

Act 38
Nutrient Balance Sheet

Word Version User Guide
&
Sample Nutrient Balance Sheet

October 2023

Pennsylvania Nutrient Management Program
Pennsylvania's Nutrient Management Act (Act 38, 2005)

Introduction

Nutrient Balance Sheets (NBS) are required under Pennsylvania's Nutrient Management Act – Act 38 to meet the manure exporting requirements for manure exported from an operation with an Act 38 nutrient management plan for two specific export scenarios:

- Manure exported to known agricultural operations for agricultural land application for crop production.
- Manure exported through a manure broker which is land applied to agricultural operations for crop production.

All Act 38 Nutrient Balance Sheets must be prepared using the current version of the Nutrient Balance Sheet Standard Format provided by the Pennsylvania Nutrient Management Program. The current version of the NBS Standard Format can be downloaded from the Pennsylvania Nutrient Management Program website (<https://extension.psu.edu/programs/nutrient-management>). The NBS Standard Format is available in two software formats: Microsoft Excel and Microsoft Word. This guide provides direction on how to complete the Act 38 Nutrient Balance Sheets using the Microsoft Word format. A similar User Guide is available for the Microsoft Excel format.

Supporting References & Resources

This guide is intended to be primarily a “How-To” document rather than a comprehensive summary of the regulations, policy and guidance related to exported manure under the Act 38 Nutrient Management Program. There are several important resources available that should be referenced to understand the regulations, policy and guidance not included in this guide. Following are the primary references related to Act 38 exported manure:

- Act 38 Nutrient Management Regulations (<https://extension.psu.edu/programs/nutrient-management/act-38-law-and-regulations>)
- Agronomy Facts 40: Nutrient Management Legislation in Pennsylvania: A Summary of the 2006 Regulations (<https://extension.psu.edu/nutrient-management-legislation-in-pa-a-summary-of-the-2006-regulations-1>)
- Pennsylvania Act 38 Nutrient Management Program Technical Manual (<https://extension.psu.edu/programs/nutrient-management/planning-resources/alternative-tech-manual>) which includes the following specific sections related to exported manure: Appendix 8: Importer/Broker Agreements and NBSs, Supplement 4: Sample Nutrient Balance Sheets; Supplement 10: Winter Manure Application Matrix; Supplement 11: Exporter Agreements, Supplement 12: Manure Export Sheet

Certification Requirements

To meet the requirements of the Act 38 Nutrient Management Program, NBSs must be developed by certified specialists as outlined below:

- Act 38 Nutrient Management Specialists may develop NBSs for both of the manure export scenarios noted above.
- Act 49 Manure Broker 2 may develop NBSs only for manure exported through the manure broker scenario noted above.

Nutrient Balance Sheet Components

This guide will provide basic guidance for completing each of the required Act NBS components:

- Cover Page
- Nutrient Balance Sheet Summary and Summary Notes
- Nutrient Balance Worksheets (includes one worksheet for each crop group)
- Appendix 1: Operation Maps
- Appendix 2: Option 3 Evaluations (P Index and Winter Matrix as required by Manure Plan Basis - Option 3 P Index)

Required Importer Information

NBSs must be developed for each agricultural operation that receives manure (Importer) exported from operations with an Act 38 Nutrient Management Plan unless that Importer has an approved Act 38 Nutrient Management Plan. In order to write a NBS to meet the approval requirements of Act 38, all the required information needs to be obtained from the importing operation. At a minimum, this includes the following:

- Operation Information
 - Operator/Operation Name
 - Operation Address
 - Operation Phone Number(s)
- Farm Map Information (for all fields receiving the importing manure)
 - Road Names (adjacent to and within the operation)
 - Field Identification
 - Field Boundaries
 - Field Acreage
 - Manure Application Setback Landscape Features: Streams, Lakes, Ponds, Sinkholes, Wells, Springs
 - In-Field Manure Stacking Locations (if applicable)
- Soil Test Reports (if using Options 2 or 3; must be current within 3 years)
- General Crop Information
 - Farm Crop Rotation (particular note of legume crops and double crops)
 - Crops (Crop Groups) that will receive the imported manure
- Crop Group Information
 - Crop Yields (tons or bushels per acre)
 - Manure Application History (frequency of manure applications for the past five years)
 - Legume History (does this crop follow a legume crop such as alfalfa or soybeans)
 - Planned Fertilizer Programs (planned fertilizer such as corn starter that will be applied regardless of how much manure will be applied)

- Other Organic Sources Applied (other applications of manure, biosolids, uncollected manure from grazing animals, mortality compost, food processing residuals, etc.)
- Planned Imported Manure Application Management
 - Manure Analysis Report (from Exporter)
 - Application Season (Spring, Summer, Early Fall, Late Fall/Winter)
 - Application Method (is manure incorporated and, if so, how soon after application)
 - Application Rates (rates based on calibration of the specific equipment to be used)

Manure Plan Basis Options

The focal point in the development of a NBS is the Nutrient Balance Worksheets. One worksheet is completed for each crop group on the importing operation that will receive the imported manure. The worksheet documents the crop group nutrient requirements, appropriate nutrient (manure and fertilizer) application rates, manure application timing and procedures, and the fields on the importing operation that could receive that manure over the course of the crop rotation.

In addition to collecting all of the information listed above to complete the NBSs, there should be an initial discussion with the importing farmer regarding the Manure Plan Basis options. Making this decision will impact what information is required to complete the NBS for that operation. The objective is to determine if the planned manure application rates will be based on nitrogen or phosphorus. The primary factor in this determination is the availability of current soil tests. Two secondary considerations are the phosphorus levels on the soil test reports and the impact of the required manure application setbacks. In summary, phosphorus based rates are more restrictive (lower rates) than nitrogen based rates but will require the least time and cost to develop the NBSs.

The Nutrient Balance Worksheet format provides three options for a farmer to follow in order to determine appropriate manure and fertilizer application rates, taking into account the concerns relating to the application of nitrogen and phosphorus. All three options require that nitrogen not be applied above the amount that the crop will take up the given year, with phosphorus addressed by implementing one of the following options:

- **Option 1 – P Removal** – Application rates based on phosphorus removal of the planned crop with a 150' manure application setback from streams, lakes and ponds. This option is not available for winter applied manure.
- **Option 2 – N Requirement** – Application rates based on the annual nitrogen requirements of the planned crop with a 150' manure application setback from streams, lakes and ponds. This option is only available for fields that have soil test levels less than 200 ppm phosphorus by Mehlich-3 test. This option is not available for winter applied manure.
- **Option 3 – P Index** – Implementation of the phosphorus index on each crop management unit/field where manure will be applied. All winter applied manure must use the P Index option and, in addition, must complete the Winter Manure Application Matrix.

Completing Appendix 1: Operation Maps

A recommended first step in NBS development process is the completion of the Operation Map. The NBS Operation Map does not need to be a high quality computer generated map that is to scale with colored aerial photography. It could be a simple hand drawn map. However, the map does need to include the required information and that information needs to be clearly presented so that those applying manure can find the appropriate fields and can identify manure application setbacks and in-field manure stacking locations.

An acceptable NBS map must include the following information:

- Roads and road names for roads adjacent to and within the operation.
- Field information for each field included in the NBS where imported manure may be applied: field identification, field boundaries, and field acreage.
- Manure application setback areas or vegetated buffers and the associated landscape features (streams, lakes, ponds, sinkholes, and active water wells or springs). See explanation of setbacks below.
- Location of in-field manure stacking areas, if applicable.

PAOneStop: Farm Mapping and E&S Planning System

(<https://extension.psu.edu/programs/nutrient-management/planning-resources/paonestop>)

provides a tool to create high quality farm maps and generate plan content information required for the completion of Nutrient Management Plans, Nutrient Balance Sheets, Pennsylvania Phosphorus Index, and Conservation Plans. The Farm Mapping module enables farmers and planners to create, save, and print farm maps with operation and field boundaries, field identification, field acreage, landscape features such as wells, streams, sinkholes, and manure application setbacks.

Manure Application Setbacks

Farms importing manure from Act 38 operations must follow the Act 38 manure application setbacks or manure restriction areas on all fields receiving the imported manure. Other non-imported manure applied on the importing operation must follow the manure application setbacks required by Pennsylvania Manure Management Manual which are very similar to those outlined below. The required Act 38 manure application setbacks are determined by the NBS Manure Plan Basis.

Options 1 and 2 require a 150 foot setback from surface water bodies: streams, lakes and ponds. The Option 3 setback for streams, lakes and ponds is 100 feet or 35 feet with a permanent vegetative buffer. The greater setback distance required for Options 1 and 2 permits applying the imported manure without running the P Index on each field.

In addition, all three options require the following setbacks or restrictions from environmentally sensitive areas:

- Sinkholes (Existing Open) – 100 feet or 35 feet with a permanent vegetative buffer.
- Private Drinking Water Source (Well, Spring) – 100 feet.
- Public Drinking Water Source – 100 feet or greater if required by the source regulations.

A complete summary of all applicable manure applications setbacks is provided in Pennsylvania Manure Application Setbacks and Requirements (<https://extension.psu.edu/programs/nutrient-management/manure>)

Completing Nutrient Balance Worksheets

After producing the Operation Map, the next step is to fill out a Nutrient Balance Worksheet for each crop group on the importing operation that will potentially receive the imported manure at some time during the operation's crop rotation. This guide will provide step-by-step explanation of how to complete the worksheet followed by some completed examples.

Nutrient Balance Worksheet

Crop Group		Yield	CMU/Field Identification <small>(Each field must be clearly identified on a map)</small>	Acres	
Manure Plan Basis <small>(check planning option)</small>	OPTION 1 P Removal	OPTION 2 N Requirement		OPTION 3 P Index	
	<ul style="list-style-type: none"> P removal rates 150' application setback from streams, lakes or ponds No winter application 	<ul style="list-style-type: none"> N requirement rates 150' application setback from streams, lakes or ponds Soil test < 200 ppm Mehlich 3 P No winter application 		<ul style="list-style-type: none"> P Index evaluation of fields P Index and Winter Matrix required for winter application 	
	Soil Test Mehlich 3 P (ppm)				
	<small>(Use the P₂O₅ column to determine acceptable rate)</small>	<small>(Use the N column to determine acceptable rate)</small>		<small>(Use appropriate column based on the P Index to determine acceptable rate)</small>	
Manure Group	Manure Analysis (lb/ton or 1000 gal)			Application Season	
	NH₄-N	Org.N	P₂O₅	K₂O	Application Management
Notes					

	N ¹	P ₂ O ₅ ¹	K ₂ O ¹	Recommendation Basis
A) Recommendation or Removal (lb/A) <small>N – Soil Test or Tables 1 & 2 (AG Table 1.2-3;1.2-5) P₂O₅ & K₂O – Soil Test or Table 3 (AG Table 1.2-6)</small>				Soil Tests Crop Removal
B) Fertilizer Applied (lb/A) <small>(Regardless of Manure e.g. Starter)</small>				Application Record & Notes <small>Record when the planned manure and fertilizer rates were applied or note changes.</small>
C) Other Organic Sources Applied (lb/A) <small>(e.g. Biosolids, Other Manure)</small>				
D) Residual Manure N (lb/A) <small>Table 4 (AG Table 1.2-11B)</small>				
E) Previous Legume N (lb/A) <small>Table 5 (AG Table 1.2-4) or Soil Test Report</small>				
F) Net Nutrient Requirement (lb/A) <small>(A – B – C – D – E)</small>				
G) Manure Analysis (lb/ton or lb/1000gal)	NH ₄ -N	Org N		
H) Nitrogen Availability Factors <small>Table 6 (AG Table 1.2-11A)</small>	NH ₄ -N	Org N		
I) Available Nitrogen Fractions (lb/ton or lb/1000gal) (G x H)	NH ₄ -N	Org N		
J) Total Available Nitrogen (sum of Available N Fractions from row I)	NH ₄ -N + Org N			
K) Balanced Manure Rate (tons/A or gallons/A) <small>Complete 1 column For N: (F ÷ J) For P: (F ÷ G)</small>				
L) Planned Manure Rate (tons/A or gallons/A) <small>Must be less than or equal to Row K Balanced Rate and based on the plan basis being used</small>				
M) Nutrients Applied at Planned Rate (lb/A) For N: (L x J) For P & K: (L x G)				Note: Nutrient balances for P ₂ O ₅ and K ₂ O based on crop removal (Row A) should not be used to determine additional fertilizer needs. Only recommendations based on soil tests should be used for this purpose.
N) Nutrient Balance at Planned Rate (lb/A) (F - M) (Indicate short or excess)				

¹ Completion of N column required for all options; P₂O₅ column is optional for N based rates; K₂O is optional for all rates.

Completing the Worksheet Information Section

The number of individual Nutrient Balance Worksheets (Worksheet) required to address the imported manure is determined by the Manure Plan Basis option selected.

- **Options 1 and 2** – A separate worksheet must be completed for each crop group on the importing farm that will receive the imported manure.
- **Option 3** – Because the P Index is a site (field) specific evaluation, a separate worksheet must be completed for each field on the importing farm that will receive the imported manure.

Crop Group

As stated above, a separate worksheet must be completed for each crop group on the importing farm that will receive the imported manure. The first step in identifying crop groups is to identify the crops on the importing farm that will receive the imported manure. The next step requires determining different combinations of planning and management associated with each of those crops that will cause differences in recommendations, net nutrients required, and available nitrogen. Those differences will result in different balanced or maximum manure application rates for the same crop, therefore requiring the completion of separate worksheets. The primary planning and management considerations in crop group determination are:

- NBS Planning Basis (P Removal or N Based)
- Crop Yields
- Crop Rotation (e.g., corn after legume vs. corn after non-legume)
- Crop Harvest (e.g., corn silage vs. corn grain)
- Manure Application Seasons (spring or summer; early fall; late fall or winter)
- Manure Incorporation Timing (incorporated and how soon after application vs. not incorporated)

These worksheets are not tied to a particular crop year and are valid as long as there are not changes to the manure group or crop management.

Yield

Record the realistic expected crop yields for the crop group.

CMU/Field Identification

List each field on the importing farm that will, over the course of the crop rotation on the farm, have this crop group and potentially receive this imported manure group.

Acres

Record the total combined acreage of all the fields listed in the CMU/Field Identification box.

Manure Plan Basis

Check the manure planning base option that will be used to determine manure application rates. For Options 2 and 3, list the soil test Mehlich 3 ppm P values for the fields listed on the

worksheet. If there are too many fields to list in the space provided on the worksheet, a separate summary sheet may be attached to the NBS. Another acceptable option would be to provide the range of soil test values with a statement such as: “The ppm P values for the noted 37 fields range from 53 to 84.”

Manure Group

The manure group name should include information, such as export farm name, season of application, manure type, which clearly distinguishes it from other manure groups that may be imported to farm.

Manure Analysis

Record the manure analysis results on the manure report obtained from the exporting operation. Nitrogen analysis must provide ammonium N and organic N.

Application Season

Record the season when the imported manure will be land applied on the importing operation crop fields. The season identification will be used in Table 6 to determine the nitrogen availability factor. Table 6 includes the following season options: spring, summer, early fall, late fall and winter.

Late fall and winter applications of imported manure should be avoided if at all possible. Fields receiving late fall and winter applications must have greater than 25% ground cover at the time of application. In the Act 38 program, cover is defined as living and dead plant material.

It should be noted that the Act 38 definition of winter is not exclusively a calendar consideration. Winter is defined as a time when any one of the following conditions exists:

1. the date is on or between December 15 and February 28, or
2. the ground is frozen at least 4 inches, or
3. the ground is snow covered

If any of these conditions exist, imported manure cannot be applied under Manure Planning Basis Options 1 and 2, but must use Option 3. Option 3 – P Index requires that each field on which the imported manure will be applied must be evaluated by the Phosphorus Index. The P Index must be completed by a certified Act 38 nutrient management specialist or a certified Act 49 Broker 2 who has completed the required P Index training authorizing them to conduct the P Index evaluation. In addition, the Winter Manure Application Matrix must be completed for each field that is planned to receive winter applied manure.

Application Management

If the manure will not be incorporated within 7 days after application, use the following notation: “No Incorporation”. If the manure will be incorporated before 7 days, use a notation similar to the following: “Incorporated 2-4 Days”.

Completing the Worksheet Manure Application Rate Section

Nutrient Columns & Recommendation Basis

Before beginning to complete the Manure Application Rate section, two related determinations should be made in consultation with the importing operator.

1. Nutrient Columns – Determine which of the three nutrient columns (N, P₂O₅ or K₂O) will be completed. The N column must be completed on all worksheets. The P₂O₅ column is optional for N based rates and the K₂O column is optional for all rates. A key consideration in this determination is whether the recommendation basis will provide useable additional fertilizer needs from Row N – Nutrient Balance After Manure.
2. Recommendation Basis – Complete the “Recommendation Basis” box (right of Row A) indicating whether the recommendations used in Row A are based on soil test recommendations or on crop removal values. If soil test recommendations will be used as the basis of determining the manure rate, the nutrient balance numbers are valuable to the importing operator in determining supplemental fertilizer needs. However, if crop removal values are used as the starting point, the nutrient balance numbers are not a reliable indicator of additional fertilizer needs.

Row A – Recommendation or Removal

Option 1 will use crop removal values from Tables 1, 2 or 3. Option 2 should use the recommendations from the required soil test reports instead of the nutrient removal tables. If there are significant differences in the P₂O₅ or K₂O recommendations for a crop group, one of the following approaches could be used:

- Group the fields by P₂O₅ or K₂O recommendations and complete separate worksheets.
- Complete only the N column of the worksheet.

Row B – Fertilizer Applied

The fertilizer nutrients listed here are from fertilizer, such as starter or herbicide carrier that will be applied regardless of the amount of manure nutrients applied.

Row C – Other Organic Sources Applied

In this row list the amount of nutrients from other sources such as other applications of manure, biosolids, uncollected manure from grazing animals, mortality compost, food processing residuals, etc. When other sources of nutrients are applied in addition to the imported manure, the following information must be included in the Nutrient Balance Sheet Summary Notes. For the application of other organic sources, the notes must include the type of material and the application rate. For pastures, the specifics of the pasture management must be listed including the animal groups on the pasture, numbers in each animal group, grazing season, hours per day on pasture, and where animals are watered and fed (if applicable).

Row D – Residual Manure N

This is an estimate of how much nitrogen will be available to the crop from previous manure applications. Use Table 4 to determine this value in the N column.

Row E – Previous Legume N

This is an estimate of how much nitrogen will be available to the crop following a previous legume crop. Use Table 5 to determine this value in the N column.

Row F – Net Nutrient Requirement

To obtain these values subtract the nutrient amounts from rows B, C, D and E from the recommendations in Row A.

Row G – Manure Nutrient Content

Transfer the appropriate values from the manure analysis values of the imported manure listed in the upper section of the worksheet.

Row H – Nitrogen Availability Factor

Only a portion of the total nitrogen is available to the crop in the year the manure is applied. Use Table 6 to select an N availability factor for both ammonium N and organic N and place them in the appropriate column. The table considers four aspects to determine these factors: the crop, season of application, application management with respect to incorporation, and the manure type use.

Row I – Available Nitrogen

Multiply the nitrogen content of the manure (Row G) by the nitrogen availability factor (Row H) to obtain this number and list it in the N column.

Row J – Total Available Nitrogen

Add the Available N Fractions from Row I to attain the Total Available N and list it in the N column.

Row K – Balanced Manure Rate

Use the appropriate column to determine this manure rate. For N requirement rates use the N column. For P removal rates use the P₂O₅ column.

For nitrogen divide the Net N Requirement (Row F) by the Total Available Nitrogen (Row J) and place in the N column. For P₂O₅ divide the net P₂O₅ requirement (Row F) by the P₂O₅ content of the manure (Row G) and place in P₂O₅ column. For K₂O, follow the calculation for P₂O₅ by dividing Row F by Row G.

The balance rate is the maximum amount of this manure type that can be applied for the nutrient being considered.

Row L – Planned Manure Rate

This is the actual planned manure rate. The planned rate cannot exceed the balanced rate. It should be based on the application equipment capabilities determined by calibration.

Row M – Nutrients Applied at Planned Rate

For nitrogen multiply the Planned Manure Rate (Row L) by the Total Available Nitrogen (Row J). For P₂O₅ and K₂O multiply the planned rate (Row L) by the manure nutrient content (Row G).

Single applications of liquid or semisolid manure applications may not exceed rates of 9,000 gallons per acre. If the planned manure rate exceeds 9,000 gallons per acre, the plan must designate separate applications each less than 9,000 gallons. This can be handled two ways in the nutrient management plan:

the nutrient management plan:

1. Plan the separate applications multiple applications (see “Planning Multiple Applications” below). A note must be included in the NBS Summary Notes requiring that adequate drying time occur between the separate applications.
2. Entered the total combined rate in Row L. A note must be included in the NBS Summary Notes indicating that the planned rate must be applied in separate applications during the same application season with adequate drying time between the applications. Additionally, the note must include the specific calibrated rates for each separate application.

Row N – Nutrient Balance at Planned Rate

Subtract the nutrients applied at the planned rate (Row M) from the net nutrients required (Row F). This will indicate if more fertilizer or other sources of nutrients are required to meet crop production (yield) goals. **Note:** Nutrient balances for P₂O₅ and K₂O based on crop removal (Row A) should not be used to determine additional fertilizer needs. Only recommendations based on soil tests should be used for this purpose. Negative numbers in Row N indicate that a nutrient will be applied in excess of crop need at the planned manure rate.

Planning Double Crops

The planning approach for double crops requires using a separate Nutrient Balance Worksheet for both the first crop (winter crop) and the second crop (summer crop). The planning procedure is the same as for a single crop except for three specific aspects:

- The residual manure N is divided between both the first and second crops.
- The previous legume N is allocated only to the second crop.
- A proportion of the manure N and any excess P or K applied to the winter crop must be credited to the second crop.

Following is the guidance for planning a double crop using the Nutrient Balance Worksheets.

1. Complete a worksheet for the winter crop.
 - a. Use the appropriate manure residual N values for winter crops in a double crop system from Table 4 (Agronomy Guide Table 1.2-11).

- b. If the crop is following a legume crop, there is no allocation of the legume residual N to the winter crop. The total legume residual N value will be allocated to the summer crop.
 2. After completing the worksheet for the winter crop, calculate the carryover organic N from the manure applied to the winter crop that must be credited to the summer crop as follows:
 - a. Look up the appropriate organic N availability factor in Table 6 (Agronomy Guide Table 1.2-12). The availability factor must reflect appropriate manure application season and summer crop utilization for organic N.
 - b. Multiply the *Planned Manure Rate* (Row L) times the *Manure Organic Nitrogen Content* (Row G) times the availability factors determined above in a. Example:

$$\begin{aligned} \text{Planned Rate} &= 6000 \text{ gal dairy manure/A} \\ \text{Manure Organic N Content} &= 18.9 \text{ lb} \div 1000 \text{ gal} \\ \text{Organic Nitrogen Availability Factor} &= 0.35 \text{ for summer application} \\ \\ 6000 \text{ gal/A} \times 18.9 \text{ lb} \div 1000 \text{ gal} \times 0.35 \\ &= \mathbf{37 \text{ lb N/A Carryover N to the summer crop}} \end{aligned}$$
 - c. The N Carryover from the winter crop manure application should be entered in N column for ***Other Organic Sources Applied (Row C)*** in the second worksheet for the summer crop. In addition, any **excess P and/or K** that is applied at the planned rate (negative numbers in the P₂O₅ or K₂O columns in Row N) should be entered as positive numbers in the appropriate column for *Other Organic Sources Applied (Row C)* in the worksheet for the summer crop.
3. Complete the worksheet for the summer crop.
 - a. Use the appropriate manure residual N values for summer crops in a double crop system from Table 4 (Agronomy Guide Table 1.2-11).
 - b. If the crop is following a legume crop, allocate the total legume residual N value from Table 5 (Agronomy Guide Table 1.2-4) to the summer crop.

It is important to note that these two crops are now linked together. The carryover N, P, and K for the summer crop only applies if it is following this specific winter crop. That distinction needs to be clear in the NBS Summary Notes. In addition, it may be helpful to include the winter and summer crop information in the crop group name. For example: Ryelage (Winter) and Corn Silage (Summer).

There may be situations where the winter crop may be followed by different summer crops on different fields on the farm. In that case as long as the management used on the winter crop does not change, the winter crop only needs to be entered in the NBS Spreadsheet one time. The carryover nutrients from that winter crop may be applied to multiple summer crops that follow it.

Planning Multiple Applications

The planning approach for multiple manure applications requires using a separate Nutrient Balance Worksheet for each manure application to one crop group. The planning procedure is the same as for a single application except for one specific aspect:

- After planning the first application, the second application must then be based on the nutrient balance following the first manure application.

Following is the guidance for planning a multiple application using the Nutrient Balance Worksheets.

1. Plan the first application as you would any other field/crop group.
2. For the second application, enter the same Worksheet Information Section information (crop group, manure plan basis, etc.) as for the first application.
3. The same or any other manure group can be chosen for the second application and the selected manure group information entered.
4. **Important>>>** For the second application, the *Nutrient Balance at the Planned Rate* (Row N) in the first application is entered into the *Net Nutrients Requirement* (Row F) line for the second application.
5. **Important>>>** For the second application, do not enter any other information in the *Fertilizer Applied* (Row B), *Other Organic Sources Applied* (Row C), *Residual Manure N* (Row D), or *Previous Legume N* (Row E).
6. Enter the *Planned Manure Rate* (Row L) for the second application.
7. Nutrient balances that are “Short” in the *Nutrient Balance at Planned Rate* (Row N) in the second application can be applied as supplemental fertilizer.

It is important to note that these two are now linked together. This scenario can be used on other fields that have the exact same situation. This needs to be clear in the NBS Summary Notes. In addition, it may be helpful to include the multiple application information in the crop group name. For example: Grass Hay (1st) and Grass Hay (2nd).

Completing the NBS Summary & Summary Notes

The Nutrient Balance Sheet Summary is completed by transferring the required information from each of the worksheets included in the Nutrient Balance Sheet. There are four scenarios that **require notes** to be included in the Nutrient Balance Sheet Summary Notes.

- **Crop Removal Recommendation Basis** – Use the following note: “Nutrient balances for P₂O₅ and K₂O are based on crop removal and should not be used to determine additional fertilizer needs.”

- **Manure Applied to Pastures** – If imported manure is applied to pastures, the following information used to calculate the amount of uncollected manure must be noted: animal group(s) using the pasture; number of animals in each animal group; beginning and ending months of the grazing season; number of hours/day animals are planned to spend on the pasture; and for grazing scenarios where animals have unrestricted access to both a barn and/or lot where manure is collected and a pasture, location of water source and supplemental feed (if applicable).
- **9000 Gallon Rate Limit** – If planned manure application rates are greater than 9000 gallons/acre, the following must be noted: specific calibrated rates for each separate application; that each application must be made during the same application season; and that adequate drying time must occur between the applications.
- **Winter Manure Application** - For each field receiving winter manure applications the following field condition requirements must be noted: field must have a minimum of 25% cover; whether or not manure application will be allowed if the field is snow or ice covered, and additional setbacks (if applicable) that will be used, in addition to the required winter application setbacks, for the purpose of added water quality protection.

Table 1. Nitrogen recommendations for agronomic crops. (Table 1.2-3, Penn State Agronomy Guide)

These are base recommendations and should be adjusted for previous crop, previous manure history, and planned manure applications (see “Manure Nutrient Management” section).

Crop	Recommendation (lb N/unit of expected yield)	Comments
Corn grain (bu/A)	1	For better N efficiency, delay application of the nitrogen until the corn is between 10 and 20 inches tall. If the field has a history of manure and/or legumes, delay all of the N. If there is no history of manure and/or legumes, split the N, applying one-third near to planting and delaying the balance. Adjust this recommendation for any previous legume in the rotation (see Table 1.2-4) and for residual N from previous manure applications (see Tables 1.2-11 and 1.2-12). The PSNT or chlorophyll meter test can be used to refine N recommendations for corn, especially where manure is a major nutrient source.
Corn silage (ton/A)	7	For better N efficiency, delay application of the nitrogen until the corn is between 10 and 20 inches tall. If the field has a history of manure and/or legumes, delay all of the N. If there is no history of manure and/or legumes, split the N, applying one-third near to planting and delaying the balance. Adjust this recommendation for any previous legume in the rotation (see Table 1.2-4) and for residual N from previous manure applications (see Tables 1.2-11 and 1.2-12). The PSNT or chlorophyll meter test can be used to refine N recommendations for corn, especially where manure is a major nutrient source.
Grain sorghum (bu/A)	0.75	Adjust this recommendation for any previous legume in the rotation (see Table 1.2-4) and for residual N from previous manure applications (see Tables 1.2-11 and 1.2-12).
Forage sorghum (ton/A)	7	Adjust this recommendation for any previous legume in the rotation (see Table 1.2-4) and for residual N from previous manure applications (see Tables 1.2-11 and 1.2-12).
Oats (bu/A)	0.8	Apply the N with any other fertilizer before planting. Adjust this recommendation for any residual N from previous manure applications (see Tables 1.2-11 and 1.2-12).
Wheat/rye (bu/A)	1	If plants did not tiller well, apply N by mid-March; otherwise, apply any time up to growth stage 5. Adjust this recommendation for any residual N from previous manure applications (see Tables 1.2-11 and 1.2-12).
Barley (bu/A)	0.8	If plants did not tiller well, apply N by mid-March; otherwise, apply any time up to growth stage 5. Adjust this recommendation for any residual N from previous manure applications (see Tables 1.2-11 and 1.2-12).
Small grain silage (ton/A)	15	Apply at greenup in the spring.
Grass hay (ton/A dry hay equivalent)	50	Split the nitrogen recommendation and apply it based on the expected yield for each cutting. For grass-legume mixtures, if the legume is more than 50% of the stand, the field should be managed as a legume; thus, no nitrogen is recommended. Adjust this recommendation for any residual N from previous manure applications (see Tables 1.2-11 and 1.2-12).

Table 2. Nitrogen removal by legumes. (Table 1.2-5, Penn State Agronomy Guide)

Legume Crop	Pounds of Nitrogen Removed Per Unit of Yield	Comments
Alfalfa (ton/A)	50	No nitrogen application recommended. Although legumes will use N from manure and other sources, applying N may increase the competition from weeds and grasses. If you apply manure, limit it to an application rate that balances the crop's phosphorus requirement.
Clover (ton/A)	40	No nitrogen application recommended. Although legumes will use N from manure and other sources, applying N may increase the competition from weeds and grasses. If you apply manure, limit it to an application rate that balances the crop's phosphorus requirement.
Trefoil (ton/A)	50	No nitrogen application recommended. Although legumes will use N from manure and other sources, applying N may increase the competition from weeds and grasses. If you apply manure, limit it to an application rate that balances the crop's phosphorus requirement.
Soybeans (bu/A)	3.2	No nitrogen application recommended. Although legumes will use N from manure and other sources, applying N may increase the competition from weeds and grasses. If you apply manure, limit it to an application rate that balances the crop's phosphorus requirement.

Table 3. Typical crop nutrient removal for phosphorus and potassium. (Table 1.2-6, Penn State Agronomy Guide)

Crop (units)	Per Unit of Yield		Typical Yield Per Acre	Removal for Given Yield	
	P ₂ O ₅	K ₂ O		P ₂ O ₅	K ₂ O
Corn (bu)	0.4	0.3	150 (bu)	60	45
Corn silage (T) ¹	4.0	8.0	25 (T)	100	200
Grain sorghum (bu)	0.6	0.8	125 (bu)	75	100
Forage sorghum (T) ¹	3.0	10.0	15 (T)	45	150
Sorghum/sudangrass ¹	7.0	7.0	15 (T)	105	105
Alfalfa (T) ^{2,3}	15.0	50.0	5 (T)	75	250
Red Clover (T) ^{2,3}	15.0	40.0	3.5 (T)	52	140
Trefoil (T) ^{2,3}	15.0	40.0	3.5 (T)	52	140
Cool-season grass (T) ^{2,3}	15.0	50.0	4 (T)	60	200
Bluegrass (T) ^{2,3}	10.0	30.0	2.5 (T)	25	75
Wheat/rye (bu) ⁴	1.0	1.8	60 (bu)	60	108
Oats (bu) ⁴	0.9	1.5	80 (bu)	72	120
Barley (bu) ⁴	0.6	1.5	75 (bu)	45	112
Soybeans (bu)	1.0	1.4	50 (bu)	50	70
Small grain silage (T) ¹	7.0	26.0	6 (T)	42	156

1. 65 percent moisture.
2. For legume-grass mixtures, use the predominant species in the mixture.
3. Dry hay equivalent, 10 percent moisture.
4. Includes straw.

Table 4. Residual nitrogen available from past manure applications based on historical frequency of application.

(Table 1.2-11, Penn State Agronomy Guide)

Historical Frequency of Manure Application on the Field

To use this table, determine the frequency of manure application and move to the right in the row to determine the amount of residual N that is available from past manure applications. Deduct this amount of residual N from the basic N recommendation before determining any additional fertilizer or manure application rates.

	Pounds N available to a summer crop (corn, grass hay, oats, etc.)	Pounds N available to a winter crop (wheat, barley, rye, etc.)	Pounds N available to the winter crop in a double-crop system	Pounds N available to the summer crop in a double-crop system
Rarely received manure in the past (<2 out of 5 years) NOTE: If a field only received manure once out of 5 years, but this application was made the previous year, use the frequent credit for the following year.	0	0	0	0
Frequently received manure (2–3 out of 5 years)	20	7	7	13
Continuously received manure (4–5 out of 5 years)	35	11	11	24

Table 5. Residual nitrogen contributions from legumes. (Table 1.2-4 Penn State Agronomy Guide)

Previous Crop ¹	Percent Stand	High-Productivity Fields (Soil Productivity Group 1) ²	Moderate-Productivity Fields (Soil Productivity Groups 2 & 3) ²	Low-Productivity Fields (Soil Productivity Groups 4 & 5) ²
	Nitrogen Credit (lb/A)			
First year after alfalfa	>50	120	110	80
	25–49	80	70	60
	<25	40	40	40
First year after clover or trefoil	>50	90	80	60
	25–49	60	60	50
	<25	40	40	40
First year after soybeans harvested for grain	1 lb nitrogen/bu soybeans			

1. When a previous legume crop is checked on the Penn State soil test information sheet, the residual nitrogen for the year following the legume is calculated and given on the report. This credit should be deducted from the N recommendation given on the soil test report.
2. See Agronomy Guide Table 1.1-1 in the basic soils section for information on soil productivity groups.

Table 6. Factors for calculating manure nitrogen availability based on time of application, incorporation, field history, and manure analysis with ammonium and organic N fractions; required for atypical or treated manures and recommended for all manures. (Table 1.2-12, Penn State Agronomy Guide)

The manure nitrogen availability factor is the fertilizer equivalence of the manure N or the lb of fertilizer N equivalent per pound of ammonium or organic manure N. For example, if the ammonium N Availability Factor = 0.80, effectively there is the equivalent of 0.80 lb of fertilizer N for every pound of ammonium N in the manure. Likewise, if the organic N Availability Factor = 0.35, effectively there is the equivalent of 0.35 lb of fertilizer N for every pound of organic N in the manure.

TOTAL MANURE N

AMMONIUM N ANALYSIS

Spring/summer			
For spring utilization by small grains, grazed pastures, and grass hay and summer utilization by corn, other summer annuals, grazed pastures, and grass hay			
Days to incorp. ¹	Poultry ²	Other ²	Compost
Immediately	0.90	0.80	0.80
1	0.80	0.60	0.60
2-4	0.60	0.40	0.40
5-7	0.40	0.20	0.20
>7	0.20	0.10	0.10
Grazing	0.15	0.20	n/a
Early fall: for fall and spring use by grass hay, grazed pastures, small grains, and small grain silage ³			
Days to incorp. ¹	Poultry ²	Other ²	Compost
For fall and spring use by grass hay, small grains, small grain silage			
0-2	0.80	0.60	0.40
3-7	0.50	0.30	0.20
>7	0.20	0.10	0
Grazing	0.15	0.20	n/a

ORGANIC N ANALYSIS (total N – ammonium N)

Organic N decomposed during year applied				
	Poultry	Swine	Other	Compost
Summer crop	0.50	0.50	0.35	0.10
Winter crop	0.30	0.30	0.25	0.10
Grazing pastures anytime	0.15	0.20	0.20	n/a
Additional organic N available to the summer crop in a double-crop system from manure applied in the fall for the winter crop (above)				
Summer crop	0.25	0.25	0.20	0.10

Organic N decomposed from past applications		
Manure applied	Manure	Compost
1 yr ago	0.12	0.05
2 yrs ago	0.05	0.02
3 yrs ago	0.02	0.01
4 yrs ago	0.02	0.01
5 yrs ago	0.01	0.01

Table 6. Ammonium N. Continued.

Early Fall. For following summer utilization by a summer crop following a non-harvested cover crop used as a green manure			
0-2	0.45	0.35	0.35
3-7	0.20	0.15	0.15
>7	0	0	0
For following summer utilization by a summer crop following a harvested winter crop or no winter crop			
No ammonium-N credit			
Late fall/winter⁴ For following summer utilization by a summer crop following a harvested winter crop or no winter crop			
No ammonium-N credit			
Late fall/winter⁴: for spring use by grass hay, grazed pastures, or small grains, or summer use by corn or summer annuals with green manure cover crop			
	Poultry	Other	Compost
All situations	0.60	0.50	0.50
Grazing	0.15	0.20	n/a

1. Mechanical incorporation or incorporation by 0.5 inch of rain.
2. Increase these factors by 0.2 after one day for very liquid manures (<5 percent solids) to account for soaking in on application. For spring use by grass hay or small grains, or summer use by corn or summer annuals with green manure cover crop
3. Early fall is still warm enough for plant growth and microbial activity to continue (soil temperature >50°F at 2 inches).
4. Late fall and winter are so cold that there is no plant growth or microbial activity (soil temperature <50°F at 2 inches).