



Manure Management: Getting Started

Where do I begin with manure management? Many producers are asking this question. The following information is designed to help gain an overall view of your livestock operation. Maybe you are considering a Comprehensive Nutrient Management Plan (CNMP) because you are a Concentrated Animal Feeding Operation (CAFO) or anticipate signing up for Environmental Quality Incentive Program (EQIP) cost share assistance. Maybe you have had a complaint from a neighbor or maybe you just want to keep farming in the best manner possible. Regardless of your interest in

manure management, here are some questions to ask yourself early in the process:

1. Are nutrients, pathogens, manure or polluted storm water discharging into surface waters on my farm, or is there a high risk that there could be a discharge?
2. Do I have the land base needed to sustainably spread manure nutrients?
3. Do I have adequate records showing manure applications and management activities on my farm?

What is a discharge?

A discharge is the release of nutrients, pathogens, manure or polluted storm water into surface waters of the state. Surface waters include county drains, ditches, streams, creeks, rivers, wetlands, lakes, and ponds. In addition, based on Right to Farm Generally Accepted Agricultural and Management Practices (GAAMP) for Manure Management and Utilization, it is unacceptable for nutrients, pathogens, manure or polluted storm water to leave the owner's property.

Look at your farmstead as a stranger would, consider any potential risk of discharge of nutrients. Consider what happens when there is a hard rain. Where does the runoff water from the farmstead go and is it carrying manure and other nutrients with it? Following is a list of points to consider:

- **Milkhouse and/or Parlor Wastewater**
 - Is milkhouse and parlor wastewater collected and land applied?
 - If not collected and land applied, is milkhouse and parlor wastewater treated?
 - Acceptable wastewater treatments may include appropriately sized and designed settling tanks followed by an acceptable infiltration system. This does NOT include a failed septic leach field or a direct tile line to surface water.
 - Inadequate management and maintenance of treatment systems may pose a discharge threat, particularly if near surface water.
 - Is non-contact plate cooler water prevented from reaching surface water? If not, you must obtain a non-contact plate cooler water discharge permit from the Michigan Department of Environmental Quality.
- **Silage Leachate and Feed Storage Runoff**
 - Does ANY silage leachate or runoff from feed storage and handling areas reach surface waters or form pools on the surface of the ground?

• Outdoor Lots

- Does ANY manure or feed contaminated runoff from animal housing, traffic, or handling areas reach surface water?

• Pasturing Along Surface Waters

- Is animal access to surface water limited to properly designed animal crossing and watering access points that prevent stream bank erosion?

• Manure Storage Breaches

- Are there any evident ongoing leaks or overflows of manure storages?
- Is there evidence of compromised manure storage structures that pose imminent risk of a leak or overflow?

• Other Potential Nutrient Runoff and Discharge Sources

- Manure loading and handling areas
- Composting areas
- Manure storage and stacking areas
- Drains from boot washes and other cleaning areas
- Mortality disposal (Note: Michigan law provides guidelines for mortality disposal including burial and composting restrictions.)

The above list is not comprehensive of all potential discharges, but provides examples to help you begin assessing your farmstead. If you are concerned about a discharge or the potential risk of a discharge on your farm, contact your local NRCS, Conservation District, MSU Extension, or qualified professional CNMP provider.

** In Michigan, Part 31-Water Resources Protection of Public Act 451 of The Natural Resources and Environmental Protection Act states, "A person shall not directly or indirectly discharge into waters of the state a substance that is or may become injurious to any of the following: a) to the public health, b) to domestic, commercial, industrial, agricultural, recreational or other uses that are being made or may be made of such waters, c) to the value or utility of riparian lands, d) to livestock, wild animals, birds, fish, aquatic life, or plants or to the growth propagation, or the growth or propagation thereof be prevented or injuriously affected; or whereby the value of fish and game is or may be destroyed or impaired."*

Do I have sufficient land base to land apply manure nutrients?

Applying manure to fields and recycling nutrients back for crop production is an important component of manure management. Doing this in an agronomically and environmentally sound manner is important for both short term and long term sustainability.

Phosphorus is generally the limiting element for determining land base requirements. The following charts will help you gain an *estimate* of your whole farm phosphorus balance. These charts compare the estimated amount of phosphorus being generated by the animals to the crops ability to use the nutrients. The objective is to avoid phosphorus buildup in soils. **These numbers are rough estimates of both values.** Nitrogen rates can also be estimated and manure applications should never supply more available nitrogen than one season of crop needs.

If a producer develops a manure management plan or a Comprehensive Nutrient Management Plan (CNMP), much more detail will be involved (such as precipitation, runoff from lots, bedding, cropping plans, soil tests, manure treatment practices, etc.) in refining these calculations to more realistically estimate the nutrients on the farm.

Fields with soils testing over 300 lbs. per acre Bray P1 (150 ppm) should not receive any manure based on Right to Farm GAAMP and should not be included in a manure spreading plan. Fields testing between 150 and 299 lbs. per acre Bray P1 (75-149 ppm) should only receive crop removal rates of manure phosphorus.

Compare the annual estimated phosphorus generated by all livestock (from this page) to the annual estimate crop removal calculated on the next page. If the livestock generate significantly more P₂O₅ than crop removal, soil phosphorus levels will be building.

Calculating the estimated annual phosphorus (P₂O₅) generated by livestock

Animal Type	*Weight lbs	Number of Head		Nutrient content (lb/day) P ₂ O ₅		Days per year		Pounds of P ₂ O ₅ per year
Example: <i>Lactating</i>	<i>1,400</i>	<i>250</i>	<i>x</i>	<i>0.42 P₂O₅ per day</i>	<i>x</i>	<i>365</i>	<i>=</i>	<i>38,325</i>
Dairy cattle								
Calves	150		x	0.01	x		=	
	250		x	0.02	x		=	
Heifer	750		x	0.07	x		=	
Lactating cow	1,000		x	0.30	x		=	
	1,400		x	0.42	x		=	
Dry cow	1,000		x	0.11	x		=	
	1,400		x	0.20	x		=	
							Total	
Beef cattle								
Calf	450		x	0.10	x		=	
High forage	750		x	0.14	x		=	
High forage	1,100		x	0.21	x		=	
High energy	750		x	0.14	x		=	
High energy	1,100		x	0.21	x		=	
Cow	1,000		x	0.19	x		=	
Swine								
Nursery	25		x	0.01	x		=	
Grow-Finish	150		x	0.05	x		=	
Gestating	275		x	0.04	x		=	
Lactating	375		x	0.13	x		=	
Boar	350		x	0.04	x		=	
Poultry								
Layer	4		x	0.0027	x		=	
Broiler	2		x	0.0014	x		=	
Turkey	20		x	0.0108	x		=	

Source: *Manure Characteristics MWPS-18 Manure Management Systems Series*, December 2000. Table 6: Daily manure production and characteristics, as-excreted. See this source for sheep, horse and veal and for nitrogen and potassium values. These can be found at: <http://www.maeap.org/cnmp.htm>

Note: Values are as-produced estimations and do not reflect any treatment. Values do not include bedding. The actual characteristics of manure can vary ± 30% from table values. Increase solids and nutrients by 4% for each 1% feed wasted above 5%.

*Weights represent the average size of the animal during the stage of production.



Do you spread manure over all the cropping acres listed below or are some fields receiving manure and building P levels while other fields are not? What if you compared the nutrients generated to the crop removal for only the fields on which you spread manure? Soil tests will indicate how manure applications are impacting P soil levels over time.

If the phosphorus generated by animals exceeds the crop need, consider options such as hauling manure to fields farther away, making agreements to haul manure to neighbor's fields or selling manure. Some treatment

options such as composting, liquid solid separation, etc. will not reduce phosphorus but may make hauling manure farther more feasible. Also, visit with an animal nutritionist to see if feed rations can be adjusted to reduce phosphorus in the feed, leading to reduced phosphorus excretion in the manure.

If you are planning to expand the livestock operation, consider the increased amount of P_2O_5 that will be generated and if additional crop land will be necessary to manage these levels.

Phosphorus (P_2O_5) Removal (lb/unit of yield) by Several Michigan Field Crops.

Crop	Unit	Pounds of P_2O_5 removed per unit	Acres	Yield	Estimated total P_2O_5 crop removal per crop	
<i>Multiply the pounds of P_2O_5 removed per acre times the number of acres times yield</i>						
<i>Example:</i> Corn	Grain	bushel	0.35	100	135	4,725
Alfalfa	Hay	ton - dry	10			
	Haylage	ton - wet	3.2			
Corn	Grain	bushel	0.35			
	Hi Moist. grain	ton	12			
	Silage	ton-wet	3.6			
Dry Edible Beans	Grain	cwt	1.2			
Soybeans	Grain	bushel	0.88			
Sugar Beets	Roots	ton	1.3			
Wheat	Grain	bushel	0.62			
Orchardgrass	Hay	ton	17			
Estimated total annual P_2O_5 crop removal:						
Estimated total annual P_2O_5 generated from livestock: (previous page)						

Source: Fertilizer Recommendations for Field Crops in Michigan (Christenson, et al. 1992)

Note: For crop removal values for additional field crops, vegetables and for nitrogen and potassium values, visit <http://www.maeap.org/cnmp.htm>

Keeping Good Records

Record keeping is increasingly necessary. Although documenting your actions for protection under Right to Farm or a complaint is important, record keeping for on-farm nutrient management is even more critical.

When the rate per acre of manure applications and the nutrient content of the manure are known, the actual nutrients per acre can be calculated. Amounts of additional fertilizer can then be determined and applied prudently. Applying fertilizer beyond that which is needed is an unnecessary expense and is not environmentally sound.

Soil and manure testing along with calibrating manure application equipment will fine tune any cropping program by supplying a known rate of nutrients. Record keeping is vital to the whole process and also maintains conformance with the Right to

Farm GAAMPs. Often, producers keep records of the main manure storage systems; it is important that all manure, from all barns and storage systems, is accounted for as it is spread on fields or otherwise leaves the farm.

Record of manure applications should include:

- Date(s) of manure/wastewater applications(s)
- Source, rate and form of manure/wastewater applied
- Date and rates(s) and form of other nutrients applied (fertilizers, sludge, compost, etc.)
- Date(s) of incorporation where applicable
- Method of applications (surface applied, injected, irrigated, etc.)
- Acres and area of field nutrients applied
- Weather conditions during manure applications
- Field conditions during application of manure



Other items to have on hand include:

- Field maps, current crops, realistic yield goals, previous crops and yields.
- Soil tests (less than 3 years old) and recommended nutrient application rates
- Total volume of manure produced based on number of loads
- Plant tissue sampling reports and pre-sidedress nitrate tests (where applicable)
- Complete N, P, K nutrient budget by field

Attached are two, sample record keeping sheets. These forms are also available at <http://www.maeap.org/cnmp.htm>. They are Excel and Word documents so they can be customized to fit individual farm needs. A pocket size record keeping booklet is available from Farm Bureau, Greenstone, Michigan Dept. of Agriculture, Michigan Milk Producers Assoc., Michigan Pork Producers Assoc., MSU Extension or Calhoun County Extension (269-781-0908).

Where To Go To Begin Collecting Helpful Items

Soil tests: Your county MSU Extension office sells MSU soil test boxes, complete with instructions. Many local elevators provide soil testing services. Private crop consultants will take soil samples as part of their service package.

Manure tests: Your county MSU Extension office has a list of manure testing laboratories, which can also be accessed at <http://www.maeap.org/cnmp.htm>.

Emergency Planning: Your local Groundwater Technician, available through the Conservation District, will work with you to develop an Emergency Plan at no cost.

Soil Loss Calculations (RUSLE): Your local Conservation District or Natural Resources Conservation Service (NRCS) office can assist you in determining soil loss levels for your fields. They can also help you with a plan to decrease soil loss, if it is deemed to be too high. Allegan, Cass, Clinton, Huron, Kalamazoo, Muskegon and Ottawa Conservation Districts have MAEAP specialists who can provide this service, at no charge to you.

Winter Spreading Risk Evaluation: NRCS and some District Conservation staff can work with you to evaluate the field risk for winter manure application by using the Manure Application Risk Index (MARI).

Conservation Practice Assessment: To evaluate the conservation practices needed on fields receiving manure, call your local Conservation District or NRCS office for assistance. Cost share may be available to implement needed practices.

Soil Maps: County Soil Survey maps provide a wealth of information on soil types and field features relevant to manure applications. NRCS staff and Conservation District groundwater technicians can help you with this information.

Field Maps: County Farm Service Agency (FSA) offices have aerial maps by township and section number. These maps are excellent for drawing in field boundaries and determining acreage.

Planning for Expansion: If you are considering expanding or building new facilities, obtain a copy of the Generally Accepted Agricultural & Management Practices for Site Selection & Odor Control for New & Expanding Livestock Production Facilities (Siting GAAMPs). Call the MI Department of Agriculture at 517-335-6544 or visit <http://www.maeap.org/resources.htm>.

Nutrient Management: Some MSU Extension agents offer small group sessions to organize nutrient management elements that are part of all nutrient management plans. These sessions are not available statewide, so check with your local extension agent. Some commodity groups may sponsor these meetings as well.

Preparing for a CNMP

The items listed above represent the initial concerns that livestock operators should be addressing. If a CNMP is your ultimate goal, the above items will need more detail and documentation. Some additional items that will be helpful for completing a CNMP are seasonal, such as soil tests, manure samples, calibration of manure application rates and evaluating liners in existing manure storage systems. For these items, plan ahead and gather or record the information when possible. Other items that a CNMP provider will be expecting you to have available include:

- Animal inventory, including the number of head in each category and average weights
- Duration of animal confinement (if not totally confined)
- Cropping and yield histories, typical crop rotation, or future crop rotation
- Type and quantity of bedding used
- Amount of wastewater produced and amounts to be stored
- Engineering design drawings and/or "as built" documents for existing manure storages
- Soil maps and conservation plans

For more information on CNMP development and the Michigan Agriculture Environmental Assurance Program, visit www.maeap.org or contact Jan Wilford at MDA at 517-241-4730.

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