Ohio EPA Agronomic Rate Calculation Worksheet

Instructions

December 2023

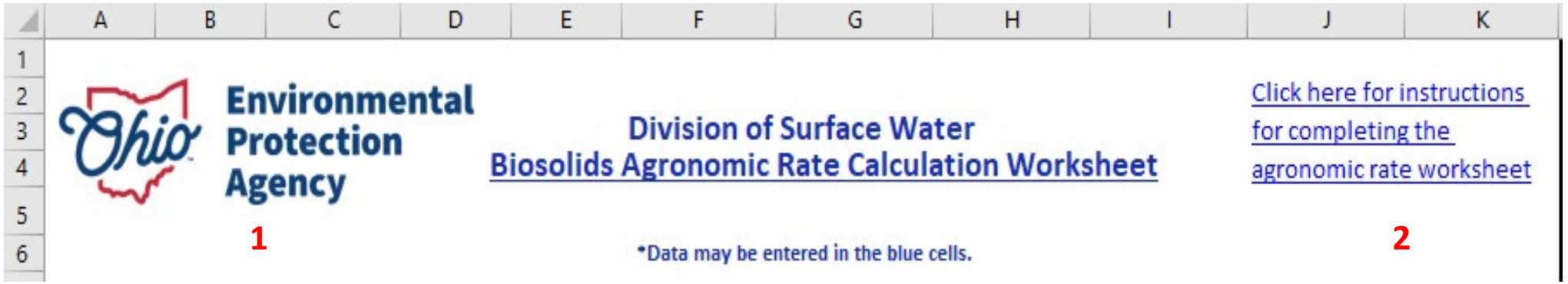
Environmental Protection Agency

Introduction

Ohio EPA's agronomic rate calculation worksheet serves to ensure compliance with Ohio Administrative Code 3745-40-08. This worksheet will automatically calculate the nitrogen agronomic rate, the multi-year phosphate agronomic rate, and the phosphorus index.

Please note that for the worksheet to function correctly all "blue boxes" must be completed either via data entry or information selection within a drop-down list. When selecting information from an applicable drop-down box, click within the "blue box" and a "▾" will appear. Simply click on the "▾" and select the applicable information. Additionally, if a box has "No Input," this means that appropriate data has not been enter into a box used for that calculation.

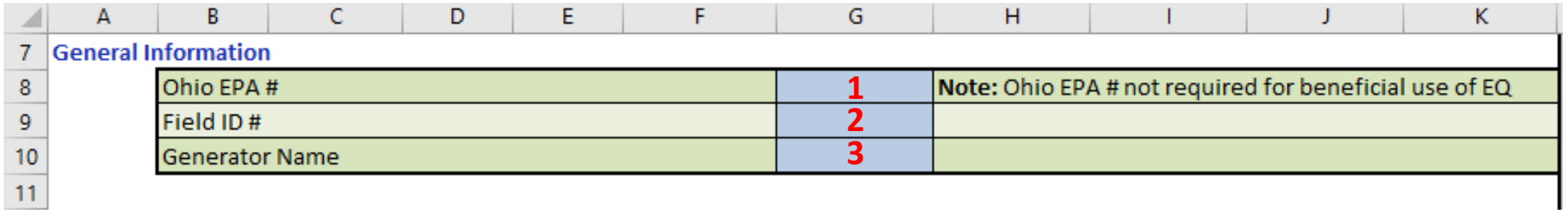
Title and Links



1. Clicking on the Ohio EPA logo will open a link to the Ohio EPA biosolids website. Please visit the site for more information on Ohio's biosolids program.

2. Clicking this link opens these instructions.

General Information



	A	B	C	D	E	F	G	H	I	J	K
7	General Information										
8		Ohio EPA #					1	**Note:** Ohio EPA # not required for beneficial use of EQ			
9		Field ID #					2				
10		Generator Name					3				
11											

1. Enter the Ohio EPA site number for the authorized beneficial use site provided by the Ohio EPA for each beneficial use site authorized in the State of Ohio (if applicable). This site number can be found on the beneficial use site approval letter for each site or on the Biosolids Site Application Map.
2. Enter the specific identification for a beneficial use site used by a generator.
3. Enter the name of the treatment works generating biosolids for beneficial use via a valid NPDES permit or a land application management plan.

Biosolids Nutrient Data

	A	B	C	D	E	F	G	H	I	J	K
12	Biosolids Nutrient Data										
13		Ammonia Nitrogen					1	mg/kg			
14		Total Kjeldahl Nitrogen					2	mg/kg			
15		Total Phosphorus					3	mg/kg			
16		Organic Nitrogen					0.00	lb/ton	4		
17		Available Nitrogen					0.00	lb/ton	5		
18		Phosphate (P_2O_5)					0.00	lb/ton	6		
19											

1. Enter the analytical results for ammonia nitrogen in mg/kg.
2. Enter the analytical results for total kjeldahl nitrogen (TKN) in mg/kg.
3. Enter the total phosphorus in mg/kg.
4. Organic nitrogen automatically calculates.
5. Available nitrogen automatically calculates.
6. Phosphate automatically calculates.

Note: Use most recent lab analysis.

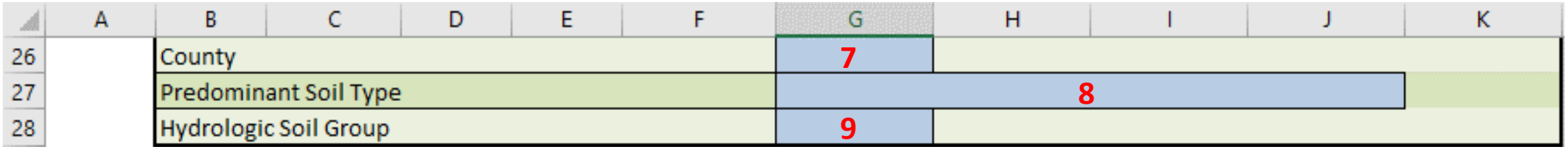
Beneficial Use Site Information - Soils

	A	B	C	D	E	F	G	H	I	J	K
20	Beneficial Use Site Information										
21		Average Soil Phosphorus					1	ppm	2	Extraction Method	
22							No Input	ppm 3			
23		Maximum Soil Phosphorus					4	ppm			
24							No Input	ppm 5			
25		Date of Soil Phosphorus Analysis					6				

1. Enter the average analytical result for the site's soil phosphorus in parts per million (ppm). If the soil phosphorus results are provided in lb/acre, divide the results by 2 to convert to ppm.
2. Select the extraction method performed from the drop-down list (Bray-Kurtz P1 or Mehlich-III).
3. Automatically calculates the Bray-Kurtz P1 soil phosphorus extraction result if the Mehlich-III method was performed.
4. Enter the highest soil phosphorus result. If there is only one sample, this number will be the same as #1.
5. Automatically calculates the Bray-Kurtz P1 soil phosphorus extraction result if the Mehlich-III method was performed.
6. Enter the date the soil phosphorus was analyzed. This is not the date that the soil samples were collected from the site. If the sample data is more than three years old, it will show "Soil test out-of-date" next to this box:

25	Date of Soil Phosphorus Analysis	1/1/2017	Soil test out-of-date.

Beneficial Use Site Information - Soils



7. Enter the county in which the beneficial use site is located.
8. Enter the predominant soil type within the beneficial use site.
9. Enter the most restrictive hydrologic soil group at the beneficial use site (Least Restrictive = A; Most Restrictive=D). If a soil is defined as dual class (A/D, B/D, C/D) the first letter is for drained areas and the second letter is for undrained areas. Example: if your soil type is B/D and is tiled, you would enter B. If untiled (natural state), you would enter D.

Note: Soil type and hydrologic soil group can be found using the Web Soil Survey instructions on the next slide.

Beneficial Use Site Information - Soils

Soil type, depth to bedrock, flooding frequency, and hydrologic soil group information can be obtained from the United States Department of Agriculture's Web Soil Survey: https://websoilsurvey.nrcs.usda.gov/app/

Web Soil Survey Steps

Step 1	Use the web soil survey program to define the Area of Interest (AOI), which is the beneficial use site.
Step 2	After the AOI has been defined, select the "Soil Map" tab near the top of the webpage. This provides a list of the soil types within the AOI.
Step 3	Select the "Soil Data Explorer" tab near the top of the webpage.
Step 4	Select the "Soil Properties and Qualities" tab, located below the "Soil Data Explorer" tab.
Step 5	In the "Properties and Quality Ratings" tab, located on the left side of the webpage, select "Soil Qualities and Features."
Step 6	Select the applicable parameter (i.e., "Depth to Bedrock", "Hydrologic Soil Group"). "Flooding Frequency" is located under the "Water Features" tab.
Step 7	Select "View Rating" to obtain the specific parameter information for the beneficial use site.
Step 8	Create a printable version to generate a PDF document that can be saved or printed for your records.

Beneficial Use Site Information – Nitrogen Requirement and Total Phosphate

	A	B	C	D	E	F	G	H	I	J	K
38		Crop Nitrogen Requirements (Year 1)					1	lb/acre			
39		Existing Available Nitrogen					2	lb/acre			
40		Non-Biosolids Nitrogen Application					3	lb/acre			
41		Commercial Phosphate (P_2O_5) Fertilizer Application						lb/acre			
42		Non-Biosolids Organic Phosphate (P_2O_5) Application						lb/acre	ex: septage, manure, industrial sludge		
43		Biosolids Phosphate (P_2O_5) Application					No Input	lb/acre			

1. Enter the “Crop Nitrogen Requirement (Year 1)” in lb/acre. This value is the amount of nitrogen needed for the crops to be grown during Year 1. If the crop nitrogen requirement entered is greater than values provided by OAC 901:10-2-14, a message will be generated to provide an opportunity to verify the crop nitrogen requirement.
2. Enter the “Existing Available Nitrogen” in lb/acre. This value is the total amount of nitrogen remaining at the beneficial use site from previous beneficial use events and crop residuals. This box may be left blank.
3. Enter the “Non-Biosolids Nitrogen Application” in lb/acre. This is the total amount of available nitrogen from commercial fertilizers, septage applications, animal waste applications, and other materials that have been or will be applied to the beneficial use site for the single crop year. If no other nitrogen has been or will be applied, this box may be left blank.

Beneficial Use Site Information - Crops

	A	B	C	D	E	F	G	H	I	J	K
29		**Year 1**					Crop 1	Crop 2	Crop 3	Crop 4	
30		Crop Type(s)									
31		Expected Crop Yield(s)(bu/acre or tons/acre)									
32		**Year 2**					Crop 1	Crop 2	Crop 3	Crop 4	
33		Crop Type(s)									
34		Expected Crop Yield(s)(bu/acre or tons/acre)									
35		**Year 3**					Crop 1	Crop 2	Crop 3	Crop 4	
36		Crop Type(s)									
37		Expected Crop Yield(s)(bu/acre or tons/acre)									

From the dropdown menu, select the crop type(s) expected to be grown and the corresponding expected crop yield as either bushel per acre or tons per acre. Three years of crop rotations and four crops per year are provided. You are not required to fill in all crop years or multiple crops per year for the worksheet to function.

If the expected crop yield entered is higher than the state average, a message will be generated to provide an opportunity to verify the expected crop yield. For crop yields that are higher than the state average, Ohio EPA recommends that supplemental information be maintained to verify how the expected crop yield(s) were determined. Ideally, actual yield reports for each field would be kept on file. Supplemental information may include the recommended expected crop yields published within Tri-State Fertilizer Recommendations.

Beneficial Use Site Information – Nitrogen Requirement and Total Phosphate (cont.)

	A	B	C	D	E	F	G	H	I	J	K
38		Crop Nitrogen Requirements (Year 1)						lb/acre			
39		Existing Available Nitrogen						lb/acre			
40		Non-Biosolids Nitrogen Application						lb/acre			
41		Commercial Phosphate (P_2O_5) Fertilizer Application					4	lb/acre			
42		Non-Biosolids Organic Phosphate (P_2O_5) Application					5	lb/acre	ex: septage, manure, industrial sludge		
43		Biosolids Phosphate (P_2O_5) Application					No Input	lb/acre 6			

4. Enter the "Commercial Phosphate (P_2O_5) Fertilizer Application" in lb/acre. This value is the total amount of commercial phosphate fertilizer that has been or will be applied to the beneficial use site during the planned crop rotation.
5. Enter the "Non-Biosolids Organic Phosphate (P_2O_5) Application" in lb/acre. This value is the total amount of phosphate from manure, septage, and/or food waste that has been or will be applied to the beneficial use site during the planned crop rotation. This box may be left blank.
6. The "Biosolids Phosphate Application" rate automatically calculates. This number is for reference and calculation purposes only.

Phosphorus Index

45	**Phosphorus Index** - **THIS SECTION IS REQUIRED TO BE COMPLETED IF SOIL P EXCEEDS 100 PPM BRAY-KURTZ (130 PPM MEHLICH III)**		
46	**OR you may choose to use the P-Index when soil P is less than 100 PPM Bray-Kurtz (130 PPM Mehlich III)**	Subvalue	
47	Soil Loss — No Input tons/acre/year	No Input	1
48–52	Connectivity to "waters of the State"	No Input	2
53	Runoff Class - Slope Range	No Input	3
54	Soil Phosphorus	No Input	4
55	Application - Commercial Phosphate (P_2O_5) Fertilizer	0.00	5
56–57	Method - Commercial Phosphate (P_2O_5) Fertilizer	No Input	6
58	Application - Organic Phosphate (P_2O_5) Fertilizer	0.00	7
59–60	Method - Organic Phosphate (P_2O_5) Fertilizer	No Input	8
61–62	Does runoff flow through a filter strip designed per USDA Ohio-NRCS Field Office Technical Guide Standard 393?	No Input	9
63	**Total Phosphorus Index**	**No Input**	10

Phosphorus Index (cont.)

1. "Soil Loss" is automatically calculated in accordance with the *Revised Universal Soil Loss Equation* (RUSLE) or *Wind Erosion Prediction Procedure* (WEPP) based on the predominant soil type entered above.
2. Select the appropriate "Connectivity to 'waters of the State'" from the drop-down box. i.e., does concentrated flow leave the site and, if so, how does flow leave the site?
3. Select the appropriate "Runoff Class – Slope Range" from the drop-down box. This value is the slope of the predominant soil type as determined by the Web Soil Survey.
4. The "Soil Phosphorus" sub value automatically calculates.
5. The "Application – Commercial P_2O_5 Fertilizer" sub value automatically calculates.
6. Select the appropriate "Method of Application – Commercial Phosphate (P_2O_5) Fertilizer" from the drop-down box.
7. The "Application – Organic P_2O_5 Fertilizer" sub value automatically calculates.
8. Select the appropriate "Method of Application - Organic Phosphate (P_2O_5) Fertilizer" from the drop-down box.
9. Answer the question, "Does runoff flow through a filter strip designed in accordance with United States Department of Agriculture (USDA) Ohio Natural Resources Conservation Service's (NRCS) Field Office Technical Guide Standard 393?" by selecting either "yes" or "no" from the drop-down box.
10. The "Total Phosphorus Index" value is the sum of the sub values and it automatically calculates.

Calculated Agronomic Rates

	A	B	C	D	E	F	G	H	I	J	K
65	Calculated Agronomic Rates - THE MOST LIMITING RATE OR THE P-INDEX RATE MUST BE USED										
66		Use the Proposed Agronomic Rate to identify an appropriate application rate									
67		Proposed Biosolids Agronomic Rate					No Input	dry tons/acre	No Input		
68		Total Phosphate Applied at Proposed Agronomic Rate					No Input	lbs/acre			
69											
70		Nitrogen Agronomic Rate				1	No Input	dry tons/acre	No Input	X = P_2O_5 above 250 lbs/acre	
71		(Multi-year)Phosphate Agronomic Rate				2	No Input	dry tons/acre	No Input	✓ = P_2O_5 below 250 lbs/acre	
72		Phosphorus Index				3			No Input		
73											

The following rates are automatically calculated based on the information entered above in the previous sections of the agronomic rate calculator:

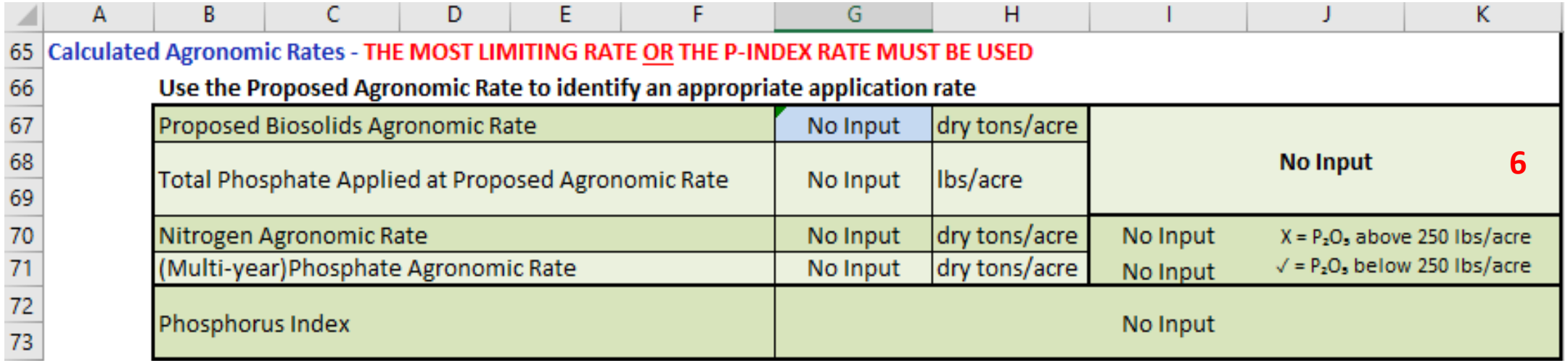
1. Nitrogen Agronomic Rate
2. (Multi-year) Phosphate Agronomic Rate (This rate is only applicable for sites with an average soil P above 40 ppm Bray-Kurtz P1 or 58 ppm Mehlich III per OAC 3745-40-08(A)(b). If crops are only entered into the first crop year, then this rate is a single-year phosphate rate. If crops are also entered for years 2 and 3, then this is the multi-year phosphate rate for all crop years entered. When the multi-year rate is used, no other phosphorus sources can be applied until crops are removed at the end of the multi-year period.)
3. Phosphorus Index (if applicable)

Calculated Agronomic Rates (cont.)

	A	B	C	D	E	F	G	H	I	J	K
65	Calculated Agronomic Rates - THE MOST LIMITING RATE OR THE P-INDEX RATE MUST BE USED										
66		Use the Proposed Agronomic Rate to identify an appropriate application rate									
67		Proposed Biosolids Agronomic Rate				4	No Input	dry tons/acre	No Input		
68		Total Phosphate Applied at Proposed Agronomic Rate				5	No Input	lbs/acre			
69											
70		Nitrogen Agronomic Rate					No Input	dry tons/acre	No Input	X = P_2O_5 above 250 lbs/acre	
71		(Multi-year)Phosphate Agronomic Rate					No Input	dry tons/acre	No Input	✓ = P_2O_5 below 250 lbs/acre	
72		Phosphorus Index					No Input				
73											

4. The "Proposed Biosolids Agronomic Rate" initially populates with the calculated nitrogen agronomic rate. However, this value may be changed to a different proposed agronomic rate, but it may never be higher than the calculated "Nitrogen Agronomic Rate". The "Proposed Biosolids Agronomic Rate" will determine the output for the "Total Phosphate Applied at Proposed Agronomic Rate" and may be changed to ensure an appropriate total phosphate applied.
5. The "Total Phosphate Applied at Proposed Agronomic Rate" represents the total phosphate applied in lb/acre from biosolids and non-biosolids sources. This rate should be below 250 lb/acre unless the requirements of OAC 3745-40-08(A)(2)(a)(iii) are met to allow a rate of 250-500 lb/acre. Any application over 500 lb/acre is prohibited.

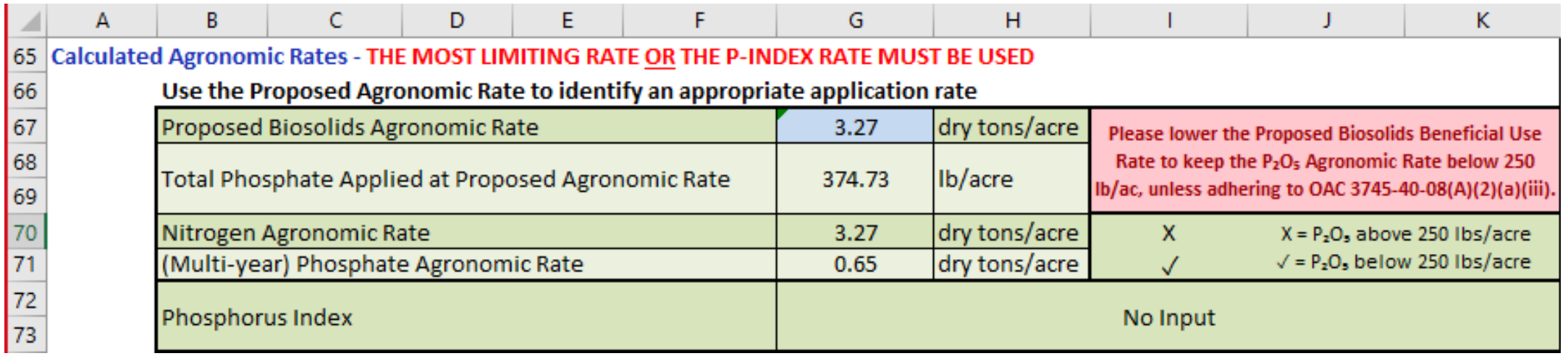
Calculated Agronomic Rates (cont.)



	A	B	C	D	E	F	G	H	I	J	K
65	Calculated Agronomic Rates - THE MOST LIMITING RATE OR THE P-INDEX RATE MUST BE USED										
66		Use the Proposed Agronomic Rate to identify an appropriate application rate									
67		Proposed Biosolids Agronomic Rate					No Input	dry tons/acre	No Input		6
68		Total Phosphate Applied at Proposed Agronomic Rate					No Input	lbs/acre			
69											
70		Nitrogen Agronomic Rate					No Input	dry tons/acre	No Input	X = P_2O_5 above 250 lbs/acre	
71		(Multi-year)Phosphate Agronomic Rate					No Input	dry tons/acre	No Input	✓ = P_2O_5 below 250 lbs/acre	
72		Phosphorus Index					No Input				
73											

6. This box displays a message that provides the user with information regarding the “Total Phosphate Applied at Proposed Agronomic Rate”:
   - If the total phosphate rate is less than 250 lb/acre, then no changes are needed to the "Proposed Biosolids Agronomic Rate".
   - If the total phosphate rate is greater than 250 lb/acre, but less than 500 lb/acre, you must adhere to OAC 3745-40-08(A)(2)(a)(iii) OR change the "Proposed Biosolids Agronomic Rate" to calculate a total phosphate rate less than 250 lb/acre.

Calculated Agronomic Rates (cont.)



	A	B	C	D	E	F	G	H	I	J	K
65	Calculated Agronomic Rates - THE MOST LIMITING RATE OR THE P-INDEX RATE MUST BE USED										
66		Use the Proposed Agronomic Rate to identify an appropriate application rate									
67		Proposed Biosolids Agronomic Rate					3.27	dry tons/acre	Please lower the Proposed Biosolids Beneficial Use Rate to keep the P_2O_5 Agronomic Rate below 250 lb/ac, unless adhering to OAC 3745-40-08(A)(2)(a)(iii).		
68		Total Phosphate Applied at Proposed Agronomic Rate					374.73	lb/acre			
69											
70		Nitrogen Agronomic Rate					3.27	dry tons/acre	X	X = P_2O_5 above 250 lbs/acre	
71		(Multi-year) Phosphate Agronomic Rate					0.65	dry tons/acre	✓	✓ = P_2O_5 below 250 lbs/acre	
72		Phosphorus Index					No Input				
73											

7

7. This box is a quick reference guide that informs the user if either the calculated “Nitrogen Agronomic Rate” or “(Multi-year) Phosphate Agronomic Rate” yields a total phosphate rate above or below 250 lb/acre. The check mark does not indicate that the user must use that agronomic rate.

Beneficial Use Site Records

Note: The section "Beneficial Use Site Records" should be completed after land application.

	A	B	C	D	E	F	G	H	I	J	K
75	Beneficial Use Site Records										
76		For Liquid Biosolids: Percent Total Solids				1		%	Instructions: For liquid biosolids, enter the		
77		For Liquid Biosolids: Gallons Beneficially Used				2		gallons	calculated dry tons (G78) for dry tons of		
78		For Liquid Biosolids: Calculated Dry Tons				3	-		biosolids beneficially used in G79.		
79		Dry Tons of Biosolids Beneficially Used						dry tons	No Input		
80		Acreage Used									
81		Acreage Authorized									
82		Actual Application Rate					No Input	dry tons/acre			
83		Actual Total Phosphate Rate					No Input	lbs/acre			

Note: Boxes G76-G78 only need to be completed if liquid land application was performed.

1. Enter the % total solids for liquid biosolids (if applicable).
2. Enter the total gallons beneficially used at the site (if applicable).
3. Automatically calculates the total dry tons used on the site. This value should then be entered into the "Dry Tons of Biosolids Beneficially Used" box (G79).

Beneficial Use Site Records (cont.)

	A	B	C	D	E	F	G	H	I	J	K
75	Beneficial Use Site Records										
76		For Liquid Biosolids: Percent Total Solids						%	Instructions: For liquid biosolids, enter the calculated dry tons (G78) for dry tons of biosolids beneficially used in G79.		
77		For Liquid Biosolids: Gallons Beneficially Used						gallons			
78		For Liquid Biosolids: Calculated Dry Tons					-				
79		Dry Tons of Biosolids Beneficially Used				4		dry tons	No Input		
80		Acreage Used				5					
81		Acreage Authorized				6					
82		Actual Application Rate				7	No Input	dry tons/acre			
83		Actual Total Phosphate Rate				8	No Input	lbs/acre			

4. Enter the total dry tons of biosolids beneficially used at the site.
5. Enter the acreage on which the biosolids were beneficially used. This number may differ from the “Acreage Authorized” if only a portion of the site was beneficially used.
6. Enter the total acreage authorized for the beneficial use site.
7. This box calculates the actual application rate in dry tons of biosolids per acre. This rate may differ from the proposed or calculated agronomic rate utilized in the previous section.
8. This box calculates the total phosphate applied per acre from both biosolids and non-biosolids sources, based upon the user's actual application rate.

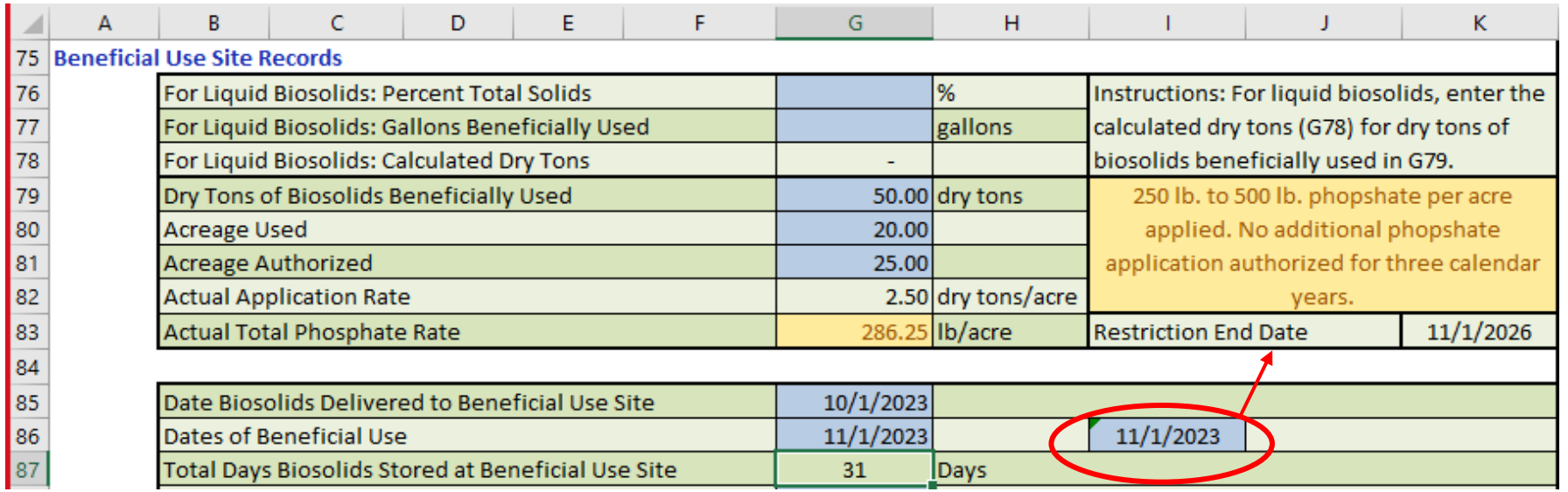
Beneficial Use Site Records (cont.)

	A	B	C	D	E	F	G	H	I	J	K
75	Beneficial Use Site Records										
76		For Liquid Biosolids: Percent Total Solids						%	Instructions: For liquid biosolids, enter the		
77		For Liquid Biosolids: Gallons Beneficially Used						gallons	calculated dry tons (G78) for dry tons of		
78		For Liquid Biosolids: Calculated Dry Tons					-		biosolids beneficially used in G79.		
79		Dry Tons of Biosolids Beneficially Used						dry tons			
80		Acreage Used									
81		Acreage Authorized									
82		Actual Application Rate					No Input	dry tons/acre			
83		Actual Total Phosphate Rate					No Input	lbs/acre			

9 No Input

9. If the “Actual Total Phosphate Rate” is 250-500 lb/acre, the following message will appear in this box: “250-500 lb phosphate per acre were applied. No additional phosphate application is authorized for three calendar years.”

Beneficial Use Site Records (cont.)



	A	B	C	D	E	F	G	H	I	J	K
75	Beneficial Use Site Records										
76		For Liquid Biosolids: Percent Total Solids						%	Instructions: For liquid biosolids, enter the		
77		For Liquid Biosolids: Gallons Beneficially Used						gallons	calculated dry tons (G78) for dry tons of		
78		For Liquid Biosolids: Calculated Dry Tons					-		biosolids beneficially used in G79.		
79		Dry Tons of Biosolids Beneficially Used					50.00	dry tons	250 lb. to 500 lb. phopshate per acre		
80		Acreage Used					20.00		applied. No additional phopshate		
81		Acreage Authorized					25.00		application authorized for three calendar		
82		Actual Application Rate					2.50	dry tons/acre	years.		
83		Actual Total Phosphate Rate					286.25	lb/acre	Restriction End Date	11/1/2026	
84											
85		Date Biosolids Delivered to Beneficial Use Site					10/1/2023				
86		Dates of Beneficial Use					11/1/2023		11/1/2023		
87		Total Days Biosolids Stored at Beneficial Use Site					31	Days			

10

10. If the “Actual Total Phosphate Rate” is between 250 and 500 lb/acre, then once the last day of beneficial use is entered into cell I86, this box will show the date that the three-year restriction ends for this site.

Note: “Dates of Beneficial Use” is meant to be the first and last day of beneficial use. Entering the first date will automatically populate the last date with the same date. However, this last date may be changed if beneficial use occurred over multiple days.

Beneficial Use Site Records (cont.)

	A	B	C	D	E	F	G	H	I	J	K
86		Date Biosolids Delivered to Beneficial Use Site					1				
87		Dates of Beneficial Use				2		to			
88		Total Days Biosolids Stored at Beneficial Use Site					3	Days			
89		Immediate Incorporation or Injection performed?					4				
90		Date Signage Posted at Beneficial Use Site					5				
91		Total Days Sign Posted before Land Application					6	Days			
92		Date Signage Removed from Beneficial Use Site					7				
93		Is a permanent sign posted at the beneficial use site?				8	☐ Yes	☐ No			
94	Ohio EPA (11/23)										

1. Enter the first date that biosolids were delivered to the beneficial use site.
2. Enter the first and last dates of beneficial use at this site.
3. This box calculates the total number of days biosolids were stored at the site (if applicable). It will turn red if the value entered is greater than or equal to 90 days, which is the maximum duration field storage may occur for biosolids.
4. Choose the appropriate answer in the drop-down list to indicate if immediate incorporation or injection was performed.
5. Enter the date signs were posted at the beneficial use site.
6. This box calculates the total number of days signs were posted at the site from the date biosolids were delivered to the site.
7. Enter the date that signs were removed from the site (if applicable).
8. Check the appropriate box to indicate if a permanent sign was posted at the beneficial use site.

Ohio EPA Biosolids Contacts

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Resources

- Culman, S., Fulford, A., Camberato, J., & Steinke, K. (2020). Tri-State Fertilizer Recommendations. https://agcrops.osu.edu/FertilityResources/tri-state_info
- Ohio Administrative Code 901:10-2 (2021). Appendix E, Table 1 Phosphorus Index Risk Assessment Procedure. https://codes.ohio.gov/assets/laws/administrative-code/pdfs/901/10/2/901$10-2-14_PH_FF_A_APP13_20210203_0904.pdf
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