample #: CA86216 4722-44 **Type:** L5-North	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**61**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86217 4722-45 **Type:** L5-South	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**47**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86218 4722-46 **Type:** L5-East	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**47**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86219 4722-47 **Type:** L5-West	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Total Phosphorus as P	**SM4500 PB.5 & E**	**46**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86220 4722-48 **Type:** L6-North	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Chloride	**EPA 300.0**	**253**	**mg/L**	**1.740/5.800**	**20**	**NA**	**3/23/2021**	**RG**
Total Phosphorus as P	**SM4500 PB.5 & E**	**47**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86221 4722-49 **Type:** L6-South	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Chloride	**EPA 300.0**	**250**	**mg/L**	**1.740/5.800**	**20**	**NA**	**3/23/2021**	**RG**
Total Phosphorus as P	**SM4500 PB.5 & E**	**63**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86222 4722-50 **Type:** L6-East	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Chloride	**EPA 300.0**	**251**	**mg/L**	**1.740/5.800**	**20**	**NA**	**3/23/2021**	**RG**
Total Phosphorus as P	**SM4500 PB.5 & E**	**49**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**
Sample #: CA86223 4722-51 **Type:** L6-West	**Collector:**			**Date/Time Collected:**	03/22/2021 09:00 AM	**Sample Date:**		
Chloride	**EPA 300.0**	**252**	**mg/L**	**1.740/5.800**	**20**	**NA**	**3/23/2021**	**RG**
Total Phosphorus as P	**SM4500 PB.5 & E**	**51**	**mg/L**	**1.100/3.700**	**100**	**3/24/2021**	**3/24/2021**	**SS**

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LOD = Limit of Detection
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All LODs and LOQs are adjusted to reflect dilution

RL = Reporting Limit
NA = Not Applicable

Water Analysis

Submitted for

Laboratory Sample #
CA86216 - CA86223
4722-44 - 4722-51

Date Received: 23-Mar-2021

Date Reported: 25-Mar-2021

Information Sheet # WW032321-03

WDNR Lab Certification Number	**737109450**
WDATCP Lab Certification Number	**55-424**

Test Name	Method	Results	Units	LOD/LOQ	Dilution Factor	Prep Date	Test Date	Analyst

Report Authorized by: Date: 03/25/2021

[Bracketed results] specify values greater than or equal to the LOD but less than or equal to the LOQ and are within a range of less-certain quantitation. Results greater than the LOQ are considered to be in the range of certain quantitation. LOD/LOQ units are the same as Result units.

LOD = Limit of Detection
LOQ = Limit of Quantitation

All LODs and LOQs are adjusted to reflect dilution

RL = Reporting Limit
NA = Not Applicable

Lagoon Samples - Old Samples (2020)		
Sample	**Value**	**Units**
North	27	mg/L
South	28	mg/L
East	28	mg/L
West	N/A	mg/L
AVG	27.7	mg/L

Phosphorous Loading - Old Lagoon Samples (2020)		
Parameter	**Value**	**Units**
Lagoon Water Concentration	27.7	mg/L
Average Yearly Irrigation	62.0	MGY
lbs TP Applied	14,298	lbs/yr
Concentration TP Applied	0.23	lbs/1000 gal
Concentration P2O5 Applied	0.53	lbs/1000 gal
P2O5 Per 12,000 Gal App	6.35	lbs

Alex Ciessau:
3yr Irrigation Avg. (2020, 2021, 2022) used by previous modeler.

Alex Ciessau:
P2O5 = Crystalline form in which P occurs in the soil.

SnapPlus models P applications as P2O5 apps.

P2O5 = 43.6% P by mass

Alex Ciessau:
Value used by previous SnapPlus modeling in old modeling efforts. **SnapPlus rounded to 0.5.**

Lagoon Samples - New Samples (2023)		
Sample	**Value**	**Units**
1	49	mg/L
2	38	mg/L
3	38	mg/L
4	36.0	mg/L
AVG	40.3	mg/L

Phosphorous Loading - New Lagoon Samples (2023)		
Parameter	**Value**	**Units**
Lagoon Water Concentration	40.3	mg/L
Average Yearly Irrigation	64.2	MGY
lbs TP Applied	21,546	lbs/yr
Concentration TP Applied	0.34	lbs/1000 gal
Concentration P2O5 Applied	0.77	lbs/1000 gal
P2O5 Per 13,107 Gal App	10.09	lbs

45% P Concentration Incease vs. 2020 Sample Average

Alex Ciessau:
Anticipated Irrigation to WQT Spray Fields (A,B,C,E,N-F) in 2024 - 2030. Valued used new SnapPlus modeling.

Average of All Lagoon Samples		
Sample	**Value**	**Units**
AVG	34.9	mg/L

Phosphorous Loading - Avg Lagoon Samples		
Parameter	**Value**	**Units**
Lagoon Water Concentration	34.9	mg/L
Average Yearly Irrigation	64.2	MGY
lbs TP Applied	18,659	lbs/yr
Concentration TP Applied	0.29	lbs/1000 gal
Concentration P2O5 Applied	0.67	lbs/1000 gal
P2O5 Per 13,107 Gal App	8.74	lbs

Alex Ciessau:
Anticipated Irrigation to WQT Spray Fields (A,B,C,E,N-F) in 2024 - 2030. Valued used new SnapPlus modeling.

26% P Concentration Incease vs. 2020 Sample Average

Alex Ciessau:
Value entered into New SnapPlus modeling. **SnapPlus rounded to 0.7.**

See "Saputo_Nutrients_R1" spreadsheet for N & K20 of 0.76 lbs/1000 gal and 0.86 lbs/1000 gal respectively. **SnapPlus rounded these values to 0.8 and 0.9 respectively.**

H - SNAPPLUS N & K2O CALCS (LAGOON SAMPLES)

N & K2O CONCENTRATIONS FOR SNAPPLUS MODELING

N & K2O Concentrations Summary

Parameter	mg/L	Convert to	mg/L	lb/1000 gal
N	90.75	as N =>	90.75	0.76
K	85	as K2O =>	103	0.86

Additional Lagoon Sampling Raw Data
(N & K Concentrations For Summary Table Above)

DATE	N (mg/L)	Z Score	K (mg/L)	Z Score	HS+LS Potassium	Z Score
May-21	155	1.3				-
Jun-21	23	-1.4				-
Jul-21	196	2.2				-
Aug-21	29	-1.3				-
Sep-21	97	0.1				-
Oct-21	175	1.7				-
Nov-21						-
Dec-21						-
Jan-22					630	-
Feb-22					1124	-
Mar-22					470	-
Apr-22	127	0.7			220	-
May-22	51	-0.8			519	-
Jun-22	68	-0.5			235	-
Jul-22	59	-0.6			96	-
Aug-22	48	-0.9			143	-
Sep-22	95	0.1			170	-
Oct-22	83	-0.2			262	-
Nov-22	105	0.3	89	0.2	368	-
Dec-22			112	1.3	566	-
Jan-23			74	-0.5	129	-
Feb-23			114	1.4	516	-
Mar-23			79	-0.3	220	-
Apr-23			73	-0.6	363	-
May-23	77	-0.3	54	-1.5	450	-
Jun-23	64	-0.5			190	-
Average (mg/L)	**90.75**		**85**		**Not used since blend of HS and LS**	
ST. DEV (mg/L)	**48.8**		**20.2**			

Alex Ciessau:
Samples below from combination of L3/L4/L5/L6.

Note these are storage lagoons post treatment in existing aerated lagoon and clarification by gravity clarifier. Some of this water is hauled off and spray irrigated elsewhere when they don't have capacity or run into issues at the WWTP.

Additional sampling of L6 conducted for precise P (P2O5) concentrations (2020 & 2023) for SnapPlus modeling. Refer to separate P205 Calcs.

Alex Ciessau:
SnapPlus rounded to 0.8

Alex Ciessau:
SnapPlus rounded to 0.9

Alex Ciessau:
NOTE: Saputo only needs to monitor BOD/Chloride/TKN/Nitrate/Total N and pH to the spray fields.

Alex Ciessau:
Statistical outliers may be identified by Z scores greater than +/-3.

No outliers were identied in this dataset.

I - SNAPPLUS FIELD DETAILS AND CROP PARAMETERS

Spray Field Details Entered Into SnapPlus Baseline

Field	Total Field Area	Approximate Circular Irrigated Area (ac)	Crop	Historic Whole Field Harvest (tons)	Historic Harvest Circular Irrigated Area (tons)	Yield - Whole Field (tons/ac)	Yield - Circular Irrigated Area (tons/ac)	Notes
A	37	29.3	Hay	90	71.3	2.4	2.4	
B	37	29.2	Hay	90	71.0	2.4	2.4	90 cows (50 adult & 40 calves), free range ~180 days/yr
C	37	29.1	Hay	90	70.8	2.4	2.4	90 cows (50 adult & 40 calves), free range 180 days/yr
E	24	13.2	Hay	70	38.5	2.9	2.9	
F-N	37	13.8	Hay	90	33.6	2.4	2.4	

Alex Ciessau:
Using yield goal of 2-3 tons/ac for all harvested perennial vegetation (Grass Hay) in SnapPlus modeling (baseline & reduction conditions).

It is assumed Fields G & H will achieve similar yields when converted to harvested perennial vegetation.

Row Crop Fields G & H Details Entered in SnapPlus Baseline

Note: These fields are owned by Saputo and contracted out to a third-party farmer. Rotation inputs provided below summarize multiple interviews with the third-party farmer who operates and manages agricultural practices on these fields.

Rotation 1: Corn - Soy (Historical)

Crop Years	Crop	Yield Goal	Fertilizer	% Nutrients (N/P/K...)	Application Season	Application Rate	Spread Method	Tillage
2016 - 2020	Corn	151-170 units/ac	Corn Fertilizer (Old Planter)	10-12-30-6 N-P2O5-K2O-S	Spring	125 - 200lbs/ac (Depending on Soil Test)	Subsurface	Fall Chisel, Fall Cultivation, Spring Cultivation
			28% UAN (Liquid)	28-0-0 N-P2O5-K2O	Summer	30 gal/ac	Unincorporated	
2021	Soy	46-65 units/ac	Soy Fertilized (Old Planter)	4-10-47-0 N-P2O5-K2O-Zn	Spring	125 lbs/ac	Incorporated	Fall Chisel, Fall Cultivation, Spring Cultivation
2022	Corn	151-170 units/ac	[Liquid Starter (Paralign)]()	5-15-3-0.8 N-P2O5-K2O-Zn	Spring	3 gal/acre	Incorporated	Fall Chisel, Fall Cultivation, Spring Cultivation
			Urea (Solid)	46-0-0 N-P2O5-K2O	Summer	160 lbs/acre	Unincorporated	
			Turkey Manure (Solid)	SnapPlus Template Values	Fall (Previous Year Post Soy Harvest)	4 tons/acre	Incorporated	
2023	Soy	46-65 units/ac	Soy Fertilized (Old Planter)	4-10-47-0 N-P2O5-K2O-Zn	Spring	125 lbs/ac	Incorporated	Fall Chisel, Fall Cultivation, Spring Cultivation

Rotation 2: Corn - Soy (Future/Anticipated)

Crop Years	Crop	Yield Goal	Fertilizer	% Nutrients (N/P/K...)	Application Season	Application Rate	Spread Method	Tillage
2024, 2026, 2028, 2030	Corn	151-170 units/ac	[Liquid Starter (Paralign)]()	5-15-3-0.8 N-P2O5-K2O-Zn	Spring	3 gal/acre	Incorporated	Fall Chisel, Fall Cultivation, Spring Cultivation
			Urea (Solid)	46-0-0 N-P2O5-K2O	Summer	160 lbs/acre	Unincorporated	
			Turkey Manure (Solid)	SnapPlus Template Values	Fall (Previous Year Post Soy Harvest)	4 tons/acre	Incorporated	
2025, 2027, 2029	Soy	46-65 units/ac	Potash	Muriate of Potash (KCl) 0-0-60 N-P-K	Spring	125 lbs/ac	Incorporated	Fall Chisel, Fall Cultivation, Spring Cultivation
			Calcium Sulfate (Gypsum)	0-0-0-14-0-19 N-P-K-S-Mg-Ca	Spring	75lbs/ac	Incorporated	

Alex Ciessau:
Modeled as Fall app during preceding Soy Year in SnapPlus.

Alex Ciessau:
Modeled as Fall app during preceding Soy Year in SnapPlus.

Alex Ciessau:
All Tillage Modeled as Fall Chisel, No Disk.

J - SNAPPLUS BASELINE P TRADE REPORTS

WQ1: P Trade Report

Reported For	**Saputo Cheese Plant Spray Fields**
Printed	**2024-08-20**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields A, B, C, E, F_BASELINE (WW, B & C Grazing Cows, Other Fields Grass Hay).snapDb	

Prepared for:
Saputo Cheese Plant Spray Fields
attn:Saputo

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

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

Questions? Please contact DNRphosphorus@wisconsin.gov

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

P Trade Report				**PTP**										
Field Name	**Soil Series**	**Soil Symbol**	**Acres**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
A	FREEON	FnB	29	85	87	72	93	86	116	104	85	114	118	121
B	FREEON	FnB	29	100	116	110	127	116	132	142	123	149	153	158
C	FREEON	FnB	29	113	143	130	126	129	154	158	143	158	162	166
E	FREEON	FnB	13	72	53	55	119	40	95	114	48	52	53	55
F-N	FREEON	FnB	14	103	120	60	67	48	51	43	40	56	57	59
Total			**115**	**473**	**519**	**427**	**532**	**418**	**548**	**561**	**439**	**528**	**543**	**559**

PTP		
2028	2029	2030
124	128	131
162	166	171
171	175	180
57	58	60
60	62	63
574	**589**	**605**

WQ1: P Trade Report

Reported For	**Saputo Cheese Plant Row Crop Fields**
Printed	**2024-08-20**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields G & H_BASELINE (Corn Soy Row Crop & Nutrient Apps).snapDb	

Prepared for:
Saputo Cheese Plant Row Crop Fields
attn:Saputo Cheese Plant

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

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P Trade Report				PTP										
Field Name	Soil Series	Soil Symbol	Acres	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
G	FREEON	FnB	16	28	27	26	57	72	63	76	63	78	64	79
H	FREEON	FnB	9	20	20	20	37	49	41	52	41	53	41	54
Total			**25**	**48**	**47**	**46**	**94**	**122**	**104**	**128**	**103**	**130**	**105**	**133**

PTP	
2029	**2030**
65	81
42	55
106	**136**

K - SNAPPLUS REDUCTION P TRADE REPORTS

WQ1: P Trade Report

Reported For	**Saputo Cheese Plant Spray Fields**
Printed	**2024-08-28**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields A, B, C, E, F_REDUCTION (No WW Apps).snapDb	

Prepared for:
Saputo Cheese Plant Spray Fields
attn:Saputo

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

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Questions? Please contact DNRphosphorus@wisconsin.gov

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P Trade Report				**PTP**										
Field Name	**Soil Series**	**Soil Symbol**	**Acres**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**
A	FREEON	FnB	29	85	87	72	93	86	116	104	85	100	49	49
B	FREEON	FnB	29	100	116	110	127	116	132	142	123	121	62	61
C	FREEON	FnB	29	113	143	130	126	129	154	158	143	130	71	70
E	FREEON	FnB	13	72	53	55	119	40	95	114	48	46	23	23
F-N	FREEON	FnB	14	103	120	60	67	48	51	43	40	49	25	25
Total			**115**	**473**	**519**	**427**	**532**	**418**	**548**	**561**	**439**	**446**	**229**	**229**

PTP		
2028	**2029**	**2030**
49	49	49
61	61	61
70	70	70
23	23	23
25	25	25
228	**228**	**227**

WQ1: P Trade Report

Reported For	**Saputo Cheese Plant Row Crop Fields**
Printed	**2024-08-28**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields G & H_REDUCTION (No Row Crops, No Nutrient Apps, Rye & Alfalfa-Grass Hay).snapDb	

Prepared for:
Saputo Cheese Plant Row Crop Fields
attn:Saputo Cheese Plant

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

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

Questions? Please contact DNRphosphorus@wisconsin.gov

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P Trade Report				**PTP**										
Field Name	**Soil Series**	**Soil Symbol**	**Acres**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
G	FREEON	FnB	16	28	27	26	57	72	63	67	28	6	4	2
H	FREEON	FnB	9	20	20	20	37	49	41	48	23	9	7	5
Total			**25**	**48**	**47**	**46**	**94**	**122**	**104**	**115**	**51**	**15**	**10**	**7**

PTP	
2029	2030
1	1
4	4
5	**4**

L - CREDIT DASHBOARD CALC AND SAMPLE CALC

CREDIT DASHBOARD

Long Term Credit Balance

Parameter	Units	Annual Credit Values						AVG
		2025	2026	2027	2028	2029	2030	2026-2030
Total Spray Field P Credits	lbs/yr	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Total Row Crop Fields P Credits	lbs/yr	0.0	8.2	12.4	15.4	16.6	17.3	**14.0**
Total Credits P Generated	**lbs/yr**	**0.0**	**8.2**	**12.4**	**15.4**	**16.6**	**17.3**	14.0
Credits P Required	lbs/yr	59.5	80.5	80.5	80.5	80.5	80.5	**80.5**
Credit Balance	**lbs/yr**	**-59.5**	**-72.2**	**-68.1**	**-65.1**	**-63.9**	**-63.2**	**-66.5**

Interim (10 Year) Credit Balance

Parameter	Units	Annual Credit Values						AVG
		2025	2026	2027	2028	2029	2030	2026-2030
Total Spray Field P Credits	lbs/yr	22.9	261.3	274.7	287.9	301.4	314.8	**288.0**
Total Row Crop Fields P Credits	lbs/yr	43.6	96.1	78.9	105.5	84.2	109.7	**94.9**
Total Credits Generated	**P lbs**	**66.5**	**357.4**	**353.5**	**393.4**	**385.6**	**424.5**	**382.9**
Credits Required	P lbs	59.5	80.5	80.5	80.5	80.5	80.5	**80.5**
Credit Balance	**P lbs**	**7.0**	**277.0**	**273.1**	**313.0**	**305.1**	**344.0**	**302.4**

Credit Balance - Supplementary Calcs

Parameter	Units	Annual Credit Values					
		2025	2026	2027	2028	2029	2030
WW Discharge	GPD	280,000					
WW Discharge [1]	MGY	77	102	102	102	102	102
P Discharge Conc.	mg/L	0.100					
P Discharged	lbs/yr	64.2	85.2	85.2	85.2	85.2	85.2
P Allowed [2]	lbs/yr	4.75	4.75	4.75	4.75	4.75	4.75

[1] Assumes creek discharge begins April 1st 2025, equal to 275 Days of Discharge in 2025.

[2] Assumes WLA 2.5 PPY X 1.9 multiplier (4.75 lbs/yr) per DNR 7/9/24 WQBEL Memo

CREDIT GENERATION INPUTS

Parameter	Units	Value
TMDL credit Threshold	lbs/ac	2.0
TMDL credit Threshold [1]	lbs/ac	1.0
Trade Ratio		1.2

[1] 65% reduction per local TMDL but rounded up to 1 in compliance with flexible baseline policy

Alex Ciessau:
PLUG AND PLAY WWTS Discharge Concentration

Alex Ciessau:
Year 1 (2025): Monthly credit prorating applied to spray fields based on anticipated establishment of credit generating practices by Aug 31st, 2025. 33% (4 of 12 months) of calculated annual credit value is available (WWTS allocated credits generated Sept, Oct, Nov, Dec).

Alex Ciessau:
Calculated using SnapPlus Tainter TMDL file and instructions provided by Matt Claucherty per 2/16/21 email.

Matt Claucherty confirmed via 10/31/23 email that 2/16/21 Tainter TMDL files is most up to date.

Long Term Credit Generation

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
A	Modeled Area	ac	29.3						N/A
	Baseline	P lbs	114.2	117.5	120.9	124.3	127.7	131.1	122.6
	Reduction	P lbs	100.4	49.3	49.3	49.3	49.2	49.0	57.8
	Savings	P lbs	13.8	68.2	71.6	75.0	78.5	82.1	64.9
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	3.9	4.0	4.1	4.2	4.4	4.5	N/A
	Reduction	P lbs/ac	3.4	1.7	1.7	1.7	1.7	1.7	N/A
	Difference	P lbs/ac	-2.4	-0.7	-0.7	-0.7	-0.7	-0.7	N/A
	Difference x acres	P lbs	-71.1	-20.0	-20.0	-20.0	-19.9	-19.7	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
B	Modeled Area	ac	29.2						N/A
	Baseline	P lbs	148.8	153.2	157.6	162.0	166.4	170.8	159.8
	Reduction	P lbs	120.7	61.7	61.4	61.1	60.8	60.6	71.1
	Savings	P lbs	28.1	91.5	96.2	100.9	105.6	110.2	88.8
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	5.1	5.2	5.4	5.5	5.7	5.8	N/A
	Reduction	P lbs/ac	4.1	2.1	2.1	2.1	2.1	2.1	N/A
	Difference	P lbs/ac	-3.1	-1.1	-1.1	-1.1	-1.1	-1.1	N/A
	Difference x acres	P lbs	-91.5	-32.5	-32.2	-31.9	-31.6	-31.4	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Interim (10 Year) Credit Generation

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
A	Modeled Area	ac	29.3						N/A
	Baseline	P lbs	114.2	117.5	120.9	124.3	127.7	131.1	122.6
	Reduction	P lbs	100.4	49.3	49.3	49.3	49.2	49.0	57.8
	Savings	P lbs	13.8	68.2	71.6	75.0	78.5	82.1	64.9
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	3.9	4.0	4.1	4.2	4.4	4.5	N/A
	Reduction	P lbs/ac	3.4	1.7	1.7	1.7	1.7	1.7	N/A
	Difference	P lbs/ac	0.5	2.3	2.4	2.6	2.7	2.8	N/A
	Difference x acres	P lbs	13.8	68.2	71.6	75.0	78.5	82.1	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**11.5**	**56.8**	**59.7**	**62.5**	**65.4**	**68.4**	**54.1**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
B	Modeled Area	ac	29.2						N/A
	Baseline	P lbs	148.8	153.2	157.6	162.0	166.4	170.8	159.8
	Reduction	P lbs	120.7	61.7	61.4	61.1	60.8	60.6	71.1
	Savings	P lbs	28.1	91.5	96.2	100.9	105.6	110.2	88.8
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	5.1	5.2	5.4	5.5	5.7	5.8	N/A
	Reduction	P lbs/ac	4.1	2.1	2.1	2.1	2.1	2.1	N/A
	Difference	P lbs/ac	1.0	3.1	3.3	3.5	3.6	3.8	N/A
	Difference x acres	P lbs	28.1	91.5	96.2	100.9	105.6	110.2	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**23.4**	**76.3**	**80.2**	**84.1**	**88.0**	**91.8**	**74.0**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
C	Modeled Area	ac	29.1						N/A
	Baseline	P lbs	157.6	162.0	166.4	170.9	175.3	179.8	168.7
	Reduction	P lbs	129.7	70.7	70.4	70.1	69.9	69.6	80.1
	Savings	P lbs	27.9	91.3	96.0	100.8	105.4	110.2	88.6
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	5.4	5.6	5.7	5.9	6.0	6.2	N/A
	Reduction	P lbs/ac	4.5	2.4	2.4	2.4	2.4	2.4	N/A
	Difference	P lbs/ac	-3.5	-1.4	-1.4	-1.4	-1.4	-1.4	N/A
	Difference x acres	P lbs	-100.6	-41.6	-41.3	-41.0	-40.8	-40.5	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
E	Modeled Area	ac	13.2						N/A
	Baseline	P lbs	51.9	53.4	55.0	56.5	58.1	59.6	55.8
	Reduction	P lbs	45.7	22.7	22.7	22.7	22.6	22.6	26.5
	Savings	P lbs	6.2	30.7	32.3	33.8	35.5	37.0	29.3
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	3.9	4.0	4.2	4.3	4.4	4.5	N/A
	Reduction	P lbs/ac	3.5	1.7	1.7	1.7	1.7	1.7	N/A
	Difference	P lbs/ac	-2.5	-0.7	-0.7	-0.7	-0.7	-0.7	N/A
	Difference x acres	P lbs	-32.5	-9.5	-9.5	-9.5	-9.4	-9.4	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
F-North	Modeled Area	ac	13.7						N/A
	Baseline	P lbs	55.5	57.1	58.7	60.3	61.9	63.5	59.5
	Reduction	P lbs	49.1	25.2	25.2	25.3	25.2	25.2	29.2
	Savings	P lbs	6.4	31.9	33.5	35.0	36.7	38.3	30.3
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	4.1	4.2	4.3	4.4	4.5	4.6	N/A
	Reduction	P lbs/ac	3.6	1.8	1.8	1.8	1.8	1.8	N/A
	Difference	P lbs/ac	-2.6	-0.8	-0.8	-0.8	-0.8	-0.8	N/A
	Difference x acres	P lbs	-35.4	-11.5	-11.5	-11.6	-11.5	-11.5	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
G	Modeled Area	ac	15.9						N/A
	Baseline	P lbs	62.9	77.8	63.7	79.5	64.5	81.2	71.6
	Reduction	P lbs	27.9	6.3	3.5	1.6	0.9	0.5	6.8
	Savings	P lbs	35.0	71.5	60.2	77.9	63.6	80.7	64.8
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	4.0	4.9	4.0	5.0	4.1	5.1	N/A
	Reduction	P lbs/ac	1.8	0.4	0.2	0.1	0.1	0.0	N/A
	Difference	P lbs/ac	-0.8	0.6	0.8	0.9	0.9	1.0	N/A
	Difference x acres	P lbs	-12.0	9.6	12.4	14.3	15.0	15.4	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**8.0**	**10.3**	**11.9**	**12.5**	**12.8**	**9.3**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
C	Modeled Area	ac	29.1						N/A
	Baseline	P lbs	157.6	162.0	166.4	170.9	175.3	179.8	168.7
	Reduction	P lbs	129.7	70.7	70.4	70.1	69.9	69.6	80.1
	Savings	P lbs	27.9	91.3	96.0	100.8	105.4	110.2	88.6
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	5.4	5.6	5.7	5.9	6.0	6.2	N/A
	Reduction	P lbs/ac	4.5	2.4	2.4	2.4	2.4	2.4	N/A
	Difference	P lbs/ac	1.0	3.1	3.3	3.5	3.6	3.8	N/A
	Difference x acres	P lbs	27.9	91.3	96.0	100.8	105.4	110.2	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**23.3**	**76.1**	**80.0**	**84.0**	**87.8**	**91.8**	**73.8**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
E	Modeled Area	ac	13.2						N/A
	Baseline	P lbs	51.9	53.4	55.0	56.5	58.1	59.6	55.8
	Reduction	P lbs	45.7	22.7	22.7	22.7	22.6	22.6	26.5
	Savings	P lbs	6.2	30.7	32.3	33.8	35.5	37.0	29.3
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	3.9	4.0	4.2	4.3	4.4	4.5	N/A
	Reduction	P lbs/ac	3.5	1.7	1.7	1.7	1.7	1.7	N/A
	Difference	P lbs/ac	0.5	2.3	2.4	2.6	2.7	2.8	N/A
	Difference x acres	P lbs	6.2	30.7	32.3	33.8	35.5	37.0	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**5.2**	**25.6**	**26.9**	**28.2**	**29.6**	**30.8**	**24.4**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
F	Modeled Area	ac	13.7						N/A
	Baseline	P lbs	55.5	57.1	58.7	60.3	61.9	63.5	59.5
	Reduction	P lbs	49.1	25.2	25.2	25.3	25.2	25.2	29.2
	Savings	P lbs	6.4	31.9	33.5	35.0	36.7	38.3	30.3
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	4.1	4.2	4.3	4.4	4.5	4.6	N/A
	Reduction	P lbs/ac	3.6	1.8	1.8	1.8	1.8	1.8	N/A
	Difference	P lbs/ac	0.5	2.3	2.4	2.6	2.7	2.8	N/A
	Difference x acres	P lbs	6.4	31.9	33.5	35.0	36.7	38.3	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**5.3**	**26.6**	**27.9**	**29.2**	**30.6**	**31.9**	**25.3**

Field	Parameter	Units	Annual Credit Values						AVG
			2025	2026	2027	2028	2029	2030	2025-2030
G	Modeled Area	ac	15.9						N/A
	Baseline	P lbs	62.9	77.8	63.7	79.5	64.5	81.2	71.6
	Reduction	P lbs	27.9	6.3	3.5	1.6	0.9	0.5	6.8
	Savings	P lbs	35.0	71.5	60.2	77.9	63.6	80.7	64.8
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	4.0	4.9	4.0	5.0	4.1	5.1	N/A
	Reduction	P lbs/ac	1.8	0.4	0.2	0.1	0.1	0.0	N/A
	Difference	P lbs/ac	2.2	4.5	3.8	4.9	4.0	5.1	N/A
	Difference x acres	P lbs	35.0	71.5	60.2	77.9	63.6	80.7	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**29.2**	**59.5**	**50.2**	**64.9**	**53.0**	**67.2**	**54.0**

Field	Parameter	Units	Annual Credit Values						AVG 2025-2030
			2025	2026	2027	2028	2029	2030	
H	Modeled Area	ac	9.1						N/A
	Baseline	P lbs	40.6	52.6	41.1	53.7	41.6	54.7	47.4
	Reduction	P lbs	23.3	8.8	6.6	5.0	4.2	3.7	8.6
	Savings	P lbs	17.3	43.9	34.5	48.7	37.4	50.9	38.8
	TMDL credit Threshold	P lbs/ac	1.0						N/A
	Baseline	P lbs/ac	4.5	5.8	4.5	5.9	4.6	6.0	N/A
	Reduction	P lbs/ac	2.6	1.0	0.7	0.5	0.5	0.4	N/A
	Difference	P lbs/ac	-1.6	0.0	0.3	0.5	0.5	0.6	N/A
	Difference x acres	P lbs	-14.2	0.3	2.5	4.1	4.9	5.4	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**0.0**	**0.3**	**2.1**	**3.5**	**4.1**	**4.5**	**2.4**

Field	Parameter	Units	Annual Credit Values						AVG 2025-2030
			2025	2026	2027	2028	2029	2030	
H	Modeled Area	ac	9.1						N/A
	Baseline	P lbs	40.6	52.6	41.1	53.7	41.6	54.7	47.4
	Reduction	P lbs	23.3	8.8	6.6	5.0	4.2	3.7	8.6
	Savings	P lbs	17.3	43.9	34.5	48.7	37.4	50.9	38.8
	TMDL credit Threshold	P lbs/ac	N/A						N/A
	Baseline	P lbs/ac	4.5	5.8	4.5	5.9	4.6	6.0	N/A
	Reduction	P lbs/ac	2.6	1.0	0.7	0.5	0.5	0.4	N/A
	Difference	P lbs/ac	1.9	4.8	3.8	5.4	4.1	5.6	N/A
	Difference x acres	P lbs	17.3	43.9	34.5	48.7	37.4	50.9	N/A
	Trade Ratio		1.2						N/A
	Final Credit	**P lbs**	**14.4**	**36.6**	**28.7**	**40.6**	**31.1**	**42.5**	**32.3**

END OF CALCULATIONS

Credit Generation Sample Calcs:

WDNR's WQT Guidance document outlines the methods for calculating long-term and interim credits. These methods have been applied to calculate the annual credits generated for each field in the preceding pages. A sample calculation is provided for Field A in 2025.

Sample calculation for Field A in 2025:

Credit Calculation Inputs:

- Baseline PTP = 114.2 lbs P
- Reduction PTP = 100.4 lbs P
- Savings is (114.2 – 100.4) = 13.8 lbs P
- TMDL credit threshold = 1 lb P/acre
- Baseline rate = 114.2 lb P / 29.3 acres = ~3.9 lbs P/acre
- Reduction rate = 100.4 lb P/ 29.3 acres = ~3.4 lbs P/acre

Long-Term Credit Calculation:

- Difference = TMDL credit threshold – Reduction rate = 1.0 – 3.4 = -2.4 lbs P/acre
- Difference x Acres = -2.4 lbs P/acre x 29.3 acres = -71.1 lbs P/year
- Trade ratio = 1.2
- Long-Term Credits = Difference x Acres / Trade ratio = -71.1 / 1.2 = -59.25 lbs P → **0 lbs P**

Interim Credit Calculation:

- Difference = Baseline rate – Reduction rate = 3.9 – 3.4 = 0.5 lbs P/acre
- Difference x Acres = 0.5 lbs P/acre x 29.3 acres = 13.8 lbs P
- Trade ratio = 1.2
- Interim Credit = Difference x Acres / Trade ratio = 13.8 lbs P/ 1.2 = **11.5 lbs P/year**

2025 WWTS Start-Up & Credit Prorating:

The proposed WWTS is anticipated to startup 2025 and begin discharging April 1st, 2025. Management practice implementation and credit generation will be sequenced during 2024 and 2025 to allow the WWTS to discharge as planned and Saputo to continue spray operations for at least part of their normal 2025 irrigation season. The credits implemented and generated in 2025 on the spray fields will be prorated monthly offering credits for the remainder of 2025. A sample calculation is provided below.

Sample calculation for pro-rated credits in 2025:

- Total Spray Fields Credits Generated in 2025 = ~68.7 lbs P/year
- Anticipated Irrigation Termination Date for Credit Generation: August 31st, 2025
- Monthly Prorating = Credits awarded September, October, November, December of 2025 = 4/12 months = 33% of annual 2025 credits available
- Total Prorated Credits Available for Remainder of 2025 = ~68.7 x 33% = **~22.9 lbs P/year**

Note: It is anticipated that any wastewater effluent remaining in the Saputo Lagoons, after spray operations are terminated 2025, will be metered into the WWTS throughout the remainder of 2025 and potentially into 2026. The increase in average flow to the WWTS, from the addition of Lagoon wastewater, will be factored into the overall total phosphorus discharge balance and compared against credits available. Review of the credit balance above indicates sufficient credits for this approach.

M - NRCS CPS - FORAGE AND BIOMASS PLANTING (CODE 512)

Fields A,E, F = Harvested Perennial Vegetation (Existing Hay Crop Maintained)

Fields G & H = Harvested Perennial Vegetation (Hay Crop Needs Establishment)

United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

FORAGE AND BIOMASS PLANTING

CODE 512

(ac)

DEFINITION

Establishing adapted and/or compatible species, varieties, or cultivars of herbaceous species suitable for pasture, hay, or biomass production.

PURPOSE

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

- Improve yield and plant longevity by providing guidance for selection and establishment of adapted and compatible plant varieties, species, and cultivars
- Improve or maintain livestock nutrition and/or health
- Provide or increase forage supply during periods of low forage production
- Reduce soil erosion
- Improve soil and water quality
- Produce feedstock for biofuel or energy production

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all lands suitable to the establishment of annual, biennial or perennial species for forage or biomass production. This practice does not apply to the establishment of annually planted and harvested grain, fiber, or oilseed crops.

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 pasture and hayland planting. This standard does not contain the text of federal, tribal, state, or local laws.

CRITERIA

General Criteria Applicable to All Purposes

1. Specie Selection and Seed Quality
   Plant species and their varieties shall be selected based upon the following:

   - Climatic conditions, such as annual precipitation and its distribution, growing season length, temperature extremes, and the USDA Plant Hardiness Zones.
   - Soil condition and position attributes such as pH, available water holding capacity, aspect, slope, drainage class, fertility level, depth, potential for flooding and ponding, and levels of phytotoxic elements that may be present.

- Individual plant resistance to disease and insects common to the site or location.
- Select forage species based on the intended use, level of management, realistic yield estimates, maturity timeline, growth characteristics, and compatibility with other species. Verify plant adaptation to the area prior to planting.

Plant species identified as restricted or prohibited by law shall not be established when using this practice standard.

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

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

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

All pasture and hayland seeding rates will be given in pounds of Pure Live Seed (PLS) and minimum seeds per square foot. If more than 20 percent of the legume seed is hard seed, increase the seeding rate for legumes by the percentage of hard seed.

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

2. Seeding Periods

The specific date that provides the best chance for success will vary from south to north and from year to year with prevailing moisture and temperature conditions. Late summer seeding is generally riskier than spring seeding. Planting at either end of the allowable range is riskier than the middle of the range. Refer to Figure 1 for planting zones and Tables 1 and 2 for planting dates.

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

Frost seeding periods statewide range from mid February to early March depending on the year. For details regarding frost seeding criteria and techniques, refer to Wisconsin Agronomy Technical Note 5, Establishing and Maintaining Native Grasses, Forbs, and Legumes; and Wisconsin Agronomy Technical Note 6, Establishing and Maintaining Introduced Grasses and Legumes.

3. Nutrient and Soil Amendment Requirements

Soil fertility and pH levels will be amended to satisfy the needs of the plant species to be established. Fertilizer and lime recommendations will be determined by a soil test, and all nutrients will be applied following Wisconsin NRCS Field Office Technical Guide (WI FOTG), Section IV Standard 590, Nutrient Management.

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

4. Seedbed Preparation

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

Plant when soil moisture is adequate for germination and establishment.

Site preparation shall be adequate to assure weed suppression.

Plant at a depth appropriate for the seed size or plant material, and ensure uniform contact with soil.

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, Establishing and Maintaining Introduced Grasses and Legumes for detailed guidance on seedbed preparation.

5. Temporary Cover and Companion Crop

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

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

Figure 1

Table 1 Perennial Introduced Grasses and Legumes (See Figure 1)

	Spring	Late Summer
North	5/1 - 6/15	7/15 - 8/10
Central	4/15 - 6/1	8/1 - 8/21
South	4/1 - 5/15	8/7 - 8/29

Table 2 Perennial Native Warm Season Grasses (See Figure 1)

	Spring Seeding	Fall Dormant Seeding
North	Thaw - 7/15	10/8 - Freeze up

	Spring Seeding	Fall Dormant Seeding
Central	Thaw - 6/30	10/15 - Freeze up
South	Thaw - 6/30	10/20 - Freeze up

Criteria for Seed Mixture Development

1. General Guidelines for Mixture Development
    1. Based on the predominant soil type, find the appropriate *forage suitability group* in Section II of the Wisconsin NRCS Field Office Technical Guide.
    2. Identify species that are suited to the planting sites pasture and hayland forage suitability group and use only those species.
    3. Species planned for pasture or hayland should be compatible with the planned management of the entire operating unit. Select species that provide high quality forage for grazing or hay as appropriate.
    4. Warm-season grasses and cool-season grasses shall not be mixed for pasture, biomass or hayland use.
    5. Seeding rates are based on seeds per square foot of Pure Live Seeds. Refer to Table 4 for common species and seeding rates. Species not listed in Wisconsin Agronomy Technical Notes 5 or 6 must be approved in advance by the State Agronomist or State Grazing Specialist.
    6. Any seeding mixture developed outside of standard mixtures listed in Wisconsin Agronomy Technical Note 6 and this standard must be approved by the State Grazing Specialist or State Agronomist.
2. Pasture and Hayland Plantings
    1. For pasture plantings, mixtures will have at least 1 grass and 1 legume. The mixture will be at least 50 percent grass seeds per square foot, and the total mix will have at least 60 seeds per square foot.
    2. 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.
    3. For pasture and hayland purposes, warm-season grasses will be established in stands of single species to facilitate uniform forage maturity.
       Required minimum seeds per square foot by specie is as follows:

        - Big Bluestem: 42
        - Indiangrass: 44
        - Switchgrass: 63
    4. For biomass plantings, species will be selected to produce uniform fuel characteristics related to size, weight, and moisture after processing. Switchgrass is the only specie currently approved for biomass production. The minimum planting rate is 60 seeds per square foot. Refer to Wisconsin Agronomy Technical Note 5 for recommended varieties
3. Variety Selection
    1. Introduced Grasses and Legumes
       Refer to University of Wisconsin Extension Publication A1525, “Perennial Forage Crop Variety Update for Wisconsin.”
    2. Native Warm Season Grasses
       Refer to Wisconsin Agronomy Technical Note 5 for recommended varieties for pasture and hayland and biomass plantings.
4. Seeding Rates

1. Full Seeding (Conventional and No-Till Planting)
   Refer to Table 3 of this standard and Wisconsin Agronomy Technical Notes 5 and 6 for standard seed mixtures

2. Interseeding
   Seed at one-half the rate of the recommended pure stand rate as specified in Table 4 for existing pastures and haylands. Seeds per square foot will vary according to specie(s) interseeded.

   Refer to Wisconsin Agronomy Technical Notes 5 and 6 for guidance regarding the interseeding of grasses, forbs, and legumes into existing vegetation.

3. Dormant and Frost Seeding
   To renovate existing pastures, frost seeding shall only be used to interseed legumes. Seeding rate will be two thirds of the Pure Stand Rate shown in Table 4. Seeds per square foot for legumes will vary according to specie.

   Dormant and frost seeding can be used when seeding big bluestem, Indiangrass, and switchgrass for pasture and hayland plantings, and biofuel production. For dormant and frost seeding, increase the seeding rate by 15 percent.

Additional Criteria for Improving or Maintaining Livestock Nutrition and/or Health

Use forage species that will meet the desired level of nutrition (quantity and quality) for the kind and class of the livestock to be fed.

Forage species planted as mixtures will exhibit similar palatability to avoid selective grazing.

Additional Criteria for Providing or Increasing Forage Supply During Periods of Low Forage Production

Select plants that will help meet livestock forage demand during times that normal farm/ranch forage production are not adequate.

Select plants that stockpile well, i.e., produce well and maintain nutritional quality into late fall and winter.

Additional Criteria for Reducing Erosion and Improving Water Quality

Select plant species that provide the amount of ground cover and root mass needed to protect the soil from wind and water erosion as determined by site conditions.

The potential for soil erosion during the establishment of a forage or biomass planting shall be assessed. Identified soil erosion resource concerns shall be addressed in the planting plan.

Additional Criteria for Producing Feedstocks for Biofuel or Energy Production

Select plants that provide an adequate volume per acre of plant materials.

Select perennial warm season biomass crops or annual crops that will produce non-fragile biomass.

Select biomass crops that will sequester carbon in the soil.

Select biomass crops that require minimum maintenance and fertilizer inputs.

Determine sustainable residue removal rates and evaluate soil quality impacts of residue removal for long term sustainability using the RUSLE2 and WEPS.

CONSIDERATIONS

1. 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 the erosion risk for each establishment alternative.

2. In areas where animals congregate, consider establishing persistent species that can tolerate close grazing and trampling.
3. Consider the potential hazard of bloat when pasture mixtures are dominated by legumes.
4. Consider the benefits of proper management of existing stands of forage which will increase pasture production rather than reseeding or interseeding. Longevity and persistence will be increased by rotational grazing systems that provide plant recovery periods and discourage selective grazing. See WI FOTG Standard 528, Prescribed Grazing.
5. Where wildlife and pollinator habitat concerns exist, consider using an approved habitat evaluation procedure for plant selection.
6. Where air quality concerns exist, consider using site preparation and planting techniques that will minimize dust generation and transport.
7. Where carbon sequestration is a goal, select deep-rooted perennial species that will increase underground carbon storage.
8. Seed counts per square foot above the recommended minimums may result in excessive competition and poor establishment of some species. It is strongly suggested that seed count minimums not exceed 25 percent of the minimum seeds per square foot for grasses.
9. When planning biomass plantings, consider the kinds and amount of plant materials as defined by the target market or end user.
10. During and after stand establishment, planning and application of the following conservation practices should be considered as applicable: Forage Harvest Management (511), Herbaceous Weed Control (315), Nutrient Management (590), and Prescribed Grazing (528).
11. Consider implementing WI FOTG Standards 595, Integrated Pest Management; 315, Herbaceous Weed Control; and 314, Brush Management, to reduce the environmental, animal, and human impacts of *noxious* and *invasive* weeds.

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.

OPERATION AND MAINTENANCE

Inspect and calibrate seeding equipment prior to use. Continually monitor the performance of the seeding equipment during planting to insure proper rate, distribution and depth of planting material is maintained.

The growth of desired seedlings shall be monitored and evaluated during the establishment period.

Monitor new plantings for water stress. Depending on the severity of drought, water stress may require reducing weeds, early harvest of any companion crops, irrigating when possible, or replanting failed stands.

New seedings shall not be grazed or harvested until plants have established sufficient root systems to withstand traffic and to recover from removal of top growth.

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.

REFERENCES

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

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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.

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.

Forage Suitability Group(s) (V.B.1.a.) – Pasture and hayland interpretation reports that provide users with forage production guidance for soils and climate conditions present in a specific area of interest.

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.

Invasive weeds (VI.K.) – 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.

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.K.) – 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 Seed (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 3? Table Label Missing.

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	6	38
		Tall Fescue	6	31
		Timothy	1	28
Group 2: Low water holding capacity, 0 to 12 percent slopes.	512-H2	Alfalfa	12	60
	512-H3	Alfalfa	10	50
		Smooth Bromegrass	4	12
Group 3: Low water holding capacity, greater	512-H3	Alfalfa	10	50
		Smooth Bromegrass	4	12

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Hay Crop				
than 12 percent slopes.				
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	47 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
Groups 1-9 For biofuel production, it is recommended that fields be harvested once per year, in the fall. Harvesting two to three weeks	512-H7	Switchgrass varieties: Blackwell Cave-in-Rock Pathfinder	7 lbs/acre 7 lbs/acre 7 lbs/acre 7 lbs/acre	63

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Hay Crop				
after the first frost will allow the plant to recycle nutrients and likely reduce future fertilization and drying costs. Switchgrass should be planted in the spring after soil temperatures reach 60˚F. Planting in a firm, well prepared seedbed should be done at a depth of ¼ inch. No-till planting after soybeans rather than corn is better, due to smoother terrain. Switchgrass should not be cut or grazed during the seeding year unless weed density is high or growth is exceptional.		Sunburst		
	512-H8	Big Bluestem	11 lbs/acre	42
	512-H9	Indiangrass	10 lbs/acre	44
Group 10: Organic soils, wetlands, ledge outcrop.	—-	Planting not feasible.	—-	—-

Refer to Wisconsin Agronomy Technical Notes 5 and 6 for companion crop recommendations.

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Rotation and Permanent Pastures				
Group 1: Low water holding capacity,	512-PP1	Alsike Clover Meadow Fescue	2 6	31 31
	512-PP1A	Alsike Clover Orchardgrass	2 3	31 45
	512-PP1B		2	31

Forage Suitability Group	**Seed Calculator Code[1]**	**Species**	**Lbs. PLS per Acre**	**Seeds per Square Foot**
seasonal high water table.		Alsike Clover Timothy	1.5	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:	512-PP7	Alsike Clover Meadow Fescue Timothy Redtop	2 6 1 1	31 31 28 115

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
High water holding capacity, seasonal high water table.				
	512-PP7B	Birdsfoot Trefoil	3	26
		Meadow Fescue	6	31
		Timothy	1	28
		Redtop	1	115
Group 8: High water holding capacity, less than 12 percent slopes.	512-PP8	White Ladino Clover	1	20
		Orchardgrass	3	45
		Meadow Fescue	6	31
	512-PP8B	White Ladino Clover	1	20
		Festulolium	7	36
		Meadow Fescue	6	31
Group 9: High water holding capacity, greater than 12 percent slopes.	512-PP9	Red Clover	5	32
		Orchardgrass	3	45
		Meadow Fescue	6	31
Group 10: Organic soils, wetlands, ledge outcrop.	—-	Planting not feasible.	—-	—-

Refer to Wisconsin Agronomy Technical Notes 5 and 6 for companion crop recommendations.

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Pasture for Horses/Sheep				
Groups 1, 4, 7: Seasonal high water table.	512-PHS1	Kentucky Bluegrass	4	200
		Meadow Fescue	4	21
		White Ladino Clover	1	20
	512- PSH1A	Kentucky Bluegrass	4	200
		Meadow Fescue	4	21
		Birdsfoot Trefoil	3	26
		Kentucky Bluegrass	2	100

Forage Suitability Group	Seed Calculator Code[1]	Species	Lbs. PLS per Acre	Seeds per Square Foot
Groups 5, 6, 7, & 8: Moderate to high water holding capacity.	512-PHS2	Festulolium White Ladino Clover	7 1	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.

Refer to Wisconsin Agronomy Technical Notes 5 and 6 for companion crop recommendations.

Table 4 Common Plants and Recommended Seeding Rates

Common Name	Scientific Name	Moisture Regime	Forage Suitability Groups	Single Species Seeding Rate (PLS) Lbs./Ac.	Seeds/Lb.	Seeds/Ft^2 /Lb./Ac.
Introduced Grasses						

Common Name	**Scientific Name**	**Moisture Regime**	**Forage Suitability Groups**	**Single Species Seeding Rate (PLS) Lbs./Ac.**	**Seeds/Lb.**	**Seeds/Ft^2 /Lb./Ac.**
Chewings Red Fescue	Festuca rubra L. ssp. Fallax	D, DM, M	2-3, 5, 6, 8, 9	5	350,000	8
Creeping Red Fescue	Festuca rubra	DM, M, WM	1, 4-9	5	350,000	8
Festulolium*	Festuca x Lolium*	DM, M, WM	1-9	12	227,000	5.2
Italian or Annual Ryegrass	Lolium perenne L. ssp. multiflorum	DM, M, WM	1, 4- 9	20	227,000	5.2
Kentucky Bluegrass	Poa pratensis	D, DM, M, WM, W	1-9	8	2,177,000	50
Meadow Fescue	Schedonorus pratensis	DM, M, WM	1, 4-9	12	227,000	5.2
Orchard Grass*	Dactylis glomerata L.*	D, DM, M, WM	1-9	10	653,000	15
Perennial Ryegrass	Lolium perenne	DM, M, WM	1, 4-9	20	227,000	5.2
Redtop	Agrostis gigantea	M, WM, W	1, 4, 7	4	4,990,000	114.5
Smooth Bromegrass*	Bromus inermis*	D, DM, M, WM	1-9	20	136,000	3.1
Tall Fescue*	Schedonorus arundinaceus*	D, DM, M, WM	1-9	12	227,000	5.2
Timothy*	Phleum pratense*	DM, M, WM, W	1, 4-9	8	1,230,000	28.2
Introduced Legumes						
Alfalfa*	Medicago sativa*	D, DM, M	2-3, 5, 6, 8, 9	12	219,000	5.0
Alsike Clover	Trifolium hybridum	M, WM, W	1, 4, 5, 7, 8, 9	3	680,000	15.6
Birdsfoot Trefoil*	Lotus corniculatus*	DM, M, WM, W	1, 4-9	7	375,000	8.6

CONTINUED...Table 4 Common Plants and Recommended Seeding Rates

Common Name	Scientific Name	Moisture Regime	Forage Suitability Groups	Single Species Seeding Rate (PLS) Lbs./Ac.	Seeds/Lb.	Seeds/Ft^2 /Lb./Ac.
Red Clover*	Trifolium pratense*	DM, M, WM	1-9	10	275,000	6.3
White Ladino Clover*	Trifolium repens*	DM, M, WM	1, 4, 5, 7, 8, 9	3	871,650	20
Native Grasses						
Big Bluestem*	Andropogon gerardii*	D, DM, M, WM	1-9	11	165,000	3.8
Indian Grass*	Sorghastrum nutans*	D, DM, M, WM, W	1-9	10	192,000	4.4
Switchgrass*	Panicum virgatum*	D, DM, M, WM, W	1-9	7	389,000	8.9

Species with an asterisk can be seeded individually at the recommended pure stand rates based on Pure Live Seeds (PLS).

Refer to Wisconsin Agronomy Technical Note 6 for the Forage Suitability Group (FSG) descriptions.

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. Refer to Table 3 for the number of seeds per pound of a particular specie.

Table 5 Recommended Varieties of Warm-Season Grass for pasture and hayland(See Figure 1)

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

Table 6 Biomass Planting Recommendations

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

Refer to Wisconsin Agronomy Technical Notes 5 and 6 for companion crop recommendations.

STATEMENT OF WORK
Forage and Biomass Planting (512)
Wisconsin

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

DESIGN

Deliverables

1. Design documents that demonstrate criteria in practice standard have been met and are compatible with planned and applied practices. Practice standard criteria related computations and analyses to develop plans and specifications including but not limited to:
    a. Document plant species selection criteria that were used.
    b. Required seedbed condition and preparation methods.
    c. Soil and seed amendments needed.
    d. Variety, origin and amount of each plant species to be planted.
    e. Planting dates, seed placement requirements and description of planting equipment.
    f. Instructions as needed for placing different seed types (i.e. fluffy, large, small, slick and dense) in suitable drill boxes.
    g. Supporting erosion control practices.
2. Written plans and specifications including location map, sketches and drawings shall be provided to the client that adequately describes the requirements to install the practice.
3. Operation and maintenance plan.
4. Certification that the design meets practice standard criteria and comply with applicable laws and regulations.
5. Documentation requirements of design modifications during practice installation.

INSTALLATION

Deliverables

1. Documentation of pre-application conference with client and contractor.
2. Staking and layout according to plans and specifications including applicable layout notes.
3. Application inspection.
    a. Actual materials used.
    b. Inspection records.
4. Facilitate, implement and document required design modifications with client, original designer, permitting and funding agencies.
5. Advise client/NRCS on compliance issues with all federal, state, tribal, and local laws, regulations and NRCS policies during installation.
6. Certification that the application process and materials meets design and permit requirements.

CHECK OUT

Deliverables

1. Records of application.
    a. Extent of practice units applied and location identified on a map.
    b. Final quantities of materials used.
2. Certification that the application meets NRCS standards and specifications.
3. Exit conference with client and contractor.

4. Provide the following information to the NRCS field office servicing the relevant land unit for entry into the Performance Results System (PRS):
    a. Technical Service Provider Name
    b. Customer name
    c. USDA program funding the practice (if known)
    d. Location of work (state, county, conservation district, land tract identifier)
    e. Land use of field where the practice was installed (cropland, etc.)
    f. NRCS practice name and quantity of practice installed in appropriate units

REFERENCES

- WI Field Office Technical Guide (eFOTG), Section IV, Conservation Practice Standard 512, Forage and Biomass Planting
- NRCS National Environmental Compliance Handbook
- NRCS Cultural Resources Handbook

Spray Field B & C - Cattle Removed; Non-Harvested Perennial Vegetation, No nutrient additions (Existing Hay Crop Maintained)

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

Existing Hay Crop Maintained...No Major Reseeding Anticipated

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.				

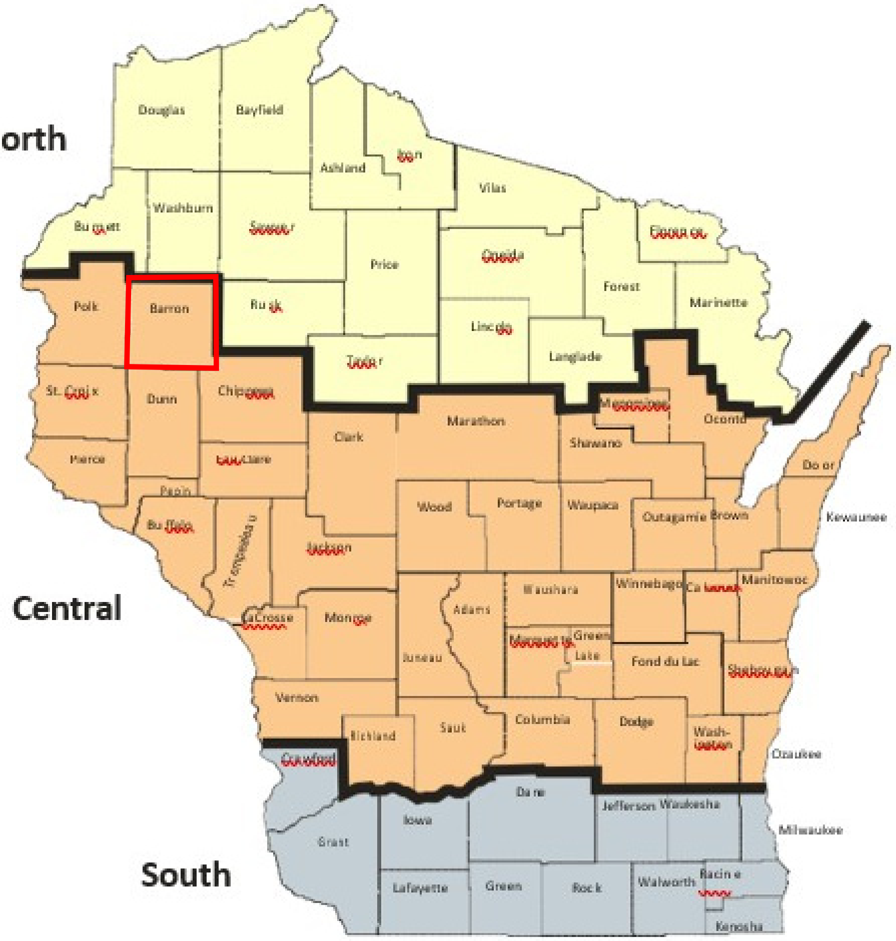

Table 14 Seeding Date/Ranges for Native Mixtures and Companion Crops

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

STATEMENT OF WORK
Conservation Cover (327)
Wisconsin

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

DESIGN

Deliverables

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

INSTALLATION

Deliverables

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

CHECK OUT

Deliverables

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

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

REFERENCES

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

N - NRCS CPS – PRESCRIBED GRAZING (CODE 528)

United States Department of Agriculture

Natural Resources Conservation Service

CONSERVATION PRACTICE STANDARD

PRESCRIBED GRAZING

CODE 528

(ac)

DEFINITION

Managing the harvest of vegetation with grazing and/or browsing animals with the intent to achieve specific ecological, economic, and management objectives.

PURPOSE

Apply this practice as a part of a conservation management system to achieve one or more of the following:

- Improve or maintain desired species composition, structure and/or vigor of plant communities
- Improve or maintain quantity and/or quality of forage for grazing and browsing animals' health and productivity
- Improve or maintain surface and/or subsurface water quality and/or quantity
- Improve or maintain riparian and/or watershed function
- Reduce soil erosion, and maintain or improve soil health
- Improve or maintain the quantity, quality, or connectivity of food and/or cover available for wildlife
- Manage fine fuel loads to achieve desired conditions

CONDITIONS WHERE PRACTICE APPLIES

practice applies to all lands where grazing and/or browsing animals are managed.

CRITERIA

General Criteria Applicable to All Purposes

Manage stocking rates and grazing periods to adjust the intensity, frequency, timing, duration, and distribution of grazing and/or browsing to meet the planned objectives for the plant communities, and the associated resources, including the grazing and/or browsing animals.

Remove forage in accordance with site production limitations, rate of plant growth, the physiological needs of forage plants, and the nutritional needs of the animals.

Provide desired grazed/browsed plants sufficient recovery time from grazing/browsing to meet planned objectives. The recovery period can be provided for part or all of the growing season of key plants. Deferment and/or rest will be planned for critical periods of plant or animal needs.

Manage livestock movements based on rate of plant growth, available forage, and identified objectives such as utilization, plant height or standing biomass, residual dry matter, and/or animal performance.

Manage grazing and/or browsing animals to maintain adequate vegetative cover on sensitive areas (i.e., riparian, wetland, habitats of concern, and karst areas).

Provide adequate quantity and quality of drinking water during period of occupancy.

Develop contingency plans to deal with expected episodic disturbance events (e.g., drought, wildfire, insect infestation, etc.).

Develop monitoring plans that directly support adaptive management decisions based upon identified ecologic triggers and thresholds to optimize the conservation outcome for the selected purposes.

Conform to all applicable Federal, State, Tribal and local laws. Seek measures to avoid adverse effects to endangered, threatened, and candidate species and their habitats.

Additional Criteria to Improve or Maintain the Health and Vigor of Desired Plant Communities.

Base the intensity, frequency, timing, and duration of grazing and/or browsing on desired plant health, expected productivity, and composition of key species to meet management objectives.

Plan periodic deferment from grazing and/or browsing to maintain or restore the desired plant community following grazing/browsing and episodic events, such as wildfire or severe drought.

Where appropriate, test soil periodically for nutrient status and soil reaction, and apply fertilizer and/or soil amendments according to soil test results to improve or maintain plant vigor.

Average stocking rates (animal units/acre) over the growing season shall not exceed those calculated in an animal forage balance unless seasonal forage production is higher than the estimated amount and minimum forage heights are maintained. The animal forage balance must also take supplemental feed into account.

The plan shall identify the primary pasture forage species and minimum stubble height using Table 1. Grazing shall be initiated when the designated species reaches a minimum height and ceased when a minimum stubble height is reached. Minimum heights may be exceeded for specific management objectives as outlined in the plan.

Table 1. Minimum Heights of Pasture Species for Initiating and Terminating Grazing

Species	Begin Grazing	End Grazing
	Minimum to Optimum Height of Vegetative Growth	Minimum
Alfalfa	8-12	4
Red Clover	8-12	4
Alsike Clover	8-12	4
Ladino Clover	8-12	4
Kura Clover	8-12	4
Festololium	6-8	3
Kentucky Bluegrass	4-6	2
Meadow Fescue	8-12	4
Orchardgrass	8-12	4
Perennial Ryegrass	6-8	3
Reed Canarygrass	8-12	4
Smooth Brome	8-12	4
Tall Fescue	8-12	4
Timothy	8-12	4
Big Bluestem	12-14	6
Indiangrass	12-14	6

Species	Begin Grazing	End Grazing
	Minimum to Optimum Height of Vegetative Growth	Minimum
Little Bluestem	4-6	2
Sideoats Grama	4-6	2
Switchgrass	12-14	6
*Minimum stubble height is critical if stand is to be maintained. This applies to that part of the grazing season after the initial rapid growth period in early May, as well as at the end of the grazing season.		

Defer grazing in the spring on out-wintering or bale grazing area until forage plants have recovered to the minimum pre-grazing height.

Additional Criteria to Improve or Maintain Quantity and Quality of Forage for Animal Health and/or Productivity

Plan grazing and/or browsing to match forage quantity and/or quality goals of the producer within the capability of the resource to respond to management.

Enhance diversity of rangeland and pasture plants to optimize delivery of nutrients to the animals by planning intensity, frequency, timing, and duration of grazing and/or browsing.

Plan intensity, frequency, timing, and duration of grazing and/or browsing to reduce animal stress and mortality from toxic and/or poisonous plants.

Provide supplemental feed and/or minerals as needed to balance with forage consumption to meet the desired nutritional level for the kind and class of grazing and/or browsing livestock.

Base the dietary needs of livestock on the National Research Council's Nutrient Requirements of Domestic Animals or similar scientific sources with appropriate adjustments made for increased energy demand required by browsing or grazing animals foraging for food including travel to and from grazing/browsing area.

Manage livestock to avoid the spread of disease, parasites, and contact with harmful insects and plants. An example is to avoid grazing young stock in paddocks following mature animals when Johne's disease is a concern or returning sheep to a paddock before the parasite cycle has completed.

Additional Criteria to Improve or Maintain Surface and/or Subsurface Water Quality and/or Quantity.

Minimize concentrated livestock areas to enhance nutrient distribution and improve or maintain ground cover.

Manage intensity, frequency, timing, and duration of grazing, browsing and/or feeding to:

- Minimize deposition or flow of animal wastes into water bodies.
- Minimize animal impacts on stream bank or shoreline stability.
- Maintain or improve hydrologic function including infiltration and/or filtering capacity and soil surface stability to reduce runoff by providing adequate ground cover, plant spacing, and plant density.
- Ensure the location and management of supplemental feeding, out-wintering, and winter feeding areas are planned and implemented to address any identified water quality resource concerns.

Additional Criteria to Improve or Maintain Riparian and/or Watershed Function.

Minimize concentrated livestock areas to improve or maintain riparian/floodplain plant community structure and functions.

Plan intensity, frequency, timing and duration of grazing and/or browsing to:

- Provide adequate ground cover and plant density to maintain or improve infiltration capacity and reduce runoff.
- Provide optimum ground cover, plant density, and/or plant structure to maintain or improve filtering capacity of the vegetation.
- Maintain adequate riparian community structure and function to sustain associated riparian, wetland, floodplain, and stream species.

Additional Criteria to Reduce Soil Erosion and Maintain or Improve Soil Health

Minimize concentrated livestock areas, trailing, and trampling to reduce soil compaction, excess runoff and erosion, and maintain soil organic matter.

Plan intensity, frequency, timing, and duration of grazing and/or browsing to provide adequate ground cover, litter, and canopy to maintain or improve infiltration.

Additional Criteria to Improve or Maintain Food and/or Cover for Fish and/or Wildlife Species of Concern

Identify species of concern in the objectives of the prescribed grazing plan.

Plan intensity, frequency, timing, and duration of grazing and/or browsing to provide for the development and maintenance of the plant structure, density, and diversity needed for the habitat requirements of the desired fish and wildlife species of concern.

Additional Criteria for Management of Fine Fuel Load

Plan intensity, frequency, timing, and duration of grazing and/or browsing to manage fuel continuity and loading to reduce wildfire hazard and/or facilitate desired conditions for prescribed burns.

CONSIDERATIONS

Protect soil, water, air, plant, and animal resources when locating livestock feeding, supplementation, handling, and watering facilities.

Design and install livestock feeding, handling, and watering facilities in a manner to improve and/or maintain animal distribution and forage production. Design and install facilities to minimize stress, the spread of disease, parasites, contact with harmful organisms, and toxic plants.

Utilization, stubble height, and other target levels are tools that can be used in conjunction with monitoring to help ensure that resource conservation and producer objectives are met.

Where practical and beneficial, start the grazing sequence in a different management unit each growing season.

When weeds are a significant problem prescribed grazing and/or browsing should be implemented in conjunction with other pest management practices to promote plant community resistance to invasive species and protect desired plant communities.

Prescribed grazing should consider the needs of other enterprises utilizing the same land, such as wildlife and recreational uses.

Develop alternatives that minimize additional grazing management infrastructure while still achieving plan objectives for the desired fish and wildlife species of concern.

Provide deferment or rest from grazing or browsing as necessary to ensure the success of prescribed fire, brush management, seeding, or other conservation practices to prevent stress or damage to key plants

Improve carbon sequestration in biomass and soils through management of grazing and/or browsing to produce the desired results.

Plan biosecurity safeguards to prevent the spread of disease between on-farm or ranch classes of livestock and between livestock farm or ranch units.

Provide shelter in the form of windbreaks, sheds, shade structures, and other protective features where conditions warrant to protect livestock from severe weather, intense heat/humidity, and predators.

If nutrients are being applied, Wisconsin NRCS Conservation Practice Standard (WI NRCS CPS), Nutrient Management (Code 590) will be applied.

Maintain conservative stocking rates as a drought contingency strategy to minimize detrimental consequences during drought on economic and ecological sustainability.

Enhance pasture sustainability by including multiply functional groups (grasses, legumes, and forbs) of forages.

Use mechanical means, such as harvesting, clipping, and inter-seeding of pastures to manipulate the pasture sward.

Plan access roads or animal trail placement to minimize erosion and enhance livestock flow.

PLANS AND SPECIFICATIONS

Prepare a prescribed grazing plan for all planned conservation management units where grazing and/or browsing will occur according to State standards and specifications.

Prescribed grazing plan will include:

- Goals and objectives clearly stated.
- Resource inventory that identifies:
    - Existing resource conditions and concerns.
    - Ecological site or forage suitability group.
    - Opportunities to enhance resource conditions.
- An overview plan map or maps with the following information:
    - Location of existing and proposed structural practices such as fences, water developments, animal trails, access roads, etc., including seasonal availability and quality of watering sites.
    - Location of critical and sensitive areas to grazing livestock such as shorelines, wetlands, forests, and natural areas.
    - Direction of livestock flow in a rotational stocking system.
    - Size and location of permanent paddocks (pasture divisions) and a typical temporary paddock.
- Forage inventory of the expected forage quality, quantity, and species in each management unit(s).
- Forage-animal balance developed for the grazing plan that ensures forage produced or available meets forage demand of livestock and/or wildlife.
- Grazing plan developed for livestock that identifies periods of grazing and/or browsing, deferment, rest, and/or other treatment activities for each management unit that accommodates the flexibility needed for adaptive management decisions as supported by the contingency plan and monitoring plan in order to meet goals and objectives.
- Contingency plan developed that details adaptive management decisions to avoid damaging the sward during severe drought and prolonged wetness, such as moving livestock to a feedlot or “sacrifice paddock” until the forage plants have recovered or the soils have become dry enough to avoid compaction. A sacrifice paddock should be big enough to feed the livestock and hold them. It should not be considered part of the acres certified as prescribed grazing.

- Monitoring plan developed with appropriate protocols and records that assess whether the grazing strategy is resulting in a movement toward meeting goals and objectives. Short-term monitoring includes grazing records in each pasture unit. Long-term monitoring determines whether the resource concerns have been solved. Identify the key areas, key plants, or other monitoring indicators that the manager should evaluate in making grazing management decisions.

OPERATION AND MAINTENANCE

Operation

Prescribed grazing will be applied on a continuing basis throughout the livestock occupation period of all planned grazing units.

Adaptive management decisions will be made as needed and documented within the plan to ensure that the goals and objectives of the prescribed grazing strategy are met.

Maintenance

Monitoring data and grazing records will be used on a regular basis within the prescribed grazing plan to ensure that objectives are being met, or to make necessary changes in the prescribed grazing plan to meet objectives.

All facilitating and accelerating conservation practices (e.g., WI NRCS CPSs, Fence (Code 382), Pest Management (Code 595), Brush Management (Code 314), Forage and Biomass Planting (Code 512), etc.) that are needed to effect adequate grazing and/or browsing distribution as planned by this practice standard will be maintained in good working order and operated as intended.

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O - FORM 3400-208 WQT CHECKLIST

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

Water Quality Trading Checklist

Form 3400-208 (1/14)

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

Applicant Information

Permittee Name: Cambrian Innovation
Permit Number: WI- 0067041-01-0
Facility Site Number: Not assigned
Facility Address: 1052 6th St
City: Almena
State: WI
ZIP Code: 54805
Project Contact Name (if applicable): Andy Kingman
Address: 15 Main Street, Suite 318
City: Watertown
State: MA
ZIP Code: 02472
Project Name: Cambrian Almena Project, LLC
Receiving Water Name: Unnamed Trib. of Hay River
Parameter(s) being traded: Phosphorus
HUC 12(s): 070500070605

Credit Generator Information

Credit generator type (select all that apply):

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

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

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

Will a broker/exchange be used to facilitate trade? ○ Yes *(include description and contact information in WQT plan)* ● No

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

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

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

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

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

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

Discharge Type	Practices Used to Generate Credits	Method of Quantification	Trade Agreement Number	Have the practice(s) been formally registered?
○ Urban NPS ● Agricultural NPS ○ Other	Row Crop Fields to Perennial Vegetation, Nutrient Apps Terminated	SnapPlus	Not Assigned (Internally Agreement #1)	○ Yes ● No ○ Only in part
○ Urban NPS ○ Agricultural NPS ● Other	Spray Ops Terminated, Perennial Vegetation	SnapPlus	Not Assigned (Internally Agreement #2)	○ Yes ● No ○ Only in part
○ Urban NPS ○ Agricultural NPS ○ Other				○ Yes ○ No ○ Only in part
○ Urban NPS ○ Agricultural NPS ○ Other				○ Yes ○ No ○ Only in part
○ Urban NPS ○ Agricultural NPS ○ Other				○ Yes ○ No ○ Only in part
○ Urban NPS ○ Agricultural NPS ○ Other				○ Yes ○ No ○ Only in part
○ Urban NPS ○ Agricultural NPS ○ Other				○ Yes ○ No ○ Only in part
○ Urban NPS ○ Agricultural NPS ○ Other				○ Yes ○ No ○ Only in part

Does plan have a narrative that describes:			Plan Section
a. Description of existing land uses	● Yes	○ No	Section 2/6
b. Management practices used to generate credits	● Yes	○ No	Section 2/6/10
c. Amount of credit being generated	● Yes	○ No	Section 8
d. Description of applicable trade ratio per agreement/management practice	● Yes	○ No	Section 7
e. Location where credits will be generated	● Yes	○ No	Sec 2 /Att A
f. Timeline for credits and agreements	● Yes	○ No	Section 8/11
g. Method for quantifying credits	● Yes	○ No	Section 6/7/8

Does plan have a narrative that describes:			Plan Section
h. Tracking procedures	● Yes	○ No	Section 12
i. Conditions under which the management practices may be inspected	● Yes	○ No	Section 12
j. Reporting requirements should the management practice fail	● Yes	○ No	Section 12
k. Operation and maintenance plan for each management practice	● Yes	○ No	Section 10/12
l. Location of credit generator in proximity to receiving water and credit user	● Yes	○ No	Att A
m. Practice registration documents, if available	● Yes	○ No	Att P
n. History of project site(s)	● Yes	○ No	Sections 2/3
o. Other: ______________________	○ Yes	○ No	

The preparer certifies all of the following:

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

Signature of Preparer	Date Signed
Simon Larson	8/29/2024

Authorized Representative Signature

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

Signature of Authorized Representative	Date Signed
Andy Kingman	08/29/2024

P - FORM 3400-207 MANAGEMENT PRACTICE REGISTRATION

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

Water Quality Trading Management Practice Registration

Form 3400-207 (R 1/14)

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

Applicant Information

Permittee Name: Cambrian Innovation
Permit Number: WI- 0067041-01-0
Facility Site Number: Not assigned
Facility Address: 1052 6th St
City: Almena
State: WI
ZIP Code: 54805
Project Contact Name (if applicable): Andy Kingman
Address: 15 Main Street, Suite 318
City: Watertown
State: WI
ZIP Code: 02472
Project Name: Cambrian Almena Project, LLC

Broker/Exchange Information (if applicable)

Was a broker/exchange be used to facilitate trade? ○ Yes ● No

Broker/Exchange Organization Name:
Contact Name:
Address:
Phone Number:
Email:

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

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

County: Barron
Closest Receiving Water Name:
Land Parcel ID(s):
Parameter(s) being traded: Phosphorus

The preparer certifies all of the following:

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

Signature of Preparer:
Date Signed:

Authorized Representative Signature

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

Signature of Authorized Representative:
Date Signed:

Leave Blank – For Department Use Only

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

Q - FORM 3400-206 NOTICE OF INTENT TO CONDUCT WATER TRADING

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 Cambrian Innovation	Permit Number WI- 0067041-01-0	Facility Site Number Not assigned		
Facility Address 1052 6th St		City Almena	State WI	ZIP Code 54805
Project Contact Name (if applicable) Andy Kingman	Address 15 Main Street, Suite 318	City Watertown	State MA	ZIP Code 02472
Project Name Cambrian Almena Project, LLC				
Receiving Water Name Unnamed Trib. of Hay River	Parameter(s) being traded Phosphorus	HUC 12(s) 070500070605		

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: Spray Irrig. nonpoint source

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:
● 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.)

Under this proposed trade, Saputo will cease spray irrigation to all five (5) spray fields (A, B, C, E and F) and terminate row cropping practices on Fields G and H. All fields will be managed as whole field perennial vegetation. Spray Fields A, E, and F and row crop Fields G and H will be converted to harvested perennial vegetation (hay) to draw down soil phosphorus levels. Spray Fields B & C will be converted to non-harvested perennial vegetation with prescribed beef cattle grazing (pasture) to manage vegetation. Cambrian, the credit user and discharge permit holder, will enter an agreement with Saputo, the credit generator to enable Cambrian direct discharge to the unnamed tributary of the Hay River.

Method for quantifying credits generated:
☐ Monitoring
☒ Modeling, Names: SnapPlus V20.4
☐ Other:

Projected date credits will be available: 1/1/2025 and 9/1/2025 - See WQT for further details

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
Simon Larson	8/29/2024

Authorized Representative Signature

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

Signature of Authorized Representative	Date Signed
Andy Kingman	08/29/2024

R – WI AGRONOMY TECHNICAL NOTE 6 – INTRODUCED GRASSES AND LEGUMES

Fields G & H (Establishing New Vegetation)

Spray Fields (Maintaining Existing Vegetation)

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.

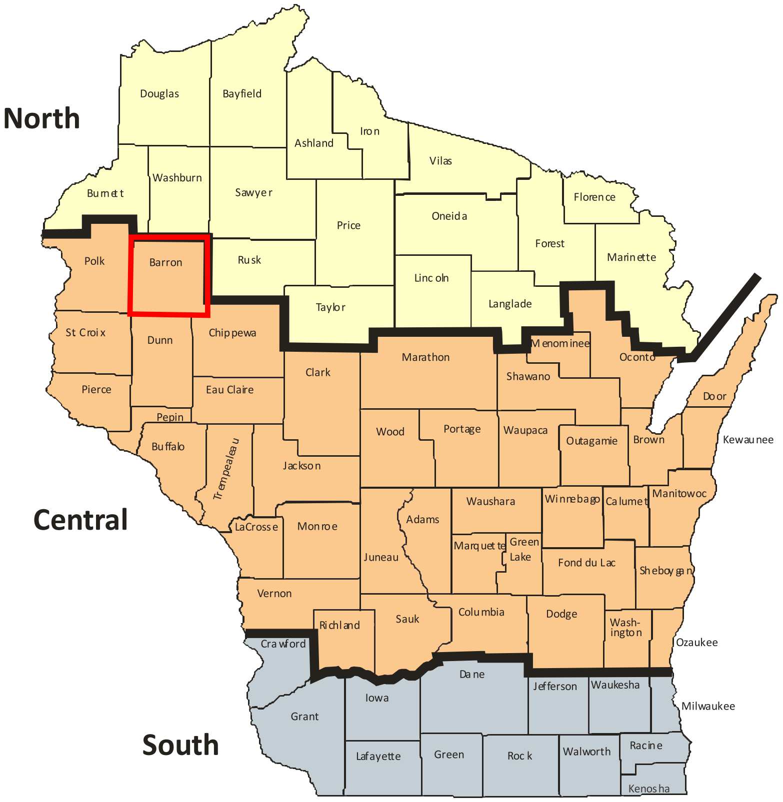
The frost seeding period in Wisconsin ranges from mid February to early March and will vary from year to year depending on the weather. Frost seeding is only allowed during active freezing and thawing cycles.

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	4	200
		Meadow Fescue	4	21
		White Ladino Clover	1	20
	512-PSH1A	Kentucky Bluegrass	4	200
		Meadow Fescue	4	21
		Birdsfoot Trefoil	3	26
Groups 5, 6, 7, & 8: Moderate to high water holding capacity.	512-PHS2	Kentucky Bluegrass	2	100
		Festulolium	7	36
		White Ladino Clover	1	20
	512-PHS2A	Kentucky Bluegrass	2	100
		Perennial Ryegrass	7	36
		White Ladino Clover	1	20
Groups 2 & 3: Low water holding capacity.	512-PHS3	Alfalfa	6	30
		Orchardgrass	3	45
Pasture for Hogs				
		Alfalfa OR	12	60
		Red clover	10	63
		Forage Rape OR	25	---
		Oats OR	35	---
		Sudangrass OR	2 bu/ac	---
		Hybrid Pearl Millet		
Summer Annuals for Supplemental Forage				
		Hybrid Pearl Millet	25	---
		Winter rye (fall planted)	1½ - 2 bu/ac	---
		Forage Rape	4 bu/ac	---
		Forage Turnips and Swedes	1½-2 lbs./ac	---
		Rape and Kale	4 lbs./ac	---

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

S – BASELINE SNAPPLUS 590 ASSESSMENT REPORT (NM3)

NM3: Field Data and 590 Assessment Plan

Reported For	**Saputo Cheese Plant Spray Fields**
Printed	**2024-08-15**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields A, B, C, E, F_BASELINE (WW, B & C Grazing Cows, Other Fields Grass Hay).snapDb	

Prepared for:
Saputo Cheese Plant Spray Fields
attn:Saputo

Field Data: 115 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
A				29.3	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**4**	**0**	**1.9**	**2**	235	2407	-80
B				29.2	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl	None-None-None-None-None-None-None-None	2019-2026	**4**	**0**	**2.3**	**3**	197	2384	-80
C				29.1	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl	None-None-None-None-None-None-None-None	2019-2026	**4**	**0**	**2.4**	**4**	231	2562	-80

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
E				13.2	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**4**	**0**	**1.9**	**3**	215	2627	-80
F-N				13.7	Barron	SPENCER SrB	5	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**5**	**0**	**1.9**	**2**	271	2387	-80

Crop Abbreviations

Abbreviation	Crop
GH	Grass hay
Pcl	Pasture, continuous stocking, low density

Tillage Abbreviations

Abbreviation	Tillage
None	None

NM3: Field Data and 590 Assessment Plan

Reported For	**Saputo Cheese Plant Row Crop Fields**
Printed	**2024-08-15**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields G & H_BASELINE (Corn Soy Row Crop & Nutrient Apps).snapDb	

Prepared for:
Saputo Cheese Plant Row Crop Fields
attn:Saputo Cheese Plant

Field Data: 25 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
G				15.9	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	No	No	Sg30-Cg-Sg30-Cg-Sg30-Cg-Sg30-Cg	FCND-FCND-FCND-FCND-FCND-FCND-FCND-FCND	2023-2030	**4**	**4.5**	**0.2**	**4**	14	193	-
H				9.1	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	No	No	Sg30-Cg-Sg30-Cg-Sg30-Cg-Sg30-Cg	FCND-FCND-FCND-FCND-FCND-FCND-FCND-FCND	2023-2030	**4**	**4.5**	**0.2**	**5**	77	193	0

Crop Abbreviations

Abbreviation	Crop
Cg	Corn grain
Sg30	Soybeans 30-36 inch row

Tillage Abbreviations

Abbreviation	Tillage
FCND	Fall Chisel, no disk

NM3: Field Data and 590 Assessment Plan

Reported For	**Saputo Cheese Plant Spray Fields**
Printed	**2024-08-15**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields A, B, C, E, F_REDUCTION (No WW, No Cows, B & C Non-Harvested Perennial Veg).snapDb	

Prepared for:
Saputo Cheese Plant Spray Fields
attn:Saputo

Field Data: 115 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
A				29.3	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**4**	**0**	**1.6**	**1**	235	396	-80
B				29.2	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Gnh-Gnh	None-None-None-None-None-None-None-None	2019-2026	**4**	**0.1**	**2.2**	**3**	197	1842	-60
C				29.1	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Gnh-Gnh	None-None-None-None-None-None-None-None	2019-2026	**4**	**0.1**	**2.2**	**3**	231	2019	-60

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
E				13.2	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**4**	**0**	**1.6**	**2**	215	616	-80
F-N				13.7	Barron	SPENCER SrB	5	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**5**	**0**	**1.6**	**1**	271	376	-80

Crop Abbreviations

Abbreviation	Crop
GH	Grass hay
Gnh	Grasslands, permanent, not harvested
Pcl	Pasture, continuous stocking, low density

Tillage Abbreviations

Abbreviation	Tillage
None	None

NM3: Field Data and 590 Assessment Plan

Reported For	**Saputo Cheese Plant Row Crop Fields**
Printed	**2024-08-15**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields G & H_REDUCTION (No Nutrient Apps, Alfalfa-Grass Hay).snapDb	

Prepared for:
Saputo Cheese Plant Row Crop Fields
attn:Saputo Cheese Plant

Field Data: 25 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
G				15.9	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	No	No	Sg30-[Cs-Fs]-AG-AG-AG-AG-AG	FCND-FCND-None-None-None-None-None-None	2023-2030	**4**	**1.5**	**0.7**	**1**	14	38	-
H				9.1	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	No	No	Sg30-[Cs-Fs]-AG-AG-AG-AG-AG	FCND-FCND-None-None-None-None-None-None	2023-2030	**4**	**1.5**	**0.7**	**2**	77	38	0

Crop Abbreviations

Abbreviation	Crop
[Cs-Fs]	Corn silage to Late Summer Direct Seeded Legume Forage
AG	Alfalfa/Grass
Sg30	Soybeans 30-36 inch row

Tillage Abbreviations

Abbreviation	Tillage
FCND	Fall Chisel, no disk
None	None

T – REDUCTION SNAPPLUS 590 ASSESSMENT REPORT (NM3)

NM3: Field Data and 590 Assessment Plan

Reported For	**Saputo Cheese Plant Spray Fields**
Printed	**2024-08-28**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields A, B, C, E, F_REDUCTION (No WW Apps).snapDb	

Prepared for:
Saputo Cheese Plant Spray Fields
attn:Saputo

Field Data: 115 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
A				29.3	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**4**	**0**	**1.6**	**1**	235	396	-80
B				29.2	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl	None-None-None-None-None-None-None-None	2019-2026	**4**	**0**	**2.3**	**3**	197	1785	-80
C				29.1	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl-Pcl	None-None-None-None-None-None-None-None	2019-2026	**4**	**0**	**2.3**	**3**	231	1961	-80

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
E				13.2	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**4**	**0**	**1.6**	**2**	215	616	-80
F-N				13.7	Barron	SPENCER SrB	5	200	0 - 2	1001 - 5000	No / No	Yes	No	GH-GH-GH-GH-GH-GH-GH-GH	None-None-None-None-None-None-None-None	2023-2030	**5**	**0**	**1.6**	**1**	271	376	-80

Crop Abbreviations

Abbreviation	Crop
GH	Grass hay
Pcl	Pasture, continuous stocking, low density

Tillage Abbreviations

Abbreviation	Tillage
None	None

NM3: Field Data and 590 Assessment Plan

Reported For	**Saputo Cheese Plant Row Crop Fields**
Printed	**2024-08-28**
Plan Completion/Update Date	**2024-08-30**
SnapPlus Version 20.4 built on 2021-06-03	
C:\SnapPlus2\MySnapPlusData\WDNR Resubmission\Saputo Fields G & H_REDUCTION (No Row Crops, No Nutrient Apps, Rye & Alfalfa-Grass Hay).snapDb	

Prepared for:
Saputo Cheese Plant Row Crop Fields
attn:Saputo Cheese Plant

Field Data: 25 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
G				15.9	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	No	No	Sg30-Csl+acv-AG-AG-AG-AG-AG-AG	FCND-SFC/Dcvr-None-None-None-None-None-None	2023-2030	**4**	**1.1**	**0.8**	**1**	14	-202	-
H				9.1	Barron	FREEON FnB	4	200	0 - 2	1001 - 5000	No / No	No	No	Sg30-Csl+acv-AG-AG-AG-AG-AG-AG	FCND-SFC/Dcvr-None-None-None-None-None-None	2023-2030	**4**	**1.1**	**0.8**	**2**	77	-202	0

Crop Abbreviations

Abbreviation	Crop
AG	Alfalfa/Grass
Csl+acv	Corn silage to annual cover crop

Tillage Abbreviations

Abbreviation	Tillage
FCND	Fall Chisel, no disk
None	None

Sg30	Soybeans 30-36 inch row

SFC/Dcvr	Spring Cultivation, cover crop disked

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

Tony Evers, Governor

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WISCONSIN
DEPT. OF NATURAL RESOURCES

9/23/2024

Simon Larson, Complete Filtration Resources
1900 E 24th Street
Marshfield, WI 54449

Subject: Cambrian Innovation - WPDES Permit WI-0067041
Water Quality Trading Plan – CONDITIONAL APPROVAL

Dear Mr. Larson:

The Department recently received a water quality trading plan (WQT Plan) supporting compliance with phosphorus effluent limits applicable to the new Cambrian Innovation Wastewater Treatment System. The initial plan was received in March of 2021, with subsequent versions received in March and August of 2024. Based on WDNR review, the final WQT Plan (dated 8/30/2024) is in general conformance with the WDNR Water Quality Trading Guidance and Section 283.84 of the Wisconsin Statutes. The WQT plan proposes discontinuation of Saputo Cheese spray irrigation as well as conversion of row crop agriculture to perennial vegetation. The timeline for practice installation, as set forth in the WQT plan, indicates row cropped fields will be converted to perennial vegetation by October 31, 2024 and spray irrigation will cease by August 31, 2025. Credits generated from approved practices result in available credit quantities shown in Table 1. These credits will be incorporated into Cambrian Innovation's draft WPDES permit and will be used to demonstrate compliance with phosphorus effluent limits upon commencement of discharge.

Table 1: Total Phosphorus Credits Available per WQT-2024-0023

Year	Available Credits (lbs/yr) – Interim	Available Credits (lbs/yr) – Long Term	Available Credits (lbs/yr) – Total
2025	66.5	0	66.5
2026	357.4	8.2	365.6
2027	353.5	12.4	365.9
2028	393.4	15.4	408.8
2029	385.6	16.6	402.2
2030	424.5	17.3	441.8

The Department conditionally approves the WQT Plan as a basis for water quality trading during the upcoming WPDES permit term. The Department has assigned the WQT plan a tracking number of WQT-2024-0023 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 issuance. 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 (608) 400-5596 or by email at matthew.claucherty@wisconsn.gov

Thank You,

Matt

Matt Claucherty
Phosphorus Implementation Coordinator
Wisconsin Department of Natural Resources

e-CC:

Alex Ciessau, SEH
Dan Schaefer, SEH
Jainish Patel, Cambrian Innovation
Andy Kingman, Cambrian Innovation
John Semenchuk, Complete Filtration Resources
Matt Seng, Cambrian Innovation
Tom Henning, SEH
Alison McVane, Saputo Cheese USA
Shawn Gilbert, Saputo Cheese USA
Jeffrey Derrick, Saputo Cheese USA
Cletus Ketter, Cambrian Innovation
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Mike Polkinghorn, DNR
Callie Lier, DNR