

PART VII – Production Area Monitoring and Inspections and Land Application Requirements

General

The permittee's approved manure management (MMP) plan shall be developed and implemented in accordance with the best management practices contained within this permit.

PRODUCTION AREA REQUIREMENTS

Table 1. Monitoring/Inspection Requirements

Action	Frequency	Record Keeping Requirements
Grab samples shall be taken of all discharges from the production area. Clean storm water that has been diverted does not need to be sampled.	Each time they occur	Date and time of sample, results of analysis, and the information required in Part III, 5 and 6. See Part I, A, 1, e.
All discharges from the production area and land application area shall be recorded in the operating record.	Each time they occur	Cause, volume, and duration of discharge and any corrective actions needed and the dates those actions were taken. See Part I, A, 1, e and Part I, A, 2, d.
In accordance with Part VII, B, 5 of this permit, grab samples shall be taken of discharges from land application areas where manure was applied on frozen and/or snow covered ground.	Each time they occur	Date and time of sample, results of analysis, and the information required in Part III, 5 and 6. See Part VII, B, 5.
Representative samples of the manure to be land applied shall be taken from each source (e.g., each lagoon, storage tank, or permanent stockpile area must be sampled).	1/year	The information required in PART III, 5 and 6. See Part VII, A, 2. (See note below.)
Representative soil samples of the manure land application fields.	Every 3 years	The information required in Part III, 5 and 6. See Part VII, A, 3. (See note below.)
Monitor operating level of all manure storage or treatment facilities.	1/week	Date and time of observation, manure level in each structure. See Part II, E. (See note below.)
Inspect manure storage or treatment facilities, including devices channeling contaminated storm water to the manure storage or treatment facility for evidence of erosion, leakage, animal damage, overflow, or discharge.	1/week	Date and time of inspection, structural integrity, vegetation condition, and any corrective actions needed and the dates those actions were taken. (See note below.)
Inspect storm water diversion devices or runoff diversion structures.	1/week	Date and time of inspection, observations of flow quantity and color, structural integrity (e.g. signs of cracks, sparse or stressed vegetation, erosion, etc.), any corrective actions needed and the dates those actions were taken.
Inspect drinking and cooling water lines that are located above ground, readily visible or accessible for daily inspections.	Daily	Date and time of inspection, number of leaks, any corrective actions needed and the dates those actions were taken.
Monitor forecast at the CAFO location.	Every land application event	Date, weather conditions (including percentage chance of rain) 24 hours prior to application, at the time of application, and 24 hours after application. See Part VII, A, 5 and Part VII, B, 2, e.
Inspect land application fields.	In accordance with MMP	Date and signs of discharge or runoff into surface waters and/or conduits to surface waters of the State.
Inspect land application equipment.	In accordance with MMP	List of equipment, date of inspections, corrective actions, calibration dates. (See note below.)

Note: Much of this information is required in the operating record for the Review Compliance Certificate or Permit to Operate issued by the Director of ODA. The operating record form provided by ODA is an acceptable format for maintaining records for the purposes of complying with this permit as well. However, make sure that additional records required by this permit are added to those record keeping forms.

1. Any deficiencies found as a result of these inspections must be corrected as soon as possible. Deficiencies not corrected within 30 days must be accompanied by an explanation of the factors preventing immediate correction.
2. Records of mortalities management and practices used by the CAFO shall be maintained to ensure compliance with Part I, A, 1, f.
3. Records documenting the current design of any manure storage structures, including volume for solids accumulation, design treatment volume, total design volume, and approximate number of days of storage capacity must be maintained at the CAFO.

LAND APPLICATION REQUIREMENTS

A. CONTENTS OF THE MMP

1. **Nutrient Budget:** The manure management plan shall include a total nutrient budget for the operation, based on 1) targeted crop yields based on actual crop yields, 2) soil productivity information, 3) historical yield data, 4) realistic potential yield, or 5) combinations of yield data. The plan shall consider all potential sources of nutrients including quantity of manure and manure nutrients, organic by-products, wastewater, commercial fertilizer, crop residues, legume credits, and irrigation water and a summary of the total acres of land to be used for land application.
2. **Manure Characterization:** At a minimum, manure from each manure storage or treatment facility shall be analyzed annually for the following: total nitrogen, ammonium nitrogen, organic nitrogen, phosphorus, potassium, and percent total solids. Procedures for the collection and analysis of the samples shall be in accordance with Publication A3769, "Recommended Methods of Manure Analysis; Published by the Board of Regents of the University of Wisconsin System, University of Wisconsin-Extension".
3. **Soil Characterization:** At a minimum, soil samples shall be taken to a uniform depth and the fertility analysis shall include: pH, phosphorus, potassium, calcium, magnesium and cation exchange capacity.
 - a. Soil fertility analysis shall be conducted in accordance with Publication 221, "Recommended Chemical Soil Test Procedures for the North Central Region; Published by the North Central Regional Committee on Soil Testing and Plant Analysis (NCR-13), North Dakota Agricultural Experiment Station". See Part VII, A, 3, e, below.
 - b. Sample shall be representative of a land application site with one composite soil sample representing no more than twenty-five acres or one composite soil sample for each land application site, whichever is less. A sample depth of 8 inches shall be used unless justified otherwise in the plan.
 - c. The manure management plan shall specify the soil sampling frequency in accordance with the following requirements:
 - (1) A site that receives manure shall be soil tested, at a minimum, once every three years.

(2) For any land application site used by the owner or operator the land application site shall be sampled at least six months following application.

- d. Results of the soil sampling events shall be recorded and shall include the location of the soil sample collection site, the depth of the sample collected and the analysis.
- e. In developing appropriate manure application rates for land application methods, the owner or operator shall use the Bray P1 soil test level or equivalent appropriate phosphorus soil test, (Mehlich III, Olsen, Phosphorus Retention Test). The owner or operator shall choose a phosphorus soil test method and identify the selected method in the manure management plan.

4. Land Application Methods – Methodology for Determining Manure Application Rates

- a. Determine if the land application site has soils that are prone to flooding and when the expected flooding seasons are according to Table 3. For timing restrictions, see Part VII, B, 2, c.
- b. The manure application rate shall be based on the land application site's soil tests that are no older than three years. See Part VII, A, 3, above.
- c. The manure application rate shall be based on the most current manure test results. The manure test results expressed as a nutrient percentage shall be converted into either pounds per ton of dry manure or pounds per one thousand gallons of liquid manure.
- d. Determine if a solid or liquid manure application will be performed. The manure application rate shall be based on the most limiting factor (i.e., most restrictive factor for the purpose of protecting surface water quality) of the following:

(1) For liquid manure (less than 20% solids):

- i. The crop nitrogen requirements or removal expressed in thousands of gallons of manure per acre, as determined in accordance with g., below;
- ii. The crop phosphorus requirements or removal expressed in thousands of gallons of manure per acre, as determined in accordance with h., below;
- iii. The restrictions on the volume of liquid manure application, in accordance with Part VII, B and Part VII, C, Tables 21 and 22, with volume expressed as a measure of gallons per acre or inches per acre, with twenty seven thousand two hundred gallons equal to one acre/inch;
- iv. The application rate shall not exceed the available water capacity in the upper eight inches of the soil for both subsurface and nonsubsurface drained sites in accordance with Part VII, C, Table 4; and
- v. The application rate shall be adjusted to preclude surface ponding and/or runoff from a land application site. See Part VII, B, 2.

(2) For solid manure (greater than or equal to 20% solids):

- i. Either the crop nitrogen requirements or removal of nitrogen expressed in pounds per ton of dry manure per acre, as determined in accordance with g., below;

- ii. The crop phosphorus requirements or removal expressed in pounds per ton of dry manure per acre, as determined in accordance with h., below; or
 - iii. The restrictions on the volume of solid manure applied, taken from Part VII, B and Part VII, C, Tables 21 and 22, with volume expressed as a measure of tons/acre.
- e. Determine if solid manure will be stockpiled at the land application site. Stockpiles shall meet the setbacks in Part VII, B, Table 2.
- f. For liquid manure applications, determine restrictions based on Part VII, C, Table 4 Available Water Capacity and Tables 21 and 22 Most Limiting Manure Application Rates (for Tiled Fields and Non-Tiled Fields). For solid manures, determine restrictions based on Part VII, C, Tables 21 and 22 Most Limiting Manure Application Rates Charts (for Tiled Fields and Non-Tiled Fields).
- g. The manure application rate for nitrogen shall be the most restrictive value (i.e., most restrictive factor for the purpose of protecting surface water quality) determined after considering the following:
 - (1) The application rate for nitrogen shall be based on utilization of crops at the recommended agronomic rates (using the Ohio Agronomy Guide, OSU Bulletin 472) and based on minimum runoff and leaching to waters of the state, as determined in accordance with (3) below.
 - (2) In determining the agronomic rate for nitrogen, the owner or operator shall do the following:
 - i. Determine the nitrogen requirements (based on Part VII, C, Tables 6, 7, and 8) or removal rates (based on Part VII, C, Table 5) for a realistic yield goal of planned crops; Determine the nutrient removal for the expected cropping sequence using Part VII, C, Table 5 Nutrient removed in Harvested Portions of Crops. Determine residual nitrogen credits for the expected cropping sequence using Part VII, C, Table 8 Residual Nitrogen Credits Based on Previous Crops.
 - ii. Subtract the nitrogen credit to be given to the next crop in accordance with values for previous crops, subtract credits for crop residues and legumes grown in previous years, and subtract nitrogen that will be added in other forms including commercial fertilizer and organic by-products (see Part VII, C, Table 8); and
 - iii. When applying nitrogen to a grass or legume cover crop that is growing or being established immediately after manure application, manure can be applied at the recommended nitrogen rate (using the Ohio Agronomy Guide, OSU Bulletin 472) for the next non-legume crop or the nitrogen removal rate for the next legume crop.
 - (3) In determining how to minimize nitrogen leaching to waters of the state, the owner or operator shall do the following:
 - i. Assess each land application site with the Ohio nitrogen leaching risk assessment procedure in Part VII, C; and
 - ii. If the nitrogen leaching risk assessment procedure completed in accordance with i above, demonstrates that the land application site has a high nitrogen leaching potential and no growing cover crop, then application of manure shall be limited to fifty

pounds per acre as applied nitrogen calculated at the time of application (by adding ammonia-nitrogen to one third of organic nitrogen) from June to October first.

- (4) Use the current manure analysis and the relevant sections of the following tables in Part VII, C to determine the amount of manure nutrient available for crop production: Table 10 Calculating Available Nitrogen of Manure, Table 11 Nitrogen Sufficiency ranges for Corn, Soybeans, Alfalfa and Wheat, and Table 12 Sidedress N Fertilizer Rates for Corn.
 - (5) When using legumes as a nitrogen removal source, the maximum legume nitrogen removal must be less than or equal to one hundred and fifty pounds per acre.
- h. The manure application rate for phosphorus shall be the most restrictive value (i.e., most restrictive factor for the purpose of protecting surface water quality) determined after considering the following:
- (1) The application rate for phosphate applications shall be based on the following:
 - i. Estimated plant uptake by crops at the recommended agronomic rates (using the Ohio Agronomy Guide, OSU Bulletin 472);
 - ii. Soil test analysis;
 - iii. Subsequent phosphorus removal in plant biomass (see Part VII, C, Table 5); and
 - iv. Minimum runoff to waters of the State.
 - (2) In determining the agronomic rate for phosphate application, the owner or operator shall do the following:
 - i. Determine the phosphorus requirements for a realistic yield goal of planned crops and/or crop rotations (see Part VII, C, Tables 13, 14, 15, 16, and 17);
 - ii. Subtract phosphorus that will be added in other forms including commercial fertilizer and organic by-products; and
 - iii. The application rate for phosphorus shall not exceed the removal rates for a realistic yield goal of planned crops, unless following the procedures in h, (3) below.
 - (3) In determining how to minimize phosphorus runoff to waters of the State, the owner or operator shall do the following:
 - i. Prior to the land application of manure, a land application site shall be assessed with either the phosphorus index risk assessment procedure or the phosphorus soil test risk assessment procedure in Part VII, C. This risk assessment shall be used in the determination of manure application rates and the results shall be documented as required in Part VII, A, 5. Use the phosphorus index risk assessment procedure if the Bray P1 value of the soil test is over one hundred and fifty parts per million. The phosphorus index risk assessment procedure shall only be relied upon for a transitional period of time to allow the owner or operator an opportunity to find other fields or other methods to distribute nutrients from the facility in order to achieve less than one hundred and fifty parts per million Bray P1 soil test method;

- ii. There shall be no multi-year phosphorus applications on fields where either the phosphorus index risk assessment procedure produces a high rating or the phosphorus soil test risk assessment procedure produces a high potential rating. There shall be no phosphorus applications on fields where either the phosphorus index risk assessment procedure produces a very high rating or the phosphorus soil test risk assessment procedure produces a very high potential rating; and
 - iii. Phosphate manure application rates above two hundred and fifty pounds per acre are not recommended. However, if phosphate concentrations in liquid manure exceed sixty pounds of phosphate per one thousand gallons or eighty pounds phosphate per ton for solid manure, rates higher than two hundred and fifty pounds per acre may need to be applied due to limitations of the application equipment. In no case shall manure application exceed the rates specified in Part VII, A, 4, g and Part VII, A, 4, h, (3), ii. In no case shall phosphate applications exceed five hundred pounds per acre of phosphate during one year. When phosphate applications exceed two hundred and fifty pounds per acre the following additional criteria applies:
 - Phosphate applications exceeding two hundred and fifty pounds per acre in any one year shall not be applied on fields with a phosphorus soil test exceeding 100 ppm Bray P1 or equivalent, results of a phosphorus index risk assessment procedure notwithstanding.
 - The manure shall be immediately injected or incorporated 3 to 5 inches deep.
 - The manure shall not be applied on either frozen or snow covered ground.
 - There shall be no further phosphate applications for a minimum of three years on land with a phosphorus soil test level below 40 ppm (80 pounds per acre) Bray P1 or equivalent and no additional phosphate applications for a minimum of five years on land with a phosphorus soil test level above 40 ppm (80 pounds per acre) Bray P1 or equivalent.
 - i. A comparison shall be made of all the manure land application requirements. The selected rate shall be documented in accordance with the record keeping requirements in Part VII, A, 5.
5. Record Keeping Requirements: At a minimum, the following records must be kept by the permittee:
- a. Expected crop yields.
 - b. The date(s) manure is applied to each field.
 - c. Weather conditions at the time of application and for 24 hours prior to and following application. See Part VII, B, 2, e.
 - d. Test methods used to sample and analyze manure and soil.
 - e. Results from manure and soil sampling.
 - f. Explanation of the basis for determining manure application rates, as provided by Part VII, A, 4.
 - g. Calculations showing the total nitrogen and phosphorus to be applied to each field, including sources other than manure.

- h. Total amount of nitrogen and phosphorus actually applied to each field, including documentation of calculations for the total amount applied.
- i. The method used to apply the manure.
- j. Date(s) of manure application equipment inspection.

B. LAND APPLICATION RESTRICTIONS (Effective beginning on the date that coverage under this permit is granted.)

- 1. Land application of manure shall be conducted in accordance with the following:

Table 2. Manure Application Rate Restrictions

Manure Application Distance Restrictions and, Where Appropriate, Rate Restrictions For the Following Items
Streams, Lakes, Ponds, Watercourses, Other Surface Water, Waterways, Open Tile Line Intake Structures, or Other Conduits to Surface Waters
Manure shall not be applied closer than 100 feet, unless a 35-foot vegetated buffer has been established where manure application is prohibited. A mandatory 35-foot vegetated buffer must be established along fields with perennial streams regardless of setback requirement.
Public Drinking Water Surface Water Intakes
Land Application shall not take place within the emergency management zone of a public water system using surface water. Otherwise, manure shall not be applied closer than 300 feet from the edge of the field.
Seasonal Salmonid and Cold Water Habitats
Manure shall not be applied closer than 100 feet, unless a 35-foot vegetated buffer has been established where manure application is prohibited.
Public Drinking Water Wells
Land application shall not take place within a highly susceptible drinking water source protection area (as defined by Ohio EPA) for a community public water system using ground water and not within the inner management zone for all other community public water systems using ground water.
Land application shall not take place within the inner management zone of a drinking water source protection area or within 300 feet of a water supply well serving a transient non-community or non-community, non-transient public water system using ground water, whichever distance is greater.
Private Drinking Water Wells
For injection application and surface application followed by incorporation within 24 hours, manure shall not be applied closer than 100 feet.
For surface application not followed by incorporation within 24 hours, manure shall not be applied closer than 300 feet.
Class V Agricultural Drainage Wells, Agricultural Wellheads, or Sinkholes
For injection application and surface application followed by incorporation within 24 hours, manure shall not be applied closer than 100 feet.
For surface application not followed by incorporation within 24 hours, manure shall not be applied closer than 300 feet.
Springs
Manure shall not be applied closer than 300 feet.
Slope
For fields with a slope less than 15%, surface application can be used when yearly average soil loss is less than five tons per acre or "T", whichever is less.

Manure shall not be applied to cropland over 15% slope or to pasture/hay land over 20% slope unless one of the following precautions are taken: a. Immediate incorporation or injection with operations done on the contour, unless the field has 80% ground cover (residue or canopy); b. Applications are timed during periods of lower runoff and/or rainfall (May 20 to October 15); c. Split applications are made (separated by rainfall events) with single applications not exceeding 5000 gallons per acre for liquid manure or 10 wet tons per acre for solid manure; d. The field is established and managed in contour strips with alternated strips in grass or legume.
Stockpiling of Manure
Streams, Lakes, Ponds, Watercourses, Waterways, Open Tile Line Intake Structures, or Other Conduits to Surface Waters, minimum 300 feet. (Stockpiling within waterways or concentrated flow areas is prohibited.)
Public and Private Wells/Springs, minimum 300 feet.
Flooding/flood plains/floodways, prohibited.
Public drinking water surface intakes, minimum 1500 feet.
Class V agricultural drainage wells and sinkholes, minimum 300 feet.
Slope, 0-6% only.

2. Timing/Site Restrictions:

- a. Prior to land applying manure, the permittee shall inspect the land application area to determine the suitability of the site for land application (considerations shall include tile location and depth, soil type, evidence of soil cracking, available water capacity of the soil, crop maturity, prior precipitation, forecasted precipitation, etc.) and document field conditions at the time of the inspection. See Part VII, A, 5. Broken tiles or blow out holes shall be repaired prior to land application.
- b. For fields with soil cracks greater than six inches deep, the soil must be tilled before the land application of liquid manure or the application must be delayed until the cracks are sealed. However, liquid manure applications may be made on tiled fields with growing crops if the application rate is less than or equal to a quarter of an inch or six thousand seven hundred gallons per acre and tile plugs are used or tile stops closed prior to application. See Part VII, B, 3 below.
- c. For fields that are prone to flooding, floodplains, or floodways, manure must be injected or incorporated within 24 hours of application. No manure application shall occur during periods of expected flooding. See USDA, NRCS Field Office Technical Guide.
- d. Land application of manure shall not cause ponding or runoff. For liquid manure applications, the land application shall not exceed the available water capacity in the upper eight inches of the soil in the application field.
- e. Land application shall not occur on saturated soils or during rain or runoff events, and shall not occur if the forecast contains a greater than fifty per cent chance of precipitation as determined in "Managing Manure Nutrients at Concentrated Animal Feeding Operations, Appendix M, United States Environmental Protection Agency, EPA-821-B-04-006, August 2004," exceeding an amount of one-quarter inch for hydrologic soil group D soils and one-half inch for hydrologic soil group A, B, and C soils, for a period extending twenty-four hours after the start of land application. Record weather conditions in the operating record for conditions at the time of

application and for twenty-four hours prior to and following application. For determining hydrologic soil groups, refer to USDA-NRCS Engineering Field Manual, Chapter 2 – Ohio Supplement (1989), Table 2.1, pages 2-42 through 2-83.

- f. If solid manure is applied on conventionally tilled bare soil, the manure shall be incorporated into the soil within two days after application on the land. This requirement does not apply to no-till fields, pasture, or fields where crops are actively growing.
 - g. Manure application shall not take place on fields where soil loss exceeds “T” (Tolerable Soil Loss, See USDA, NRCS Field Office Technical Guide).
3. For land application sites with subsurface tile drainage, the permittee shall visually monitor all field tile outlets before, during and after application of manure to the site and record the results of that monitoring. The permittee shall have access to or methods/devices to stop or capture subsurface drain flow. If manure reaches the subsurface drain outlet to waters of the State, the application of manure shall cease and the flow stopped or captured. If land application has caused manure laden water to be discharged from a field tile, Ohio EPA shall be notified by calling 1-800-282-9378 as soon as possible, but in no case later than 24 hours following first knowledge of the occurrence. See Part I, A, 2, d.
 4. For the land application of liquid manure to sites with subsurface tile drainage, the following criteria must be followed:
 - a. Application rates shall be less than or equal to half an inch or thirteen thousand gallons per acre per application event;
 - b. A tool shall be used that can disrupt and/or close the preferential flow paths in the soil using horizontal fracturing, or the surface of the soil shall be tilled three to five inches deep to a seedbed condition to soak up the liquid manure and keep it out of preferential flow channels;
 - c. If injection is used, manure shall only be injected deep enough to cover manure with soil. The soil shall be tilled at least three inches below the depth of injection prior to application; and
 - d. For fields with growing crops or continuous no till fields where tillage is not an option, all tile outlets from the application area are to be plugged/tile stops closed prior to application.
 5. Manure shall be managed in such a manner to prevent land application on frozen or snow covered ground. Every attempt shall be made by the permittee to avoid land application during the frozen or snow covered ground conditions because of lack of agronomic benefit and high risk of pollution of surface waters. As stated in Part II, failure to take appropriate action to avoid land application on frozen and/or snow covered ground is a violation of this permit and subject to enforcement. The nutrients in the manure applied on frozen and/or snow covered ground shall be included in the manure application rate calculations for the next crop.

If practical, manure should be injected and/or incorporated within 24 hours to minimize surface manure runoff. Where manure is not injected or incorporated within 24 hours, the following frozen and/or snow covered ground restrictions are mandatory.

Other locations for manure disposal shall be investigated prior to the land application (i.e., transfer of manure to another waste treatment or storage facility, wastewater treatment plant, rental or acquisition of a storage tank, etc.).

Stockpiling of solid manure, in accordance with this permit, shall be utilized rather than spreading on the field.

Only limited quantities of manure shall be applied to address manure storage limitations until non-frozen or non-snow covered soils are available for manure application.

Records must be maintained for all instances of application on frozen or snow covered ground that include: date, amount applied, location, acres applied to, weather and soil conditions including depth of snow cover, surface residue cover, and reason for applying manure at that time.

In addition to all of the above land application restrictions (restrictions on fields prone to flooding, not causing ponding or runoff, restrictions on saturated soils, and requirements for tilled fields), the following criteria must also be met for surface manure application on frozen or snow covered ground per application event per field per winter season:

- a. The field must have greater than or equal to ninety percent surface residue cover at the time of application, and vegetation/residue shall not be completely covered by ice and/or snow at the time of application;
- b. The maximum manure application rate is five thousand gallons per acre for liquid manure, ten wet tons per acre for solid manure with more than fifty percent moisture, and five wet tons per acre for solid manure with less than fifty percent moisture. Depending on soil hydrologic group and surface residue cover, the liquid manure application rate on frozen soils may need to be lowered to prevent manure ponding or runoff;
- c. Manure shall not be applied on more than twenty contiguous acres. Contiguous areas for application are to be separated by a break of at least two hundred feet. Areas used for application are to be the furthest from surface waters and present the least potential for runoff;
- d. Setbacks from surface waters and conduits to surface waters (including grassed waterways and surface drains) must be a minimum of two hundred feet. This setback shall also have at least 90 percent surface residue cover, and vegetation/residue shall not be completely covered by ice and/or snow at the time of application. This distance may need to be further increased due to local conditions and other setback restrictions in Part VII, B, 1;
- e. For fields with slopes greater than six percent, manure shall be applied in alternating strips sixty to two hundred feet wide generally on the contour, or in the case that the field is managed in contour strips with alternative strips in grass or legume, manure shall only be applied on alternative strips. Note that the application rate shall be determined for each separate application strip area, not area of entire field;
- f. Manure phosphate applications exceeding two hundred and fifty pounds per acre are prohibited.

If the permittee surface applies manure on frozen or snow covered ground, concentrated field surface drainage and tile outlets shall be visually monitored at the conclusion of the manure application, and periodically afterwards when weather is likely to produce manure runoff including when temperatures rise, snow melts, and in conjunction with rainfall, etc., until the manure has been assimilated into the field and is no longer likely to discharge into waters of the State. If the land applied manure discharges to waters of the State, then the permittee shall notify Ohio EPA within two hours of detection of the runoff event. In accordance with Part I, A of this permit, a discharge of manure to waters of the State from land application on frozen and/or snow covered ground that is not the result of a precipitation event is prohibited and a violation of the permit.

If the ammonia nitrogen level in a water quality sample is determined to be 26 mg/L or greater in the discharge at the point it enters waters of the State, then any additional surface application of manure to frozen and/or snow covered ground is prohibited on the field where the runoff event occurred. In the event that the permittee follows the permit requirements and runoff from frozen or snow covered fields discharges to waters of the State with an ammonia nitrogen content of 26 mg/L or greater in a total of three surface land application events, then surface application of manure on any frozen and/or snow covered ground is prohibited for that permittee from that point on.

In the event that a permittee fails to comply with the land application requirements for frozen or snow covered ground (including notification of discharges, monitoring and record keeping requirements) more than two times, then land application on any frozen or snow covered ground will be prohibited for that permittee upon receipt of the third notice of violation by Ohio EPA.

In addition to the visual monitoring and reporting requirements stated above, the permittee shall collect representative grab samples from discharges of land applied manure into waters of the State at the point that the discharge enters waters of the State (i.e., concentrated field surface runoff or field tile outlet discharge prior to entrance to surface water) and have the sample analyzed for, at a minimum, the following parameter:

00610 – Nitrogen, Ammonia (NH3) – mg/L

The permittee shall: (a) collect the sample within 30 minutes of the first knowledge of the discharge; or (b) if the sampling in that period is inappropriate due to dangerous weather conditions, collect the sample as soon as possible after suitable conditions occur, and document the reason for delay.

The permittee shall report the results of the discharge sample(s) to Ohio EPA, Central Office, Division of Surface Water, within 14 days of occurrence. The report shall, at a minimum, contain the sample results, describe the reason for the discharge, the location, estimate of quantity and duration of the discharge, and duration of the precipitation leading up to the event, as well as any measures taken to clean up and eliminate the discharge and required land application records stated above. Laboratory results not available at the time of the report submittal shall be submitted to Ohio EPA within five days of receipt.

- 6. The permittee is responsible for complying with this permit for land application activities conducted on each site where the permittee, or anyone employed by the permittee, owns, operates, or land applies manure generated from the CAFO or determines timing and amount of manure to be applied on fields not otherwise owned, rented, or leased by the CAFO.

C. Tables and Procedures for Manure Application Rate Determination

Note: Much of the information contained in this section is consistent with ODA rule in OAC 901:10-2-14 and associated appendices.

Table 3. Soils Prone to Flooding

Soils Prone to Flooding	Months	Comment	Soils Prone to Flooding	Months	Comment
Abscota Variant	Feb-Jun		Medway Variant	Nov-May	
Adrian	Nov-May		Medway, limestone substratum	Nov-Dec	
Aetna	Dec-Jun		Melvin	Sep-May	Frequently flooded, long

Soils Prone to Flooding	Months	Comment	Soils Prone to Flooding	Months	Comment
					duration
Alganssee	Nov-May		Melvin	Dec-May	
Algiers	Dec-Jun	Frequently flooded	Mentor	Jan-Dec	
Alluvial land	Nov-Dec	Occasionally flooded	Millgrove	Nov-Jun	
Alluvial land	Jan-Dec	Long duration	Montgomery	Nov-May	
Ashton	Dec-May	Very long duration	Moshannon	Dec-May	
Beaucoup	Mar-Jun		Muskego	Nov-May	
Bonnie	Oct-Jun		Newark	Dec-Apr	
Brookston	Dec-May		Newark Variant	Jan-Apr	
Carlisle	Nov-May		Nolin	Feb-May	
Ceresco	Mar-May		Nolin Variant	Feb-Apr	
Chagrin	Nov-May		Olentangy	Nov-Dec	
Chavies	Nov-Mar		Orrville	Nov-May	
Clifty	Nov-May		Otego	Nov-Dec	
Coblen	Nov-Jun		Papakating	Nov-Jun	
Cohoctah	Nov-Apr		Patton	Jan-Dec	
Cuba	Jan-May		Peoga	Jan-Dec	
Defiance	Jan-May		Pewamo	Mar-Apr	
Edwards	Sep-May		Philo	Dec-May	
Eel	Oct-Jun		Piopolis	Mar-Jun	
Eel Variant	Jan-May		Pope	Nov-Apr	
Elkinsville	Jan-Dec		Rockmill	Sep-Jun	
Euclid	Dec-Jun		Romeo	Mar-Jun	
Fitchville	Dec-Jun		Ross	Nov-Jun	
Flatrock	Dec-Apr		Rosburg	Nov-Jun	
Flatrock, limestone substratum	Nov-Apr		Sarahsville	Dec-May	
Fluvaquents	Nov-Jun		Saranac	Nov-May	
Genesee	Oct-May		Scioto	Nov-Jun	
Genesee Variant	Jan-May		Sebring	Nov-Jun	Occasionally flooded
Gessie	Oct-May		Senecaville	Dec-Apr	
Glendora	Jan-Dec		Shoals	Oct-Jun	
Grigsby	Dec-Apr		Shoals Variant	Nov-May	Used in Miami, Putnam, and Richland Counties
Hackers	Jan-Apr		Shoals Variant	Oct-Jun	Used in Champaign County
Harrod	Nov-Jun		Shoals, Till Substratum	Nov-Dec	
Hartshorn	Nov-May		Skidmore	Dec-May	
Haymond	Dec-May		Sligo	Mar-Apr	
Holly	Sep-May	Frequently flooded, very long duration	Sloan	Nov-Jun	
Holly	Nov-May		Sloan, Till Substratum	Nov-Dec	
Holton	Dec-Jun		Stanhope	Nov-Dec	
Huntington	Dec-May		Stendal	Jan-May	
Joliet	Apr-Jun		Stone	Nov-Jun	
Jules	Mar-Jun		Stonelick	Nov-Jun	
Kerston	Mar-May		Stringley	Nov-Jun	
Killbuck	Jan-Dec		Taggart	Jan-Dec	
Kinn	Dec-Apr		Tioga	Nov-May	
Knoxdale	Dec-Apr		Tioga Variant	Jan-Apr	
Kyger	Nov-May		Toledo	Nov-May	
Landes	Jan-Jun		Tremont	Jan-Dec	
Landes Variant	Nov-Jun		Wabash	Nov-May	
Lanier	Nov-Jun		Wabasha	Sep-Jun	
Latty	Jan-May		Wakeland	Jan-May	

Soils Prone to Flooding	Months	Comment	Soils Prone to Flooding	Months	Comment
Lenawee	Mar-May		Wallkill	Sep-Jun	
Lindside	Dec-Apr		Wappinger	Jan-Dec	
Linwood	Nov-Jun		Warsaw Variant	Jan-May	
Lobdell	Jan-Apr	Frequently flooded	Wayland	Nov-Jun	
Lobdell	Nov-Apr		Wick	Oct-Jun	
Martinsville	Jan-Apr		Wilbur	Oct-Jun	
Martisco	Mar-Jun		Willette	Nov-Dec	
McGary Variant	Jan-Dec		Seperick	Nov-Jun	
Medway	Nov-Jun		Zipp	Dec-May	

Available Water Capacity (AWC)

This table shall be used to determine the AWC at the time of application and the liquid volume in gallons that can be applied not to exceed the AWC. To determine the AWC in the upper 8 inches use a soil probe or similar device to evaluate the soils to a depth of 8 inches. For land application, liquid manure application may also be calculated by converting acres per inch to gallons per acre. This conversion is based on the following formula: 1 acre – inch equals 27,156 gallons per acre.

Table 4. Available Water Capacity

Available Moisture in the Soil	Sands, Loamy Sands	Sandy Loam, Fine Sandy Loam	Very Fine Sandy Loam, Loam, Silt Loam, Silty Clay Loam	Sandy Clay, Silty Clay, Clay, Fine & Very Fine Textured Soils
<25% Soils Moisture	Dry, loose and single-grained; flows through fingers.	Dry and loose; flows through fingers.	Powdery dry; in some places slightly crushed but breaks down easily into powder.	Hard, baked and cracked; has loose crumbs on surface in some places.
Amount to Reach AWC	20,000 gal/acre	27,000 gal/acre	40,000 gal/acre	27,000 gal/acre
25-50% or Less Soil Moisture	Appears to be dry; does not form a ball under pressure.	Appears to be dry; does not form a ball under pressure.	Somewhat crumbly but holds together under pressure.	Somewhat pliable; balls under pressure.
Amount to Reach AWC	15,000 gal/acre	20,000 gal/acre	30,000 gal/acre	20,000 gal/acre
50-75% Soil Moisture	Appears to be dry; does not form a ball under pressure.	Balls under pressure but seldom holds together.	Forms a ball under pressure; somewhat plastic; slicks slightly under pressure.	Forms a ball; ribbons out between thumb and forefinger.
Amount to Reach AWC	10,000 gal/acre	13,000 gal/acre	20,000 gal/acre	13,000 gal/acre
75% to Field Capacity	Sticks together slightly; may form a weak ball under pressure.	Forms a weak ball that breaks easily, does not stick.	Forms ball; very pliable; slicks readily if relatively high in clay.	Ribbons out between fingers easily; has a slick feeling.
Amount to Reach AWC	5,000 gal/acre	7,000 gal/acre	11,000 gal/acre	7,000 gal/acre
100% Field Capacity	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.	On squeezing, no free water appears on soil, but wet outline of ball on hand.
Above Field Capacity	Free water appears when soil is bounced in hand.	Free water is released with kneading.	Free water can be squeezed out.	Puddles; free water forms on surface.

NOTE: Liquid manure applications to tiled fields must be less than or equal to 13,576 gal/acre.

Table 5. Nutrients Removed in Harvested Portions of Crops

Crop (Yield)	Nutrients Removed For Given Yields ^a			Nutrients Removed for Unit Yields ^b	
	N	P ₂ O ₅	K ₂ O	P ₂ O ₅	K ₂ O
	Pound/Acre			Pound/Bushel or Ton	
Alfalfa (6 T)	340 ^c	80	360	13.3 lb/T	60 lb/T
Corn (150 Bu)					
Grain	135	55	40	0.37 lb/bu	0.27 lb/bu
Stover	100	25	160		
Corn-Silage (26 T)	235	80	235	3.1 lb/T	9.0 lb/T
Grass – Cool season (3.5 T), Tall grasses and/or Forage legumes (established)	140	45	175	13.0 lb/T	60.0 lb/T
Oats (100 Bu)					
Grain	65	25	20	0.25 lb/bu	0.20 lb/bu
Straw	35	15	100	0.15 lb/bu	1.0 lb/bu
Sorghum-grain (7,600 lb)					
Grain	105	30	30	0.39 lb/100 lb	0.39 lb/100 lb
Stover	80	50	230		
Soybean (50 Bu)	190 ^c	40	70	0.80 lb/bu	1.4 lb/bu
Sugar Beets – roots (25 T)	100	50	250	2.0 lb/T	10.0 lb/T
Tobacco – Burley and Cigar filler					
Leaf (3000 lb)	105	25	185		
Stems and Suckers (2000 lb)	55	15	65		
Leaves and Stalks				1.3 lb/100 lb	8.3 lb/100 lb
Wheat (55 Bu)					
Grain	70	35	20	0.64 lb/bu	0.36 lb/bu
Straw	30	5	50	0.90 lb/bu	0.91 lb/bu

^aSource: National Plant Food Institute and others.

^bSource: Ohio Agronomy Guide, 12th Edition.

^cInculcated legumes fix nitrogen from the air.

Table 6. Nitrogen Rates^a for Corn Based on Yield Potential

Corn Yield Potential (bu/acre)						
Previous Crop	80	100	120	140	160	180+
Corn, small grains	80	110	140	160	190	220

^aN fertilizer rates are based on the following relationship:

$$N \text{ (lb/acre)} = -27 + (1.36 * \text{yield potential}) - N \text{ credit or } 110 + [1.36 * (\text{yield potential} - 100)] - N \text{ credit}$$

Table 7. Nitrogen Rates for Wheat Based on Yield Potential

Yield Potential (bu/acre)	Nitrogen Rate (Pounds N to Apply/acre)
50	40
70	75
90+	110

1. N rate is based on the following relationship:

$$N \text{ (lb/acre)} = 40 + [1.75 * (\text{yield potential} - 50)]$$

2. No nitrogen credits are made based on previous crop.

Table 8. Residual Nitrogen Credits Based on Previous Crop

Previous Crop	Nitrogen Credits
	Pounds of N
Corn, small grains	0
Soybeans	30
Grass sod	40
Established forage legume	
Average stand (3 plants/ft ²)	b
Good stand (5 plants/ft ²)	b
Annual legume cover crop	30

^bN credits for established forage legume = 40 + 20 * (plants/to maximum of 140/ft²)

Ohio Nitrogen Leaching Assessment Procedure

Soils are classified as having a high, medium or low nitrogen leaching potential with relative index ratings from 0 - 10+ for their potential to leach nitrates below the root zone. The leaching potential is rated as high, medium or low by combing the soil's hydrologic soil grouping (A, B, C or D), the local county's annual rainfall, and the local county's season rainfall (October 1 to March 1).

To determine the soil's nitrogen leaching potential, use the following procedure:

1. Determine the soils hydrological soil grouping – A, B, C or D. For this information, refer to USDA-NRCS Engineering Field Manual, Chapter 2 – Ohio Supplement (1989), Table 2.1, pages 2-42 through 2-83.
2. Determine the local county's annual rainfall and the local county's season rainfall (October 1 to March 1). For this information, refer to USDA-NRCS Engineering Field Manual, Chapter 2 – Ohio Supplement (1989), Exhibit OH2-3, Supplement pages 1 through 4 and USDA-NRCS Engineering Field Manual, Chapter 2 – Ohio Supplement (1989), Exhibit OH2-1 and Sheets 1 though 3.
3. Refer to Table 9 below for the respective county to determine the soils relative leaching index rating.
 - (a) Soils with a rating of 0-2 have a low potential to leach nitrates below the root zone.
 - (b) Soils with a rating of 3-10 have a medium potential to leach nitrates below the root zone.
 - (c) Soils with a rating of 10+ have a high potential to leach nitrates below the root zone.
 - (d) All soils with systematic subsurface drains (tile) are rated high potential.

Table 9. Ohio (By County) Leaching Index Ratings for Soils by Hydrologic Groups (A, B, C, D)

County	A	B	C	D	County	A	B	C	D
Adams	15	10	6	4	Licking	15	8	6	4
Allen	10	6	4	2	Logan	15	8	4	4
Ashland	15	8	4	4	Lorain	15	8	4	2
Ashtabula	15	10	4	4	Lucas	10	6	4	2
Athens	15	10	6	4	Madison	15	8	6	4
Auglaize	10	8	4	2	Mahoning	15	8	4	4
Belmont	15	10	6	4	Marion	15	8	4	4
Brown	15	10	6	4	Median	15	8	4	4
Butler	15	10	6	4	Meigs	15	10	6	4
Carroll	15	8	4	4	Mercer	10	8	4	2
Champaign	15	8	4	4	Miami	15	8	4	4
Clark	15	8	6	4	Monroe	15	10	6	4
Clermont	15	10	6	4	Montgomery	15	10	6	4
Clinton	15	10	6	4	Morgan	15	8	6	4
Columbiana	15	8	4	4	Morrow	15	8	4	4

County	A	B	C	D	County	A	B	C	D
Coshocton	15	8	4	4	Muskingum	15	8	6	4
Crawford	15	8	4	2	Noble	15	8	6	4
Cuyahoga	15	8	4	4	Ottawa	10	6	4	2
Darke	15	8	4	4	Paulding	10	6	4	2
Defiance	10	6	4	2	Perry	15	8	6	4
Delaware	15	8	4	4	Pickaway	15	8	6	4
Erie	10	8	4	2	Pike	15	10	6	4
Fairfield	15	8	6	4	Portage	15	8	4	4
Fayette	15	10	6	4	Preble	15	10	6	4
Franklin	15	8	6	4	Putnam	10	6	4	2
Fulton	10	6	4	2	Richland	15	8	4	4
Gallia	15	10	6	4	Ross	15	10	6	4
Geauga	15	10	4	4	Sandusky	10	6	4	2
Greene	15	10	6	4	Scioto	15	10	6	4
Guernsey	15	8	6	4	Seneca	10	6	4	2
Hamilton	15	10	6	4	Shelby	15	8	4	4
Hancock	10	6	4	2	Stark	15	8	4	4
Hardin	10	8	4	2	Summit	15	8	4	4
Harrison	15	8	6	4	Trumbull	15	8	4	4
Henry	10	6	4	2	Tuscarawas	15	8	4	4
Highland	15	10	6	4	Union	15	8	4	4
Hocking	15	10	6	4	Van Wert	10	6	4	2
Holmes	15	8	4	4	Vinton	15	10	6	4
Huron	10	8	4	2	Warren	15	10	6	4
Jackson	15	10	6	4	Washington	15	10	6	4
Jefferson	15	8	6	4	Wayne	15	8	4	4
Knox	15	8	4	4	Williams	10	6	4	2
Lake	15	10	4	4	Wood	10	6	4	2
Lawrence	15	10	6	4	Wyandot	10	8	4	2

Calculating Available Nitrogen of Manure¹

Use the following table to calculate available nitrogen based on time of year and type of application. Determine available nitrogen by multiplying the percent available for ammonia N and organic N and adding them together (i.e., $0.5 * \text{NH}_4\text{N} + 0.33 * \text{Organic N}$).

Table 10. Available Nitrogen

Manure Applied	Manure Available Nitrogen	Poultry Manure Available Nitrogen	Available Nitrogen %		Time of Application	Days Until Incorporation ²				
			Tons	Pounds			Pounds	NH ₄	Organic	Date
							50	33	Nov-Feb	<5
							25	33	Nov-Feb	>3
							50	33	Mar-Apr	<3
							25	33	Mar-Apr	>3
							75	33	Apr-Jun	<1
							25	33	Apr-Jun	>1
							75	15	Jul-Aug	<1
							25	15	Jul-Aug	>1
							25	33	Sep-Oct	<1
							15	33	Sep-Oct	>1

¹The calculations are for all animal manures. It is assumed that 50% of the organic N in poultry manure is converted to NH₄ rapidly and is therefore included in the NH₄ column for calculating available N.

²Incorporation is the mixing of manure and soil in the tillage layer. Disking is usually enough tillage for conserving N availability.

Table 11. Nutrient Sufficiency Ranges for Corn, Soybeans, Alfalfa and Wheat

Element	Corn	Soybeans	Alfalfa	Wheat
	Ear leaf sampled at initial silking	Upper fully developed leaf sampled prior to initial flowering	Top 6 inches sampled prior to initial flowering	Upper leaves sampled prior to initial bloom
Percent (%)				
Nitrogen	2.90-3.50	4.25-5.50	3.76-5.50	2.59-4.00
Phosphorus	0.30-0.50	0.30-0.50	0.26-0.70	0.21-0.50
Potassium,	1.91-2.50	2.01-2.50	2.01-3.50	1.51-3.00
Calcium	0.21-1.00	0.36-2.00	1.76-3.00	0.21-1.00
Magnesium	0.16-0.60	0.26-1.00	0.31-1.00	0.16-1.00
Sulfur	0.16-0.50	0.21-0.40	0.31-0.50	0.21-0.40
Parts Per Million (ppm)				
Manganese	20-150	21-100	31-100	16-200
Iron	21-250	51-350	31-250	11-300
Boron	4-25	21-55	31-80	6-40
Copper	6-20	10-30	11-30	6-50
Zinc	20-70	21-50	21-70	21-70
Molybdenum	-	1.0-5.0	1.0-5.0	-

Original Source: M.L. Vitosh (Michigan State University), J.W. Johnson (The Ohio State University), and D.B. Mengel (Purdue University) (1995). Tri-State Fertilizer Recommendations for Corn, Soybeans, Wheat and Alfalfa. Bulletin E-2567. East Lansing Michigan; Michigan State University.

Sidedress Nitrogen Fertilizer Rates for Corn, Based on a Presidedress Nitrate Soil Test at the 4 to 6 Leaf Stage

Instructions: To effectively use the presidedress nitrate soil test, soil samples should be collected when the corn is in the 4 to 6 leaf stage, or 6 to 12 inches tall. Where manure or fertilizer has been broadcast, sampling procedures consist of taking a composite soil sample of 20-25 soil cores at random throughout the sampling area. The cores should be collected to a depth of 12 inches.

Table 12. Sidedress Nitrogen Fertilizer Rates for Corn

Soil Nitrate Level	Corn Yield Potential (bu/acre)					
	80	100	120	140	160	180
ppm NO ₃ -N	Pounds Additional Fertilizer N To Apply Per Acre					
0-10	80	110	140	160	190	220
11-15	50	80	110	140	160	190
16-20	30	60	90	120	140	170
21-25	0	10	40	60	90	120
>25	0	0	0	0	0	0

Table 13. Phosphate (P₂O₅) Rate for Corn

Soil Test	Yield Potential (bu/acre)				
	100	120	140	160	180
ppm (lb/acre)	Pounds P ₂ O ₅ /acre				
5 (10)	85	95	100	110	115
10 (20)	60	70	75	85	90
15-30 (30-60)	35	45	50	60	65
35 (70)	20	20	25	30	35
40 (80)	0	0	0	0	0

Table 14. Phosphate (P₂O₅) Rate for Corn Silage

Soil Test	Yield Potential (tons/acre)				
	20	22	24	26	28
ppm (lb/acre)	Pounds P ₂ O ₅ /acre				
5 (10)	115	125	130	135	140
10 (20)	90	100	105	110	115
15-30 (30-60)	65	75	80	85	90
35 (70)	35	40	40	45	45
40 (80)	0	0	0	0	0

Table 15. Phosphate (P₂O₅) Rate for Soybeans

Soil Test	Yield Potential (bu/acre)				
	30	40	50	60	70
ppm (lb/acre)	Pounds P ₂ O ₅ /acre				
5 (10)	75	80	90	100	105
10 (20)	50	55	65	75	80
15-30 (30-60)	25	30	40	50	55
35 (70)	10	15	25	25	30
40 (80)	0	0	0	0	0

Table 16. Phosphate (P₂O₅) Rate for Wheat

Soil Test	Yield Potential (bu/acre)				
	50	60	70	80	90
ppm (lb/acre)	Pounds P ₂ O ₅ /acre				
5 (10)	80	90	95	100	105
10 (20)	55	65	70	75	80
15-30 (30-60)	30	40	45	50	55
35 (70)	15	20	20	25	30
40 (80)	0	0	0	0	0

Table 17. Phosphate (P₂O₅) Rate for Alfalfa

Soil Test	Yield Potential (tons/acre)				
	5	6	7	8	9
ppm (lb/acre)	Pounds P ₂ O ₅ /acre				
5 (10)	115	130	140	185	165
10 (20)	90	105	115	130	140
15-30 (30-60)	65	80	90	105	115
35 (70)	35	40	45	50	60
40 (80)	0	0	0	0	0

Phosphorus Index (P Index) Risk Assessment Procedure

The P Index is a procedure that combines well-established factors that influence the runoff of phosphorus to surface waters. Each of the factors is evaluated based on site-specific data and weighted according to its overall effect on phosphorus transport. Each of the site subvalues are added together to establish an overall site rating of low, moderate, high, or very high risk.

In most cases the use of the P Index will allow higher rates of phosphorus application than the Phosphorus Soil Test Risk Assessment Procedure. The use of the P Index should be viewed as a continuous measure until other alternatives can be developed to utilize excess phosphorus produced on the farm.

Purpose:

The P Index is a planning tool designed to help identify fields or areas of fields on a farm that have a higher or lower risk of phosphorus runoff from manure or other organic materials. Based on the risk assessment the appropriate land treatment and nutrient application treatments can be planned to minimize phosphorus transport from the site.

Procedure:

Use the P Index Assessment Procedure Worksheet to determine the site's overall P Index. Use the following guidance to determine each of the site's subvalues. The subvalues are added together to determine the overall site P Index. The worksheet can be photocopied as needed. A "Field Summary Worksheet" is also available with this procedure to record a series of site/field values for a given farm. It can be photocopied as needed.

1. SOIL EROSION – Sheet and rill erosion as measured by the Revised Universal Soil Loss Equation (RUSLE) [USDA-NRCS (2001) National Soil Survey handbook, Section 618.55] or Wind Erosion Prediction Procedure (where wind erosion is the primary concern) [USDA-NRCS (2001) National Soil Survey handbook, Section 618.72]. Determine the predicted soil loss and multiply by (1) to determine the "soil loss" site subvalue.
2. CONNECTIVITY TO WATER – Defines the vulnerability of P to be transferred from the site to a perennial stream or water body. The more closely connected the runoff is from the field via concentrated flow (from a defined grassed waterway or surface drain) to a perennial stream or water body the higher the vulnerability of P transport. To determine the "connectivity to water" site subfactor ask the question: Does concentrated flow (via a defined waterway, tile inlet, or surface drain) leave the site? Read the value definitions to determine the site's "connectivity to water" subvalue.
3. RUNOFF CLASS – This represents the effect of the Hydrologic Soil Group (A, B, C, D) combined with the effect of slope. This factor represents the site's runoff vulnerability. Use the table below to determine the runoff class. The runoff class is the site's subvalue.

Table 18. Runoff Class Matrix – Phosphorus Index Values

Slope Range	Hydrologic Soil Group			
	A	B	C	D
<1%	0	1	3	6
1-3%	1	2	4	7
4-6%	2	3	5	8
7-10%	3	5	7	10
11-15%	4	6	9	12
>15%	6	8	11	15

4. SOIL “P” TEST (BRAY-KURTZ P1) – The soil test procedure using the Bray P1 extraction, or other extraction test calibrated to Bray P1, that provides an index of plant available P expressed in either ppm or lbs/acre (ppm x 2 = lbs/acre). Determine the Bray P1 value in ppm and multiply the ppm by (0.07) to determine the soil P test site subvalue.
5. FERTILIZER P₂O₅ APPLICATION RATE – The amount of manufactured (commercial) phosphate fertilizer applied expressed in lbs/acre of P₂O₅. To determine the site’s subvalue multiply the year’s P fertilizer application rate by (0.05).
6. FERTILIZER P₂O₅ APPLICATION METHOD – Defines if the phosphate (P₂O₅) fertilizer is actually incorporated into the soil and the time interval between application and incorporation or if the fertilizer is applied over a given amount of crop residue. Incorporation or injection with the fertilizer application equipment or using a tillage tool operated a minimum of 3-4 inches deep to incorporate the P₂O₅ fertilizer. To determine the site’s subvalue select the description that most closely describes the method of application. The value with that description is the site’s subvalue.
7. ORGANIC P₂O₅ APPLICATION RATE – The amount of phosphate applied (expressed in lbs/acre of P₂O₅) from manure, sludge, or other bio-solids. To determine the site’s subvalue multiply the year’s P fertilizer application rate by (0.06).
8. ORGANIC P₂O₅ APPLICATION METHOD – Defines if the phosphate (P₂O₅) from the manure, sludge, or other bio-solids is actually incorporated into the soil, the time interval between application and incorporation, or if the manure/bio-solids are applied over a given amount of crop residue. Incorporation or injection with the application equipment or by using a tillage tool operated a minimum of 3-4 inches deep to incorporate the manure, sludge, or other bio-solids. To determine the site’s subvalue select the description that most closely describes the method of application. The value with that description is the site’s subvalue.
9. BUFFER STRIP – Deduct 2 points if field runoff flows via sheet flow through a designed filter strip – minimum 35 feet wide. For the type of buffer strip that is limited to the use of filter strips only, it is critical that sheet flow crosses the filter strip, not concentrated flow, to credit a 2 point deduction.

Table 19. Phosphorus Index Risk Assessment Procedure Worksheet

Site Characteristic	Phosphorus Vulnerability Values				
1. Soil Erosion	Soil Loss (tons/acre/year) * 1.0				
2. Connectivity to Water – Does concentrated flow (via a defined waterway, tile inlet, or surface drain) leave the site?	No, and the site is not adjacent to an intermittent or perennial stream. Value = 0	No, but the site is adjacent to an intermittent or perennial stream. Value = 4.0	Yes, but the site is intermittent or perennial. Value = 8.0	Yes, and the site is adjacent to and/or the concentrated flow outlets into an intermittent stream or through a tile inlet. Value = 12.0	Yes, and the site is adjacent to and/or the concentrated flow outlets into a perennial stream or through a tile inlet; OR outlets to a pond or lake within 1 mile. Value = 16.0
3. Runoff Class	See Runoff Class Matrix				
4. Soil Test Bray-Kurtz P1 ppm	Bray-Kurtz P1 (ppm) * (0.07)				
5. Fertilizer P ₂ O ₅ Application Rate	Fertilizer P ₂ O ₅ Applied (lbs/acre) * (0.05)				
6. Fertilizer P ₂ O ₅ Application Method	0 Applied Value = 0	Immediate incorporation OR Applied on 80% cover Value = 0.75	Incorporation <1 week OR Applied on 50-80% cover Value = 1.5	Incorporation >1 week & <3 months OR Applied on 30-49% cover Value = 3.0	No incorporation OR Incorporation >3 months OR Applied on <30% cover Value = 6.0

Site Characteristic	Phosphorus Vulnerability Values				
7. Organic P ₂ O ₅ Application Rate	Available – Manure/Biosolids P ₂ O ₅ Applied (lbs/acre) * (0.06)				
8. Organic P ₂ O ₅ Application Method	0 Applied Value = 0	Immediate incorporation OR Applied on 80% cover Value = 0.5	Incorporation <1 week OR Applied on 50-80% cover Value = 1.0	Incorporation >1 week & <3 months OR Applied on 30-49% cover Value = 2.0	No incorporation OR Incorporation >3 months OR Applied on <30% cover Value = 4.0
Buffer Strip Factor (Deduct 2 points if field runoff flows through a designed filter strip – minimum 35 feet wide)					
TOTAL SITE INDEX VALUE =					
Field Vulnerability for Phosphorus Loss to Surface Water					
Phosphorus Index for Field	Generalized Interpretation of Phosphorus Index & Management				
LOW < 15	LOW potential for P movement from the field. If farming practices are maintained at the current level there is a low probability of an adverse impact to surface waters from P loss. Manure or other biosolids can be applied to meet the recommended nitrogen for the next grass crop or nitrogen removal of the next legume crop.				
MEDIUM 15-30	MEDIUM potential for P movement from the field. The chance of organic material and nutrients getting into surface water exists. Runoff reduction practices such as buffers, setbacks, lower manure/biosolids rates, cover crops, and crop residue practices alone or in combination should be considered to reduce P loss impacts. Manure or other biosolids can be applied to meet the recommended nitrogen for the next grass crop or nitrogen removal of the next legume crop. Applications of P at the crop removal rate should be considered.				
HIGH 31-45	HIGH potential for P movement from the field and for an adverse impact on surface waters unless remedial action is taken. Runoff reduction practices such as buffers, setbacks, lower manure/biosolids rates, cover crops, and crop residue practices alone or in combination should be considered to reduce P loss impacts. Limit application of P to crop removal rates for one year.				
VERY HIGH > 45	VERY HIGH potential for P movement from the field and an adverse impact on surface water. Remedial action is required to reduce the risk of P loss. A complete soil and water conservation system is needed. Apply no additional P.				

**Phosphorus Soil Test Risk Assessment Procedure
Nitrogen and Phosphorus Application Criteria for Manure**

Criteria Application to All Soil Test Levels:

1. Nitrogen application rates from manure shall be based on Total Ammonium Nitrogen content plus 1/3 of the Organic Nitrogen content calculated at time of application when applied during the summer, fall, or winter for spring planted crops. When applied in the spring for spring planted crops the nitrogen application rate can be adjusted to apply the recommended nitrogen within the P₂O₅, K₂O, and other limitations.
2. Nitrogen rates are not to exceed the succeeding crop's recommended Nitrogen for non-legume crops or the Nitrogen removal in the crop's biomass for legume crops.
3. All applications are based on current soil test results (not more than 3 years old).
4. No manufactured P₂O₅ applied above 40 ppm Bray P1 or equivalent test, unless recommended by appropriate industry standards or the land grant universities for specialty crops, vegetable crops, etc.
5. Manure shall be applied in accordance with the restrictions and setbacks in this permit.

Table 20. Phosphorus Soil Test Risk Assessment

"P" Soil Test Level	Application Criteria
Bray P1 < 40 ppm (<80 lbs/acre) OR Other equivalents (e.g., Mehlich 3)	Recommended N or P ₂ O ₅ . Manure can be applied to meet the succeeding crop's recommended nitrogen requirements for non-legume crops or the nitrogen removal for legume recommended P ₂ O ₅ but not to exceed the nitrogen needs of the succeeding crop.
Bray P1 40-100 ppm (80-200 lbs/acre) OR Other equivalents (e.g., Mehlich 3)	Recommended N or P ₂ O ₅ Removal whichever is less. The field shall have >30% ground cover at the time of application or the manure shall be incorporated within one week. The manure can be applied to meet the succeeding crop's recommended nitrogen requirements for non-legume crops or the nitrogen removal for legume crops; or P ₂ O ₅ removal (annual or multiple year applications) whichever is less.
Bray P1 100-150 ppm (200-300 lbs/acre) OR Other equivalents (e.g., Mehlich 3)	Recommended N or P ₂ O ₅ Removal whichever is less. Manure shall be applied so as not to exceed the succeeding crop's recommended nitrogen requirements for non-legume crops or the nitrogen removal for legume crops. In addition, a multiple year application of Phosphorus is not authorized.
Bray P1 > 150 ppm (> 300 lbs/acre) OR Other equivalents (e.g., Mehlich 3)	1. No additional P ₂ O ₅ – Use P ₂ O ₅ draw-down strategies; or 2. Shall use the Phosphorus Index Risk Assessment Procedure in Part VII, C.

Table 21. Most Limiting Manure Application Rates for Tiled Fields

Select the Most Limiting Application Rate Based on the Following Criteria					
Field Situation & Time of Year	Limiting Application Rate Criteria				
	Nitrogen	P ₂ O ₅ ⁴	K ₂ O	Tons/acre Gallons/acre	Available Water Capacity Table
Subsurface Drained (Tiled) Fields					
(Apr-Jun) Subsurface Drained or High N Leaching Potential	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	13,000 gal/acre	Upper 8"
(Apr-Jun) Pasture >20% or Cropland >15% Subsurface Drained or High N Leaching Potential	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	⁵ 10 wet tons, 5,000 gal/acre unless contoured strips or incorporated immediately	Upper 8"
(Jul-Sep) No Growing Crop Subsurface Drained or High N Leaching Potential	² 50 lbs/acre as applied N	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	13,000 gal/acre	Upper 8"
(Jul-Sep) With a Growing Cover Crop Subsurface Drained or high N Leaching Potential	³ Next year's crop needs as applied N	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	13,000 gal/acre	Upper 8"
(Jul-Sep) No Growing Crop, Cropland >15% Subsurface Drained or High N Leaching Potential	² 50 lbs/acre as applied N	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	13,000 gal/acre	Upper 8"
(Oct-Mar) Subsurface drained or High N Leaching Potential	³ Next year's crop needs as applied N	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	13,000 gal/acre	Upper 8"
(Oct-Mar) Pasture >20% or Cropland >15% Subsurface Drained or High N Leaching Potential	³ Next year's crop needs as applied N	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	⁵ 10 wet tons, 5,000 gal/acre – unless contoured strips or incorporated immediately	Upper 8"
Frozen or Snow-Cover Subsurface Drained or High N Leaching Potential	³ Next year's crop needs as applied N	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal < 500 lbs/acre	⁵ 10 wet tons < 50% solids, 5 wet tons > 50% solids, liquid manure 5,000 gal/acre	
¹ Crop needs factoring N losses – Maximum total nitrogen applied to meet the succeeding crop's recommended nitrogen requirements for non-legume crops or 150 lbs/acre nitrogen for the succeeding legume crop. Considers loss of N through application method and time of year.					
² 50 lbs/acre as applied N – Nitrogen application limited to 50 lbs/acre based in the addition of the NH ₄ (ammonium/ammonia) content of the manure + 1/3 of the organic nitrogen content of the manure as applied. Considers no losses due to application method or time of year.					
³ Next year's crop needs as applied N – Maximum total nitrogen applied to meet the succeeding crop's recommended nitrogen requirements for non-legume crops or 150 lbs/acre nitrogen for the succeeding legume crop. Considers no losses due to application method or time of year.					
⁴ Under special conditions and criteria the rate of P ₂ O ₅ application can be increased to 500 lbs/acre (See Part VII, A, 4, h, (3), iii). Frozen or snow-covered ground and field over 100 ppm Bray P1 soil test are exempt and are always limited to applications less than or equal to 250 lbs/acre P ₂ O ₅ .					
⁵ Wet tons refers to the weight of the manure as it is applied – including solids and moisture weight.					

Table 22. Most Limiting Manure Application Rates for Non-Tiled Fields

Select the Most Limiting Application Rate Based on the Following Criteria					
Field Situation & Time of Year	Limiting Application Rate Criteria				
	Nitrogen	P ₂ O ₅ ⁴	K ₂ O	Tons/acre Gallons/acre	Available Water Capacity Table
Non Subsurface Drained (Tiled) Fields					
(Apr-Jun) Not Subsurface Drained Pasture >20% or Cropland >15%	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	⁵ 10 wet tons, 5,000 gal/acre unless contoured strips or incorporated immediately	Upper 8"
(Jul-Sep) Not Subsurface Drained	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre		Upper 8"
(Jul-Sep) Not Subsurface Drained Pasture >20% or Cropland >15%	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre		Upper 8"
(Oct-Mar) Not Subsurface Drained	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre		Upper 8"
(Oct-Mar) Not Subsurface Drained Pasture >20% or Cropland >15%	¹ Crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal <500 lbs/acre	⁵ 10 wet tons, 5,000 gal/acre – unless contoured strips or incorporated immediately	Upper 8"
Frozen or Snow-Cover Not Subsurface Drained	¹ Next year's crop needs factoring N losses	Crop needs or crop removal <250 lbs/acre	Crop needs or crop removal < 500 lbs/acre	⁵ 10 wet tons < 50% solids, 5 wet tons > 50% solids, liquid manure 5,000 gal/acre	
¹ Crop needs factoring N losses – Maximum total nitrogen applied to meet the succeeding crop's recommended nitrogen requirements for non-legume crops or 150 lbs/acre nitrogen for the succeeding legume crop. Considers loss of N through application method and time of year.					
⁴ Under special conditions and criteria the rate of P ₂ O ₅ application can be increased to 500 lbs/acre (See Part VII, A, 4, h, (3), iii). Frozen or snow-covered ground and field over 100 ppm Bray P1 soil test are exempt and are always limited to applications less than or equal to 250 lbs/acre P ₂ O ₅ .					
⁵ Wet tons refers to the weight of the manure as it is applied – including solids and moisture weight.					