

Target GPM Calculator for Flow Meters: Line-by-line Definitions

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Headings in **bold** are cells that may be modified. On the spreadsheet, most cells with contents that can be changed or that require data input by the user have borders and colored shading.

Targets worksheet

1. My Dairy

Replace this text with the name you want to use for this set of locations

2. Year

Replace if different

3. Date

Change this date to the date of the beginning of this irrigation

4. Season

Enter a crop or crop season, such as “summer” or “corn”

5. Toolbox

Macros **MUST** be enabled for the toolbox to function. If nothing happens when you press the toolbox button, close the file and re-open it, this time enabling the macros

6. Source lagoon

The name of the lagoon that will be used for this irrigation

7. Thousand gallons needed

The total volume of lagoon water that will be used during this irrigation

8. Extra location

Serves as a “scratch pad” when you don’t want to overwrite existing parameters. This “location” will not be included on the field data sheet.

9. Location

Type a name of each field, check or irrigation set.

10. Acres

The number of acres associated with each location

11. Irrigation number

Enter “p” or “pre” for a preirrigation; 1, 2, 3 etc. for an in-season irrigation

12. Expected run time

The number of hours the fresh water irrigation is expected to take for this location

13. Target lbs/ac available N

Enter the amount of AVAILABLE nitrogen you wish to apply. The TOTAL amount of nitrogen you will need to apply in order to supply the crop with that amount of available nitrogen will be calculated when lagoon concentration information is entered. Total nitrogen will appear just below the available nitrogen value you entered.

14. lbs/ac total N applied

The TOTAL amount of nitrogen that will be applied if the desired amount of available nitrogen is applied. The total is higher than the available nitrogen because some of the organic form nitrogen will not become available for crop use during this crop season.

15. Sample name

Entering a sample name is optional. A sample name is automatically entered if a sample is selected from the "samples" tab on the toolbox.

16. TKN-N (mg/L)

Total Kjeldahl Nitrogen is the most common analysis used to estimate total nitrogen in lagoon water. It is comprised of both ammonium form and organic form nitrogen. mg/L is milligrams per liter and is the same as parts per million. If your lab report is in different units, such as pounds per thousand gallons or acre inch, you will have to convert these values into mg/L or ask your lab for the original analysis results. Compliance reporting also requires reporting in mg/L.

17. ammonium-N (mg/L)

Ammonium form nitrogen is dissolved ammonia. It results from the breakdown of urea and is also a waste product from bacterial activity. It is the same molecule as fertilizer ammonia and is immediately available for crop use.

18. % organic-N

The percent of the total nitrogen that is in the organic form. If more than about 30% of the total nitrogen is organic, it may be difficult to account for enough to the organic form N to meet regulatory requirements. Depending on the size of the particles, pipeline plugging, manure crusts on the soil, and uneven distribution of nutrients may become major issues as well when the organic form nitrogen is a high percentage of the total.

19. % org-N available

The percent of the organic nitrogen that is expected to become available to this crop. This will vary depending on the temperature and length of time remaining in the season, and the size, age and composition of the particles. Remember that organic nitrogen that remains as a crust on the surface will not begin to become available until it is incorporated. Remember that large losses of nitrogen from leaching or denitrification are common and may account for not seeing crop response to nitrogen that became available but was lost before it could be utilized by the crop.

Until studies provide better information, here are some interim guidelines:

- 80% early in the summer, no crust on surface
- 60% mid warm season, no crust on surface
- 50% early warm season, minor crust on surface
- 30% cool season, or some crust in warm season
- 20% medium crust, winter season, or late in warm season

If you have experience that confirms or refutes these estimates, please share it!

20. Available N (mg/L)
The concentration of nitrogen in the pond that is either available immediately (ammonium) or will become available during the crop season. Ammonium nitrogen + the percent of the organic N that will become available.
21. Target GPM
The calculated gpm that will achieve the target application rate. If the calculated gpm is lower than the pump can safely tolerate, the minimum pump output (as set in ## below) is returned and the lagoon pump run time is reduced.
22. Lagoon only run time
This will be the same as the irrigation run time unless the calculated gpm is less than the minimum pump gpm entered on line 34. If the lagoon run time is less than the freshwater run time, the lagoon should be run during the last portion of the irrigation, otherwise the application is unlikely to be uniform.
23. LW % of run time
The lagoon run time expressed as a percent of the total run time. This is useful if the run time is calculated for the entire field but the lagoon pump run time needs to be calculated in the field for and individual check or irrigation set. Multiply the run time for the check or set by the lagoon % run time ÷ 100 to get the time to run the lagoon pump on that check or set.
24. Velocity (ft/sec)
The calculated velocity of the water in the lagoon transfer pipeline based on the inside diameter (ID) that was entered on line 35. If the calculated velocity is lower than the minimum velocity entered on line 36, the velocity cell here will change color to alert you. The application rate will not be modified, however.
25. Thousand gallons needed
The volume of lagoon water that will be needed for this application to this location in 1000 gallons
26. Acre-inches per acre
The volume of lagoon water that will be needed for this application to this location in acre-inches
27. Application Rate Quick Calculator
Provides a handy way to check application rates during an irrigation. Especially useful to see how far off target the application will be if the irrigation isn't going as planned.
- 28. Actual GPM**
Enter the current flow rate of the lagoon output (pump or gravity) in gpm (gallons per minute)
- 29. Actual hours**
Enter the hours that the current location has taken to irrigate (lagoon flow only) or is expected to take.
30. Applied available N/acre
The calculated amount of available nitrogen that will be applied at the actual GPM and hours entered above in lbs/acre

31. Applied total N (lbs/A)

The calculated amount of total nitrogen that will be applied at the actual GPM and hours entered above in pounds per acre.

32. Pump and Pipeline Parameters

Entering the pipeline parameters in this section is optional but recommended.

33. Calculated GPM

The gpm needed to apply the target rate at the full run time. This will be the same as the target gpm unless this calculated rate is equal to or less than the specified minimum pump gpm (line 34).

34. Minimum GPM

Enter the lowest gpm at which the pump may be run without damage to the pump. This gpm may also be set to force a minimum pipeline velocity in accordance with the table 1 below. If the calculated gpm for the target application rate is lower than the safe operating gpm, the program will return the minimum pump output and provide the pump run time for that application, which will be less than the irrigation run time.

35. Pipe inside diameter (in.)

Enter inside diameter of the largest section of the undiluted lagoon water transfer pipeline in inches if you want to have the program alert you if the calculated velocity is too low prevent solids from settling out in the pipeline.

36. Minimum velocity (ft/sec)

The minimum velocity in feet per second that will be sufficient to prevent solids from settling in the liquid manure transfer pipeline. NRCS recommends a minimum of 2 to 5 ft/sec for 4-10% suspended solids. Use the lower or higher value depending the expected level of solids, the slope and roughness of the pipeline, and how difficult it would be to clean out a plugged pipeline.

Minimum gpm to maintain velocity in pipe to prevent solids from settling

feet per second	manure pipeline diameter (inches)												
	2	4	6	8	10	12	15	16	18	20	24	30	36
2	20	78	176	313	489	705	1101	1253	1585	1957	2819	4404	6342
2.3	23	90	203	360	563	810	1266	1441	1823	2251	3241	5065	7293
3	29	117	264	470	734	1057	1652	1879	2378	2936	4228	6606	9513
4	39	157	352	626	979	1409	2202	2505	3171	3915	5637	8808	12,684
5	49	196	440	783	1223	1762	2753	3132	3964	4893	7047	11,010	15,855

Table 1. Use this table to determine the minimum gpm that will maintain a high enough velocity to prevent solids from settling out and plugging the pipeline. NRCS recommends a minimum of 2-5 ft/sec for 4-10% suspended solids. Use the higher or lower velocity depending on your solids level, the slope and roughness of the pipeline, and how difficult it would be to clean out your pipeline should plugging occur.

Default LW Sample Sets Tab

Often, a reliable analysis of the lagoon water that will be applied is not available prior to that application. This sheet sets up a series of estimated concentrations that can be used as defaults until better information on the concentrations is available. Up to five sets of ten samples each can be accommodated.

Sample sets can consist of analyses from previous years, on-farm quick test results, estimated dilution series for when fresh water is being added to the pond during application, or educated guesses.

1. Sample Set Name

Modify these sample set names to suit your own purposes. Sample sets can be selected from the samples tab in the toolbox for insertion into the target spreadsheet.

2. Season or Type

An identification for the type of sample or sample name is required in this column.

3. Sample notes

An entry in this column is optional. The sample name or other identifying information entered here will appear alongside the sample name when this sample is selected from the targets toolbox.

4. % total N in organic form

The percent of the total nitrogen that is in the organic form. See “targets” comments #18.

5. % of organic N available this crop

The percent of the organic form nitrogen that will become available for crop use during this season. See “targets” comments #19.

6. Total Kjeldahl Nitrogen (mg/l or ppm)

TKN is the most common laboratory analysis for total nitrogen in lagoon water. See note on “targets” #16.

If using quick test results, add the organic nitrogen and ammonium nitrogen together and enter the total nitrogen here.

7. Ammonium nitrogen (mg/L)

See note on “targets” #17.

8. Nitrate-N (mg/L)

Nitrate form nitrogen is rarely present in significant quantities in lagoon water unless the lagoon is oxygenated or has been recently refilled with fresh water that contains significant nitrate. This value will not automatically be used in the targets sheet. If you wish to count all of it in your target rate, add the nitrate concentration to the ammonium concentration. If you wish to account for a portion of it, either add that portion to the ammonium concentration, or add it all to the TKN concentration and adjust the % organic available as desired.

9 through 11. Phosphorus, Potassium, and Salt

These concentrations are not used in this version of the target calculator sheet. However, they will be used in the application recordkeeping spreadsheet that is currently being developed, which will support default sample concentrations to be used for interim or on-farm-only application calculations, in addition to recordkeeping for compliance purposes.