

Manure Irrigation, the Permitting Process and What You Need to Know & Other Nutrient Management Topics

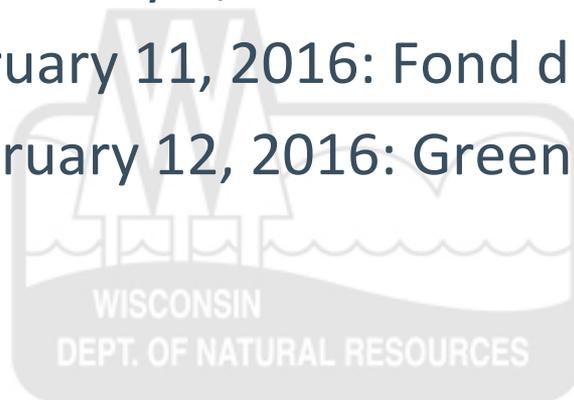
Joe Baeten

WDNR – Nutrient Management Program Coordinator

February 4, 2016: Rice Lake

February 11, 2016: Fond du Lac

February 12, 2016: Green Bay



Overview

- What is Manure Irrigation?
 - Potential Benefits
 - Potential Concerns
- Prevalence of Manure Irrigation at CAFOs
- Manure Irrigation Requirements
- Manure Irrigation Plan
- Manure Irrigation Workgroup
- NMP Review – Common Issues
- Common Questions from CAFOs

What is Manure Irrigation?

- The application of liquid manure or process wastewater to cropland using equipment that discharges manure into the air via a single nozzle or multiple nozzles or hoses and disperses the manure over distances greater than could be achieved using typical moving vehicle or manure hauling equipment.

What is Manure Irrigation?

- Center Pivot Systems



What is Manure Irrigation?

- Center Pivot Systems



Photo by Mark Borchardt

What is Manure Irrigation?

- Center Pivot Systems



What is Manure Irrigation?

- Traveling Gun



Photo by Mark Borchardt

What is Manure Irrigation?

- Tanker with Nozzle(s)



Potential Benefits

- Timing of manure application
 - Surface and groundwater protection
 - Less risk for manure surface runoff
 - Reduce leaching below root zone
 - Reduce entry in drain tiles
 - Recycle water / manure treatment
 - More precise nutrient management
- Road safety and reduced road damage
- Farm management
- Economic benefits

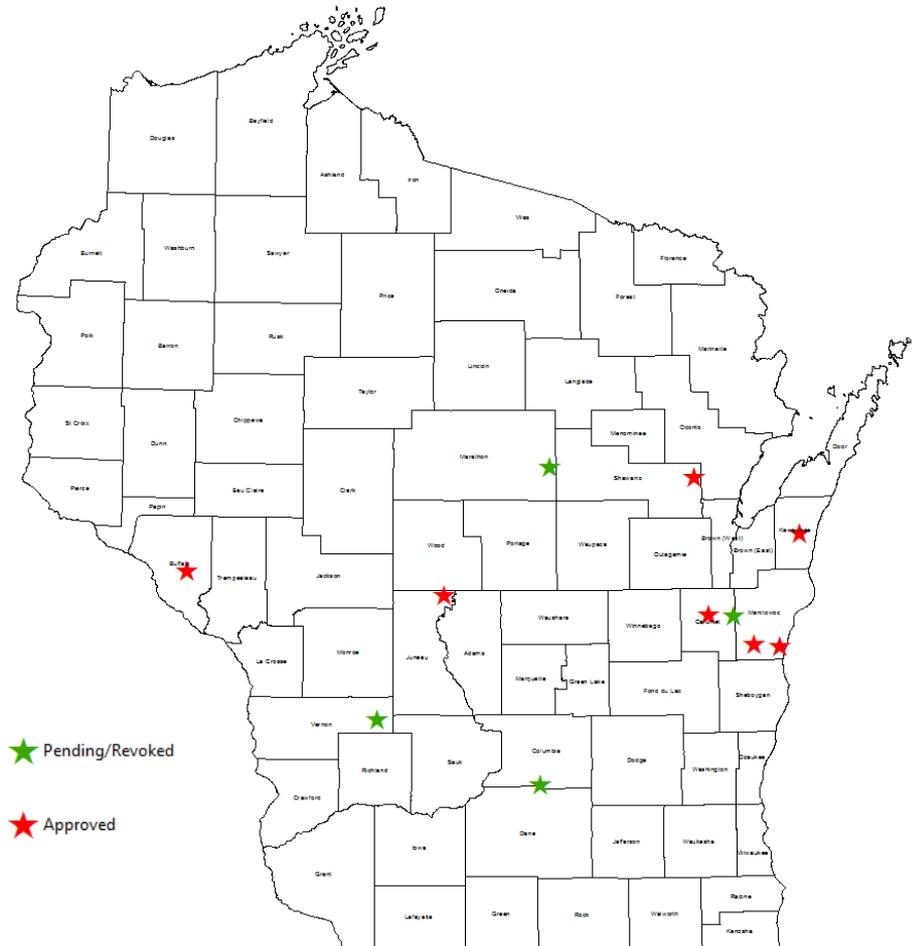


Potential Concerns

- Public health risk from airborne pathogens and other contaminants
 - Inhalation
 - Deposition on surface
- Drift or overspray
- Odor and air emissions
- Surface and groundwater contamination
- Implementation and compliance issues

Prevalence of MI at CAFOs

- 7 Approved
- 4 Pending or Temporarily Revoked
- WDNR does not track or regulate manure irrigation at non-CAFO farms.



Manure Irrigation Requirements

Current Manure Irrigation Setbacks for CAFOs		
<i>Restrictive Feature</i>	<i>Setback</i>	<i>Code Reference</i>
Community Public Water Supply Well	1000 feet	NR 214.14(1)(a)
Non-Community Water Supply Well	250 feet*	NR 214.14(1)(a)
Inhabited Dwelling	500 feet*	NR 214.14(1)(b)
Depth to Groundwater & Bedrock	5 feet*	NR 214.14(1)(c)
Direct Conduit to Groundwater	100 feet	NR 243.14(2)(b)8
Navigable Waters & Conduits	25-100 feet	NR 243.14(4)(a)
Wetland	25 feet	NR 243.14(4)(a)

*Greater setback compared to conventional application method.

Manure Irrigation Requirements

- Additional restrictions and limitations:
 - Ponding or runoff is prohibited,
 - Even distribution over the field,
 - Hydraulic application rate may not exceed 10,000 gallons per acre,
 - Operated in a load/rest cycle,
 - Annual soil testing requirements, and
 - Other conventional application requirements.

Manure Irrigation Requirements

- Other sections that give DNR authority:
 - Department may require reduced hydraulic application rates or grass buffer strips,
 - Department may restrict irrigation during times of the year (dormant or no crop established),
 - Department may require monitoring of BOD₅, TSS, forms of nitrogen, chloride, metals, or others pollutants,
 - Department may require the installation of a groundwater monitoring well system, and
 - Department may require more stringent requirements than what's in section NR 243.14.

Manure Irrigation Plan

- If a CAFO wants to apply manure and/or process wastewater via irrigation they must develop a manure irrigation plan.
- The manure irrigation plan is part of the farm's NMP.
- A manure irrigation plan consists of.....

Manure Irrigation Plan

- Narrative / Questionnaire
- Initially developed in April 2013.
- May be revised once the Manure Irrigation Workgroup and Research is complete.

DNR Manure or Process Wastewater Irrigation Questions
 April 2013

FIELDS

- What fields will be used for land application of liquid manure or process wastewater with irrigation equipment?
- Are these same fields addressed within all of the following: NMP narrative, NMP maps, NMP re-evaluations (e.g., SIMAP software)?

RESTRICTION MAPS AND SETBACKS

- Do restriction maps reflect all NR 243.14 general land application requirements and SWQMA setbacks/practices?
- Do restriction maps reflect NR 214.14 prohibition on floodplain location and setback requirements for wells (250 feet), occupied residences (500feet- can be reduced or waived with written landowner permission, may be increased based on the type of irrigation system and potential for aesthetic and public health impacts) and bedrock or groundwater (5 feet separation from field surface)?
- Are manure irrigation applications planned to occur within grassed waterways shown on restriction maps? If yes, please contact DNR for additional SWQMA and field monitoring requirements.

IRRIGATED MANURE OR PROCESS WASTEWATER CHARACTERISTICS

- What type of liquid manure or process wastewater sources will be applied using irrigation equipment- digested manure, non-digested manure, solid separated manure?
- Have manure or process wastewater source(s) been tested by certified lab?
- What do lab sampling results show for NH_3 solids content? Please summarize using excel/spreadsheet or other format.
- Has a running average of lab sample results been calculated?
- Will sample results used to plan manure irrigation application rates?
- Has ammonia-N content been tested?
- Will ammonia-N content be used or tested in future to more accurately determine N availability of liquid manure or process wastewater?
- If manure digester is present, what is temperature is digester operated at- mesophilic or thermophilic temperature range (X X degrees)?
- Have manure digesters been shown with the potential to significantly reduce pathogen concentrations compared to undigested manure sources? Please cite source(s) of this info.
- Have other practices planned or implemented to control pathogens in manure and wastewater? If yes, please describe.
- Before using irrigation equipment, will additional samples of manure and process wastewater sources be collected and analyzed for ammonia-N content to more accurately determine N availability and refine application rates within the NMP plan?
- Will all future samples of irrigated manure or process wastewater sources shall be analyzed for ammonia-N content?

EQUIPMENT DESIGN

- What type of manure irrigation equipment will be used- mobile or center pivot system?
- What type nozzle(s) will be attached to irrigation equipment? Please provide copies of equipment and nozzle manufacturer specifications and photos of irrigation equipment and nozzles that will be used for manure irrigation applications(s).
- Does equipment or nozzle manufacturer specifications recommend operating pressures or other management practices to increase droplet size and reduce drift?
- Nozzles are designed to break liquid into droplets, which are measured in microns (1/1000 of a millimeter). A human hair is 100 microns. What is the median droplet size range (in microns) selected nozzle(s) can achieve?
- Were selected nozzle(s) designed to keep droplet size > 250 microns?
- Was equipment speed considered when selecting nozzle(s)?
- What height above the ground will nozzles be located?
- Will extensions or other attachments (e.g., drop tubes, hoses) be attached to equipment/nozzles to reduce drift?
- Will spray nozzles be located as near to the ground surface as practical to minimize wind drift of the wastewater?
- If under ground water irrigation lines are used to transport liquid manure and water, how will this equipment be designed to prevent manure cross contamination of groundwater resources?

EQUIPMENT OPERATION, TIMING AND METHODS

- What pressure range (psi) will irrigation equipment be operated at- 0-20psi, 20-40 psi, 40-60psi, > 60 psi, other?
- What speed range (mph or feet per min) will equipment be operated at? If more than one speed range is planned, please specify?
- Was nozzle design considered in determining planned equipment speeds?
- What height range (feet above ground) will application(s) occur at- 0-3ft, 3-10ft, 10-15ft, 15-20ft, > 20ft, other?
- What months will application(s) occur?
- Will application(s) occur before crop establishment?
- Will application(s) occur after established crops and during time(s) of peak crop nutrient need?
- Will split applications be used?
- Based upon concentrations of manure or process wastewater, what application rates are planned?
- Will any application rates exceed 10,000 gal/acre?
- Will application(s) be made to meet nutrient needs of following season/year crop(s)?
- Will irrigation equipment be connected to underground lines and risers in fields?
- Will irrigation equipment be connected to manure storage pits using above ground hoses?
- If under ground water irrigation lines are used to transport liquid manure and water to fields, how will this equipment be operated to prevent manure cross contamination of groundwater resources?
- How long will application(s) last? 1-2 hrs, 2-4 hrs, 4-6 hrs, 6-8 hrs, 8-10 hrs, > 10 hrs?
- Will application(s) occur during daylight hours?
- Will application(s) occur during night hours?
- How will irrigation equipment be calibrated to confirm target application rates are met?
- What frequency will equipment calibrations occur?

DRIFT AND RUNOFF PREVENTION + PATHOGEN REDUCTION

What strategies/monitoring procedures will be used to prevent drift or runoff of irrigated manure or process wastewater off of field(s) and into surface water resources/adjacent properties?

- Will application(s) only be completed during daylight hours?
- Will weather forecast be reviewed prior to all irrigated manure or process wastewater applications?
- Will copies of weather forecasts will be printed/saved and kept with the NMP plan to verify weather forecasts?
- What maximum forecast or observed wind speed will be used as threshold to shut equipment down to prevent drift off of field?
- Will the following weather conditions be monitored and recorded before and during application(s)?
 - o Wind speed and direction
 - o Sunlight exposure on field (e.g. full, partial, none)
 - o Air temperature
- What frequency will weather conditions be monitored during application(s) – every hr, 2hrs or other?
- What equipment will be used to evaluate weather conditions?
- What frequency will field conditions and boundaries will be visually monitored and recorded during application(s) to verify (via presence/absence) drift beyond field boundaries, entry into adjacent properties or nearby surface waters (e.g., ditches, streams, rivers, lakes- every hr, 2hrs, other)?
- Will irrigation modeling for field soil moisture conditions be used/calculated prior to application(s)? If yes, what model or techniques/methods will be used?
- If center pivot used, will end sprinkler be shut off during application to reduce drift?
- Will manure irrigation lines/equipment be inspected and recorded before and during application(s) to detect/prevent spills and leaks?
- What operating pressure range will be used, in tandem with selected nozzles or other equipment/management practices (e.g., speed, height, etc.), to maximize droplet size and minimize drift/runoff risk?

RESPONSE ACTIONS FOR DRIFT/RUNOFF OUTSIDE FIELD BOUNDARY

- What response actions will be followed if application(s) or drift/runoff from field and into water/water/adjacent properties?
- What response actions will be followed if irrigation line leaks/spills are detected?
- Will application be stopped immediately and spill response/containment/clean up procedures be implemented, including reporting such event to DNR staff?

DNR MANURE IRRIGATION RESEARCH AND SETBACK REQUIREMENTS

- Does farm understand the department is currently funding manure irrigation research to determine pathogen content and drift distance(s) using various irrigation equipment designs, and operating/field conditions?
- Does farm understand if such research demonstrates setbacks > 500 feet from occupied residences are necessary to protect public health and/or the environment, the department may require NMP revision and larger setback distances?

Manure Irrigation Plan

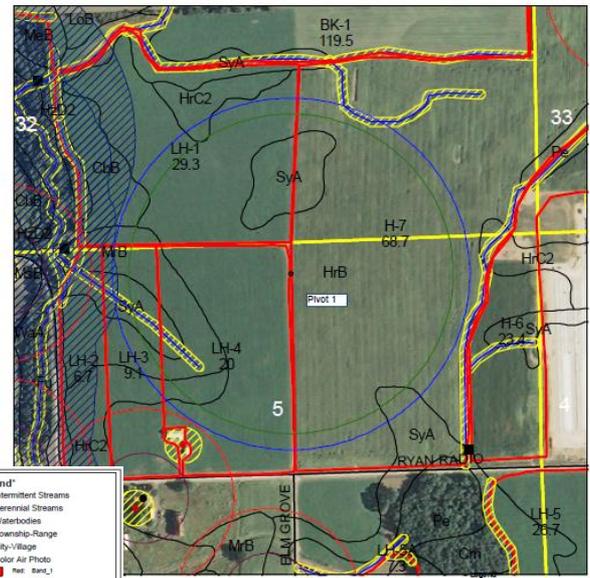
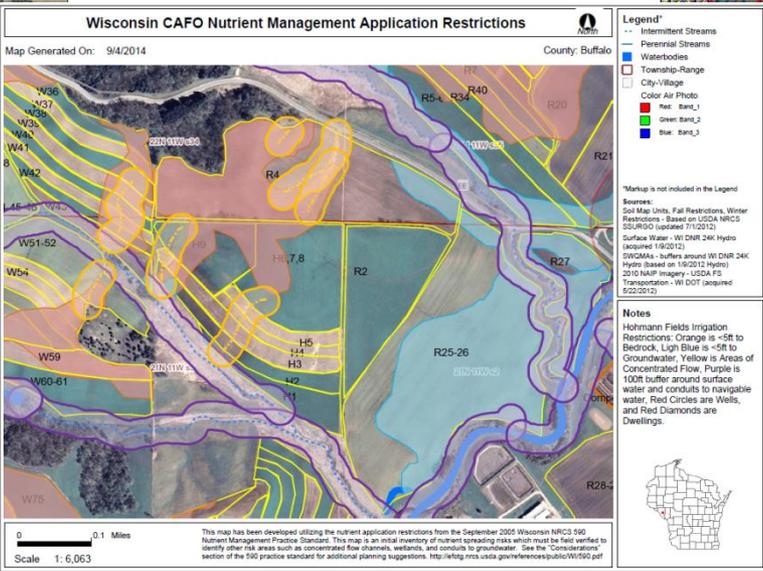
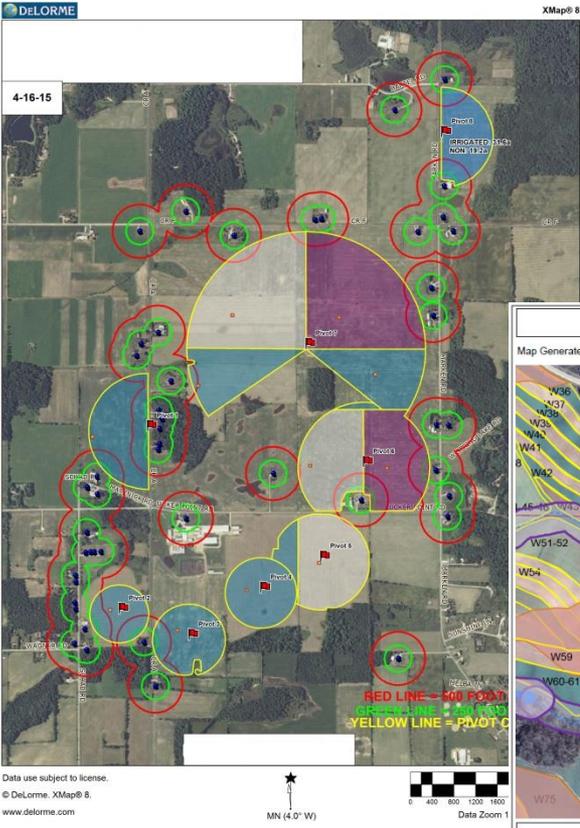
- Narrative / Questionnaire
 - Fields
 - Restriction Maps
 - Manure / Process Wastewater Characteristics
 - Equipment Design
 - Operation, Timing and Methods
 - Drift and Runoff Prevention
 - Response Actions for Drift / Runoff

Manure Irrigation Plan

- Restriction Maps
 - Only required for fields planned to be used for manure irrigation.
 - Should include all required setbacks and restricted soils.
 - Department does allow field verification of soils.
 - Must identify on map where manure will be irrigated.

Manure Irrigation Plan

- Restriction Maps



Data use subject to license.
© DeLorme, XMap® 8.
www.delorme.com

This map has been developed utilizing the nutrient application restrictions from the September 2005 Wisconsin NRCS 590 Nutrient Management Practice Standards. This map is an initial inventory of nutrient operating risks which must be field verified to identify other risk areas such as concentrated flow channels, wetlands, and conduits to groundwater. See the "Considerations" section of the 590 practice standard for additional planning suggestions. <http://efn14.nrcs.usda.gov/referencepublications/W590.pdf>

Manure Irrigation Plan

- Drift Monitoring Log

Irrigation Application Record Sheet

Field _____ Crop _____

Date	Time	Pivot Operating Properly		Wind Speed (mph)	Wind Direction	Sunlight Exposure (full, partial, none)	Temp. (°F)	Evidence of Surface Runoff		Evidence of Offsite Drift		Tile Outlets Inspected		Notes:
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	
		Yes	No					Yes	No	Yes	No	Yes	No	

Monitoring of irrigation equipment will be completed at least every _____ hour(s) when in operation.
 Any deficiencies found during monitoring activities should be explained in the notes section.

Manure Irrigation Plan

- Equipment Specifications
 - Typically you can get this information from the manufacture
 - Specs include:
 - Size of nozzle,
 - Operating pressures,
 - Droplet size,
 - Ability to operate the system in changing weather conditions,
 - Etc.

Manure Irrigation Plan

- Other Information:
 - Manure and process wastewater test results,
 - For manure sources planned to be used for irrigation.
 - Soil test results,
 - For fields proposed for manure irrigation only.
 - Photos of irrigation equipment.



Manure Irrigation Plan

- Department Review
 - Complete Manure Irrigation Plan is submitted to the Department.
 - Currently all plans are reviewed by Nutrient Management Program Coordinator (Joe Baeten).
 - An irrigation request is not a substantial revision.
 - Department denies or approves plan.
 - Approval is conditional.
 - Reporting requirements are done with the Annual Report and/or NMP Update.

Manure Irrigation Workgroup

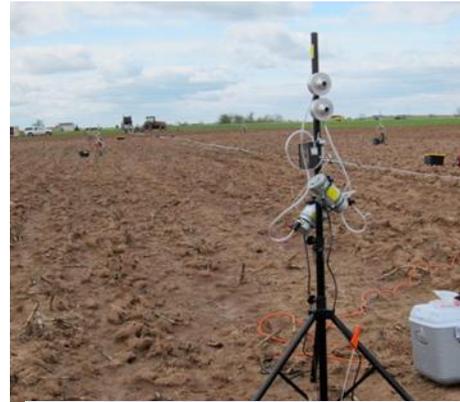
- Diverse workgroup:
 - 3 UW-Madison members (Chaired by Ken Genskow)
 - 1 USDA member
 - 2 WDNR members
 - 1 NRCS member
 - 1 DATCP member
 - 2 DHS members
 - 2 County Health Department members
 - 3 Dairy Farmers / PDPW members
 - 1 Agronomist member
 - 1 PNAAW member
 - 1 Organic Farmer / Concerned Citizen member
 - 1 WLWCA member

Manure Irrigation Workgroup

- Purpose of the workgroup is to review and develop guidance on the practices of applying livestock manure or process wastewater through irrigation equipment.
- Workgroup is developing a report that includes background information, discussions of factors influencing the concerns and benefits associated with the practices, and any recommendations developed by the group.
- Last face-to-face meeting held September 30, 2015.
- Expected release date for the report is mid-February 2016.
- <http://fyi.uwex.edu/manureirrigation/>

Manure Irrigation Workgroup

- Manure Irrigation Research
 - Identify weather variables (e.g., wind speed, solar radiation, relative humidity) most important for airborne pathogen transport during manure irrigation.
 - Develop statistical model to predict airborne pathogen transport.
 - Use quantitative microbial risk assessment to establish safe setback distances.



END OF MANURE IRRIGATION TALK QUESTIONS?

WISCONSIN
DEPT. OF NATURAL RESOURCES

NMP Review – Common Issues

- Lack of cross-referencing between SnapPlus and Restriction Maps.
 - Missing restriction maps for fields,
 - Field names don't match,
 - Missing restrictions in SnapPlus.

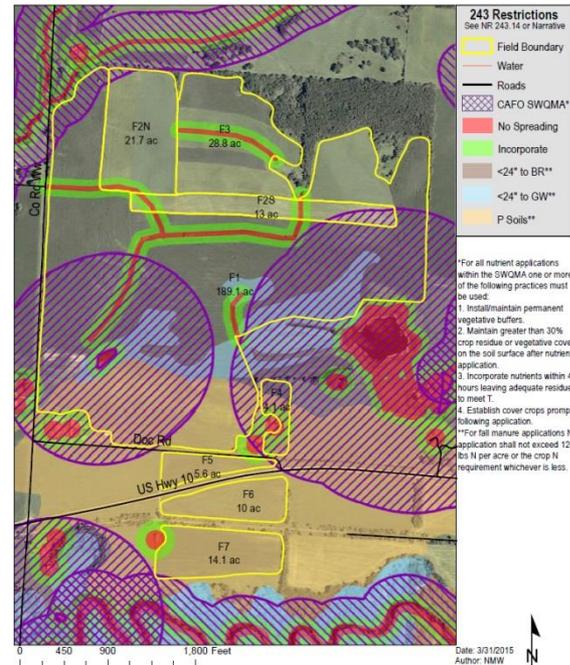
SnapPlus Field Data and 590 Assessment Plan

Reported For	243	Prepared for:	
Nutrient Management Plan			
Printed	2016-01-25		
Plan Completion/Update Date	2015-04-30		
SnapPlus Version	15.1 built on 2015-12-18		

WPDES Permitted Farm

Field Data: 1,428 Total Acres Reported.

Field Name	F. Grp	FBA Trct	FBA Fid	Ac.	County	Soil Map Symbol (Critical)	F. Slope %	F. Slop Len ft	Blow Field Slope To Water %	Dist To Water ft	N/Fld Ros	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/acre	Rot Avg Soil Loss t/acre	Rot Avg PI	Soil Test P ppm	Rot P205 lbs/ac	P205 Target lbs/ac	
Anderson		1950	1,2,3,4	58.8	Iron	DENGM E(204C)	11	150	2.1 - 6	1001 - 5000	%	No / No	No	No	[Og-Fj]-A-A-A-A	SCD-None-None-None	2015-2020	5	2.4	0.5	4	39	142	-
Andy Rowe				17.5	Iron	WORME T(815A)	2	250	6.1 - 12	301 - 1000	W %	No / No	No	No	Csl-[Og-Fj]-A-A-A-A	FCD-SCD-None-None	2014-2019	3	0.3	0.4	1	121	-130	-110
Bart Innis		344	2,3	23	Iron	SULTZ (574B)	3	200	2.1 - 6	1001 - 5000	P %	No / No	No	No	Csl-As-A-A-A-A	SFC-SCD-None-None	2014-2019	5	0.1	0.6	0	94	-4	0
Berube East				80.4	Iron	GICHGA M(444B)	4	200	0 - 2	1001 - 5000	C %	No / No	No	No	RCg-RCg-RCg-Csl-Csl	None-None-None-None	2014-2019	5	0.7	0.8	1	11	8	-
Berube West				150.3	Iron	GICHGA M(444B)	4	200	2.1 - 6	301 - 1000	R C %	No / No	No	No	RCg-RCg-RCg-Csl-Csl	None-None-NT-SFC-SFC	2014-2019	5	1.4	0.6	2	12	-11	-
Blanford		173	1	13.2	Iron	SULTZ (574B)	3	200	2.1 - 6	1001 - 5000	P L %	No / No	No	No	Csl-Csl-As-A-A-A	SFC-SFC-FCD-None	2014-2019	5	0.1	0.5	0	14	129	-
Carl Lindstrom		1785	1	22.8	Iron	GICHGA M(444B)	4	200	More than 12	0 - 300	S D %	No / No	No	No	GH-GH-GH-GH-GH	None-None-None-None	2014-2019	5	0	1.6	0	7	162	-



For all nutrient applications within the SWQMA one or more of the following practices must be used:
 1. Install/maintain permanent vegetative buffers.
 2. Maintain greater than 30% crop residue or vegetative cover on the soil surface after nutrient application.
 3. Incorporate nutrients within 48 hours leaving adequate residue to meet T.
 4. Establish cover crops promptly following application.
 **For fall manure applications N application shall not exceed 120 lbs N per acre or the crop N requirement whichever is less.

NMP Review – Common Issues

- Lack of cross-referencing between NMP and engineering documents.
 - Manure volumes/tonnage do not match,
 - Animal numbers do not match.
 - Narrative – SnapPlus – Engineering Docs – App.

NMP Review – Common Issues

- Missing tile line, field verification, and calibration logs
- Issues with recurring gullies / conc. flow paths
 - Not being vegetated
 - Not included on the restriction maps
 - Issue with reissuances



NMP Review – Common Issues

- Not receiving all SnapPlus reports (when data file isn't submitted)
 - Reports that should be submitted include (at minimum):
 - Compliance Check Report
 - Field Data and 590 Assessment Report
 - DNR CAFO Nutrient Mass Balance Report
 - DNR CAFO Annual Spreading
 - Annual Manure Production Report (for first year and each year of expansion)
 - Annual PI Report
 - Crop Trends Production Report
 - Soil Test Summary Report

NMP Review – Common Issues

- Missing 180-day storage calculation.
- Winter spreading maps missing greater setbacks
 - Identify area of the field where winter spreading will occur.
 - Ditches are flow channels.
- Missing land owner table in the narrative.
- Fields not identified as receiving other nutrient sources (industrial, septage, etc.)

Common Questions from CAFOs

- Because I'm a CAFO why can't I apply manure to a growing cover crop in the fall.
 - False, you can apply manure to a cover crop in the fall just be cautious; don't kill the crop.



Common Questions from CAFOs

- My manure lagoon is mapped as a lake and has a SWQMA, how can I change this?
 - Verification must be done by the appropriate government entity.



Common Questions from CAFOs

- How can I manage my solid manure during the Winter?
 - Solid manure can be applied during the winter except during February or March.
 - Must follow an approved winter spreading plan.
 - Be aware of snow depth and spreading requirements.
 - Solid manure can be headland stacked during February and March if there is no other storage at the production site.

Common Questions from CAFOs

- How can I manage my solid manure during the Winter?

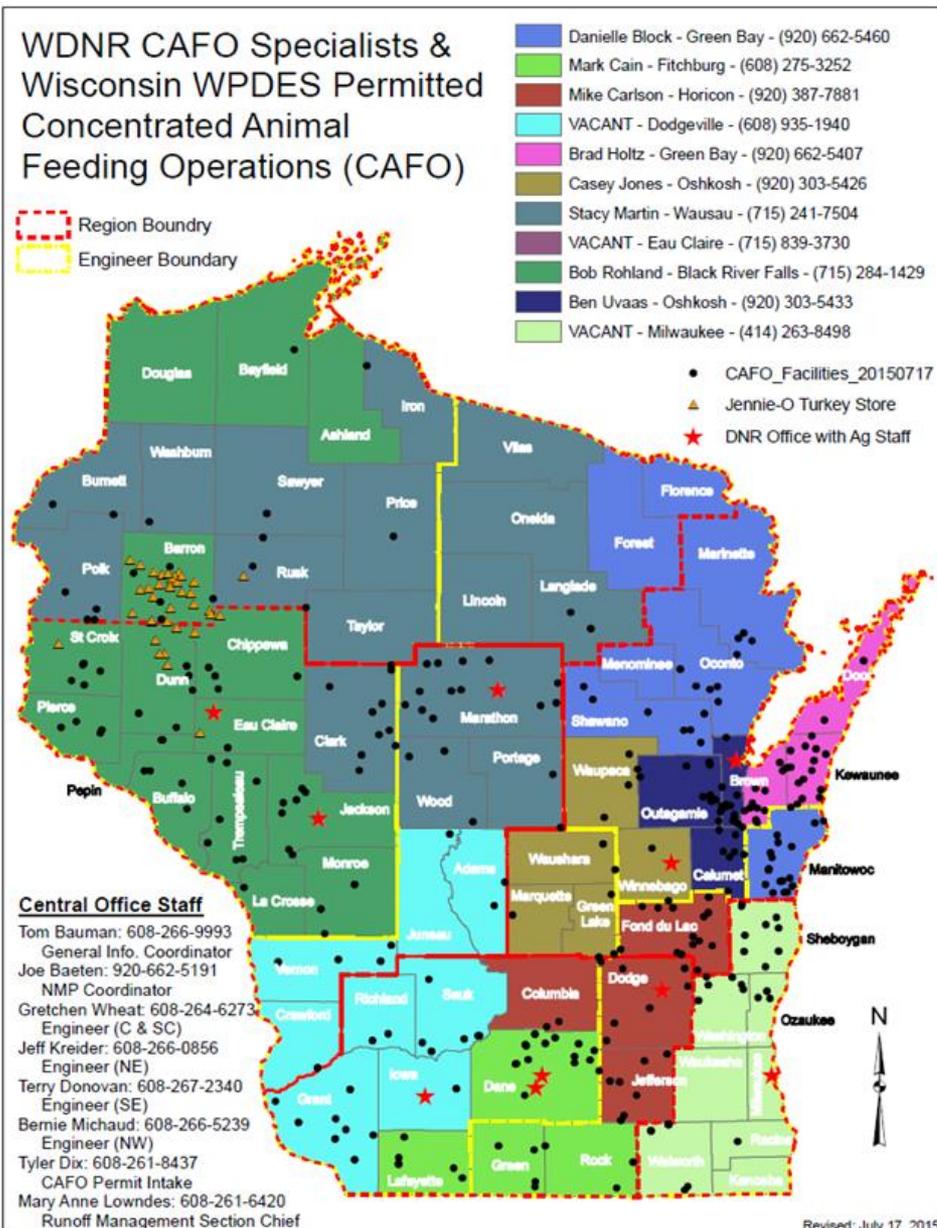
Headland Stack



**Solid Manure
Winter Spreading**



WDNR CAFO Staff Update



QUESTIONS?

Joe Baeten

WDNR Nutrient Management Program Coordinator

Green Bay Service Center

(920) 662-5191

Joseph.Baeten@Wisconsin.gov

WISCONSIN
DEPT. OF NATURAL RESOURCES